THE AUSTRALIAN EEB
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THE BEST IN ELECTRONICS FOR EVERYONE

December 1967, P. 179
February 1968, P. 1

CONTENTS: Why two dates on this issue? Originally we were going to be clever and put out an extra December issue, to include a few desirable items in Vol III. Then happened Australia's Annual Postal Experience [at least it didn't happen at Christmas this time !], and most of our Staff went Elsewhere for the summer holiday, and besides, it is too hot to work [what must it be like further North ?]. So, presto, this has turned into the February Issue-- how nice. No January issue, remember?...

THIS IS SERIOUS ! -- M. R. Burford, VK5ZQ .

Presumably your hobby is quite precious to you or you would never have invested such time, care, devotion and money in it. Why, then, are so many amateurs so complacent of warnings of annihilation?

Complacency is not hard to find, and often only disaster will expel it, and then there may be no way to repair the damage done. Usually it is only the few that see things at all clearly or perhaps are in the position to see what lies ahead.

The very existence of Amateur Radio is constantly being threatened, and measures must be taken to combat these threats before they materialise.

One way to combat these threats is to unite in the Wireless Institute of Australia, which is about to strengthen itself by Federation, when it will truly become 'The Wireless Institute of Australia.' There is strength in numbers, and to what better organisation could you give your support? The W.I.A. is pledged to promote and foster the development of amateur radio, and to protect its interests by whatever means it has at its disposal.

How loud do you suppose the voice of a single amateur would be heard in official quarters? Not above a whisper I'll warrant ! Even many individual voices would barely create a rustle; only a united mass of individuals with one powerful voice will be heard or heeded in high places.

Public relations must become and remain a very important part of our activities and W.I.C.E.N. and amateur participation in the Scout Jamborees On the Air are invaluable to us in this regard.

We must all strive to keep our great hobby alive and strong by stimulating interest in it and by encouraging membership of the WIA. Every licensed 'ham' should be a member--100% membership is our goal.

-- VK5ZQ, President VK5 Division [Reprinted from VK5 Journal, Sept. 1967]

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AROUND THE SHOP -- RLG

[illegible] to open a shop but hard to keep it open.
—Chinese Proverb

Owing to the unfortunate matter of devaluations, it will be necessary to raise charges, as follows: Subscriptions: $NZ1.25, Stg 12/6. Vol II: $NZ1.75, Stg 17/6. Vol III: $NZ1.85, Stg18/6, $US2.20. Australian subscriptions remain at $A0.99, or near offer. The new US figure is not devaluation -- only my own inaccurate sliderule.

If you take it for granted that the EEB is always late you will be pleasantly surprised if it arrives on time. Note that we have never committed ourselves as to the 'on time' to be expected. Let us know if you miss two months issues [but not January], but be glad that we manage somehow to publish this rag at all.

I have stopped selling 2N4250 Fairchild transistors [at cost], because I have enough of them, but I continue to receive enquiries by people who want them. To each

POSTSCRIPT: The Editor wishes to apologise for the rotten duplicating quality, thumb prints, spots, etc. on some pages of this issue. We had some 'help'. Makes life more interesting.

enquirer I have sent suggestions that he act cooperatively with others to buy stuff, but until recently everyone seems to have preferred to pay 50% more for the privilege of acting individually. Now we have Mr. D. J. Bedford, 59 Central Ave. Moonah, Tasmania 7009 who is selling AY1115 transistors at cost. Originally he considered getting the 2N4248 [See June 1967 EEB], but found that the AY1115 is virtually identical, at a much lower price [35c each in 100-lots, including tax!]. The AY1115 has the same remarkable linearity as the 2N4248 [1.05; see June EEB], but much cheaper. It doesn't have the gain of the 2N4250, but it has half the cost. If you don't need the VHF rating of the AY1101, and if you need silicon, low noise, and linearity, the AY1115 would appear to be the best general purpose transistor. [But for VHF note the AY1114. For higher gain and price, the 2N4122. Both have very low noise at RF, with f_T in the 400Mc region!].

Anyhow, please send your 35c per transistor to Mr. Bedford, NOT the EEB; he much prefers Postal Orders [uncrossed], but if you must send a cheque, add 5c for the coffers of the Sovereign State of Tasmania. If you want data sheets, add another 10c to the order. And if you want the transistors at all, you had better send him a stamped 4 x 9 in. self-addressed envelope. No SSAE, no transistors. He is doing this as a favour to you and to himself, and does not intend to lose money on it.≪Fairchild says available early February≫

Now, how about someone to take on the horde of people who want 2N4250's? I mention these financial matters here, because I believe it is to the benefit of experimenters to learn practical methods for saving money on their hobby, by intelligent cooperation, so that they can do more experimenting! ≪If anyone takes on 2N4250, I'll take a dozen≫

I see that a recent issue of "Auto-Call" has christened us 'THE AUSTRALIAN ELECTRONICS EXPERIMENTERS BULLETIN', and I must admit that that sounds good, though it should in no manner be construed to indicate that the Bulletin is a subsidiary of Australian Electronics [it is the other way about]. But we'll still abbreviate it 'Australian EEB'. To newcomers we must hasten to explain that the name 'Equipment Exchange Bulletin' was designed to scare off potential subscribers, particularly in New Zealand, because we didn't have the equipment to handle the vast circulation that we deserve. Now matters have changed, and although my bombastic style still offends sensible Kiwis, we now look forward towards a vast circulation, particularly on the east bank of the Tasman.

By the way, "Auto-Call" is a rather interesting little magazine, published in the Wilds of Kansas, and full of bits of gossip about what is going on in the Amateur World. Amidst the various groups struggling for power and influence on the far side of the Pacific, "Auto-Call" is one of the few sources of information you can trust, if it matters.* It is also full of homey chatter about all sorts of things even including anti-gravity and flying saucers. If you want to see for yourself, send us $A1.25, and we'll organise a subscription for you; that's easier than your obt ining a bank draft, and we have $US credits anyhow, that need spending. Oh yes, the above offer includes New Zealanders too: send $1.25 in your own money, and we'll give it to Peth to spend. I don't know what I'm going to do with all that credit that is accumulating in N.Z., but I'll find a way. If anyone ever plans to go there for a trip or something, please let me know first, and we'll make a transaction.

Talking further about money [this is just one of those days], I managed to organise a magazine reprint of an article I had published, called 'WHY ABUSE SEMICONDUCTORS?' and was going to include it gratis in a forthcoming issue of the EEB. But it turns out that it cost a wee bit more than I expected, and for the sake of the sagging EEB finances I think we'd best offer it separately for sale--just like the Proper Magazines do with special items. The article contains pure essence of Gunther, and modestly I recommend you to it. It is the equivalent of a couple of issues of EEB, and contains a number of commonsense observations about semi-conductors. It can save you a lot of money and headaches, because it is the distilled essence of numerous abused semiconductors. And all

* Won't it be interesting to see what they have to say about "Ham Radio" magazine?! [P.191 here]

this for only 35c! Just the cost of one AY1115, heh. Please send Postal Orders or Stamps or Something, but not a cheque unless you add another 5c. Do it now, and you'll likely receive a copy instead of a refund; we'll send you the article when it arrives next month. If you want to do something particularly nice for me you can also include a SAE, about $4\frac{1}{2}$ x 9 inches; if you send a 3 x 5, the article will come out looking very strange. << Next month has come, and so have the 'Abuse' articles. $3.50/dozen ! Be the first in your block >>

We have received from Chris Horwitz of NSW an interesting defence of the use of microcircuits et al by experimenters, and shall present it to you in the next issue. It is a meaty subject, and fraught with implications. It is basically a question [in my opinion] whether experimenters should spend their time constructing or using; I don't call Meccano-type assembly "construction", however complex. In this lies the whole question of whether one is to be a participant or an observer of life. It is easier to be an observer, but it is a lot less satisfying. -- RLG.

P.S. Remember: No January issue, so please don't write to us about it.
Has anyone else missed their November 1967 issue? Our goode olde PMG's Dept is certainly expensive, isn't it."

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LITERATURE REVIEWLET -- RLG

Several interesting local items have caught my eye [eyes?]. Particularly the November -

Electronics Australia,

that much misunderstood and much appreciated magazine. I always find Williams' Editorials informative and wise; i.e. I agree with them. His tone on the Integrated Circuit revolution is almost plaintive, but he asserts the wretched things are here to stay, and invaluable for engineers. I very much agree, but maintain that they have precious little value for experimenters ... And oh the problems of type proliferations!

At EEB we have approached the problem of vast semiconductor types by selecting various main types [in our series Selected Semiconductors], and pointing out that you need not worry about exact replacement; use a transistor with gain, frequency, etc. suitable for the circuit, and don't worry about it further! Even the question of silicon vs germanium isn't very important unless temperature effects are important. But I might make one exception. If high linearity is needed, you have either to use plenty of negative feedback or use one of the more linear transistors [2N4248-50, AY1115, 2N4354].

In this Nov. El. Aust is explored the proliferation of Gobbledegook in modern electronic [and other?] terminology ... 'Effective use of this schedule will minimise the service available to you', and much more. Very entertaining--and true. And in addition to the usual fascinating Scientific American-type of coverage in front, E.A. has several very fine constructional articles; who complains about their lack? And of course there is the usual informative section on Technical Books and Publications, announcing, among other things, the appearance of the 4th Edition of the G.E. SCR Manual, and several more books on Computers for the brave souls who build their own. And a long and interesting section on radio amateur activities. In Jan issue nice triggered square wave adapter.

- Let us, therefore, have no more letters moaning about El. Aust, and averring that EEB is the best magazine ever. EEB is all right sometimes, but it is ludicrous to compare it to El. Aust, a properly professional magazine with a solid month of fascinating reading. Australia is fortunate to have it at hand. [EEB too, of course.]

Coryra. [See also Sept 1966 EEB P. 94]

On a much more modest scale, of course, is Coryra, the official publication of the Youth Radio Clubs Service, available by subscription of $1 from 14 Hovea St. O'Connor, A.C.T. 2601. For any of our readers who sometimes feel overwhelmed by the technical level of EEB, Coryra will give a pleasant and quite practical respite. And it is a MUST for all young radio enthusiasts. Along with an 80-40M two transistor converter, the November 1967 issue featured a Moisture Alarm, with a sensing plate of foil imbedded in

epoxy, and a detector consisting of a single AY1114 as common-emitter driving a relay. I must definitely make one, to supplement my cranky barometer. The wife will appreciate it too, for the clothes. From the Feb 1968 issue of Coryra, it looks as though it is becoming a first rate experimenters publication: 8 pages of transist. radio troubleshooting techniques, and a very fine article on transformerless tr pwr amps! And lots more for 1968. Don't miss it!! (See EEB, III, p.57)-- Australian Experimenter.

We'd tell you something about this, but have received no further free copies beyond the first two very interesting issues. Aust Exp appears to have the advantage for beginners that much of its material is available in kit form. Since Clive pays for his EEB sub, I suppose I'd better send for his rag too, just to keep up with the ubiquitous Witchell and Co. I did that, and got some copies. Format has improved, with interesting projects of all kinds for beginners, and a serialised Basic Course on Transistors. Nice. Break-In. [also 73, June 1967, and CQ, Nov. 1967]

The October issue of the New Zealand Break-In has an article on techniques of photographing electronic equipment; from the results of photos in various magazines, this article should be reprinted worldwide. A sheet-metal bender is also described, and this looks like an ideal answer to a problem that has been bothering me financially for some time. It will bother you too if you compare the prices of commercially built chassis with the price of sheet aluminium. B-I continues with a clever way of securing turns of air wound coils by heating them electrically to allow them to melt into a rod of plastic! And an article on our recent subject, printed circuits: the circuit is put on graph paper, points for holes are pricked through the paper onto the burnished copper, and-- this is clever--plastic contact paper is put over the diagram and cut out to the exact shape of the wiring. The cut out strip is then put intact onto the copper, using the pin pricks as guides, and forms a 'resist' in the usual Ferric Chloride etching process. But the one I still like the best is to use the kind of matrix board having holes already every 0.1 inch, and just put wires through, from components or separately. Very simple and quick, and easily modified! But note the latest of a large number of Printed Circuits articles, in Sept 1967 CQ Mag--excellent, with photos etc.

They read my mind!

B-I

The editorial examines the current question of whether or not there is any life left in experimental radio. The Editor asserts that the 'Ham Spirit' is still there and can be stimulated, although the equipment used may be commercial. I agree very much with the former, and disagree strongly with the latter statement, a subject about which I shall have more to say anon. See also this issue of EEB, p. 190 and p. 192.

The Jan-Feb issue of Break-In will include an article by Ced Davis and myself, on the versatile Common Base Oscillator, an interesting and useful configuration. I recommend that you don't miss it. The recent currency devaluation allows us to obtain an Associate Membership in the NZART [therefore subscription to B-I] for only $A2.00, and that must be about the best bargain in amateur radio magazines in the whole world now! We'll arrange it for you if you like, but please do add an extra 10c to cover costs. The article describes use of the Oscillator to test crystals and transistors for freq. response.

Amateur Radio-I

Ordinarily I don't bother to review the WIA publication 'Amateur Radio', simply because I assume that if you are an honest experimenter you already subscribe to it via membership in the Institute. But in the November issue in particular, I note an article on Field Effect Transistors by Rick, VK5ZFQ, reprinted from the Journal of the VK5 Division, probably the most active and enthusiastic WIA group in the country. This is exactly the article I was planning to reprint here, and I am most pleased to see it in 'AR'. I recommend it to your close examination. The only difficulty is the fact that some of the best FETs they have been using come from T.I., whose Australian outlet is not always available for the ready supply of semiconductors to experimenters. More hopeful may be the use of Motorola material, e.g. MPF-102 etc. and of course Fairchild, though the latter's VHF material is not necessarily as inexpensive. EEB Review of Selected Transistors by Motorola soon.

In a personal communication, Rick writes that one can often deduce frequency range of FETs from the transconductance figure at 100Mc, but "the only actual frequency graph I have seen was for the TIXM12, which has a flat transconductance curve from d.c. to 350Mc, and then falls to about half at 500Mc, dropping to virtually nothing at about 800Mc. Other FETs may or may not follow a similar curve of [performance]".

Amateur Radio-II: IMPORTANT

Be it noted that Ron Brown and I are going to publish an extensive review of the technical characteristics of the transistors found on the IBM Computer Circuit Boards, and that this will appear only in a forthcoming issue of "Amateur Radio", not in the EEB. The only way you will get a copy will be to join the Wireless Institute of Australia, if you have not already done so, and I strongly advise you to do this for your own benefit and for the good of your hobby, whether or not you are a "ham". Not only is the organisation worthwhile, not only does it provide a good source of technical information through various channels, but it provides as well a bond of fellowship in person and/or on the air which is difficult to discover elsewhere. Specific information for joining may be obtained from your local Division. Or write to P.O. Box 36, East Melbourne, Victoria for further details. Mention EEB while you're about it. Why not? Membership $A4.00 or equivalent; Subscription to Amateur Radio only = $3.60, so it pays to join the Institute!

For the benefit of our overseas readers, I might mention that there has been no article of this type published yet in any of the main international magazines, and furthermore an Editor turned something similar [but not as complete] down from me, because he asserted that transistors were so cheap from other sources that there would be no interest in Computer Board components. Imagine! Overseas people can/apply to join the Wireless Institute of Australia through the Tasmanian Division if they wish, and we shall be pleased to take care of that for them. They should send their application, stating call [if any] and interests, and $US4.50or 37/6 stg to us at Sandy Bay.

CQ

In the October CQ, an interesting CW break-in system, with fast make, slow break; one FET, two transistors, and a few relays and diodes. Among much else there is also an interesting article showing how it is possible to improve filtering efficiency and regulation considerably if you tune the choke of a choke-input filter; in this country of course the fo would be 50c/s. But I very much disagree with the author who says that there is no problem with transients from chokes [re silicon diode rectifiers], because he measured the peak voltage across the choke and found it not excessive. This is absurd. The problem comes when the choke is subjected not to an ordinary rectified sine wave, but to the sharp pulse that can occur when the power supply is turned on or off: if you use a choke input filter, be sure to bypass your diodes with condensers, e.g. 0.005µF for 400PIV, and inversely otherwise with voltage. Actually, though, if you tune your input choke, the condenser across the choke to tune it will automatically bypass transient peaks, so the author is right, but for the wrong reason. He also mentions that some experts "say that capacitor input is bad because of the heavy charging current." Nonsense; everyone by now ought to know that you merely put a resistor in series with a silicon diode to limit the maximum charging current. These subjects are covered in my article "Why Abuse Semiconductors?". The same issue of CQ also has an article on Log Periodic Antennas, a must for beam antenna enthusiasts. // November issue: diode switched xtal filters for rx. Very fine idea.

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LETTERS

1] I have been looking up all the books I have which may have suitable DC/DC converters. So far, I've only come across two which come near my requirements, both for 12V DC to about 250V DC. I would have to buy the transformer, as no details about the transformer are given, and I don't know enough to work out the required windings, etc. I'm going to try to get the book you mentioned, the "Transistor Radio Handbook" [Editors & Engineers]. It could come in handy for other reasons too. I have the G.E. & RCA Transistor Manuals, plus a couple of Mullard books, etc. Eventually I'll come across something suitable to my needs. For a start I want to replace the vibrator power unit in my car radio...
-- H. S. Gutsche, Loxton, S.A.

[[We sent Mr. Gutsche a copy of an article from Break-In which describes a transistorised vibrator substitute, and which will form part of a forthcoming series on DC/DC converters. Some time ago, there was also an article in 73 which described [continued on P.184]

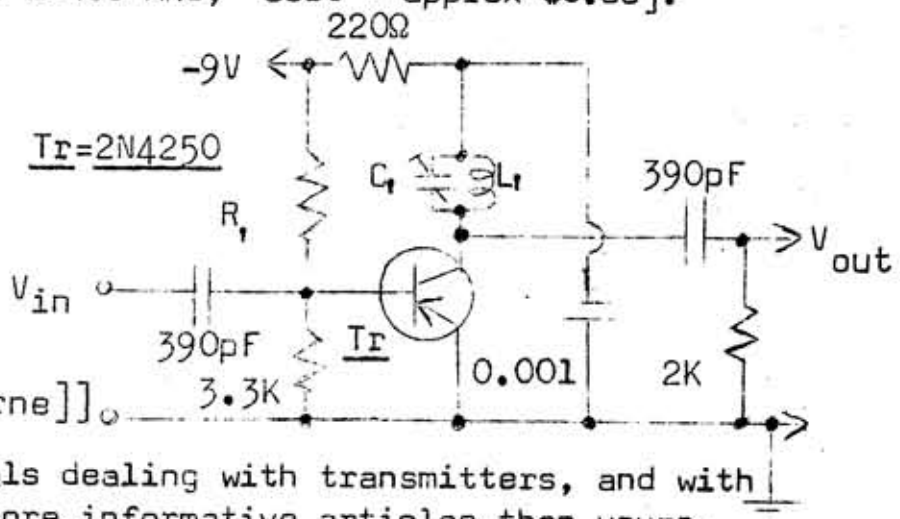
the use of two ordinary filament transformers, one for the base feedback, the other for the collector step-up. But the use of these or even vibrator transformers will give relatively poor efficiency, even if you manage to wind your own. The only proper answer is to use a torroid model, and it is by far the easiest and simplest matter to save up a bit and buy one from A & R or equivalent. But if efficiency is not a major consideration, just about any oscillator circuit will work, with filament or vibrator transformer low voltage winding as load. There is not much mystery in it, and the T. Radio Hbk. will give you all necessary cautions and general concepts... By the way, for transformer winding, you might try Witchell's Transformer Manual, or equivalent. [1967 EEB, P. 43, 59]]

2] I am planning an experiment and article on the change in capacity with respect to voltage across various types of condenser. Most of us know an electrolytic changes capacitance inversely with voltage. However, not so many people are aware that there is an imperceptible change with other condensers, which is obvious in a VFO in which one is installed. Old Clive took me to task, but I said to him 'I TRIED IT' and this is the final test, I think. Would you like an article on this subject?
-- R. Davis, VK1RD, O'Connor, A.C.T.

[[YES! -- Ed.]]

3] Have been having a few problems with Texas Instruments regarding purchase of FET's. TI FET TIXM12 looks good - NF @ 100 MHz = 2 db; info on same up to 600 MHz. Cost = $2.30; delivery - dubious. Apparently VK3 WIA is purchasing FET's for VHF Converter projects for approx 80c ea. [Converters will be produced in kit form soon. Cost - approx $7.00. VK6 WIA is thinking of purchasing bulk supply of kits for distribution.] Checked on Transistor TI-XM05, [P.107 - Aug EEB]. This type now discontinued - TI type 2N2415 recommended as substitute. [Also on P.107]. [2N2415 - Ft = 560 MHz; Max gain @ 500 MHz = 14 db; NF @ 200 MHz = 2.4 db; 3.4 db @ 450 MHz; Cost = approx $3.00].

Have been fiddling with the 2N4250 Transistor as a VHF Amplifier/Multiplier. Results @ 27 MHz are:- Vin = 100 mV Vout = 5.0 V. [R1 changed from 47K for Vin = 100 mV, to 100K for Vin = 1.0 V.]



-- G. R. Grieve, Forrest, W.A.
[[The Motorola MPF-102 is also cheap, and likely considerably more available than the T.I. items; ask Cannon Electric, Melbourne]]

4] Articles have been published in many journals dealing with transmitters, and with transistors in general, but I have yet to find more informative articles than yours. BV_{ebo} was something I have never heard of until I became a subscriber to EEB. The saving in open-base circuit transistors has amply repaid me for my subscription already!

I have been an ardent transistor experimenter for some time now, and at the moment almost at the end of a long project of a 14Mc SSB transceiver. At the last count I was up to 27 transistors and 10 diodes, and I still have the driver, p.a. and power supply circuits to build. Due to the abovementioned difficulties with BV_{ebo} I have been temporarily diverted into the construction of a transistor voltmeter to measure drive voltages. Perhaps you now see why I anxiously await your article on the subject. The present line of attack is basically a simple affair using an FET [MPF102] with a balanced meter circuit. A reasonable input impedance of 10MΩ on d.c. is being aimed at comparable with a VTVM. This, of course will be preceded by a diode probe, although I have been toying with the idea of another FET for this.
-- P. Lumb, G3IRM, Suffolk, England.

[[If you wish to show your gratitude, you might send us an article on your projects, one article for each! Or at least circuit diagrams with a few words of explanation. --Ed.]]
[[For an apparently very good FET-VM, see Radio Electronics, Oct 1967; Cf EEB, Vol 3, P142]]

TRANSISTORISED CAR REGULATOR SYSTEMS -- Staff

This is a subject which has always fascinated us, so that we thought that you might be interested in two such systems which have been published. Although this does not cover the subject of regulation of alternator systems appearing in the newer automobiles, those already contain their own sophisticated regulation systems. The following are useful to replace the ordinary vibrator-type regulators which have an annoying tendency to wear out, and to produce much radio interference.

The system described by G2IG on P.95 of the February 1965 RSGB Bulletin is designed for positive earth, shown here as Fig. 1. The circuit is pretty obvious. TR1 picks up voltage changes through the zeners CR2, 3, and feeds current through the emitter followers to the field winding, F. TR4 picks up signal across R4, therefore acts as current regulator. Field resistance in this instance was 6Ω, so Ie of TR3 = 2.5A when V_d = 14V. Ic of TR3 = 2.5A, Ic of TR2 = 50mA [depending on gain]. WL = warning light circuit of ignition, as usual. One weakness of this circuit is that CR2 and CR3 zeners must add up to about a volt more than the fully charged battery, or about 16V; this is difficult to accomplish unless you are able to select them from a large number. The circuit of Fig. 2 makes this feature adjustable, and is able to eliminate TR1.

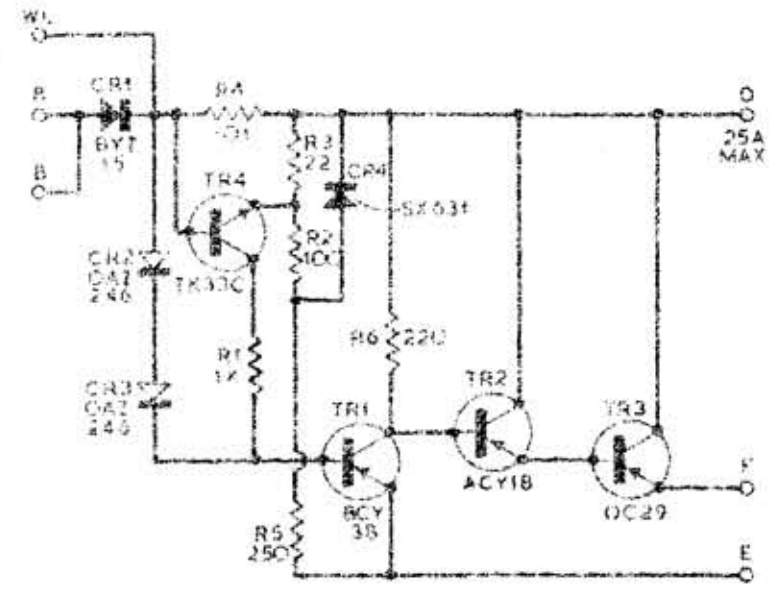
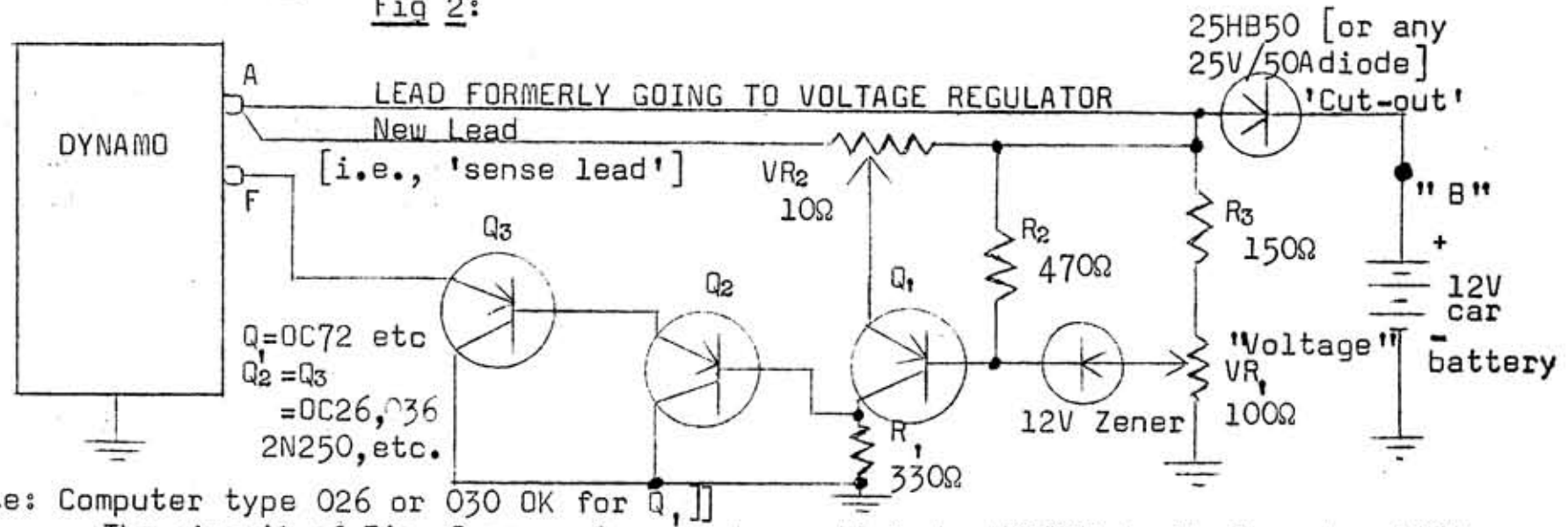


Fig. 1. Semiconductor voltage regulator and current limiter designed for a Series IV Humber Super-Snipe.

Fig 2:



[[Note: Computer type 026 or 030 OK for Q1]]

The circuit of Fig. 2 comes from a nice article by VK5ZBE in the November 1967 issue of the WIA/VK5 Journal. Negative earth is assumed; this will be likely for most non-British cars, but you cannot take it for granted; it must be determined unequivocally for each car. Presumably a positive earth system could be made by permuting Fig. 2 into Fig. 1 with a little experimentation. Similarly, this system will probably work for 6 volt systems, with suitable values of zeners and resistances.

In Fig. 2, the problem of the 0.01Ω resistor is avoided by a "sense lead" connected directly to the armature terminal of the dynamo. Evidently the resistance of the old "A" lead is used in place of the resistor; if necessary for control, however, this [old] lead may have to be lengthened somewhat, but this is easier than adding

fractional resistance values   To adjust the Fig. 2 ckt [presumably similar for Fig. 1], substitute a 12Ω,25W resistor for the battery. Adjust the regulator for 13.5V. Adjust the current control for about 25A. Be sure to build sturdily; cars cause much vibration... By the way, Fig. 2 does have an advantage, in that the collectors of Q2 and Q3 can be earthed directly, thereby dispensing with mica insulators; use silicone grease between transistors and heat sink.

In the next EEB or so we hope to bring you a few details about Condenser-Discharge ignition systems; the conventional transistorised type has been covered quite adequately in Vol I EEB and in Radio TV Hobbies about the same time. [The Vol I EEB article will be repeated in our 'Anthology' in due course]

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ADVERTISING [Personal Adverts free if reasonable length. Commercials, $1 half page, $1.50, full page]

WANTED. One 200W Mains Transformer, with at least primary intact ... cheaply perhaps? -- C. Horwitz, 81 Prospect Road, Summer Hill, N.S.W. 2130.

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AUSTRALIAN ELECTRONICS [76 View St., Hobart, Tasmania 7005] regrets to announce that a great lot of transistor sockets sold rapidly, and are no more. Also no more 'Parametric Amplifiers' by 73. 'VHF Antennas' temporarily out of stock. And: No more Computer Boards!

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MORE DETAILS about the AR7 advertised on P.160 This is a General Purpose Communication Receiver, almost identical with the American HRO, but produced by AWA. Many hams are using the AR7, and it is a popular item because of its high performance. As with nearly any receiver under $200, however, it will want a product detector for SSB. It uses 5 coil boxes for bands 500Kc to 30Mc. The main tuning dial is large and smooth, and spins over the range smoothly. The Rx has all the usual functions of a good Communication Receiver: 2RF, 2IF, Xtal and phasing, variable IF selectivity, ANL, S-meter, AVC, etc. This one is complete with separate P/S. Size 19x10x10 in. Wt about 40-50 lbs. Silver grey finish. The set is in good order, and the price is favourable. $70, f.o.r. -- A. Shawsmith, 35 Whynot St., West End, Q'land. 4101.

STOP PRESS: A.E. has acquired a modest lot of a lower quality transistor socket -- at a lower price. $1.05 per dozen. Quite adequate. Don't delay this time.

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LETTERS [Contined from P. 184]

5] I take a very basic view on the use of tubes vs transistors. I use a transistor where its characteristics fit the circuit requirements, and a tube when its characteristics do likewise. I do not use transistors just for the sake of using them. Transistors can have grave restrictions when problems of dissipation pulse operation, or linearity are concerned. Most of these problems occur in high power transmitters, in SSB, and in receivers capable of working into high overload conditions.

For small signals, high density equipment, and on-off operations, you can't beat transistors and their use is proper. But to use transistors just for "one-upmanship" as is often done, to the detriment of performance ... I just don't see it.

On the other hand, progress in transistors and circuits is opening up new applications. For example there is a low frequency 50KW transistorized amplifier built for the Navy, consisting of 10 modules, 5KW each. Each has a multiplicity of transistors in switching mode -- an "on-off" type of Class C amplifier, with suitable circuits to smooth out the birdies. It seems like an odd way to do it, but the overall efficiency is close to 90%, from power mains to antenna. And you can't do that with tubes ... And, QST has an article this month about a transistor preamplifier for 1296Mc with a 3db noise figure.

I was talking with some engineers the other day, and asked them where transistors would be in a few years. They showed me a 50W, 500Mc transistor, and their goal is 50W at 1000Mc. For ordinary low power applications, they predicted that the dual gate FET would take over [e.g. of the 3N140 type]. Its high input resistance would be protected by a built-in zener diode, making the transistor impervious to static charges. Plastic versions, good up to 500Mc or so would probably sell for 50c or so, [Continued on P.188]

A SINE WAVE REGENERATIVE SWITCH! [or "SINE WAVE MULTIVIBRATOR"!]Ref: Dec EEB, P.165

We have just come across an interesting variation of the Metronome's 2-transistor oscillator in the RSGB Bulletin for April 1961 ["Technical Topics", P.472]. Since it bears a certain resemblance to the PUJT circuit used in the Metronome [with resistor No. function roughly equivalent], and since it is unusual in producing a good AF sine wave, we present it for your interest. The configuration is, however, not complementary, and this requires that the feedback be obtained from the emitter rather than collector of Tr2 [through R4]. Conversion of this circuit to complementary [NPN/PNP] is left as an exercise for the student. When L is a high-Z headphone or equivalent, voltage developed across it is about 0.3V, and is "almost pure sine wave output", at about 1500cps, with the values shown. A good sine wave is very useful as a generator for signal to a balanced bridge; distortion products blur the null. An amplifier of conventional design can be used to increase the output.

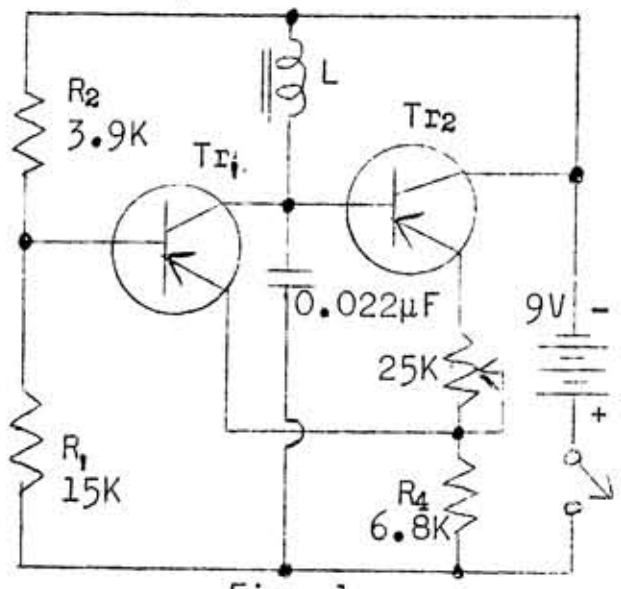

Fig. 1

A sine wave is not nearly as pleasing a sound as a distorted wave, therefore for code practice or other aural applications, the circuit of Fig. 4, P.167 December EEB is more suitable, with Sw2 on, and R4 and R2 adjusted to give continuous oscillation;* if less volume is required, lower battery voltage can be used, or S_1 can be shunted by a resistor; for serious purposes, the Sw3 system is unnecessary. For generating the purest sine waves, a Wien Bridge Oscillator is better [Ref. EEB, June & July 1967], but more complicated... Ah what an embarrassment of riches; I remember when it was a real problem to find a simple circuit for a transistorised sine wave oscillator. A proper Wien Bridge sine-wave oscillator with very low distortion is described in the Schwartz Selected Semiconductor Circuits Handbook, P.5-38, and in the Techpress [identical] equivalent, Vol I, P.138. Just for the record, the Schwartz reference also contains a very low distortion Twin-Tee oscillator [P.5-35] and, surprisingly, an ordinary feedback type but designed for low distortion [P.5-31]; it is interesting to see what can be accomplished with ordinary circuits, with good design.

A valved equivalent to Fig. 1 is described by W6VAT in the April 1962 73, but he uses it as a proper multivibrator with resistance load, producing square waves. Simple one-tr base-leakage sine wave osc in EEB Oct 1965 P3-4, & July 1967, P. 78-79.

Concerning PUJT's and Regenerative Switches:

Although the two-transistor regenerative switch [which we have christened the 'Pseudo-Unijunction Transistor'] is a favourite configuration for use as an 'analogy' for the operation of SCR's [see Fig. 2], its unique properties mimicking SCR's, UJT's, SCS's, or Tunnel Diodes have not until recently received the recognition they deserve -- not counting our own discussions on the subject [EEB P. 165]. Now we have discovered the 'RCA SCR Experimenters Manual' < available from an EEB Advertiser > beginning with operation on P. 24, and continuing throughout the book in a glittering array of useful applications! Requirements for substitutions by locally available components are fairly obvious-- but remember that we have 240V mains rather than 120V. For theory of operation see 73, May 1962, p. 30-31; GE Tr. Manual, 7th, Ch.16.

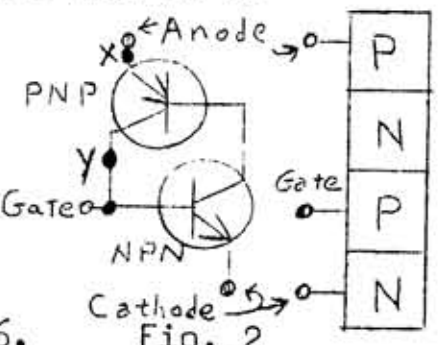

Fig. 2

In the RCA book, the PUJT is used primarily only as a UJT, but it is also capable of function as an SCS [see Refs, EEB, Vol. III, p. 165], Tunnel Diode [EEB, May 1966, and forthcoming], and as a Shockley Diode. This latter is analogous to the application as Tunnel Diode, but with a zener diode between points 'X' and 'Y' in Fig. 2, with cathode at 'X'. For some fascinating applications of the Shockley Diode [for which we should substitute the zener-modified PUJT], see 'Four Layer Semiconductors' by K8AOE, 73, Oct 1962, p. 16ff: Very fast retrace CRO sweep generator, multivibrators of various types, RTTY keyer, keyer, etc. Presumably the PUJT can be used in place of any UJT or the others in various ckts, e.g. in the G.E. SCR Hobby Manual. See also 'G.E. Tr. Manual,' 7th Ed, Ch. 13-16.

* For footnote, see bottom on P. 189...: Sorry, but no room here for nice afterthought.

LETTERS [Continued from P.186]

and would have noise figures of 2 or 3 db, plus excellent dynamic range.
-- W. I. Orr, W6SAI, San Carlos, California.

[[I am very much in agreement with this commonsense view of transistors, although I have been approaching it, perhaps, from the opposite camp. I'm becoming less convinced that transistors should be used on principle, particularly where something else will work easier or better. This is glaringly obvious in the matter of transistors vs valves used as Class C RF amplifiers, as I discussed at length in the Aug & Sept 1967 EEB. I'm now working on a hybrid version, based on an interesting QST design, where power for rapid-heating valves in the p.a. is derived directly from a transistorised modulator. There is no reason why this principle couldn't be applied equally well to SSB, though of course as with all matters involving that exalted mode, it would be more complicated. -- Ed.]]
[[As you may have noticed, I have been stressing the need to acquire familiarity with valve circuitry in order fully to understand transistor applications; I am not alone in this opinion, and only the most rabid transistorites think otherwise. And I have frequently mentioned the "Radio Handbook", published by Editors & Engineers as an excellent basic text. It is worth having on the bookshelf of every experimenter, and its only drawback is its prodigious cost. This can be made considerably less painful by sending away for it to "The Bookstore" as described on P.126 of the Sept 1967 EEB, as indeed for nearly any American technical work. For those of you who despair at the outrageous prices demanded in most Australian bookshops, the article in the Sept EEB is required reading. -- Ed.]]

-- The following comment was received on the above exchange:

6] I have seen the description of that Navy 50KW transmitter, and it is a horror, so Bill need not be so generous to transistors. It is designed for use at about 50 to 150Kc, and the actual mode of operation is to "synthesize" the output waveform using switching, and as far as I can gather, it cannot be modulated, and this is only suitable for pulse code systems; very pretty, but horribly complicated.

[Letter continued on P. 189]

AS AN INTERESTING BACKGROUND TO THE ABOVE EXCHANGE WE REPRINT THE FOLLOWING ITEM:

Australians: See the last issue of 'Miniwatt Digest'

Letters [Continued from P. 188].

Comment: Why does everyone want to know where transistors are going in the next few years? Valves are making just as much progress in their own field. For example, Nuvistors in a TO-5 case, 750mW anode dissipation, 9.8mA/V [9,800 Micromhos], r_p = 6300 ohms, μ = 62, etc. THESE FIGURES ARE THE SAME ORDER AS A TRANSISTOR!!!! But in addition, up goes G_c. Indeed, G_c and h_{fe} for a good valve leaves any dual gate FET out in the cold.
-- R. A. J. Reynolds, VK7ZAR, Newtown, Tas.

[[Rod has developed a sophisticated considerably improved design for that strange switching p.a. system, and we hope to publish the bones of it here, if he can clean up the maths from the IREE version. It uses a switching system analogous to Pulse Width Modulated power amplifiers, but considerably more complicated. It eliminates completely all problems of collector voltage breakdown associated with ordinary Class C p.a.'s, but substitutes for them a requirement for close switching control; if the switching goes wrong, two power transistors appear [instantaneously] directly across the power supply, with results which need not be imagined. -- Ed.]]

7] Beside myself with rage at my own stupidity which has cost me nearly $90. Don't think this is any good for "Should have known better" but it can at least be a WARNING TO WANTONS, said wantons being those silly enough to mess around with micrologic integrated circuitry.

Working on a rather sophisticated project with Fairchild modules. They are very delicate. In early experiments I managed to get some feed-back in the apparatus and buggered up a decade counter and decoder driver, $30. Got everything going nicely and demonstrated it today to the customer who was very happy with its performance. All that remained was to clean up a few boards etc. and tidy up some wiring. Expected to deliver the prototype next week and collect some "loot". It contains two counter tubes with 150 volts on their anodes, fed from a separate tapping on power supply, with its own rectifier and condenser [.16 MFD]. The rest of the gear is fed with 4 volts and 12 volts again with separate rectifiers and condensers [2,000 MFD].

For added safety [?], when the power is switched off I always disconnect the 150 volt lead from the terminal on the decade board, so that I can check that everything is quite O.K. before reconnecting it prior to next switch on. Sounds alright, but it wasn't! While the gear was switched OFF and I was attending to the wiring, the 150 volt lead inadvertently fell across the 4 volt terminal. I saw and heard a spark - there was still a residual charge in the .16 MFD condenser. Didn't worry as I felt sure that the 2000 MFD condenser on the 4 volt supply and all the rest of the gear [about 20 standard transistors] would absorb the rush of current. They didn't! When ultimately I reconnected and switched on the thing failed to operate. Yes! The micrologic units had busted - all four of them, $60. But none of the other transistors, condensers etc. suffered any damage. The peak could only have been for a fraction of a nanosecond but it was evidently sufficient to bust the tiny units in the modules. As you once remarked in postscript - "Nuts on modules". Now that the horse has bolted. I'll fit a bleeder resistance on the 150 volt ten so this cannot happen again. -- "Electroloon", Victoria

---

* [Footnote from P. 187]: In the February 1962 73 [P. 62], K6EAU presents a Code Practice Oscillator using the PUJT configuration, similar to that of Fig. 4 of our Metronome circuit, but using a crystal speaker [or earpiece?], serving also as the feedback condenser albeit in a different part of the feedback loop; see Fig. 3. If an inductive load were used as in the Metronome, a 0.003µF could be used in place of the crystal unit. See also P.371 of the 6th Ed of GE Transistor Manual, or P. 378 of 7th Edition.

This oscillator, or any of the others can easily be used as CW Monitor as long as power requirement is low, simply by replacing the battery by rectified voltage obtained from RF stolen from the transmitter-- preferably via a low Z coupling running into a paral. resonant tank, as is customary for RF pickup for a CRO.

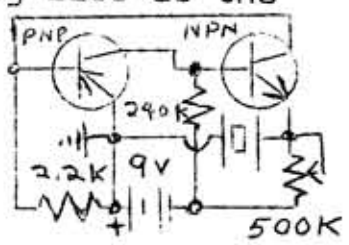

Fig. 3

8] [Reprinted from 73, August 1967]
Isn't it time u wr eliminated? DSB would defeat ur narrow bandwidth. I prefer AM for audio quality. SSB has no base power. It sounds rotten and I've listened on a lot of new rcvrs too. Splatter is terrible. SSB commercial fad--I don't want a xcvr.. Even if you can make 1 kc precision gear--but u will never hve perfect operators!! It isn't the gear so much as those sloppy unrespectful operators on the air, particularly SSBers. What about static on SSB--ha ha. Wipes out SSB. SSB-- Scientific Step Backward.
--John Fickeisen, WB2IQE, Moravia, New York.
"Punctuation ours--grammar his! -- 73 Editor"

[[EEB Ed Note: No doubt this entertaining piece was in response to a 73 Editorial that suggested that AM be eliminated formally. Although the above item is amusing, there is much boney truth in its phrases. Aside from several cogent technical arguments, including actual space on progressively more crowded bands, questions of VHF equipment stability, the desirability of FM, the uses of DSB, and the question whether a badly adjusted AM is worse than an SSB adjusted by the same operator--aside from all that, the fact is that formal elimination of AM would be an intolerable infringement of the freedom of experimenters, and a mandatory and unnecessary complexification of equipment operating under conditions where SSB is neither necessary nor desirable. What is the good of the argument that communication efficiency is increased by putting all of the power into the sidebands? It is the same old QRO argument that says essentially, let's operate with the highest possible power, so we can have a natter. For that why not use the telephone, with perfect VOX? QRP AM operation tests real amateur skill of construction, antenna technology, and operating proficiency--and with all the many manifest advantages of ease of transmission and reception of AM. If "AM" is a dirty word, and if TVI is a problem, NBFM has many advantages, and even some of the advantages of readability of SSB [with a better signal/noise ratio]. G2HCG points this out cogently in the Sept 1960 issue of the RSGB Bulletin [P.106], showing that it suffers less problem from interference of all kinds, given and received, much easier to build, adjust, and receive--if detector is suitable. The matter of interference is no small one on VHF, where antenna gains can produce signals of the same order of magnitude as from high power TV stations. And so forth. The Editorial in the Sept 1965 issue of "Amateur Radio", by VK3ZS is also worth rereading... Oh nuts, I'm not going to succeed in scuttling Progress singlehandedly, but I certainly resent the increasingly unnecessarily complicated development of our technology, where new things are grasped because they are newer or smaller or cheaper or quicker, without any real consideration of the human beings behind the knobs. Like Modules and Integrated circuits and the rest,* SSB may be better for some kinds of communication for some people, particularly if they are willing to suffer its own kinds of disadvantages. But it is arrant nonsense and a cruel abuse of technological power to demand that we should all fit into this ethnic conformity. If, in the interests of efficiency, our world is going to demand that individuals be sacrificed to the tastes of technocratic fashion, I'd just as soon get off.]] Lots more discussion on compulsory SSB in Letters to Ed of subsequent 73's.

9]... Re Puzzle in Dec EEB, seems likely 'X' generates a peaky waveform, whose peak to avg value is large. At A, the meter looks at half wave avg, but at B a full wave rect. charges a loss-free capacitor to the peak value of the waveform, viz, 1100V. Definitely not a sinusoid, more likely a square pulse of short duration... I have a considerable number of transistors with illegible numbers from ckt boards. How to decipher?... I built the Metronome < Dec EEB > which promptly blew up a few 033 and an 083, before settling down properly, even though no other components were faulty. Why?? --R. Klar, Tottenh,Vic.

[[Ed Reply: Several people made similar comment on Puzzle, but although on the right path, they still haven't said what is in 'X'; no amplifying components there**. Re illeg. transistor markings, see forthcoming article in 'Amateur Radio' which will explain all... Very interesting about the popped transistors in the Metronome. Probably due to the amazingly high peak currents [remember: Inductive Load !], and some transistors stand up to it better than others. Didn't encounter this trouble with several we tried, but it is possible. Probably a good idea not to use a supply over 3V; it works well with 1-1/2V]]

*cf. EEB Vol III Sept 1967, P.120.; Dec 1967, P. 175. Also last page of this issue.
** More, much more about this next month. A remarkably complicated yet simple answer.

NOTE FROM EEB:
FOR YOUR CONVENIENCE, AND TO HELP THIS NEW MAGAZINE OFF TO A START, YOU MAY SEND US EQUIVALENT $A, AND WE'LL SEND THEM THE $US FOR YOU.

See also the controversial article by W6SAI in 73, Nov 1963, p. 69, and Feb 1964 p. 81. And the only intelligent reply to it (amongst many), by W4LCY in 73 in May 1964, p. 54. All very relevant to the points raised by VK5ZQ on P. 1 of this issue's EEB.

CBers, Novices, and all that Jazz

Dear 73,

A short, though pointed, dissertation upon your July editorial, if I may.

First, although I try to keep abreast of developments in hamdom, and regularly purchase most of the magazines in the field, I am not myself an amateur. This is not due to lack of ability—I could pass the test tomorrow with no difficulty. My choice was based upon a lot of consideration and thought.

. . . It is my own personal observation that the Citizen's band has done more to afford hamdom new members than you realize . . . I can point out a dozen in my area who have forsaken CB for the ham bands, if for no other reason than to be able to talk without incessant "break-break-break" from some loud-mouthed moron whose brains are wired to switch off when he hits the mike button.

Granted, initially, CB holds a sort of appeal to a newcomer to radio . . . plunk down $8, shell out a few more bills for a full-house peanut-power transceiver, and presto—instant radio. For a while it is the greatest thing since puberty. However as time progresses, and one gets to know the type of clowns who share these bands, he gets an itching to go somewhere where the people are a shade more sane, and considerably more intelligent.

I think it is well to look elsewhere for the source of the apathy which is running amateur radio down the ramp behind the dinosaurs and the dodos.

I would offer this possibility. That ham radio has simply lost all it's glamour, as I believe you pointed out. There was a day when to be a ham, one spent long hours burning the midnight lights, sweating over a hot soldering iron, cussing an occasional scorched thumb, and laboriously piecing together a home-brew monster that, with a healthy dose of miracle working, might possibly work.

Today the ham is a new breed. He memorizes the code, bones up on the theory, and lays out a wad of the long green for a room full of prewired, pretested, guaranteed-to-work-or-your-money back, appli-ances with their aesthetic chromium knobs and pretty lights.

Frankly, ham radio has been overwhelmed by science. I do believe that, as you noted, more good PR will alleviate this apathy somewhat, and the news of a ham rig on the moon will draw a lot of fence riders into the pasture. Howevermuch, we have another question . . . why does hamdom need more hams?

Evidently, there are too many hams on the air already, without adding to the confusion. You may well point out the huge silence which envelopes the VHF bands, and I fully agree. But it is one thing to promote them and quite another to get John Q. Ham to go up there and clear out the lower bands. VHF is the playground of the elite amateur who is well up on his theory and who can do more than twiddle knobs and call CQ.

So there the situation stands—a few hearty souls up on the high end and all the other 99.5% crammed like sardines into 80 thru 10, fighting tooth and nail for a few unmolested kHz on which to carry a QSO.

What we need is not more amateurs, but more HAMS of the old school who don't rely on their wallet, and who aren't afraid to try something new and different.

This is one major reason I am avoiding becoming a ham myself. There is no one around here on VHF and I'll be damned if I'm going to get into that rat-race on the dc bands. I'm going to just stand back and watch, as hamdom strangles itself to death, because nobody has the brains to get out and go up, and the low bands will gradually turn into mass confusion.

As I see it now, more amateurs will kill ham radio, rather than cure it.

If you can present a convincing enough case, I'll go for the ticket and join the hysteria. I don't suppose that one more carrier will matter that much . . . will it?

--Bob Renaud
Washington, Mass [U.S.A.]

[[Now if we could get a few more hardy souls to try 432 and 1296 [Mc] in northern New England.. 73 Ed]]

The true value of horse sense is shown by the fact that the horse was afraid of the car during that period when the pedestrian laughed at it.
—Quoted in Atlanta Times.

The above item reprinted from October 1967 issue of 73, P. 109, together with the part which didn't get included by the electronic stencil. In an advertisement by a manufacturer of quite good American electronic equipment, they state "All it takes is.... parts PLUS Patience, Workmanship, Integrity, Experience and Know-how." It does indeed.

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CONTENTS:

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A 50Ω 50Watt INDICATING DUMMY LOAD

-- G. R. Grieve [VK6]

The circuit shown in Fig. 1 shows the results of a few tests, to obtain a simple direct-reading RF Wattmeter and dummy load. This device makes it much easier to test

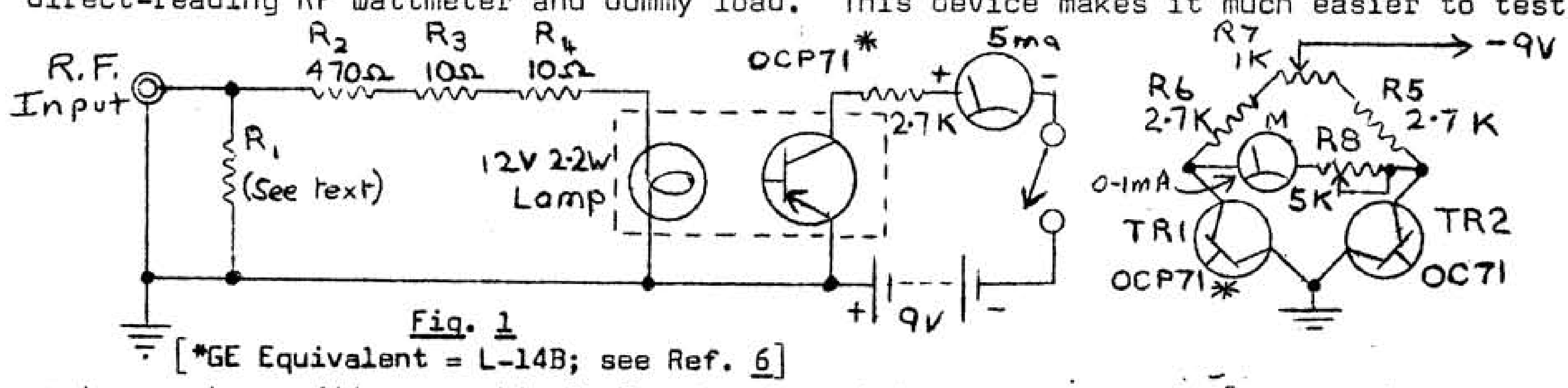


Fig. 1

[*GE Equivalent = L-14B; see Ref. 6]

or tune a transmitter, particularly when transistors are involved [tune for maximum output]. A number of 1W resistors are placed in parallel to give the desired resistance. They must be the composition [preferably deposited] carbon type, not wire-wound. -Ref.13- In Fig. 1, for 50Ω, eighteen 1K 1W resistors are paralleled to form R1; R2 and the others form part of the total resistance. The resistance of the lamp, L, varies from 8 to 11Ω, but this change is negligible in comparison with the other resistances.* For 75Ω input, R1 should consist of seventeen 1.5K 1W resistors; for 300Ω, R1 could be seventeen 680Ω paralleled resistors, and R2+R3+R4 = 1.2K. [But see later discussion, Fig. 5].

The conventional method for paralleling resistors in a dummy load, is to drill holes in two circular pieces of metal, insert the leads of the resistors into the holes, and solder carefully; this forms a sandwich of the two discs with the resistors between. A bit of room should be left between each resistor. A good method of feeding the lot is to install a female coaxial connector in the middle of one disc, and run the centre wire to the other disc. The leads to the resistors should be clipped off quite short, but soldering must not transfer too much heat to the resis-

* This increases reliability, and is a notable improvement over systems of Refs. 9-11

tor body. Use a hot iron, pre-tin all surfaces, and apply heat only briefly, using plenty of solder. Nearly any type of solderable metal may be used for the discs, but best is No. 18 gauge copper of the type used for flashing on roofs.

All parts may be mounted in an ice cream or tobacco tin of suitable size, or in a conventional rectangular aluminium box. The main requirements are that it be r.f. and light tight. This prevents r.f. radiation, and leakage to the phototransistor. The signal from the phototransistor depends on the amount of light from L, which is determined by the voltage across R1, and thence by the power dissipated by the lot, according to the classical:

P= Power (WATTS) dissipated in resistance, R. (Ω)

[1] $P = E^2/R.$ E= Potential developed across the resistance. (V)

The range of this instrument can be increased or decreased at will, merely by changing either the lamp or the distance between phototransistor and lamp. Once determined, however, the geometry should be fixed firmly to preserve calibration. Calibration of current reading vs power input must be done individually for each installation, so there is little point in reproducing my curve here. The system shown in Fig. 1 has an advantage that the curve is fairly linear over the middle two-thirds of the range.

The power rating of the unit will depend on the number of resistors used for R1. Since RF power is usually rated for RMS, this unit will handle about 20W continuously, or 50W intermittently. If your likely maximum power range is lower, the numbers and values of resistors in R1 may be reduced appropriately, for an increase in frequency response [and decreased cost]. For higher power, more resistors [of higher resistance] can be paralleled.

The limitation of this device is the leakage current of the phototransistor, which varies considerably with temperature; readings should be made relatively quickly. This could be compensated for by the use of a circuit such as that of Fig. 2, which balances out the leakage in a bridge, with zero adjust, R7. R8 can adjust calibration electrically for a given physical geometry, and its value will depend on the sensitivity of the meter movement used. For temperature compensation, Tr2 should be in thermal [but not illumination] contact with Tr1.

For the benefit of newcomers to electronics, I should mention that a phototransistor may be obtained at modest cost, by scratching off the upper third of paint from an ordinary OC71. Results are quite satisfactory, compared to an OCP71 if the axis of the transistor is oriented to the light for maximum signal. Much better than cutting the top off of a transistor! [Ref. 6]

If care is taken with the physical arrangement of R1 and the coaxial socket system, this device should give consistent readings up to 50Mc, and probably higher [Ref.13] This will depend on the size of the R1 unit. For example, another system [Ref. 3] was good up to about 300Mc with R1 being only a single 2W resistor, with short leads everywhere. If calibration is made with ordinary 50 cps alternating current, calculated RMS power should be multiplied by two to give peak power. Peak power, however, would only be relevant for SSB and other peak-operating systems, so that main calibration can be in RMS. A calibration curve may be drawn, or the meter face may be calibrated directly, depending on your ambition. Obviously, if you wish the maximum accuracy at VHF, the voltage across R1 should be measured with a proper diode r.f. probe and valve voltmeter, at the highest frequency to be encountered. From this the power is calculated according to Equation [1].

Editor's Addendum:

This system is superior to those using light bulbs as the only dummy resistance [Eg: Refs.1,9-11], because the resistance of light bulbs varies enormously with voltage across them; for example a 100W lamp will have half the resistance at 5W or less as at 100W. One idea from Refs 1 & 10 might, however, prove useful: If you have an old photographic

light meter it could be used as the light-sensing device, with very good sensitivity. It also has a scale which is usually logarithmic, and this ought to straighten out the calibration curve. Alternatively, an ordinary selenium photocell plus meter could be used. It would have the advantage over Fig. 1, that temperature sensitivity and leakage would be negligible, but a sensitive meter is desirable. See also my discussion of Refs. 7 & 8.

In Ref. 2 is described an interesting variation of the Dummy Load/RF Meter, which measures the voltage directly across R1, by using a rectifier. This is shown in Fig. 3:

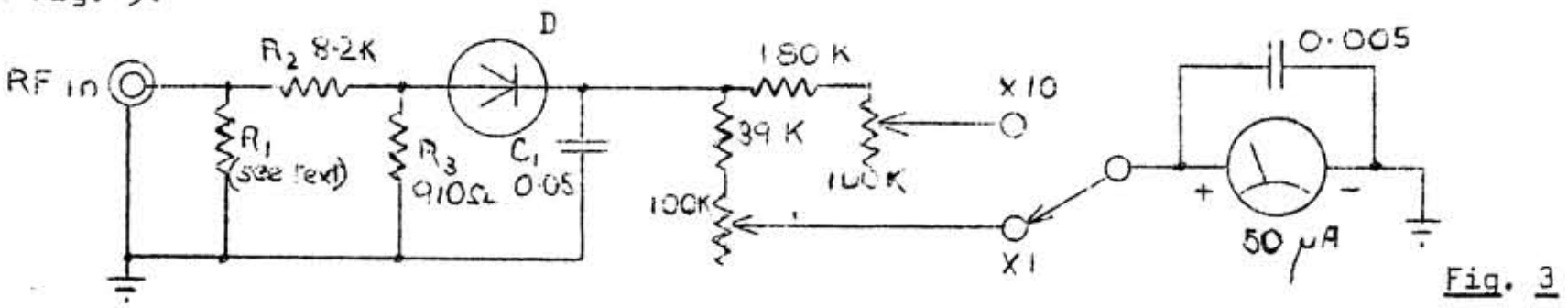


Fig. 3

In this case, R1 consisted of thirty 1500Ω 2W resistors in parallel, with the usual sandwich geometry. It was rated at 60W continuous, or 100W intermittently. The system was calibrated by measuring the voltage across R1 or R3 with an r.f. detector probe and associated conventional valve voltmeter. Voltage across R3 is 0.1 of the voltage across R1, and this is useful when the voltage encountered across R1 exceeds the PIV rating of the r.f. probe. The power is calculated from Eqn [1], where R = R_1. In the American article they calibrated the meter directly in peak watts, presumably for the esoteric requirements of Citizens Band transmitters, but here we shall be satisfied by RMS. Note that the instrument needs to be calibrated with the r.f. probe at full scale only [in this case, 5W or 50W], and that all other calibrations on the meter can be determined by the relative voltage across R1, and the formula. In my opinion, if C1 were increased temporarily to 0.5μf, calibration could be made at 50 cps, and would be reasonably good up to HF. For best accuracy, of course, the r.f. probe would be necessary.

In Ref. 3, a similar arrangement is used as in Ref. 2, but a valve voltmeter is used as the detector, so that the circuit simplifies to Fig. 4. It has the advantage that the unit is its own r.f. probe, and power can be calculated directly from the VTVM's d.c. meter reading, according to:

$$[2] \qquad P_1 = \frac{[Vm + Vd]^2}{R_1}$$

where Vm = d.c. meter reading, Vd = voltage drop across the diode. If the diode is a 'gold bonded' germanium type such as 1N281 or OA5, Vd = 0.1V. An ordinary germanium point contact diode such as OA90 or those on computer boards will have Vd = 0.13V or so. Silicon types [OA200, black silicon on Boards] will have 0.3 to 0.35V. Note that R2 and R3 form a voltage divider with the usual 11 Meg input resistance of a valve voltmeter, so that Vm is 0.707 of the actual diode voltage, giving RMS volts reading. If the VTVM has a resistance different from 11 Megs, R2 should be changed accordingly.

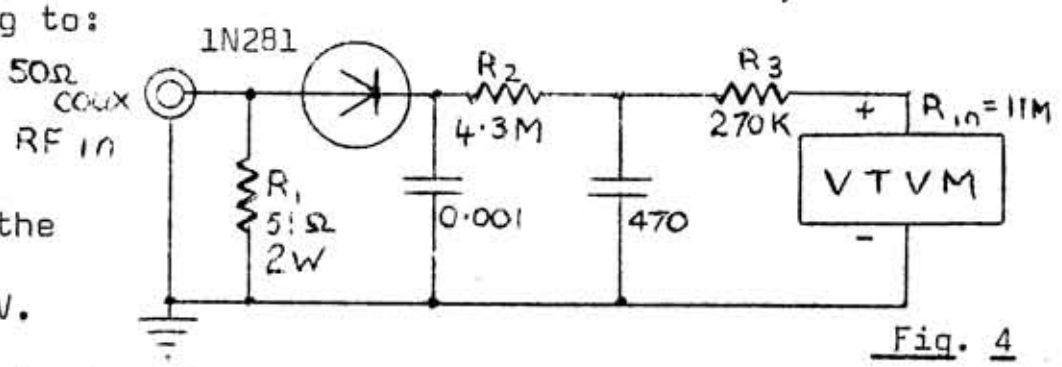


Fig. 4

The systems of Figs. 3 or 4 are particularly adaptable to use at very low power levels, as you might find with small transistorised equipment, while the system of Fig. 1 is less adequate below 1W, because of the finite power required to light the lamp. This could undoubtedly be improved as desired, by the use of a more sensitive lamp, and a more sensitive light detector, or merely placing Tr1 closer to the lamp. Any of these systems could be used to measure power from a system having a higher characteristic impedance than R1, without the inconvenience of having to change the

cf: Refs 1 & 8

value of R1, simply by putting an external resistance in series with the input to the dummy load. The voltage across R1 will be less in direct proportion to the fraction of total resistance, with power reading being reduced in the same proportion. Thus, if the added series resistance is Rs, if Pt is the power to be measured, and if P1 is the power in R1 according to Equation [2], then to measure Pt:

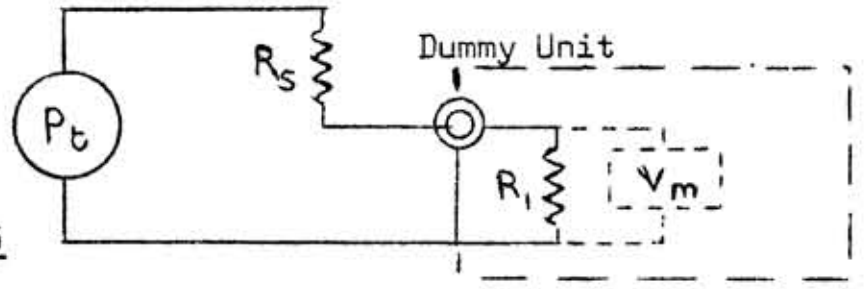


Fig. 5

$$P_t = \frac{P_1}{R_1/[R_1+R_s]}$$

$$= [P_1][1/R_1][R_1+R_s]$$

It should be noted that the power delivered to an antenna will not necessarily be the same as read by this instrument. It will depend on standing waves on feeders, and on various reactances. The noninductive load presented by R1 is ideal, and it will be a rare antenna that will present a noninductive load to the final. Therefore any antenna reactance must be balanced out with the coupling controls of the transmitter. This can, however, be done as a final adjustment, with all preliminaries being accomplished with the dummy.

The use of the dummy allows not only power level measurements, but also various experimentations, without risk of interfering with other signals. It can be worthwhile to install a coaxial switch or relay so that the Dummy can be used rapidly and conveniently. Among the experimentations possible is the worthwhile one of adjusting all circuit parameters to get the best efficiency--the most r.f. output for a given d.c. input to the various stages. This is most easily done with valves, e.g. by increasing grid bias and drive, consistent [however] with modulation linearity. With transistors some problems can arise, as discussed at length in the August and Sept. 1967 EEB's. For an excellent general discussion of RF Power Measurements, see Ref. 5.

References: [Owing to lack of space, References 6-12 will be presented and discussed next month]

1] 'RF Output Indicator' by John Wilson, 73, Nov. 1961, p.84.

2] 'Build Dummy Load and RF Meter', by E.F. Rice and A. Mueller, Radio-Electronics, Nov. 1967, p.50.

3] 'Accurate Milliwatt Level RF Power Measurements' by D.J. Bernays, K4UWX, 73, June 1962, p.18.

4] See also 'Aqueous Dummy Loads', by A.P. Marion, W2CUE, QST, June 1965, p.16. R1 can consist of wires dipped into conducting salt solutions, but there are plenty of problems.

5] Radio Frequency Power Measurements. U.S. Govt Publication NBS 536 [Nat. Bureau of Standards]

* *

HOMO MICRONESIS

'If a job's worth doing well, it's not worth doing at all' -- Australian Proverb.

I have been sneering at Microcircuits, and the modulisation of human values* particularly in reference to equipment used by experimenters. Nasty me.

I herewith give an open opportunity for rebuttal, to an eloquent dissenter, Chris Horwitz, of Summer Hill, New South Wales:

'You stated recently that microcircuits are not good. Why? Because they work first go; they don't go wrong -- i.e., component fatigue doesn't exist; they are small; they are fast. Surely, even with low-down amateurs, the idea, not the equipment, is the important thing. If the idea is worthwhile, why get held up by

*EEB, Vol. III [1967], pp.111, 120, 181. Vol IV; pp 3, 11, 12.

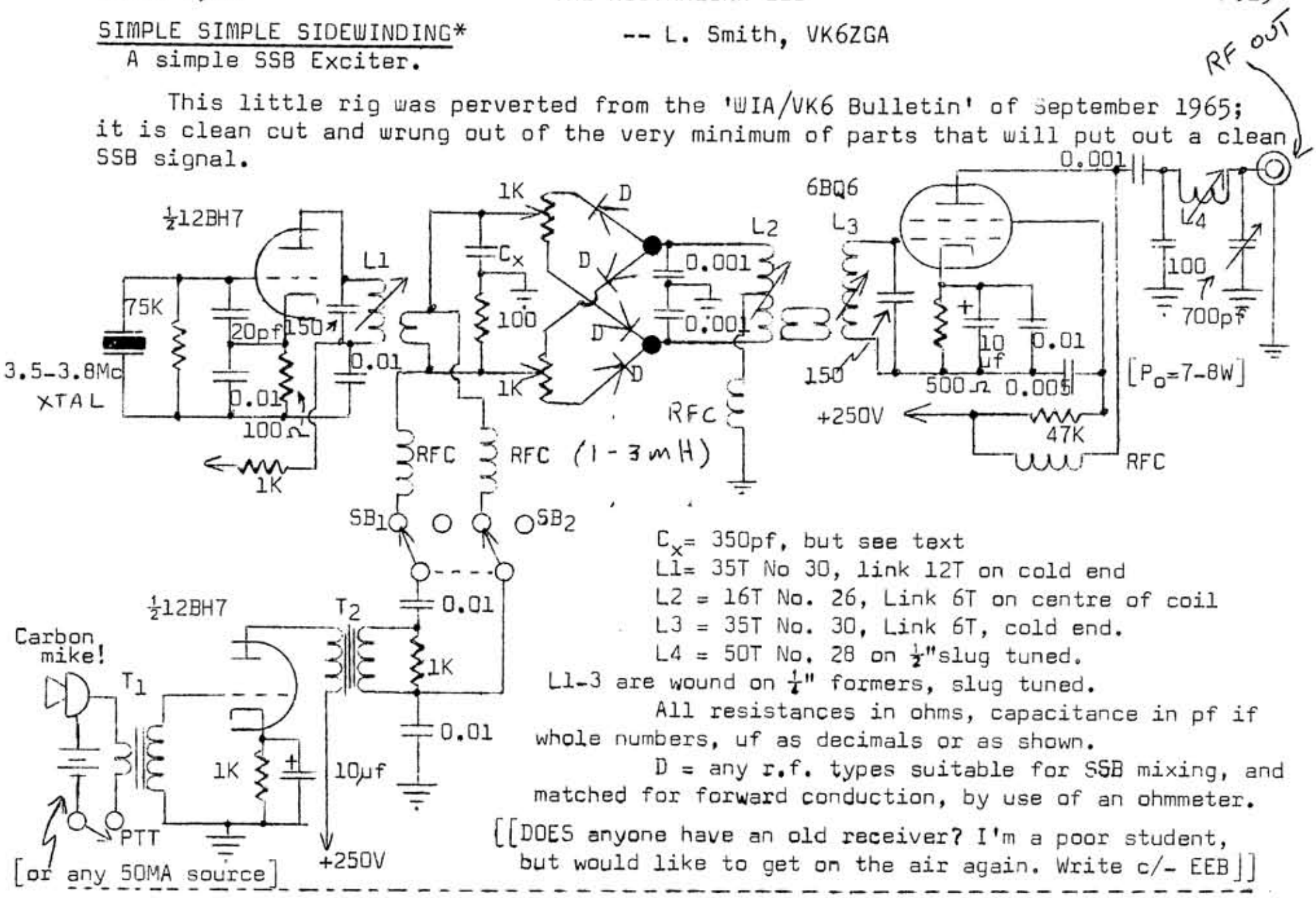
[Continued on P. 24]

SIMPLE SIMPLE SIDEWINDING*

A simple SSB Exciter.

-- L. Smith, VK6ZGA

This little rig was perverted from the 'WIA/VK6 Bulletin' of September 1965; it is clean cut and wrung out of the very minimum of parts that will put out a clean SSB signal.



Cx= 350pf, but see text
L1= 35T No 30, link 12T on cold end
L2 = 16T No. 26, Link 6T on centre of coil
L3 = 35T No. 30, Link 6T, cold end.
L4 = 50T No. 28 on ½"slug tuned.
L1-3 are wound on ¼" formers, slug tuned.
All resistances in ohms, capacitance in pf if whole numbers, uf as decimals or as shown.
D = any r.f. types suitable for SSB mixing, and matched for forward conduction, by use of an ohmmeter.

[[DOES anyone have an old receiver? I'm a poor student, but would like to get on the air again. Write c/- EEB]]

First off, the r.f. signal is fixed phased and so is the audio, but due to the fact that we are using a carbon mike with its limited audio band pass, it really works out fine for fixed phasing.

Measurements were made in actual operation, and we came up with these figures: 1200 cps: 30db suppression. 2500 cps: 20db suppression. 500 cps: 15db suppression. This may not be commercial SSB but it sure beats the pants [sic] off DSB.

Construction of this unit requires no special parts, and at that the tolerances are real loose. It is only necessary that the tuned circuits resonate at the operating frequency, and that the audio coupling transformer have about a 600 ohm output to the diode modulator. For this purpose I have used an ARC 5 Rx output transformer.

It is important that as little as possible of the xtal oscillator voltage get into the fields of the coils L2, 3, 4. Keep the osc coil, L1 as far from the other coils as possible to avoid trouble in nulling out the balanced modulator. The diodes must be in matched pairs as to forward resistance.

Don't think that by adding an extra audio valve and xtal mike you will improve the rig. The secret of the quality is in the carbon mike and its limited band pass, and added bandpass in the audio section will cause the fixed phasing to go too far out at both ends. If you want to build this rig for use on any other bands you can do so by making the tuned circuits resonate at the desired frequency. Keep in mind, however, that the r.f. phasing unit will have to be changed to present about 100 ohms to the balanced modulator and the link. This means that you will need only one half the capacity of Cx for twice the frequency.

* For Footnote, please see overleaf.

Tuning up the rig is simple. Unbalance one pot, and tune all coil slugs for maximum output. Tune the output pi network L4 and condenser for maximum. Then adjust the balance pots for minimum output. You are now in business, and ready to be called a liar, for it is not possible to build a phasing rig with only two valves. Or is it?

VK6GH suggests that Rx and Cx in the r.f. phase shift network shown as 100 ohms and 350pf be replaced by 68 ohms and 680pf. Also that care be taken to see that the screen voltage of the 6BQ6 is 175-200. A 6GQ6 is a direct substitute for a 6BQ6.

For a rather more elegant apparatus, see '5 Watts S.S.B. - Home-Brew Without Hangover', by Greg Johnston, Amateur Radio, Jan 1967, p.9. It uses a lattice filter, etc.

[Continued on P. 25D]

* *

ELECTROLYSIS FOR PRINTED CIRCUITS** -- contributed by Fr. Anselm C.P., Vk9

..... To make the circuit, simply paint the circuit design onto the laminate board with shellac and allow to dry, then attach a crocodile clip to an unpainted part with a lead running from the clip to the positive terminal of a car battery or low voltage transformer and rectifier unit. Immerse the board in copper sulphate solution and place a piece of copper wire somewhere in the solution so that it does not touch the board or clip. Attach this wire to the negative terminal of the power source and the process will begin.

The unpainted copper will pass slowly into solution. When the current has ceased to flow, the unwanted copper will have all been etched away. If isolated patches of copper remain, it will be found that these are very thin and are easily removed with a pen-knife.

The process is both safe and cheap, as the amount of electricity used is almost negligible and copper is deposited from the solution and onto the negative wire at a rate equal to that at which it is being removed from the board, hence the copper sulphate solution remains at an almost constant concentration and none is lost. The slight increase in concentration is due to some loss of water.

For the average board the length of time needed using 12 V., 2 oz. would be about one hour. [sic].

This method has been thoroughly tested and used and I assure you that it is entirely successful.

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THE AUSTRALIAN POST [sic] OFFICE -- by the Editor

It is with much gnashing of teeth that we have suffered the latest outrage of the expensive & excecrable service we suffer from the Australian Post Office. It appears that in past months some letters have simply not been received at Huonville, containing subscriptions or renewals. Where are they? God knows, and He hasn't told us. Well, we regret this situation very much, but can only wait for letters of complaint to arrive, whence we readjust our mailing lists as necessary. Don't send cash when you subscribe. If you send a Postal Order, keep the stub. If you send a cheque [made out for 5c more if you wish to help us with the abominable Tasmanian Tax] keep track of the payment, and let us know if it isn't submitted for payment within a few months..... What a life.

---

* [From previous page] In spite of the Editor's antipathy to both amputated sidebands and valves, he has to admit that this device is so simple and practical [sic] that a host of new ducklings are likely to result. Can someone transistorise it? e.g. like the exciter in the Aug. 1967 issue of Amateur Radio. -- A transistorised transverter will be included as part of the constructional section of Transistorised Transmitters; the Tr Tx series will continue next month. -- Ed.

** Reprinted from: 'Practical Electronics' Oct. 1966, by P.R. Newell, Blackburn, Lancs.

TRANSFORMER LEAKAGE IMPLICATIONS; or: the art of creating Silk Purses -- Staff.

-- A discussion of the December 1967 Puzzle, posed originally by D.K. Madden of Hobart, to whom we also owe the basic solution.

In the December EEB we presented an apparently simple Puzzle, but one which has rather unexpected ramifications. For continuity, we reproduce the original here, as Fig. 1. A reads 120V. B reads 1100V. The resistance from D to E is 13.57Ω when the switch is in position C. What is in 'X'?

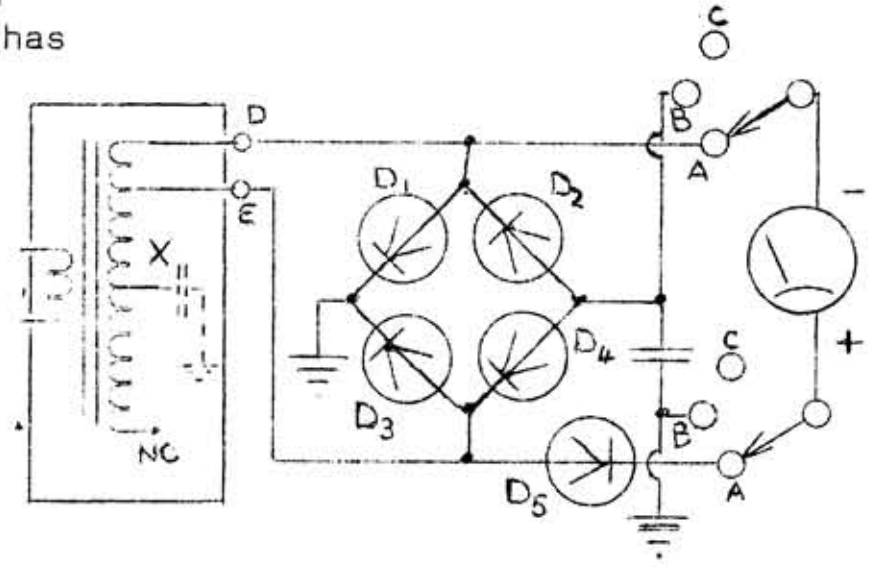


Fig. 1

The trouble is that we did not add the important qualification that 'X' is very simple; no valves or anything. It is simply a transformer with a full secondary voltage of 3200V, tapped at about 270V, RMS. Points D and E are connected to the LT portion of the winding, at one end. When the switch is at A, the meter merely reads the half-wave average rectified [D5] voltage from the LT winding; the winding itself, of course, has a low d.c. resistance. When the switch is at B, a rather strange thing happens. There is appreciable leakage to earth from the centre of the HT winding.* Now assume that the polarity of secondary voltage places terminal D negative with respect to terminal E. You would expect D1 and D4 to be cut off, and D2 and D3 to be conducting, i.e., forward biased. However, the EHT winding results in a very much higher voltage at the equivalent leakage point, X, which then places the cathode of D3 very much positive with respect to its anode, and which therefore cuts it off! Since D1 and D4 are already biased off by the LT, D2 is the only one which can conduct, and the bridge has now become a half wave rectifier. Thus, the condenser now sees only the half wave rectified signal from D2. When the transformer reverses polarity, the leakage current back biases D2 and D4, and is conducted back through D1 and/or D3 without bothering the condenser at all.

The net result is that the condenser charges to some high potential [depending on leakage parameters], the actual value of which depends on its discharge through the high resistance meter. This Puzzle has considerable practical value, because it shows a real situation in which Mr. Madden found a ridiculously high voltage on a condenser which should not have carried more than a few hundred volts. It was part of a typical X-Ray power installation, and could have had serious results if Mr. Madden had placed himself across the condenser rather than the meter; the condenser retains its charge for some time even after the power is removed. The matter of leakage from the secondary centre is also not unimportant. It can be most hazardous to assume that an apparently unearthed EHT secondary winding is 'safe' with respect to earthed loads; don't touch <u>either</u> end of an unearthed EHT winding while the power is on!

---

* Rod Reynolds says: 'Because of symmetry of the transformer windings with respect to earth, it looks to the external circuit as though there is an equivalent capacity representing the distributed capacity of the whole secondary, but localised at the <u>centre</u> of the winding'. There was much more, but I didn't understand it, so won't mention it here.

1A] Discussion: Leakage Reactance [R.A.J. Reynolds] [New Assistant Ed! Details next month]

Unfortunately, our lack of mentioning the basic simplicity of this system caused our correspondents to go to a lot of work, and yet their answers [p. 23] are fairly consistent with assumptions not involving a transformer source. Before we proceed to that, I should like to point out a few basic corollaries to the above arguments, derived from many tedious hours thinking about this silly problem!

It is possible to postulate the existence of a diode-switched pulse which excites an HT transformer secondary [having, therefore, high inductance] to resonance trains at 10-20Kc. This effect is likely not the main source of the HT leakage in this system, although it could be significant in SCR-controlled circuits, where the switching action can be violent, and enormous transients could be expected. The distributed capacity mentioned on Page 21, above [oh, its not all that complicated] should be quite sufficient to feed the required energy to the bridge, without invoking any core-saturation or pulse excited resonance phenomena.

If you consider the resistance in the load circuit to be, say, 10Megs [including all circuit leakages], then if the effective half-secondary supply voltage is 1600V, the value of the leakage condenser can be shown [by graphical integration] to be about 218 pf. This value is rather low for a large transformer of the type used here, and my guess is that if the real values of circuit leakage etc were to be determined, a typical value of 500 to 750 pf would be found. Its implications have been discussed, above.

1B] Shock Excitation of transformers [RLG]

Rod's mention of pulse-excited oscillation of an HT secondary is all that remains of a more elaborate but inapplicable hypothesis, alas, but it reminds me of the complexities which attend turn-on of nearly any transformer. Without any extra condenser across the primary, there is a finite chance that the turn-on will be at such a point in the cycle that a large transient will be produced, with disastrous effect on the diodes in the secondary leg. For this reason, an unsuppressed transformer requires rectifier diodes with safety factors of 3-5 times nominal peak voltage rating*.

This effect has a nasty corollary. Several years ago I read in Radio-Electronics that someone blew up several a.c. voltmeters which were connected to HT windings [no other load] before power was applied; obviously in the days before diode-protected meters. It appears that this is caused by a special kind of transient. Rod Reynolds says:

"This would have been due to the high energy voltage spike caused by the application of input voltage at a peak value coinciding with a high residual flux in the transformer core from a previous recent turn-off." Moral: Always turn a transformer on before measuring its HT secondary voltage.

If you place a 0.01uf [800WV, for safety!] condenser across the 240V mains, it will cure most ordinary transients, and will allow the use of rectifier silicon diodes with safety factors of about 1.5*; the capacity can be inversely proportional to voltage, if in secondary.

If, however, you place a 0.1uf condenser on the primary of your power transformer, you stand a chance of trouble again, from shock-excited resonance of the primary with the 0.1 uf, unless you put the correct value of a resistance in series with it; see the formula in the silicon diode section of any Mullard Semiconductor Technical Manual.***The above explanation is not wholly exact, according to Rod, but the fact still remains that if you put too much or too little C across the primary of the transformer, you can have trouble. I repeat this too, because a friend recently found this out the hard way even though he read my Diode Technical Notes**. See also: "Diodes in Power Aupplies", VK7RG, AR, 9/66, p. 17.

* Yes yes, I know I have said this before, but who listens? E.g., cf. VK2ZEZ/T in AR, March'67.
** Available for SAE. See Also EEB, Vol I [1965], Feb & May, if you have them.
*** See also: Miniwatt Digest, Jan 1966: Transient Suppression for SCRs; July 1962, p. 155 for the forumlas relative to RC networks to suppress transients for diode power supplies.

2] From T. Cengia, Wynyard, Tas.: 'An RF Spike Source is in X.' Well, this has elements of similarity to Rod's original idea, but isn't too applicable now; we'll send him a Consolation Prize. His answer to Puzzle 2 stated that diode non-linearity affected meter calibration. This is not strictly true in the way that he meant it; see Item 4b.

- -

3] From R. Klar, Tottenham, Vic.: 'These possibilities:

a] 'X' is a source of asymmetrical waveform, which seems unlikely.

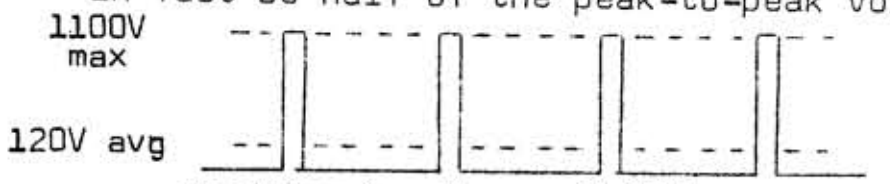
b] 'X' generates a peaky waveform, whose peak to average value is large. When switched to A, the meter looks at the half wave average value, i.e. 120V. At B a full wave rectifier charges a loss-free capacitor to the peak value of the waveform, viz: 1100V. Definitely not a sinusoid, more likely a square pulse of short duration.'

-- Not too bad, though CRO analysis of the waveform at A would have disproved this. And how about that 13.57Ω output resistance? Mr. Klar also described an interesting modification of the December Metronome system: The output of the Metronome was fed to the 220V and 240V taps [only] of a power transformer. An 8 inch 3Ω speaker was taken from the 6V winding, and a 1/25W neon was connected to the 600V secondary winding. Result: both sight and sound signal ....

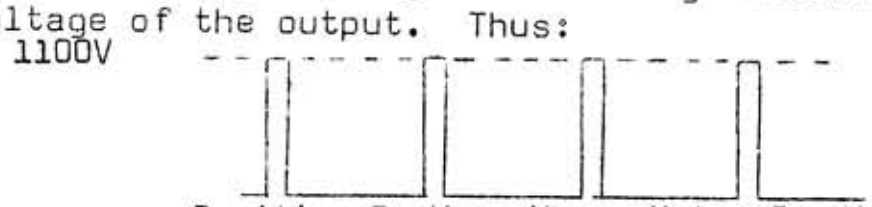
- -

4] From R. E. Dunk. Sefton, N.S.W.:

a] 'Box 'X' could contain a high power output stage driven by a square pulse input having a mark to space ratio of approx 1:4.6. The d.c. meter will only read the average voltage of any waveform presented to it, so that on position A, half wave rectification without filtering would occur, causing the meter to read the low average d.c. value of the pulses. On position B, full wave rectification with filtering would occur, causing the meter now to read the high average d.c. voltage which would in fact be half of the peak-to-peak voltage of the output. Thus:



Position A. $V_{avg} = 0.109V_{max}$



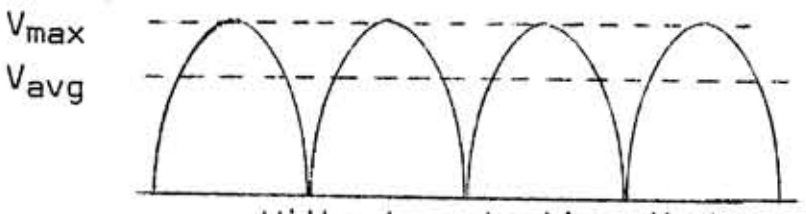
Position B. $V_{avg}=V_{max}$= Meter Reading.

[If Mark/Space = 1:1, Vavg = 0.5Vmax. Therefore M/S = 0.5/0.109 = 4.6]

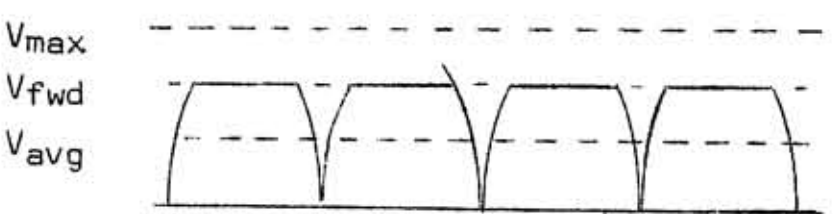
b] 'In reference to Puzzle 2, most multimeters supply the d.c. meter movement with full wave but unfiltered a.c. when on the a.c. ranges, and the movement is proportional to the average d.c. value with the scale calibrated to read RMS for a sine wave.

'If the forward voltage of the diodes is not far enough above the d.c. FSD voltage of the meter, the diodes will clip the peaks of the full wave input, lowering the average d.c. value, and causing the meter to read low.

'This problem is more apparent with the poorer sensitivity meters as the peak to peak voltage applied is greater with respect to the margin likely to be allowed between the FSD voltage of the meter and the forward voltage of the protection diodes. Thus:



Without protective diodes



With protective diodes [low meter readng]

'Since, for a sine wave, Vmax is more than double Vavg, the forward voltage of the protecting diodes must be more than double that of the meter movement if accuracy is to be maintained on the a.c. scales.'

-- Part [a] is similar to that of Mr. Klar, with similar comment. Except that Mr.

Dunk cleverly showed the output being taken across an output choke in a diagram not reproduced here, thus accounting for the low d.c. resistance. Part [b] sounds plausible except for the third paragraph; the ratio of peak to average value will always be the same for a given waveform, indeed $\pi/2$ for a full wave rectified sine wave he shows [though in most simple meter rectifiers, output is half wave, and the ratio is now π]. And this must have nothing to do with the sensitivity of the meter movement. Also, how does one explain the fact that the lower reading was still obtained even though a number of the protecting diodes were put in series?

We have given these gentlemen a big E for Effort, and a bit of a nice reward. We don't have a very large circulation, but it is a choice one! How about helping us to increase it? Tell your friends about the Impossible Puzzles in the EEB, and the astonishing answers to them.

* *

Homo Micronesis [Continued from P.18] -- by RLG

faulty design or parts which are really secondary?

'The other objections you make are based on the assumption that amateur equipment was conceived such that it broke down and so that it was bulky and inefficient. Objections like these are prudish about the wrong things. There are only two objections to IC's: when they do break down they cannot be repaired even by microsurgery [I tried, fool that I am]. The other objection every struggling amateur knows.'

Well, I'm not sure what the other objection is, but I'd hazard a guess that when the struggling amateur gets through putting together a set of put-together electronic meccano toys, he exults in the fact that 'it works', but then is left with a vague sense of disquiet; 'did I build that?' Of course it works first go; someone else has done all the work, and you have just carried out his instructions. For that kind of thing I can hire a girl who knows nothing about electronics, but who is careful.

I have not said that microcircuits are not good; they are excellent -- for the engineer. But I maintain that they have no place, or very little, in an ordinary experimenter's workshop. This will not endear me to manufacturers of such toys, but it is still true.

Does it really matter whether you create interesting and useful things in the workshop rather than buying them neatly packaged and well engineered? Does it really matter whether you build your own amateur equipment rather than buying 'Amateur' equipment from big firms? Indeed, does it really matter whether you do anything, rather than having someone else do it for you?

Is the convenience, polish, ease, cheapness, compactness, and ownership worth the loss of individuality and the loss of personal participation in the world? Your attitude on this kind of matter will be the same attitude that you will bring to other aspects of your society: the kinds of cars you drive, the kinds of houses you build, the kind of education you give to your children, and the kind of politicians you elect to represent those attitudes.

Do you want to build a society based on British tradition of creativity, or on American tradition of engineering? What kind of society do you prefer, Australians?

P.S.: Mr. Horwitz is a keen experimenter, in spite of his strange philosophies, as you will see in an EEB article in May.

****

URGENT ANNOUNCEMENTS: Unimaginative readers whose cars use 12V batteries rather than the 300V variety, may reinterpret somewhat the staements on p. 186/8 last month. With the 12 ohm 25W R in place of battery, adjust output voltage to 13.5V; or if you don't have a R, an approximate adjustment will be 14.3V to no load. Then disconnect R, connect a somewhat discharged battery, and adjust the current control to about 25Amps; a battery can be discharged by starting the car a few times in succession. If necessary to gain control, the "former" dynamo lead can be lengthened a bit... For ckt as shown, dynamo return is to +,inside.

Readers who wonder why they lost a month when resubscribing, did not read the notice we printed a few months ago; we have a new labelling system. Same No. of actual copies sent.

FROM AUSTRALIAN ELECTRONICS, 76 View St., Hobart, Tas., 7005. Everything Post "Free".

Concerning Delivery: We do what we can with the Post. Now we certify nearly every piece of merchandise, to avoid problems. Problems even appear with First Class post, as illustrated by the note on P. 20 of this issue of EEB. We also had an incident recently which involved a very ordinary letter which took 10 days to wend its way to Hobart from N.S.W. It concerned a matter of some urgency, and the result was consternation and expense. Complain to the PMG? Ha. We have done that before, with even more cause. Sometimes we even get an answer, without results, of course. One parcel marked "FRAGILE" arrived in ragged condition; honestly, it had tyre marks on it!

Concerning Stock: We seem to have acquired ~~several~~ a few copies of the famous G.E. Transistor Manual [7th Edition], which can be sold for the [amazing, for Australia] price of $2.15, while they last. Similarly we have the G.E. SCR & Transistor Hobby Manual, for $1.50. Together with a few copies of the RCA SCR Experimenters Manual [$1.00], these books introduce a wide range of applications and theory of Silicon Controlled Rectifiers. Subjects covered by one or the other of these books include the use of SCR's in motor speed control, lamp dimmer, battery charging, tachometer, electronic ignition, remote control, model railroad control, phototimer, flasher, etc! To convert ratings for locally available SCR's, merely determine maximum PIV in the circuit [by inspection], and multiply by about 2. Avg fwd current depends on load, of course. And remember that the American mains are 115V, ours 240V/50cps.

By an interesting coincidence [related to the needs of a customer and ourselves] we also happen to have several SCR's in stock. Current is avg fwd operating value. Namely:

0.8A: 100V = $0.85, 200V [$I_g \leq$ 10uA!] = $1.25, 300V = $1.40 200V [$I_g >$ 10uA] = $1.10
2.0A: 600V [OK for Mains, if 0.1uF across mains] = $2.70; will control up to 500W.
4.7A: 150V [I_g 0.01-10mA] = $1.25, 200V = $1.60; 10A: 200V = $2.10

Where gate current is not indicated, it is ordinarily less than 10mA. The 200V/0.8A items, however, are a phenomenon. Most of them have $I_g \leq$ 2uA, which means that you can control an enormous amount of power with practically nothing; control by RF, static charge, proximity effect [a.c. pickup], etc becomes practical. This is the sort of sensitivity you would expect from a Silicon Controlled Switch [ref G.E. Tr Manual], but in this case there is only one [cathode] gate.

To ensure reliability, put a condenser across the a.c. input. For HT, 0.01uF, for LT 0.1uF; if no transformer is used, these values can be increased tenfold. And: Use a 27K resistor [not larger than 56K] from gate to cathode, and be sure to use a diode between the gate and the current source. Detailed characteristics are shown on each SCR sold.

The 0.8A SCR's will get hot with 0.8A, therefore need good air circulation for max current [American rating 1.5Amps!], or a simple metal strap to hold them down to a piece of metal. The higher current ratings need an appropriate heat sink, silicon grease, etc. At least two square inches [total] per watt to be dissipated, assuming a fwd drop of 1.5V.

Pretty Transistor Sockets: Sorry these are all gone, in a hurry. But we do have some ugly black ones now, which work OK. At least they are round; how do you drill a rectangular hole? The present stock of the ugly sockets is limited, and at $1.05 per dozen, they are not likely to last very long. Ideal for experimenting, RF, etc. Very popular indeed.

Concerning Books: It is not easy to buy books by post, even at our low prices, because it is difficult to know the contents from a title. We have, therefore, prepared a detailed description of nearly every book in stock, which should make it easier for you. It comes to about a dozen foolscap pages, and is more fun than browsing through a bookshop. Cheaper too, because you won't be as susceptible to buy by impulse, not to mention the fact that our prices are probably the lowest in Australia. We do recommend our books to your consideration, because they are selected to provide the most information for the least cost. If you want the Giant Packet, please send a largish SAE, with a 9c stamp on it. You provide the stamp because of our low prices, and low margins. Be sure to specify "Packet" or such.
Other Stock: Remember we still have some diodes, 200-2000V at competitive prices, etc.

15c/transistor. First come, first served.

A very few Computer Boards have just arrived.

EEB P. 25A

march 1968

volume 1, number 1

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11 valves p.p. 6146 B final

departments

offices

Greenville, New Hampshire 03048
Telephone: 603-878-1441

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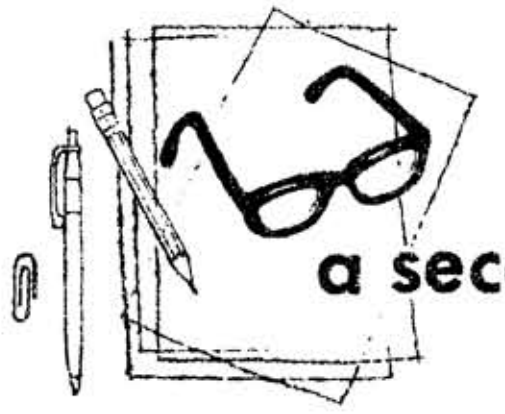
EEB NOTE: The strange-looking vertical stripe at the right is actually an attractive red bar, but it did not come out very well in reproduction.

✱ Excellent, darn it.

EEB P. 25 B



a second look

by jim fisk

The birth of a magazine is a complicated process. It starts as an idea and develops through the coordinated efforts of authors, artists, typographers and pressmen. The ingredients are varied: articles, schematics, long-distance telephone calls, photography, advertising, subscriptions, public relations, paper and ink, all lovingly stirred together with prodigious amounts of midnight oil. Name: **ham radio**, born January, 1968.

Why **ham radio?** Very simple. The electronics and communications industry is moving forward at a tremendous clip, and so is amateur radio. Single sideband has largely replaced a-m, transistors are taking the place of vacuum tubes, and integrated circuits are finding their way into the ham workshop. The problem today, as it has always been, is to keep the amateur well informed. This doesn't mean that you have to impress your readers by printing every piece of state-of-the-art news that appears on the horizon.

Quite to the contrary. If you limit yourself to the state of the art, you'll get lost in a hurry. Advances are being made so rapidly, you just get tuned in and there's something new to worry about. And, since each new advance is built on what has been done in the past, if you don't get a clear idea of present techniques, you'll be hopelessly lost as time goes on.

Transistors have been with us for fifteen years, but it has just been within the last year or so that hams have started really thinking in terms of solid state. True, you usually wait for that old vacuum-tube equipment to wear out before replacing it with solid-state gear, but many of the little gizmos around the shack that you've put together in the past few years should be transistorized. Are they? Probably not.

When vacuum tubes became practical devices, amateurs were among the first to use them in home construction. Likewise with semiconductor diodes. Not so with Transistors. Why? Because hams didn't have enough good **practical** information to go by. Unfortunately, transistors blow out a lot easier than tubes, and many amateurs who experimented with them in the early days were disillusioned by a row of "dead soldiers" on their bench.

What it amounts to is this. There is an awful lot of state of the art practice which you've got to understand before you get into state-of-the art design. If you're an engineer, fine, but not all hams are engineers. Most hams want practical circuits which they can adapt to their special jobs.

As an example of where this state-of-the-art phobia has taken us, consider single sideband for a moment. I would guess that at least 80% of the hams operating on our lower bands are using single-sideband equipment. But how many of them actually understand what goes on inside that box? Not nearly enough!

The problem here is that ssb appears to be a lot more complex than a-m. Certainly the gear required to generate a ssb signal is more complex than that old a-m rig, but under-

EEB P. 25C

standing what makes it tick is not. The two modes are very closely related. Not particularly compatible, but related. The problem is that a simple, concise explanation of sideband has been lacking. Several excellent articles along this line were written in the early fifties, but many of the hams who have sideband equipment now have never seen them.

Ham radio is designed to fill this gap. It is designed to inform. It will be geared to the state of the art—the state of the art in practice. It will be a magazine which shows you how to use new devices and old. Although we will encourage the use of solid state, we will not discriminate against vacuum tubes for the sake of being modern. There are a lot of places where vacuum tubes are still very practical and desirable gadgets.

When new techniques and devices become available, look for a complete description of how to use them in **ham radio.** Our articles will run the gamut from the simple to the complex, but they will all be oriented to the practical approach—the amateur approach. Not all of you are interested in the same things, nor do you have similar electronic backgrounds, so the fare served up in **ham radio** will be varied.

We will have simple projects for the novice and the one-night-a-week experimenter, involved projects for the experienced ham who likes to work in his shop, practical design and theory articles for the fellow who wants to start from scratch, and the last word for the VHF'er, RTTY bug and ATV enthusiast.

Amateur radio, just by its nature, is a very diversified hobby. Each ham follows his own special interests, whether home construction, public service, DX, traffic or a multitude of others. If you don't see an article that covers your particular plane of interest, it's because no one has taken the time to write it. If you have a little gimcrack that you've just put together, and think others would be interested in what it can do, draw a schematic, take some pictures and write it up. You don't have to be a professional writer to get your name in print; most of ours are not.

In addition to full-length feature articles, we are in the market for shorties for the **ham notebook.** If you have found a new and better way of doing something in the shack, have a new construction wrinkle, or have some small gem of technical information to convey, send it in to **ham notebook.** This monthly feature will cover everything from Antennas to Zener diodes, construction and design—technical tips that are useful around the shack and shop. You'll get paid for your efforts, and the rest of our readers will benefit from your ingenuity.

If you're interested in contributing something to **ham radio,** write for our "Author's Guide." This handy little pamphlet shows how to put your story together, the essentials of clear writing, the abbreviations we use, and what we need in terms of schematics and photographs. It also outlines our rates and payment policy.

Payments for manuscripts are generous and immediate. If we like your article, you'll get a check with our letter of acceptance, usually within a week of when you put it in the mail. After we accept it, it won't sit in our files for months or years waiting for publication. It will be put into print just as soon as possible. Articles that sit in the file are no good to the reader, to the author or to us. Nobody wants to read about (or build) a VHF converter today that was the hottest thing on two wheels when it was originally designed three years ago!

ham radio will not stand still. We will always be looking for ways to improve because amateur radio is a dynamic hobby, always on the move. As the equipment, techniques and challenges of amateur radio change, so will we. We'll constantly try to make **ham radio** more useful to you as well as more interesting and stimulating. We can promise you now, we'll never become complacent, we'll always try to make **ham radio** better.

Jim Fisk W1DTY
Editor

Note: If you received more than one copy of this first issue of **ham radio,** don't worry about it–it simply means that you're an active amateur and your name has appeared on more than one of our mailing lists. Just give the extra copy to a friend who hasn't seen it.

here we are

a word from the publisher

Here we are! It's been a long trip since early October when Jim and I decided that there was definitely a place for **ham radio**. Where will the money come from? What will we call it? What will it look like? How will we get subscribers? How will we obtain advertisers? All of these questions, and many more, had to be answered one by one as **ham radio** began to take the final shape that you see here.

It has not been an easy road. We did not expect it to be. However, there have been many unexpected rewards along the way as many folks, both individual amateurs and those in industry, have given us valuable support and encouragement. We quickly found that there were many others who felt just as strongly as we that our magazine would be quite useful to the amateur community.

Can amateur radio really support a new magazine? We think it can, and here are some reasons why: Much has been said in recent years about what is wrong with our hobby, but altogether too little about what is healthy and right about it. We feel that amateur radio is a healthy patient and that it is going to be with us for a long time to come. Let's face it, we wouldn't be investing our time and money in this project if this were not the case.

In spite of what others may say, you need only look at the Call Book to see that the total number of licensees is continuing to grow. Admittedly, this growth may not be as fast as CB or other parts of the electronics industry, but still, we are growing. This growth could be, and should be, faster, but it is up to us in amateur radio to provide growth. No one else is going to do it for us.

There was, perhaps, a certain period of indecision during the incentive-licensing controversy. This issue has been decided, and the amateur knows exactly where he stands in the future. Home construction ideas and equipment purchases can now be planned with the full assurance that you'll be able to use this gear as intended. The potential newcomer need have no apprehension over what his future operating privileges will be.

One of our major enemies is considered to be Citizens Band, and yet, it has been a failure. Even Chairman Hyde of the FCC has now suggested that major changes, including an increase in the license fee and a technical examination, should be considered as a means of improving this service. This could well have a very positive effect on amateur radio. The many youngsters who are introduced to radio each year via CB might well be channelled to our novice bands. Both radio services would benefit from this change in policy, as would the individuals involved.

A new outlook is necessary. If we continue to work with old ideas and concepts, we can hardly expect to maintain our traditional spot in the electronics world. We are a branch of one of the fastest moving areas of technology. If you have any doubts, look at the developments of the past few years in solid-state techniques or satellite communications. Amateur radio will have to look and act the part if we are to keep up.

Ham radio intends to take a very positive step in the advancement of amateur radio. As a start, this magazine looks years ahead of others because we have taken advantage of new techniques and ideas in technical publishing to bring you something very timely in appearance. Equally as much effort is going into the preparation of editorial material. A lot of work has been done to make the articles easier to read. Ideas have been more clearly organized, words and sentences have been carefully put together with professional techniques designed to make **ham radio** easier and more enjoyable to read!

We still have a lot to do. Our business is communications technology. This goes just as much for the printed word as for the latest integrated circuit. There will be many more new ideas in **ham radio** as the months go by. We think you'll like them.

Skip Tenney W1NLB
Publisher

WE regret having to tip the Publisher of Ham Radio on his side, but we need the space:

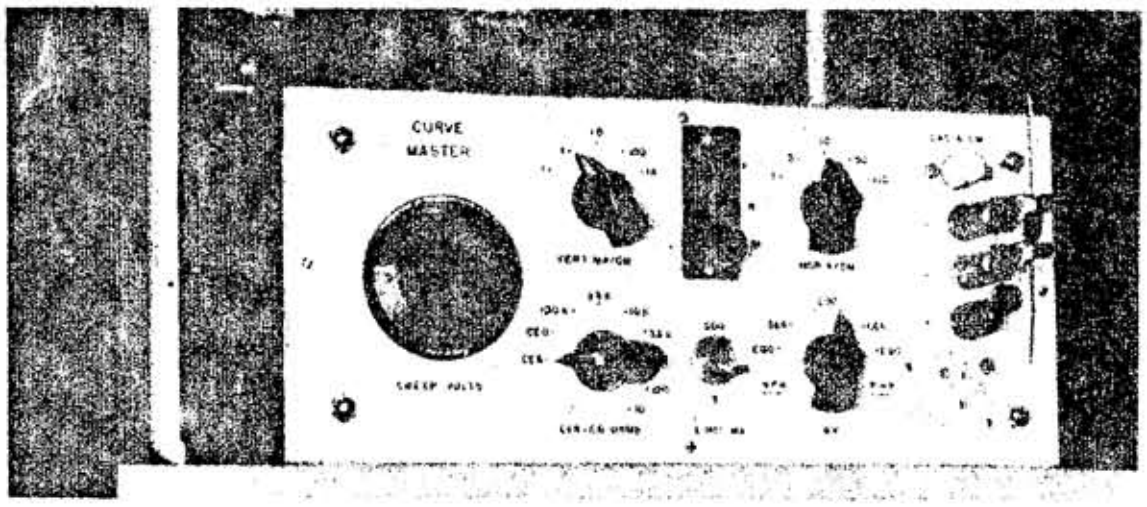
SIMPLE SIDEWINDING [continued from P. 20]. A few notes by the Editor.

Another more conventional apparatus is also described by VK2ASK in Amateur Radio of December 1967, using a balanced modulator-- and transistors. A rather interesting article appeared in the SSB Column of VK5NN in AR of 11/67, describing several good ideas for improving receivers; should go well for all modes. Indeed, if one has a nice receiver which filters out the carrier and one sideband of an AM station entirely, why should one regard AM with such contempt? One can turn all AM's into the Exalted Sideband mode, and we can all live in peace with our own strange ideas; article soon in EEB by W1CTW on Exalted Carrier.

The frequency-limitation requirements of the VK6 Tx here described could be improved further, or used with a less restrictive microphone, by installing a "Speech Crispening Circuit" peaking at 2Kc or so, as described in the Miniwatt Digest, Dec. 1967, p. 194. Peak is 13db above -0.4db via a twin-T network and one BC108 transistor. See also: "Modern Desidn Methods Applied to the Speech Filter" in QST, Nov. 1967 p. 51; uses a bandpass filter, but you can also find designs for filters in any Radio Handbook [Editors & Engineers], etc.

Another method, good for improving effectiveness of any modulation system, but particularly for SSB is "A Simple Silicon AGC Circuit," by VK2AMA, in Amateur Radio, Sept. 1967, p. 5, using three diodes and a transistor between mike and preamp, using preamp output. It has 40db of speech compression at "negligible" harmonic distortion. It allows the maintainance of maximum sideband output without the necessity of an automatic load control system. The circuit described by VK1AU in the same issue of AR does not appear to be as favourable for distortion or ease of adjustment. The 3-transistor Audio Compressor by W3JHR described in the January 1967 AR is equivalent, but self-contained. It contains the useful idea of using an RFC at the input to exclude RF-- an important matter for compressors.

OHO! LOOK AT WHAT WE HAVE HERE. REFER TO "CRO FOR DIODE (& TRANSISTOR) TESTING", EEB; JUNE, SEPT, NOV 1967. BUT this one is definitely the best one of them all. A real value for semiconductor addicts.



oops:
P.S.: Small world:
See also
"TRANSISTOR CURVE TRACER"
in Electronics World
Jan. 1968 p. 55-66.
Much more complicated, but can display whole families of characteristics.
And only for transistors

the

curve master

An oscilloscope attachment for tracing the characteristic curves of active devices

Tom Lamb KBERV, 1066 Larchwood Road, Mansfield, Ohio 44907

The curve master is an attachment for an oscilloscope which will display the volt-ampere characteristics of almost any two-terminal device as well as most transistors. As examples, here are some of the devices that can be electrically displayed:

1. Common signal and power diodes (silicon, germanium, selenium, gallium arsenide, etc.)
2. Zener diodes
3. Tunnel diodes and back diodes.
4. Neon bulbs and V-R tubes.
5. Photocells (photo-resistors).
6. SCR's and light-activated-switches (LAS).
7. Thyrites and thyrectors.
8. Transistors; NPN and PNP, germanium or silicon.

The range of the **curve master** is 1000 volts reverse, and several amperes forward. With a little experience, you can identify a diode or transistor as silicon or germanium by their unique forward-conduction and reverse-leakage characteristics. Since they vary quite widely, semiconductor ratings should always be checked. With a curve tracer you can easily pick out especially good units from your stock for special uses. The **curve master** will check and grade surplus and bargain devices—and may even convince you not to buy any more!

← This can be increased by using a larger XFR, of course.

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EEB P. 25F

how it works

The basic circuits of a two-terminal curve tracer are shown in **fig. 1.** An ac voltage is applied to the device under test, and at the same time, to the horizontal axis of an oscilloscope. Any current drawn by the device is displayed as a voltage drop on the vertical axis. The horizontal voltage can be increased beyond the device's breakdown point without harm, since the voltage sweeps this region very quickly and the breakdown current is limited by circuit resistance. Since the test voltage goes both positive and negative, both the forward and reverse regions of the device are displayed as shown in **fig. 1A.**

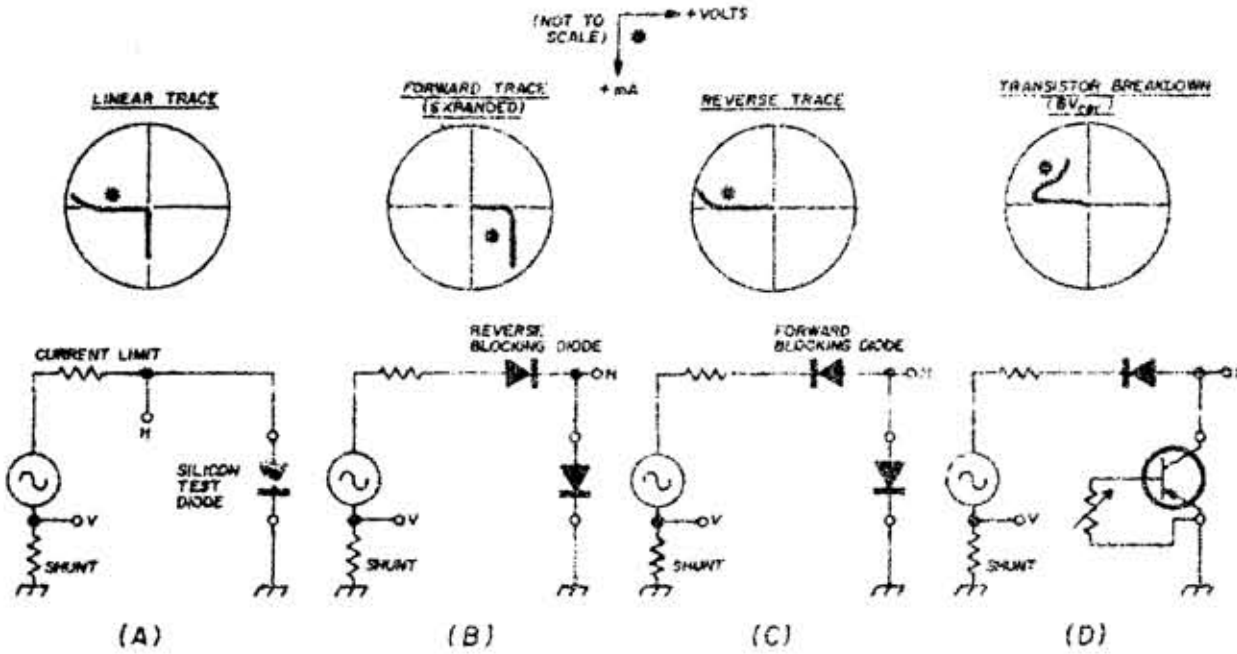

fig. 1. The basic two-terminal curve tracer and several different types of traces which may be obtained with it.

A series diode can be added (**fig. 1B** and **1C**) to eliminate either part of the trace. This permits expansion and detailed examination of the remaining part, and also establishes the start of the trace for voltage measurement reference.

A typical transistor set up is shown in **fig. 1D.** Each transistor junction is checked individually. The **curve master** is made up of these simple circuits with shunts and multipliers to allow a wide range of readings on any scope. It will display voltages from less than one volt to 1000 volts, and current from less than 100 micro-amps to several amperes.

the circuit

The complete schematic of the **curve master** is shown in **fig. 2.** The 750-Vac transformer supplies the forward and reverse test voltages. Diodes D1 and D3 are the blocking diodes described above. S3 selects the region to be displayed—forward, reverse or both. S2 selects the value of the shunt resistance to give vertical ranges of 0.1, 1.0, 10, 100, and 1000 mA per division. S4 has two functions: sections C and D are the horizontal voltage range multipliers, providing ranges of 1, 5, 10, 50, and 100 volts per division; sections A and B select the current-limiting resistances, in two ranges, 5 and 500 mA maximum, as selected by the limit switch S1. S6 selects the transistor junction to be displayed and reverses the test polarities for NPN or PNP devices. S7 adjusts the base-emitter resistance for the BVcer tests. An internal calibrator (S5 and D4) is provided for calibrating the scope.

construction

There is nothing critical about the layout. Just remember that up to 1 kV appears across the switches and test jacks, so everything should be well insulated. Diode D3 must be rated above the maximum test voltage and may be made up of several 400- or 600-volt TV-type power diodes in series. D1 is a 50-volt or better diode rated at several amperes. D2 bypasses any reverse leakage from D1. The 750-Vac transformer may be any small receiver transformer with a secondary voltage of at least 750 volts (1 kV peak). All low-voltage windings are series connected to supply the low-voltage, high-current, forward sweep. If the secondary voltage is too low,

AND SO FORTH, FOR 6 more LOVELY PAGES!
YOU'LL HAVE TO GET THE MAG, TO FIND OUT....

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CHANGE OF ADDRESS must MUST include Renewal Date; see address label. Please cooperate! BOUND VOLUMES: I [1965] unavailable, sorry. II [1966]: $A1.65, $NZ1.75, $US2.00, 17/6. Vol. III [1967]: $A1.75, $NZ1.85, $US2.20. Stg. 18/6. Nice covers 35c. All Post "Free".

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THE ABOVE COUPON MAY BE SENT DIRECTLY TO HAM RADIO MAGAZINE, GREENVILLE, NEW HAMPSHIRE 03048, U.S.A., WITH $US DRAFT. Or, for your convenience, and to help this new magazine off to a start, you may send the above coupon to us, together with equivalent $A [90% of $US] PLUS 10c [to cover our costs!][or 15c if cheque], and we'll send it to them for you. This looks like a good opportunity to be in on something good, but all coupons sent via us must reach P. O. Box 177, Sandy Bay, Tas., 7005, not later than March 27, 1968. By the way, if you sent $1 in response to our advert for Ham Radio last month, you can now send another $2 if you prefer the 11-issue offer, and we'll combine them for you. But please note the deadline.

FROM: THE AUSTRALIAN EEB
[An informal Electronics
Experimenters Bulletin]
P.O. Box 177, Sandy Bay,
Tasmania 7005, Australia.

TO:

1-71
2008

[Registered at the G.P.O., Hobart, for transmission by post as a periodical]

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AN INFORMAL ELECTRONICS EXPERIMENTERS BULLETIN

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Assistant Ed: VK7ZAR
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April 1968 Vol. 4, No. 3

= =

CONTENT:

ASSISTANT EDITOR!

We are pleased to announce that we have acquired an Assistant Editor, R.A.J. Reynolds, VK7ZAR. The only problem will be to keep Rod from using too many equations and big words. On the other hand, early readers will remember his fine articles introducing SCR's to the EEB. He has the ability to state complicated ideas simply, if he so desires, an ability which comes with good knowledge of the field. In comparison, look at the mileage I get out of Ohm's Law - all the rest is filler!

I hope to be able to put Rod to work on several important projects, including the EEB Anthology, and our long-overdue Anthology of Transistorised Transmitters. In addition it will help to have someone attack the several bulging folders in my files. It takes every available minute of my spare time just to keep EEB going routinely.

The EEB Anthology will be a boon to those who missed Vol I, and soon Vol II will be gone too. The situation is incredible. A few months ago we had a couple of advertisements asking for Vol I complete or in parts, with price left open. One chap volunteered a few issues, at a price. I am impressed; maybe we ought to print up a couple dozen more copies of Vol I, and distribute them through an intermediary at $5 each, eh?

Ideally I ought to give the typescripts of each issue to Rod to survey before committing them to stencil, but I'm rather afraid of this. He's likely to find so many inaccuracies that we'll never publish anything.

Seriously, though, it is a rare person who will work to help an enterprise like this. We have also had several other worthy souls who have submitted ideas or articles far beyond the call of duty or subscription credit, and I have tried to acknowledge some of them a bit by listing them as 'Associates' on the back page. It is heart-warming, because there is negligible financial reward, only the satisfaction of doing something creative, and of sharing it with others.

* * * * * * * * * * *

I see that our Typiste has changed my "Honi soit qui mal y soit" to the more conventional form, and "... Inefficient Males" to a less offensive title, but that's all right. She catches spelling errors and does final organisation of all text, so she has earned the right to do a bit of alteration in favour of discretion.

EDITORIAL

"There is no need for panic; Bubonic Plague is no worse than a bad cold."
-- Anonymous, 17th century.

A few months ago, Barrie, our mathematician, advanced the hypothesis that it would be better to call Editorials by some other name, because who ever pays any attention to Editorials? So I tried that. Result: everyone wants to know "what happened to your controversial editorials?" -- including Barrie. In view of the nature of last month's 'Homo Micronesis', it would appear that one can be as controversial as one pleases, if one provides a misleading title. Can't win. So here are plenty of them:

Honi soit qui mal y pense.

I have received some remarkably snide comments about my occasional use of Latin. I was a Pole, a Catholic, a Snob, an expatriate Yank, etc. Shux, I like the sonorous sounds of Latin, that's all. Also, I am not wholly convinced that English is everywhere and always the most expressive tongue in the world. As for that Christmas Poem, sure it was banal; you want headier stuff in the EEB? The title of that poem meant: 'Peace on earth to men and beasts', because nowadays it can be sorta hard to tell the one from the other.

That Deadline!

I apologise for the very sharp squeeze between the delivery of the March EEB at the end of March, and the deadline for Ham Radio subscriptions at the end of March. But those who had the faith to send in subs were still included even after the deadline, because it was our fault, and indeed part of the delay in posting was caused by problems of reproducing the HR advert. Even so, the first advert for HR appeared last month, and I was amazed that only a few dozen people took advantage of it. Our tastes must be jaded indeed when we refuse something that is free, when it is obviously good. But dozens of people paid $1 or $3 for H.R.. Interesting.

Bound Volume III [1967]:

Perhaps related to that subject, a reader has subbested that it is unwise to economise on covers of bound volumes, because of and so forth. I don't think so. In these times, everything costs more and more, particularly printed matter, courtesy of Her Majesty's Post Office. Now, I realise that, just as most people didn't much appreciate being offered free an excellent technical publication, they probably don't much appreciate our saving them a few pennies, but look at it this way: If you pay $1.75 for a bound volume instead of $2.75, you can use the difference to buy some beer [what you can buy of it nowadays for that money], which can be sipped slowly as you peruse the pages of the bound volume. This lends the maximum aesthetic enjoyment to a creative experience--and after all, for what more are we living? Besides--if you want to improve the covers, you need only spray or paint them with plastic.

Again this year, the bound volumes appear to be delayed slightly. We start to put them together as soon as possible, but in Australia everything moves with deliberated haste. It has its advantages.

Cross Modulation.

The other day I had the startling experience of rejecting, for the first time, a suggested article by a reader. It would have been a transistorised mixer. But I feel that the subject has been covered ad nauseam in the readily available ham literature. Furthermore, the cross-modulation problem of transistors in front-end RF applications often leaves something to be desired. FET's and Nuvistors* meet these criteria admirably, so that it seems hardly worthwhile to continue with transistors in this service** [See footnote next page]. I have the uncomfortable feeling,

*Also those clever valves running 12V on anode. See 73, May 1966, P.38: "12V on Six Meters."

however, that this constitutes some kind of milestone: the beginning of the demise of the transistor. But I think that eventually the Tr, FET, and valve will strike a real equilibrium in which the characteristics of each will be used to best advantage with respect to impedance, power, frequency, and so forth. //For FET Front Ends, See QST, Jan, Feb, & Mar 1968. All kinds.

Integrated Circuits [concluded]

But I refuse to admit IC's into that company, for Reasons. One has to draw a line somewhere, and that's it. The increasing number of IC articles in the experimenters literature has made it much easier for me to tear out worthwhile articles from the various magazines, particularly where it makes it possible to avoid conflict of one good article with another which starts on a subsequent page. When the mags contain nothing but IC's, it will be even easier: I'll simply stop subscribing, and devote all that time and money to other things. Maybe just as well.

Why Magazines??

In the present situation, with a flood of Magazines that cross my desk every month, as I clip out one or two really worthwhile articles from each, I am wondering whether it is worth it. Wouldn't the money be better spent on a yearly purchase of anthologies, circuits books, and Handbooks? [even my favourite, Technical Topics comes out in an anthology every once in a while]. Particularly as it can be a major problem to FIND a particular article in a great stack of magazines. How often have you looked for some Really Good circuit amongst the Mess, and then given up in disgust, and grabbed the Handbooks and Circuit Books instead where you knew you could find something at least? Now you mustn't take the above too seriously, or you'll stop subscribing to the EEB, and Coryra, then whom would we talk to?

Inefficient Mails:

As the latest yet, of the outrages by Her Majesty's Post Office, discussed from time to time in these pages, the Postmaster General's Department in its wisdom has decided to send "First Class" Mail by ship rather than by air between Tasmania and the Mainland, if it doesn't have the right shape. One presumes that when this "First Class" mail reaches the Mainland of Australia, it will then be handled by air 'where air service is available, and its use would speed delivery.'

Now this may not seem very important to you denizens of 'North Island', but take note: this is not the first nor the last manipulation of The Public by the Post Office. Mail service to Tasmania has not always been exceptional; that it will get worse unless letters are surcharged for 'Air Mail', extra for 'Certification' or 'Registration' or 'Express Delivery' would be amusing if it weren't so frustrating- and dangerous. When can the ordinary sender ever be sure that his particular letter will not meet the certain requirements for shape or size? You can comfortably depend on the likelihood that our mail service will become less efficient, less reliable, more inconvenient, and more expensive until those bureaucrats in the PMG's Department are enjoined from meddling with a public service which should be run solely in the public interest! Bah.

** [From Page 28]. On the other hand, if you already have a transistor front-end, or if you are plagued by cross modulation or image problems for other reasons, a neat solution seems to be provided by the RF Q Multiplier. Circuit in next EEB. A valve version is also found in the receiver chapter of late ARRL Handbooks. For that matter, why not introduce some negative feedback into the first transistor RF stage or mixer? If cross-modulation results from nonlinearity, that should improve it considerably. Has anyone heard of this having been done?

Sorry for the margins wandering all over, but we have a new typewriter, needs adjustment.

Condenser-discharge Automotive Ignitions:

Late last year we promised to present some coverage of this subject. It was based on an interesting idea by Rod Reynolds, now our Assistant Editor, and in support of it I accumulated several articles on the subject from the magazines. But the time for preparing the article did not present itself.

Now Mr. D. J. Bedford has mentioned to me that he has been experimenting with condenser discharge ignition systems, and that he would look over the File. With luck, he may be able to use that material for an article, which we shall present for your interest.

Talking about Files, I have a fairly thick File on 'Construction' which contains a few articles on 'How to Make Things that Work', along with considerable material from the magazines with various construction techniques and with various arguments on why you should or should not construct things for yourself in the first place. This File needs working up, to provide a nice series of articles on this important subject. If anyone out there feels strongly about this subject, and would like to undertake that task, I should appreciate hearing from him. I just do not have the time required to work up a lot of the very nice material in my files. It is not that we lack articles, but that this is an important subject, which ought to be presented here. In addition, the reason we don't lack articles, is the fact that I make sure that they are prepared well in advance. In this instance, there would be no hurry, and the Volunteer could work on the File at his leisure--but he should definitely work on it. There is little we can offer as material inducement, other than the usual free subscription[s] to EEB, but an arrangement could also be made to provide certain technical books from A.E. at wholesale for this person, if so desired.

Miscellaneous:

Would the chap to whom I loaned two RSGB Bulletins with TVM ckts please return them? Thank you.

To the reader who wanted to know about a reference to Public Address systems, see 'Public Address' by N. H. Crowhurst, published by Norman Price Publishers, London, for 4/6, stg. The same publisher also produces many other fine, cheap books.

In reference to the PUJT/Regenerative Switch described in the RCA SCR Manual and in the EEB in recent months, see also Radio-Electronics, Oct. 1965, RSGB Bulletin, Jan 1966 p.18-19

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LETTERS

Are Linear Circuits very Linear?

[[Peter G: What's wrong with Letters? Some are quite interesting-- besides some issues have more, some less]]

Referring to the rather critical remarks made about microcircuits in March EEB, I couldn't agree more ... PROVIDING they are about the linear IC's which have recently been invading the electronics market [most of you will have seen those horrid little integrated IF strips and audio amp's by now].

But to include digital IC's in the same category would be taking things too far. By way of example, I recently built an electronic keyer from an article published in CQ magazine last December. The project used 7 digital IC's, and 5 transistors. Total cost was a mere $22 odd, all parts bought brand new. However, to have used transistors in place of the IC's would have required a total of 38 transistors, 49 extra resistors, and would have increased the cost to $60 [no kidding]!

For these reasons, and for the improved reliability and size, I had no qualms whatever in using IC's. And the pleasure in getting the thing to work was certainly not diminished, rather increased.

Henceforth would all criticisms of microcircuits please contain the qualification " linear" ! -- P. Nesbit, VK3APN, East Malvern, Victoria. [Cont. P. 32]

SHOCK EXCITATION and TRANSIENTS in HT POWER SUPPLIES -- RLG

[Discussion continued from P.22 of the March EEB]

Last month I discussed, again, the conditions attending the production of transient overvoltages in transformers feeding semiconductor diode rectifiers, and how to suppress them. There are two other aspects which might be considered briefly:

1] Choke input filter can improve regulation and increase current available from a given transformer*, but shock excitation of the choke by turn-on [or off] process can cause ruinous transients, which could damage the rectifier diodes. Some people will swear that they have never been bothered by this problem, but

a] They may have a high safety factor [e.g. 2-4 times] of diode ratings over the peak input voltage, or

b] They may have been lucky. You can be certain that the one unlikely time that you turn on the transmitter to call a rare DX, will be the one unlikely moment that you have hit the wrong part of the a.c. cycle. It does happen.

For reliability, the price is small: Put a condenser [of suitable voltage rating!] in series with a resistor, across the choke, or from input of choke to earth-line. For most ordinary power supplies 0.05μF in series with 1KΩ will suffice, but for best reliability, use

$$C_{uF} = \frac{LI^2 \times 10^5}{4E^2}$$

[Silicon Replacement of Tube Rectifiers, W4JA, QST, Jan.** 1965, p.46], where L is inductance in henrys at minimum load, E is the d.c. output voltage, and I is max d.c. current load.

The resistance should be $\leq E/I$; I don't think it is very critical, and it is there to damp out resonant excitation discussed last month.

You can tune the choke by placing a condenser across it of such a value as to produce minimum a.c. ripple at the output, under nominal load. This will improve the regulation still more over a certain current range, and will automatically tend to bypass sharp transients [c.f. Feb EEB, p.5].[Also 73, Nov. 1966, p. 30: HT Pwr Design]

2] If you build an EHT [e.g. >1KV or so] power supply, you will find that you will probably need appreciably more safety factor for the PIV of your diode rectifiers, than for ordinary HT. This may be caused by the increased energy in high voltage spikes; it increases as the square of the voltage. This energy takes a finite time to dissipate as it pushes the depletion layer apart in the diode, and if it is excessive the junction can be punctured by the high concentration of charge in the time before the holes and electrons reach their maximum separation. This means that if the nominal voltage is high, a diode can still be punctured by a transient even though it is rated to withstand the voltage involved under static conditions, and even though it has an ordinary safety factor [e.g. 1.5].***

The situation is worsened when using a half-wave configuration, with capacitative load, because half wave imposes double the PIV on the diode than would occur with full wave. With the 2000V secondary supply for my diode tester, I had to use 12,000V worth of diodes [after an 8000V string evaporated!]: 2000V [RMS] x 1.4 [peak/RMS] x 2 [safety factor] x 2[for half wave] = 12,000. The same number of seriesed diodes were needed as for full wave, but there was no centre tap on the transformer, and a bridge would have doubled the number of diodes once again. That gets expensive. Each diode, of course, was paralleled by 20 Megs and 220pF in this instance. Probably C should have been larger to compensate adequately for hole storage effects [which make different diodes turn off at different times, thereby

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* Because the power factor is improved. It would be improved even further with resistance load -- R.A.J.R.// ** Also reprinted in Amateur Radio, August 1965.

*** This paragraph courtesy of the Assistant Editor.

placing more load on the others in the string], but the load was very low [a few microamperes for testing back biased diodes] so that too much shunting capacity would have fed too much ripple around the rectifiers. In any event it worked.

Note that in this example, R shunting the diodes could be 20Megs, not the usual 500K one often sees in this application. The leakage current of an ordinary silicon diode is at most a few microamperes at half its maximum PIV rating. This gives it a back resistance of several hundred megohms, so that a 10 Meg shunt is quite adequate for HT, for all but the lowest quality of disposals silicon diodes, or for germanium. Germanium diodes usually have some ten times the leakage of silicon ones, but they are less susceptible to transient overload, because their leakage tends to damp it out.

Further excellent information on diodes, their problems, and applications, will be found in the RCA Transistor Manual, G.E. Transistor Manual, Selected Semiconductor Circuits Handbook [Schwartz/U.S. Government Printing Office], Power Rectification with Silicon Diodes by M. Dayal [Mullard, Ltd., 1964], Reference Manual of Transistor Circuits [Mullard], and several other references mentioned in the A.E. Diode Technical Notes, which are also recommended for your perusal. Then of course there is the periodical literature which includes, among much else, the abovementioned article in QST, "Silicon Diodes and Common Sense" in CQ, Sept. 1965. And "Why Abuse Semiconductors?", available from EEB for 35c. Also: "Modern Power Supply Design", QST, Feb. 1968.

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LETTERS [Cont. from P.30] [[comment on "Are Linear Circuits very Linear?" :]]
[[The cost of 38 transistors from computer boards is about $5.70; or the cost of 38 of the excellent AY1115 transistors, new, would be $13.30. The cost of 100 resistors at disposals rates would be about $5. Construction of 38-transistors worth of gear might have taken about 20 hours, or perhaps three weeks of spare time. Reliability is a function of care and design. Compactness is commonly a grossly overesteemed fashion, but can be achieved by careful design, and the use of printed circuitry. --Ed.]]

IBM Transistors are High Quality

I acquired an Astor Transistor 8 last week which has transistor sockets in every position. Thought I'd try computer transistors in it, and much to my surprise I found 033 and 034 work perfectly in the mixer, i.f., and driver stages.

-- A. Whittingham, Stanbridge, N.S.W.

CQ Now Pays for Articles

All articles received after about March 1 are being paid for upon acceptance and receipt of all related material. Our payment rates are nominally $20 per printed page ....

Incidentally, I've noticed some bad mis-information lately in some of the foreign magazines regarding a supposed increase in CQ's overseas subscription price. It isn't true. While we've been hit with substantial domestic Postal rate increases recently, our rates for mail to foreign countries remains the same. Hence, our domestic subscription prices have been increased to $6.00 per year while our overseas rate remains at $US6.00.

-- Dick Ross, K2MGA, Port Washington, New York, U.S.A.

Sugar and Spice and .....

I would like to purchase some issues of EEB. I'd like to write to some interested in radio. What is it like in Australia. Do you have many English people near. Are you English in origin. How do you celebrate Xmas out there? We have had 1-1/2 inches of snow today, not at all nice. What are Aussie girls like? Kind regards.

-- J. Savage, 7 Weyhill Close, Swindon, Wilts. England.

[[No, I'm not English in origin. Any Aussie girls out there?? -- RLG]]

INDICATING DUMMY LOAD: References and discussion, cont. from March EEB, P.18

A point has been raised: why bother using the lamp system to detect power, when the diode-rectifier type seems so much more straightforward. The reason is that the lamp type gives a power reading independent of waveform. This can be quite important with transistor RF power amplifiers [at least] which have relatively high harmonic output, and whose tuned couplers rarely have sufficient Q. The diode rectifier type of power detector also suffers from greater sensitivity to spurious pickup.

One very simple way to measure power, however, is the use of an RF Ammeter, if available, Simply measure current into a known resistance load. But don't try to shunt the RF ammeter to change the scale; it won't work; an impedance transformer is necessary, and requires recalibration.

6] 'What's New for You?' by Paul Franson, WA1CCH, 73, Jan 1968, P.88. You can overload certain commercial non-inductive wirewound resistors by some 10 times or so, for 5 seconds; the same idea ought to apply to nearly any wirewound resistor, but has limitations with the composition type, as discussed below.

'A Compact Dummy Load for Coax Line' by K6NKZ, in CQ Antenna Roundup, p.135. In reference to overloading dummies, oil immersion seems a simple way to triple the power dissipation abiiity of carbon resistors as dummies in a sealed coffee tin. If the lamp in the March EEB article were placed, say, against a piece of perspex [lucite] against the phototransistor or photocell, there seems no reason why the electronic part of the circuit couldn't enjoy the same oil bath, with additional advantage of cooling, or at least delaying sudden temperature change. See also: Shop and Shack Shortcuts [CQ], p. 221. And: Electronic Circuits Handbook [CQ], p. 113.

The abovementioned 73 article also discusses the availability of a phototransistor produced by G.E., the L-148, which is like the OCP71, but has a built-in lens to focus the light. Obtaining it from G.E. Aust. might be another matter .....

7] 'Optical Systems for Photoelectric Devices', Miniwatt Digest, Jan 1965, p.60. The sensitivity of Mr. Grieve's system could be increased for a given light and heat production, by the use of a simple lens system; I have found the simple self-focussing bulbs used in torches, to be quite useful for such things for the experimenter, but they are rarely available above the 2.2V rating in Australia, and must also be run under-voltage if any reasonable life is to be expected--if they are made by Eveready. The British 'Winchester' type is much better if it can be obtained.

8] 'Photosensors for every application [Particularly involving semiconductors]', Miniwatt Digest, Aug. 1965, p.164. The complete description of the kind of material available in Australia and New Zealand. A variety of photosensors can be used, with varying degrees of sensitivity. Several would have lower temperature sensitivity than the OCP71. More recent: Miniwatt Digest, Jan. 1968; the lovely BPX 25 phototransis. Note also photodiode OAP12. Mullard puts out whole booklet on CdS photocells.

9] 'Resistance of Light Bulbs' Radio Handbook, 5th Edition [Radio, Ltd., 1938], P 548

'Build yourself a Light Wattmeter' by C. Henry, 73, Nov 1965, p.98.

'Light Bulbs for Dummy Loads', by W8QUR, 73, Sept. 1965, p.86. Light bulbs are good up to 100Mc, if you don't care about constant resistance with power. These references show the enormous variation of resistance of lamps with current, as much as one-tenth of the resistance at half rated lamp power. This makes them quantitatively useful only if used with a special impedance matching system, or if power is carefully matched to lamp rating to give the desired resistance. It is a most awkward arrangement, and any other kind of resistance system would seem to be more sensible ... Mr. Henry's system uses a Cds photocell [Philips, STC] + 4V. More bulb resistance date: Shop & Shack shortcuts [CQ] p. 217.

10] 'A Cardboard Mailing Tube Wattmeter', by W7CSD, 73, August 1963, p.46. See also Henry in Ref. 9. These use an exposure meter or photocell to detect light.

11] 'The Detroit Dummy' by B. Barbee, Radio-Electronics, May 1966, p.47. Uses four

6.3V lamps as dummy, for low power [4W]. Estimates power by comparison with brightness of a standard 6.3V bulb fed a known amount of power via a calibrated potentiometer.

12] 'A $2, 200-watt Dummy Load', by W2OLU, 73, May 1967, p.66. Uses surplus 'non-inductive' resistors, but only non-reactive up to about 20Mc. Ref. 6 relevant.

'Transmitter Dummy Load', by G2BVN, RSGB Bulletin, Oct. 1966, p.664. More of same, but a special glass-tin-oxide power resistor is available commercially; 250W and more, non-inductive to 70Mc.

13] 'Resistors', by W8QUR, 73, Aug. 1966, p.83. Ordinary carbon resistors, such as used in Mr. Grieve's apparatus can show reactive effects, which increase when diameter/length ratio increases. Even so, they are pretty good up to 500Mc, and obviously leave far behind all wirewound 'noninductive' resistors. A special note must be made here, however, to beware of apparent 'Carbon' resistors which have an extra wide first colour band: they are low wattage wirewounds! One of these of 1K2W has L of 3.4μH [But ideal as parasitic suppressors: the 10Ω 1/2W size has 0.24μH inductance]. Note that carbon resistors do not like to take overloads as much as other types, and if you apply 1W to a 1W resistor in air, you should not do it for too long, particularly if it is enclosed, if you want to maintain its resistance calibration.

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LETTERS

A Sad Di-Ode!

Those of us with great ambitions
  Do aspire
To achieve big things 'lectronic,
  But perspire
With sweat from brow when things go wrong
  And know
That, had we studied EEB again,
  To grow
Accustomed to the new techniques contained
  Within
Its typescript pages, we'd have learned how wrong
  To sin
With errors; Alas, poor knowledge of the art.
  Alack!
I thought I knew, and sallied to
  Attack
But all the diodes failed, and so
  It's back
To books I go with fresh resolve,
  Dammit.

-- Electroloon, Victoria.

SSB is Spoiling the Bands

I'm still sending VK4SS DX news every month, and he does the same for my mag. I haven't worked a VK yet, but most of these stations you were able to work on AM are now on SSB, and so many other SSB's call them that the lone AM does not stand a chance unless he is 5/9+. As for me, I think SSB is spoiling the bands. It makes it too easy for you to work DX; this means any DX coming up is on SSB, and then you have a whole host of people calling him. Makes quite a noise on the band.

-- Jim Coote, G3UGD, Northumberland.

[[You'll just have to join them, Jim, or go to CW--the last refuge of the competent. Actually, CW has quite a lot more DX-power than even SSB, it's quite a lot easier to read, and you can apply fantastic selectivity techniques to it to cut out the QRM. It also goes a fair bit slower, so that there is some tendency not to talk just to hear one's own lovely voice. More and more in our lovely world there is a tendency to communicate for the sake of communication, without bothering to ask whether the communication is worth making. Thoreau raised the point some time ago, but was outvoted. -- Ed]]

QUOTE WITHOUT COMMENT: 'Save that S-Line' by W2AJW [CQ, Feb. 1968]: "Save it... from premature obsolescence resulting from the trend towards transceive operation...."

LITERATURE REVIEWLET -- RLG

Last year we presented a Literature Review in the form of a multitude of titles of articles appearing in the international literature. It was very difficult, and not much appreciated by readers either. Yet, one feels compelled to do something about the flood of literature that pours across the Editor's desk each month, to share it with you.

The best methods are to use that material as background and references for EEB articles [a most trying task at times], and to present selected topics of particular interest [to me] under the above heading. It is better to say a lot about a few topics, than a little about many ..? But there are so very many from which to choose! Intelligent technical review of literature can be very useful, if intelligent...

CORYRA [14 Hovea St., O'Connor, A.C.T. 2601; $A1 for 12 issues; back issues 12c, if..]

I had a few nice words to say in February about this monthly publication of the Youth Radio Clubs Service, in continuation of our article on p.57 of the Vol III EEB. The hurried P.S. on p.4 of Feb. shows only a little of the delight I felt when examining the Feb. 1968 issue of Coryra. I think that there is now no question that this magazine has graduated to the rank of a serious experimenters' journal, and it is my opinion that if you like EEB, you'll like Coryra too, though for quite different reasons sometimes. There is simple beginner material in Coryra for those who complain that EEB is "like two people talking at once", and there is good applied or theoretical copy there for those who believe that EEB doesn't have enough applied or theoretical material.

To give you an idea, here are highlights from a few recent issues:

February: Transistor Radio Service Techniques. 8 pages, and very good indeed. Transformerless Transistor Power Amplifiers. This fine article on theory and commonsense practice gave me a twinge, because in my pile of half-finished articles there is one on just this subject, approaching it from a basic then practical point of view. That is just what Len Whyte has done here, and I'm afraid he's done it better. So if I publish that article one day, I'll modify it so as not to repeat what he has covered; it will also be an introduction to a couple of fine practical articles we have on complementary amplifiers, but the field is moving so fast! Have you seen Fairchild's new circuit, using practically nothing, but with lots of feedback? But Len gets fine results from computer board transistors, so why buy expensive types?

March: Transistor Fundamentals: a nice basic treatment, from the 1959 Radiotronics, though I'm not entirely convinced that an article like this is necessarily justified when similar material is found so easily in the various handbooks and theory books which form a basic library of every serious experimenter.

Complementary transistor power amplifiers, continued. This time using the special complementary pair from Fairchild which "have better power capabilities than the computer ones ... and are more tolerant to heat .." Maybe so, but I sent for that special set of transistors from Fairchild, and their big output transistors are a couple of little TO-18's, with big heat sinks. I'll bet that if you put heat sinks on computer board types 033 and 083, they'll give out a lot more power too. Heat can indeed be more of a problem for germanium items, but base circuit stabilising current can be reasonably high without difficulty, and heat sinks suitably situated can do the rest.[[Interesting idea, 73 Jun '65: wrap aluminium foil around leads for heat sink]]

Testing Diodes and Transistors. All about how to do it with an ohmmeter. But the author, John Bryne, ought to have mentioned that it is not necessarily enough to make certain that the ohmmeter is on the 'high' range to avoid damaging the transistor; on some ohmmeters [for example one of mine] there is a 45V battery on the highest two ranges. A middle range is safest. Furthermore I was a bit disappointed that the author did not give reference to the extensive series of articles

we have presented [Grandma's Tests] on techniques for testing all possible voltage and current properties of transistors; it is not difficult [See also: "Why Abuse Semiconductors?" by RLG] and can resolve a lot of ambiguities quickly; for example it is simple to determine whether or not a crook transistor can be used as a zener: If either base-emitter or base-collector is back biased, it will make a good zener if the back current rises very sharply as back voltage is increased beyond the zener voltage; maximum current must, of course, be limited, usually to about 100μA maximum. And results from testing transistor voltage ratings can be most gratifying. For example, for the 30V [on the specs sheets] AY1115's recently sold through the EEB, I measured some BV_{cbo} values well up around the 80V mark. True voltage measurements of your semiconductors can double the usefulness of items in your parts boxes.

Short-Wave Listening. And the usual excellent, low price Components sale. I had better not say too much about that Sale here, or Len may be swamped by bargain seekers; I have to exercise restraint, and am not always successful.

April: Transistor Fundamentals [continued]. I have to admit that the treatment is better than found in most handbooks or theory books; the problem is that the latter rarely steer a good course between stupid simplicity and stupid complexity. This series of articles does well in that regard, and I find it a good review.

Amateur Radio. A definitive article, telling what it is all about.

Preamplifiers for Transistor Amplifiers. See also the excellent series on this subject also appearing in recent issues of Miniwatt Digest or Outlook.

Complementary Symmetry Amplifiers [continued]: A Loud Hailer. Or: what to do when your neighbour starts up his electric mower on a Sunday Morning. Honestly, my neighbour took 40 ghastly minutes to do a patch of lawn I could have done over twice in 10 minutes with a hand mower. Progress?

Now, I shan't devote more time in future issues to reviewing Coryra again, because if you are interested by the above report, you'll send for back issues and subscribe to future ones, and if you're not, why bother? If Roger runs out of back issues from the flood of EEB-ites, I'll be glad to run them off for him if he sends me the skins.

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LETTERS

Commonsense Substitutions [[as part of the article on A Simple Metronome]] [[EEB, Dec '67]]

I might say parenthetically, that it is frustrating to look at USA circuits and not to be able to duplicate them exactly. The above arrangement may, therefore, prove useful in this part of the world. -- M. H. Gabriel, Brisbane, Q'land.

[[Ed. Note: One must not be very concerned about being able to duplicate 'exactly' the various circuits in the foreign literature, as I have discussed on P.158-159 of the Nov. EEB. If you know what the circuit is doing, you can easily figure out the logical substitutions. Don't worry about transistor types. Any transistor of suitable approximate power rating, frequency, and gain will work in most circuits. And for the most part, these requirements can be ascertained by inspection of the circuit, and from description of its function in the article. For the rest--a bit of experimentation, stage by stage is not difficult. After all, what experimenter wants everything set out for him perfectly? For that he can buy modules or whole apparatus.]]

How to Buff an FET

Been playing with FETs in Command TX. VG but V E R Y hard to get an effective buffer even at very low [1mw] level to prevent pulling. Old HRO now all solid state SE5301 RF/MIX/OSC VG still 455 if into SSB/AM/FM dets. --I. N. Kallam, Cardiac, Vic.

[[Vy FB OM, bt FETs wrth usng bcz vy gud linearity so no X-Mod SSB/AM/FM bah cul --G]]

TRANSISTORISED TRANSMITTERS, Part V-A -- RLG
-- References for Power Amplifier Design.

Design vs. Practice.

As I continue the discussion from the December 1967 issue, I continue to be impressed by the wealth of material available on construction of transistorised transmitters. If you wonder whether I'll ever stop talking about transmitters and start describing them [I shall], you need only look in the current ham magazines. Nearly every month you will find a constructional article in one or more of them, and even old QST has been making a good showing. There are plenty in References 9B, 18, 31, & 32, and in most circuits books and manuals. Except for a smattering of practical theory in Refs 1, 18, 31, & 32, there isn't much available on an experimenters level for transistorised transmitters. A bit of theory appears occasionally in the main ham magazines, but most of the good stuff seems to lie buried in the several excellent Application Notes of the big firms. I try to cover it a bit here, and if you want more information you'll have to consult the sources, as outlined in Refs 4, 9B, 27-30. They are well worth reading.

Mullard is reported to have published some very good material from their Convention last June, According to Ref 22 and 7, but it doesn't seem to have percolated down to Australia yet; if any of you readers in Britain can get a collection of the "Mullard Practical Planar for Transistors" which features design and construction, I really would appreciate having a look at it; it would be appreciated if that copy were extra, so we could keep it. It costs a fair bit to put material through a copy machine.

Now before continuing with the December subject of Modulation, lets take a few issues to discuss more important and more fundamental matters concerning the ubiquitous Final R.F. Power Amplifier.

The first affair will be to present a list of References for the whole series of articles on P.A.'s. I shall break tradition to present the References first, because these references are not listed to impress you, but to form a part of the text. They are put into a separate list merely for convenience and for limitation of EEB space. The comments associated with each reference should be read the first time the reference is presented in the text, and the title of the article should be noted in connection with the text. I admit that this makes rocky reading, but you will likely have to read the text more than once in any event; it is still easier and more rewarding than struggling through the great body of the original material! Some of the references are not included in the text, and should be examined for general background interest.

References for R.F. Power Amplifiers

1] Basic Theory and Application of Transistors, Army Technical Manual TM 11-690 [A good general purpose reference work. Parts of interest here cover coupling networks and neutralisation. Treatment is unsophisticated but competent].

2] CQ Magazine, Jan 1966, P. 22. "Output Circuitry Design for Transistors," by WØTKX ["The use of transistors in r.f. power amplifiers creates problems in designing the collector load and the impedance transformation circuit." See also Ref 26 here, and "High Frequency Power Amplifiers" in Ref 18.]

3] Fairchild, APP-58, in 3 parts. "Class C High Frequency Amplifier" by A. Evangelisti. [If you send to FC for this, it would be good also to ask for the sheets on the 2N708, 2N914, and 2N2368. Amplifiers described are for 70, 150, & 250Mc, QRP] [Don't overlook excellent higher power FC transistors: AY8105, SE3030, SE3035, etc. See EEB 6/67

4] Motorola, AN-100. "Achieving Stable High Frequency Design with the Mesa Transistor" by D.G. Paterson [Neutralisation vs mismatching. The use of the 2N700]. Motorola also publish several other good sheets on transistor parameters and frequency response, e.g. their duplicated sheets entitled "High Frequency Amplifier Transistors", and AN-139. See also their "Semiconductor Data Manual" with Application Notes included in back,

and the classical "Power Transistor Manual" for discussion of voltage ratings. We hope soon to present a list of Selected transistors by Motorola, analogous to lists in last June-August EEB .... In Australia, Motorola is ably represented by: Cannon Electric [Australia] P/L, P.O. Box 22, Brighton East, Victoria 3187. In the U.S.A.: Motorola Semiconductors, Box 955, Phoenix, Arizona 85001.

5] Motorola, AN-107. "Transient Protection for High-Frequency Transistors," by W.D. Roehr [Power supply d.c. bypassing, and time constants in the amplifiers]

6] Motorola A.N. 112. "400Mc Power Oscillator using the 2N700 Transistor," by W.A. Rheinfelder. [f_T = 1000Mc. Essentially a common-base or "parasitic" oscillator; see Break-In, March 1968 for article on this interesting subject].

7] Mullard Outlook, July/Aug 1967. "14Mc Power Amplifier using the BD123. Details of suitable Mullard material available are listed in the November 1967 EEB; lists of their technical publications available appear in Electronics Australia, or they can be requested.

8] QST., Feb. 1968, p. 46. "An Unusual RF Amplifier Circuit" by W3MOO

9] QST., Jan. 1968, p. 11. "Toroidal-Wound Inductors" "Why, Where, and How to use them"

9a] Radio Data Reference Book [2nd Edition], by G.R. Jessop & T.R. Preece [RSGB, 1967] [An amazing and well presented collection of a remarkable number of labour-saving graphs, charts, nomograms, and formulae on everything electronic]

9B] RCA PUBLICATIONS: In terms of technical materia we have received on request, RCA appears to be ahead of the others; the STC material is less voluminous, but also of high quality. One probably important item which I have not reviewed is the RCA Silicon Power Circuits Manual, described on P. 107 of last August's EEB. I expect it to be a gem full of sensible theory and lots of practical circuits including transmitters.

See last Sept. EEB for details of transistors and address of AWV. If their stock of RCA technical publications is lacking for a given item desired you might try: RCA Electronics Components and Devices, Somerville, New Jersey, U.S.A. The same procedure applies to the other companies: request information from the local Representatives first, and wait a decent interval of time before going further. Several of the Australian Representatives are excellent, and if you can show them that you are serious they will give you good service. When you write them, it is worthwhile to request a list of publications available, if they have one.

10] RCA Application Note SMA-20. "A 27Mc 5W Citizens Band Transmitter using RCA Transistors" by S.J. Matyckas [More complete details of the circuit in my Ref. 18]

11] RCA, SMA-10. "Design of an Amplitude Modulated VHF Transmitter using the RCA 2N2631" by S.J. Matyckas. [6 Tr, P_o = 7.5W on 50Mc. OK, but tapped parallel resonant tank]

12] RCA, ST-3250. "Design Trade offs for RF Transistor Power Amplifiers" by R. Minton.

13] RCA SMA-40. "Frequency Multiplication using Overlay Transistors," by R. Minton & H.C. Lee. [See details in the Sept. 1967 EEB]

14] RCA ST-3164. "Microwave Power Generation Using Overlay Transistors," by H.C. Lee. [Comprehensive plumbing design for SHF. Interesting discussion of common-emitter vs. common base configurations, with examples and relative power outputs].

15] RCA ST-2929. "OVERLAY". See Sept 1967 EEB for review.

16] RCA ST-3058."Overlay Transistors Move into Microwave Region." by C. Lee and G.J. Gilbert. [At low gigacycle frequencies they outperform varactors and conventional transistor amplifiers. Typical 340Mc amp with plumbing, P_o = 2.9W. Wow.]

17] RCA Ham Tips, via RSGB Bulletin, July 1967, p. 448. Also EEB Vol III, p. 123.

18] RCA Transistor Manual, Edition SC-12 or subsequent. [A delicious blend of basic theory and useful practice on a wide variety of circuits. Plus characteristics of their cheap high performance high power VHF transistors, available here from AWV. See EEB, Sept. 1967 for details of availability of 'Overlay' types].

19] RCA ST-3447. "RF Breakdown phenomenon Improves the Voltage Capability of a Transistor," by P. Schiff. [Effect can be 1.3 or more, above $f_{\alpha e}$, but don't depend on it!]

20] RCA ST-3219, "RF Power Transistors in Vehicular Radio Communications Equipment" by S. Matyckas [Theory and practical examples; details of ckt in my Ref 18].

Quite so. See Electronics Australia, Feb 1968, P. 125.

21] RCA ST-3230. "Semiconductor High Frequency Power Amplifier Design" by R. Minton.
22] RSGB Bulletin, Sept. 1967, P. 576. "Technical Topics"
23] 73, Feb. 1962, p. 12. "Final Tanks" by W6JAT. For valves, but good background.
24] 73, Apr. 1967, p. 84. "Ferromagnetic Beads" by W6SFM.
25] 73, Aug. 1967, p. 36. "Using Toroids in Ham Gear" by M.Goldstein, VE1ADH. Cf Ref 9.
26] 73, Feb. 1967, p. 64. "Practical Tips on Building Transistor Transmitters", KØCJF.
27] Clevite Applications Note 50-15, "A Common Emitter 50Mc RF Power Amplifier Design." From STC, or possibly direct from Clevite Corp, Palo Alto Plant, 1801 Page Mill Road, Palo Alto, California, U.S.A. [30W, uses their 3TX003 transistor. Ask for specs].
28] STC Appl. Note MK/179X. "Transistor RF Power Amplifiers," by M.V. Bond. Their address in Australia: Standard Telephones and Cables P/L. Electronic Components Dept, Moorebank Ave., Liverpool, N.S.W. 2170... The transistors available through STC appear to be quite good, but so far, repeated requests for a list of their transistor prices has yielded nothing, so I can't say whether they compare favourably with the RCA items in that respect.
29] ITT Semiconductor Application Note AN-1. "VHF/UHF Transistor Amplifier Design" by J.G. Tatum, In Four Parts. Obtain from STC, or possibly directly from ITT Semiconductors, 3301 Electronics Way, West Palm Beach, Florida, U.S.A. Cf. EEB Vol III, p.122.
30] T.I. Application Note, Sept 1959. "VHF Transistor Power Stages" I'm sure that TI must have more material on transmitters than this; they have whole books on transistor circuit design. If anyone has more specific information on this, please let me know. Their Address in Australia: Texas Instruments [Australia], Elizabeth, S.A. 5112. If you don't get a reply from S.A. in a month or so, you might try: Texas Instruments Inc, Semiconductor-Components Division, P.O. Box 5012, Dallas 22, Texas. The American Branch tends to be very cooperative in furnishing technical material, but they refer you to S.A. for the supply of any transistors. But .....
31] Transistor Radio Handbook, by D. Stoner & L. Earnshaw [Editors & Engineers]. This classical work contains a variety of nice practical designs of considerable interest to the radio amateur. Although it is somewhat dated, it is still so good that Sams [who now own E & E!] hasn't bothered to get out another Edition. A good book to own, along with References 18 and 32. The only problem is that the Australian price is greatly inflated over the proper one, a problem which can be solved easily by reference to p. 126 of the Vol III EEB.
32] Transistor Transmitters for the Amateur, by D. Stoner [Sams]. [Nine practical projects, plus some conventional but useful theory -- but note that the polarity of the driver transistor on P. 95 is reversed]. [[The Grapevine has it that Sams is going to publish still another book on this subject, probably involving FET's; what an embarrassment of riches]]
33] Electronics World, Sept. 1964, P. 50. "Selecting High Frequency Transistors" by R. Hejhall & D. Thorpe. [All about frequency ratings. See also Ref. 4 : AN-139]

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QST & THE ARRL HANDBOOK

There isn't enough room to start on the rest of Tr Tx, so I'd like to say a word on QST. That magazine has picked up noticeably this past year, presumably connected with healthy competition from the other magazines. A good sampling of transistorised transmitters has been included. If your Club subscribes to QST be sure to look at it.

The grapevine says that the ARRL Handbook for 1968 has "many changes, improved coverage of semiconductors... a big improvement over last year's issue." That wouldn't be difficult. From impressive adverts in QST something would seem to have happened; at least the cover of the Handbook has been changed. For the first time in 192 years, it now bears pretty pictures. The text says: 35 NEW construction projects including a 50W SSB transceiver; solid-state converter, s.s. keyer, s.s. AF generator, s.s. VOX, power supply, s.s. preamplifier/clipper, etc etc. It would seem that the semiconductor age has penetrated to Newington. Well good, better late than never. Maybe if the ARRL Handbook is good enough, it will stimulate RSGB to come out with the threatened 4th Edition of their excellent Handbook. I hear that 3rd Editions are quite out of print. A pity. By the way, does anyone have a First Edition RSGB A.R. Handbook? If so, please write EEB and we can negotiate a price, or maybe exchange for First Edition EEB, or something! Hi.

CONDENSER STEW [An April Special] -- I. N. Clusive [VK9]

The following procedure is the result of several years investigation into the properties of various kinds of condensers. Although used condensers were involved in the preliminary experiments, it is recommended that new ones be used for the final results. The resulting mixture is guaranteed to remove paint, discolour furniture, or eliminate snails from the garden. All volume measurements are with the Imperial gallon; for the American gal, add 25%.

Take 4 gals of good quality water, boil briefly, and put into a very clean 8 gal container, and cover.* Allow to cool one day or so. Put 6-12 oz good quality foil condensers in about 1-1/2 gals boiling water, and simmer for about 1/2 hr. Spoon out the condensers, which will be looking a bit wilted by this time, and add the liquid mess to the cold water.

Add 2 lbs of silicon diodes to about a gal of water, boil for about 10 min, then add the same wilted condensers to the boiling mixture and simmer for another 20 min, adding a few new condensers in the last five minutes. Spoon out the now very much used condensers, and discard them.

To the simmering liquid now add the juice of one large lemon or equivalent, and one rounded [not heaping] teaspoon of table salt, as well as a tablespoon of ammonium phosphate, and stir in. To this hot liquid add 8 lbs of melted electrolytics; it is easy to melt electrolytics--just put them into a warmish oven for several hours. Stir in the electrolytics very well, because they make quite a mess. Then turn off heat, add 1 tsp of ground chalk [not the 'dustless' kind!], and stir well again. Add to the rest of the liquid, using a knife to help remove the goo from the pan.

Cover the 8 gal container again. When its temperature has reached lukewarm, add a cup of grommets; with the cold water previously in the container, it should take only a few hours for the temperature to drop. Do not delay too long, but it should not be above blood heat. The grommets ought to be the heavy kind which sink to the bottom. There is nothing more useless than a bunch of washers floating on the top of your stew.

After a few days this mixture will begin to look rather strange, and if some of the stuff from the condensers floats to the top, it should be skimmed off carefully. In due course the mixture will settle down, and when there isn't a sign of any grommets, it will be ready. There are several ways that the mess can be utilised.

One use is as a solvent for the workshop on cold winter evenings; it is guaranteed to dissolve anything in 30 minutes, so you are cautioned to use it sparingly. Another use is in the garden, particularly on warm days; it gives the plants a strange look after 15 minutes or so.

You will have quite a lot of the stew left over, and unless you want to throw it out, you'll have to store it as possible. It will be found that a teaspoon of silicon diodes per quart of stew will enhance its keeping qualities considerably. It is important not to use more than this amount of diodes, or the mixture will deteriorate quickly. The left-over grommets at the bottom of the big container should be gathered up carefully and stored in a covered [but not sealed] container with some boiled water, in the refrigerator in event of further use.

April fuel!

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* It is quite important that the container be kept in a room with an even temperature, preferably cool.

ππππππππππππππππππππππππππππππππππππ // Talking about corrosive mixes: BY THE WAY, BEWARE when soldering the new Teflon [PTFE]-insulated wire [presented in Miniwatt Digest, Jan. 1968]. Under certain condx, when burned Teflon turns into deadly gas!!!!!!

Please say that you saw it in the eee eee bbb!

ADVERTISING

Personal advertisements free if reasonable length, otherwise please add some money. Commercial advertisements 5c/line, $1.00 half page, $1.50 full page; this is total space ordered, and can be spread out over several issues. Advertisements are accepted in exchange for good technical material. We reserve the right to omit copy etc. Free adverts are good for only one issue at a time; resubmit each month to rerun. Please write clearly.

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BULK TRANSISTORS

Please do not request any more AY1115 Transistors. They were sold rapidly, and there are no more. There appears to be plenty of demand among EEB readers for the AY1115, so if you want a number for yourself, why not order them from Fairchild and sell the rest here [See February EEB, P.2]
-- D. J. Bedford, 59 Central Ave., MOONAH, Tasmania 7009

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WANTED - One dial mechanism for a Marconi B28 [also known as a CR100]. Only the dial gear and drive system is required. The revolving indicator section is not wanted. -- B. Clarke, VK5BS, 18 Cornish St. GLENELG NORTH, Sth. Aust. 5045

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LETTERS

Printed Circuits, etc.

I was pleased to see that Grandma has the same method of preparing Printed Circuit boards as I have. But I tell you what, she's not far out. I know for a fact that several industries devoted to mass-producing electronic gear have decided that it is really the best way after all. They usually paint it on clear plastic, contact print this onto photo-resist, and etch the result. This is then punched [i.e., all holes in the same motion], and assembled. It has been found that there are less costly mistakes this way than with all the sophisticated enlargements and the like.

I am with you all the way on transistor voltage ratings too. I also, was deceived by 'flexible' junctions, and it made transistors extremely costly for a long time! [i.e., pre-EEB].

Re literature: I like the Editors and Engineers Transistor Radio Handbook very much, specially the absence of the 'oh well, we all know they aren't really as good as valves...'. Another book worth a glance, if you can get through the ghastly layout is Fundamentals of Modern Semi-conductors [sorry, the author escapes me]. I'm afraid I don't like 'Electronics Australia'..... The English Practical Electronics and Practical Wireless I like; also American Elementary Electronics is not bad sometimes. However, I for one DO read the EEB from cover to cover. -- C.P., N.S.W.

[[Electronics Australia is a fine magazine, with an ever-increasing awareness of semi-conductor technology; reread 'Old Peth' on P.22 of the March 1967 EEB, and our discussion in the August 1966 issue too .... How can you read EEB from cover to cover; it doesn't have any? -- Ed.]] [[Mr. P. also wanted to know how to buy stuff abroad. Main gist of my reply was that it wasn't worth it, particularly after crushing duty and the unreliability or plain dishonesty of surplus merchants. But if you want to try, there are plenty of advertisers in the foreign magazines, and you need only send them $US or Stg. -- by Registered Post.]]

AUSTRALIAN ELECTRONICS: 76 View St., Hobart, Tasmania 7005

CATALOGUE: April 1968

All items post paid, tax paid. Please add 5c if payment by cheque from the Mainland; not necessary for Postal or Money Orders. All prepayment, no credit. $1 Minimum. Our prices are the lowest in Australia for comparable merchandise! Delivery: Nominally slow -- strictly spare time; add 15% for rapid service. We can import items for you, if prepaid. Stock limited.

RESISTORS:

2 Watt 470K [only], metallised, high voltage non-inductive type. 3c each.

WELWYN Glass-encapsulated, new high-stability resistors: 125Meg, 1000Meg, 10KMeg: $0.65 ea; Last stock of this type of resistor. Original cost, about £5 each.

PLASTIC INSTRUMENT RADIO CABINETS: [See Feb. 1967 issue of EEB for drawing]

6½" high, 4½" deep at base [3½" at top], 11" wide at base [9" at top], made of high-impact styrene, originally designed for a portable radio. Their sloping front, sturdy construction, and convenient size make them ideal for instrument and radio work of all kinds. A 1½"x1½" cavity in the rear is designed to accomodate three ordinary "SizeD" Dry Cells, and a sliding cover fits over them securely. There is a flange ¾" from the front edge, against which a front panel can rest. No front panel is provided, but provision has been made for two screw holes in the back to accomodate a panel mounting bracket. The plastic can easily be drilled, filed, sawed, or painted; unlike perspex it will not readily chip or crack. It can also be melted or glued. If you wish, we can supply some special glue for 25c. Price for the Cabinets: $1.50, Post "free" in the Commonwealth. Delivery from Melbourne. A real bargain. Stock low.

SILICON DIODE RECTIFIERS: [Diode Technical Notes included with each order]

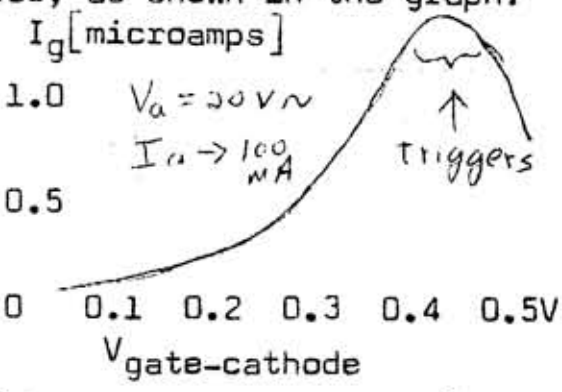
50V/100A: $5 ea, 250A/200V: $15.

Various silicon Zener Diodes, 1W, 180-220V, our choice. Work fine as 0.75A rectifiers, if PIV rating is observed [viz, same as Zener rating]. $0.25 ea, $2/doz.

SILICON CONTROLLED RECTIFIERS: [SCR Technical Note included with each order]

PIV or V_{bo}	Fwd Amps	Max I_g	Price
100	0.8	10mA	0.85
200	0.8	2mA	1.10
200	0.8	10µA!	1.25
300	0.8	10mA	1.40
200	4.7	10mA	1.60
200	10.0	20mA	2.10

The 200V/0.8A SCRs are a phenomenon. Most of them have a gate current firing sensitivity [I_g] less than two microamperes, as shown in the graph: This means that they will control an enormous amount of power with practically nothing: control by RF, static charge, proximity effect [a.c. pickup], etc becomes practical. This is the sort of sensitivity you expect from a Silicon Controlled Switch [ref: G.E. Transistor Manual], but in this case there is only one gate [the usual Cathode-Gate].



Silicon controlled rectifiers may be used for motor speed controls, lamp dimmers, battery chargers, tachometers, electronic ignitions, remote control, model railroad control, photo-timers, flashers, etc! Excellent coverage of this subject is afforded by the G.E. and R.C.A. SCR Hobby Manuals, the International Rectifier Co [Warburton Franki] SCR Handbooks Vol I & II, and the G.E. SCR Manual, 4th Edition. See the big Mainland bookshops, or order from the bookstore specified on p. 126 of the September 1967 issue of The Australian EEB, for considerably lower cost, but slower service.

FOR DIODES AND SCR'S, BE SURE TO ALLOW A PIV SAFETY FACTOR OF AT LEAST 1.5-fold. See 'Diode Notes.'

TRANSISTOR SOCKETS: Round black plastic type, adjustable three-pin type $1.05/doz.

POTTED FILTER CHOKES: 10Hy 200mA, $2.75 ea. While they last.

BOOKS: [Please add to the list of RSGB Books: SSB Equipment, $0.30, for those who like such]

It is quite impossible to include here sufficient information adequately to describe the technical books we stock, so we are not going to try. If we stock a book, you can be certain that it is a good book for the subject, and that furthermore it is sold at a reasonable

PRICE, an unusual happening in Australia. On the other hand, we have prepared a detailed description of nearly every book in stock, which ought to make it considerably easier for you to purchase by post. It comes to about a dozen foolscap pages, and is more fun than browsing through a bookshop [and likely cheaper too, because you won't be as likely to buy by impulse]. If you want this Giant Packet, please send a large SAE, with 'PACKET' marked on it.

The following books are now in stock:

CQ Books:

Diode Source Book [including articles on switching, varactor, microwave, mixer, zener, photo, tunnel, and power diodes. And detailed specs. for all 1N--- types by number and by function]	$2.50
Care and Repair of HI FI	$2.50, o.n.o.

73 Books:

73 Useful Transistor Circuits, lovely	1.00
Receivers, comprehensive, very useful	2.00
Ham RTTY, for tired typewriter mechs.	2.00
VHF Antennas, very nice indeed, BIG	2.00
Ham Clubs, how to build and keep.	1.00
Test Equipment	0.60

Sams Books:

Transistor Transmitters for Hams	2.95
Diode Circuits Handbook, very nice.	3.25
Transistor Circuit Manual [Vol I]	5.25
Handbook of Tr. Circuits [Vol II]	5.25
101 Ways to use VOM/VTVM, very nice	2.95

Motorola Books:

Zener Diode Hdbk: Ckts, characterist.	2.50

U.S. Government Books:

Introduction to Electronics	1.15
Basic Electronics [at all levels]	3.45
Basic Theory and Application of Tr.	1.75!
Theory/Use Electronic Test Equipment	1.30
RF Power Measurements	0.25
[Free with any other order of U.S. books]	
Fundamentals of Electronics [8 Vols]	17.00

[[This set, or part, can be sent on approval to appropriate institutions]]

GUNTHER ARTICLE, booklet:

"Why Abuse Semiconductors?"	0.35

[[Many details on the proper use and testing of semiconductors. A must]]

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THE SELECTED SEMICONDUCTOR CIRCUITS HANDBOOK by S. Schwartz. Hard Cover, well bound, 450pg, 8½ x 10"; $4.50, post free.

This useful book contains a remarkable collection of semiconductor circuits of basic design. The circuits are those of the most needed systems, some simple, some

[[continued, next column--]]

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complex, depending on performance required. The "Contents" illustrate the range of subjects, each of which is preceeded by an intermediate level introduction on Design Philosophy. There are eleven pages of Contents! Sections include:
I: INTRODUCTION [including preferred list of transistors, abbreviations, symbols; you can substitute Australian transistors easily by inspection of the circuit requirements].
II: DIRECT-COUPLED AMPLIFIERS.
III: LOW-FREQUENCY AMPLIFIERS.
IV: HIGH-FREQUENCY AMPLIFIERS.
V: OSCILLATORS. VI: SWITCHING CIRCUITS.
VII: LOGIC. VIII: AC/DC POWER SUPPLIES.
IX: AC/DC POWER CONVERTERS.
X: SMALL SIGNAL NONLINEAR CIRCUITS [including modulators, mixers, converters, detectors, frequency multipliers, and frequency dividers].

A further sheet of description of this remarkable book is available, on request. Circuits do not overlap those of other books, xcpt Techpress Semiconductor Circuits books.

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Techpress Books:

Selected Semiconductor Circuits:	$1.25
Transistor Specs and Substitutions [worldwide] Handbook, 3rd Edition. Nice	2.95
Diode Select-A-Spec [worldwide]	2.95
Principles of Amplitude Modulation	1.95
Principles of Electronic Oscillators	1.95
Principles of RF Power Amplifiers	1.95
Principles of Transmission Lines	1.95
Antenna Principles & Wave Propagation	2.95
Power Supplies and Regulators, lots!	2.95
Fundamentals, Vac Tubes & AF Amps, lots!	3.95
Transistor Select-A-Spec	3.95

[This lists a vast number of transistors by various characteristics. Free with order for any three Techpress Books]

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R.C.A. Tunnel Diode Manual [Amazing device, now available in Australia-- or use the PUJT/Regenerative Switch PNP/NPN transistor equivalent, described in RCA SCR Manual & in recent EEB's.] Retail price = $1.50. SPECIAL: $0.75!

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R.S.G.B. Books at less than retail prices!:

Data Book [See Electronics Australia, April 1968, p. 141. This is quite necessary because there is so very much in this book]	$1.25
Technical Topics, by Pat Hawker, G3VA	$1.00
Service Valve & Semicon. Equivalents	0.50

SIMPLE SIMPLE SIDEWINDING: Corrections & Comments [Ref: EEB, March 1968, p. 19] This item was not included in Contents on P. 27 here, because this information was received after printing it!

A] From John Mc Kenzie, ZL2ADB:

1. The sideband selector switch is incomplete. The unconnected terminals must be connected to reverse connections when the switch is thrown to the "SB2" side.
2. Earth the cathode resistor return lines of the ½12BH7 and 6BQ6 valves! [[But then it will work! SSB:Bah.]]
3. I don't think the centre-tap RFC to earth from L2 is necessary.
4. A near identical circuit appeared in the August & September 1961 issues of Break-In, the "Tucker-Tin," a two tube SSB/CW Transmitter, by Fred Johnson, ZL2AMJ. This design has been regarded over here as a classic introduction to SSB, and I think it should be slightly superior to Mr. Smith's design..... A nice project for cutting one's teeth on.

B] From Al Rechner, VK5EK:

The circuit is incomplete, and contains a couple of wrong component values. I draw attention to these not as criticism of EEB, but to assist erstwhile SSB enthusiasts.

1. The audio phase shift components between T2 and SB1/SB2 switch comprise two resistors of 1K each and two condensers of 0.1uF each, not 0.01. See circuit [[below]].
2. The audio from SB1/2 switch would be short-circuited by the secondary of L1 and the 100 ohm [should be 125 ohms] RF phase shift resistor; see circuit for correct arrangement [[below]]
3. The wiring of SB1/2 switch was incomplete.

C] Comment by EEB Editor:

In reference to Item A.3, the RFC would presumably make the balance of L2 less critical of tap and geometry -- but the link is at the centre of L2, not bottom as on our diagram.

In reference to the origin of this circuit, Leslie said in his first sentence that "the rig was perverted from the 'WIA/VK6 Bulletin of September 1965," and except for the corrections pointed out by our correspondents, perhaps represents simplifications..? Presumably ZL2AMJ's design has become so classical that he has suffered the well known fate of all truly successful innovators: annonymity. We make only slight apology for it; besides "We guarantee nothing," hi. We are pleased to reintroduce this fine design to Australia again at this time.

The circuit reproduced here is the complete one from CQ, Sept. 1962, p. 63. We are indebted to Mr. Rechner for providing this reference.

In reference to the first footnote at the bottom of P. 20 of the March EEB, someone has indeed transistorised the circuit: "An 80M Transistorized SSB Exciter" by I1TDJ in CQ, Feb. 1968, p. 54+, but as one might have expected, the 2 valves are replaced by 12 transistors! Although I am apathetic to SSB on principle, I am not against the elegant technical innovation it represents, and will welcome any contributions on the subject by EEB readers, as long as it is of particular interest.

By the way, "The Phaser for Two Metres" in the Sept. 1964 Amateur Radio has been brought to my attention. But please note that it is an FM exciter, not SSB! Phase modulation is FM in which a crystal oscillator may be used, & where frequency deviation is directly proportional to modulation frequency, not amplitude. It is translated to proper FM by a phase-correcting network FM has much to commend it and I shall be having more to say on this subject...

--RLG

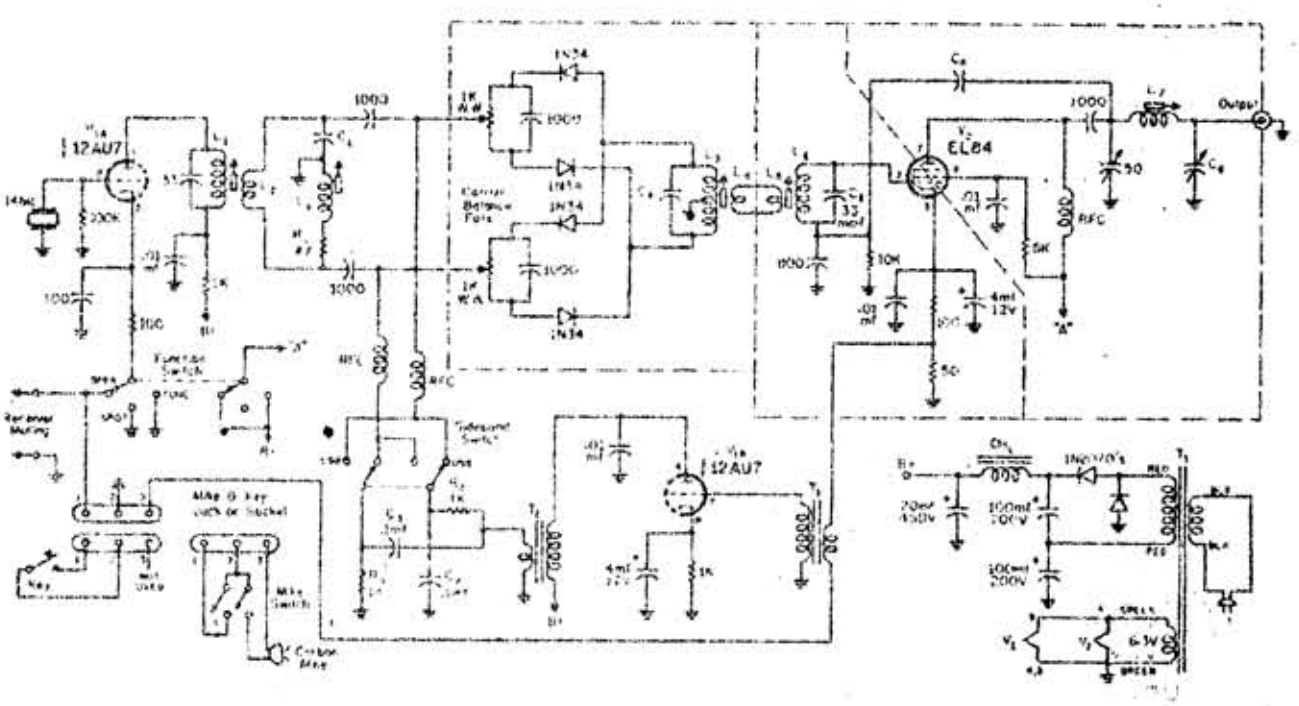

Fig. 2--Circuit of the "VHF Quacker," a simple and inexpensive sideband generator providing ample 14 mc output to drive most v.h.f. sideband heterodyning units. Although the unit has only about 15 db sideband suppression, it represents a substantial improvement over an a.m. signal of similar power.

C_1--100 mmf silver mica.
C_4--390 mmf silver mica.
C_6--25-250 mmf compression padder.
L_1, L_6--14 t. #28 e. closewound on ⅜" dia. slug tuned form.
L_2--4 t. of small hookup wire wound over L_1 (Note: do not twist the link wires more than one or two times).
L_3--6 t. bifilar wound on ⅜" form, spaced two wire diameters. (See fig. 4.)
L_4--1 t. link wound over center of L_3.
L_5--1 t. link wound over cold end of L_6.
L_7--13 t. #22 ¾" diameter spaced one wire size (Air-Dux 616).
L_8--8 turns #22 e. ¼" diameter, spread or compress to adjust.
T_1--Any carbon mike to grid transformer (such as Stancor A-4705).
T_2--Any plate to line transformer approximately 10K to 2K (such as Triad A-23X).
T_3--Power transformer, 117 v. at 50 ma, 6.3 v. at 2 a. (such as Merit P-3045).

 [[Simple ? Sideband comments -- continued:]]

Postscript: P. 128-136 of the excellent Transistor Radio Handbook [Stoner & Earnshaw, published by Editors & Engineers] also describes a 10-transistor equivalent phasing SSB exciter, with much descriptive text. This Handbook is excellent for a wide variety of subjects, and its presentation of a circuit covered by a 1968 article certainly shows that the Handbook is still current.

!!

BEWARE OF CHEAP IMPORTED TRANSISTOR RADIOS. According to Electronics World of Feb. 1968, some of them boasting 10 transistors may have only 6 or 7 functioning. Others may be rejects, put there only to make the line-up look impressive. Fact is that 6 or 7 transistors is ordinarily quite sufficient, but human nature assumes that if there are more, it has to be better. Ohmi.

CRO PI [for the Little YF at OHM] -- by Alice Gunther

Ingredients: 500V Silly Cone [or germaniums if in season]. Square Roots [be sure that Root 2 disappears]. Carbon Pile. Worm Drive. Charge of Audio or DC Currents [wait until juice flows]

Method: Load into Final Tank. Skin on interface. Pinch effect, apply high tension. Run front end mixer, but avoid Breadboard Backlash. Form a mesa crust, and modulate downward.

To cook: From a cold start, drift is inconsequential after 15 min. warm up [ignore birdies]. Cook the junctions carefully for 20 milliseconds at 25Amps, or 1 Amp for 1 minute [slow heating improves temper]. Delay the line, and dondens er. Cook for half a MHO to a brown pair of sitics, but avoid tendency to squegg. Coul ombs, and stand by for channeling.

To serve: Cut with laser beam, serve on thin wafer supported by tungsten grid. Raise the feed point, deplete the layer with small signal gain. Store in ceramic envelope.

In event of failure: Tip the whole thing down the Heat Sink!

ππππππππππππππππππππππππππππππππππππ

SUBSCRIPTIONS to R. A. Walton, 115 Wilmot St. Huonville, Tas., 7109. Uncrossed P.O.'s preferred in Australia; if cheque, it could be nice to add another 5c for the State Tax. Other countries please pay by cheque in own currency [see first page, this issue], but for NEW ZEALAND, please send P.O. or cheque to: Judi Smith, Box 5183, Auckland, 1, NZ. NOTE: Subscriptions are accepted for [only] one year at a time, and begin only with the next issue. All other 1968 copies, 13c ea. RENEWALS must be sent promptly to avoid missing any issues. Please use our envelope. BOUND VOLUMES: I [1965] unavailable, sorry. II [1966]: $A1.65, $NZ1.75, $US2.00, 17/6. Vol. III [1967]: $A1.75, $NZ1.85, $US2.20, Stg. 18/6. Nice covers 35c. All Post "Free"

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ELECTRONIC STENCILS courtesy Gestetner Pty. Ltd., done on their amazing "Gestetfax" Machine. We recommend it highly to you.

Heavens! Look at all this blank space.
I'm speechless.

FROM: THE AUSTRALIAN EEB
[An informal electronics experimenters bulletin]
P.O. Box 177, Sandy Bay,
Tasmania, 7005, Australia.

TO:

[Registered at the G.P.O., Hobart, for transmission by post as a periodical]

[illegible] 1-71
46 [illegible] St.,
[illegible] Tas. [illegible]

THE AUSTRALIAN EEB

AN INFORMAL ELECTRONICS EXPERIMENTERS BULLETIN

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Assistant Ed: VK7ZAR
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May 1968 Vol. 4, No. 4 P.45

CONTENT:

TRANSISTORISED TRANSMITTERS, Part V-B --RLG

-- Efficiency Trade-offs in R.F. Power Amplifiers.

The previously mentioned wealth of published material continues to make itself felt; in this instance in the necessity for lengthening the bibliography published last month. I'm sorry about this; I don't mean to blind you with science, as Ken Kelly says, but I also believe that there is no point in making stupid errors when someone else has already made them, and has written them all up. Therefore, please add the following items to last month's list, or at least make a note there to refer to this page for continuation:

34] CQ, March 1968, p. 67: "The Tuned Doublet," by P.C. Amis, W7RGL. [Will be relevant to my discussion of antenna matching systems].
35] QST, April 1968, p. 37: "Guidelines for Transistor Transmitters", by D.W.Nelson,WB2EGZ.
36] Miniwatt Digest, March 1966, p. 90: "The Transistor Unity Gain Parameters" [See also references 4 and 33]
37] 73, April 1964, p. 38: "The Case of the Naughty Pi-Net"

Note that in this rather lengthy list, I am mentioning principally design articles only. The practical material is even more plentiful, and will be described in our Anthology, at the earliest opportunity.

We now continue the discussion designed to convince the skeptical that a ten ohm output impedance must be handled somewhat differently than one of 10,000 ohms.

On Making Efficiencies, or: Don't modulate your mobile rig when you pass under a low tree!

It is a natural temptation to attempt to obtain as much power as possible from a final power amplifier. With valves this permits of remarkable liberties with vacuum tube structures. With transistors there are limitations. If you crank up the collector current to obtain more power output, you may find that the transistor gets hotter, and power output stays the same or decreases. If you increase collector supply voltage to improve your E^2/R, you may find a sudden and permanent fall in output power when you modulate or detune [particularly if you modulate while detuning]. If you increase RF drive in an effort to improve efficiency and power output, the same outcome is likely. If, in an effort to obtain the lovely miniaturisation suggested by transistor size, you use miniature coils, you may find your second harmonic output signal is nearly as strong as the fundamental; needless to say, efficiency at the fundamental would be poor. If, with the same motivation, you save a bit of space on the transistor's heat sink, temperature

will rise, collector current will increase, but power output won't. If the temperature increase is not accompanied by adequate stage temperature stabilisation, the collector current will continue to increase which will increase temperature which will increase current -- indeed, to the level provided by the capabilities of your power supply operating into a dead short. Why miniaturise [[35]]* ?

Now, don't these sound like real, practical situations? All right, the scoffers will then please continue to read with attention, unless they are provided with an indefinite supply of transistors. In this discussion I draw heavily from References 4, 12, 28, and 29, and from my own experience.

It is unfortunate that it is difficult to express concisely the enormous amount of interaction between voltage, gain, power, and frequency characteristics of transistors. I shall, therefore, consider these factors individually, and the interactions will be evident:

A. Transistor Ratings.

1. Collector breakdown voltage rating, BV_{ce}. If higher it results in:
   a. Lower output capacitance, Co
   b. Higher frequency response, f_T
   c. Higher saturation voltage, V_{sat}
   d. Lower maximum power output, Po [i.e., lower efficiency]
   e. Higher voltage operating capability.

The collector breakdown voltage rating is an inherent function of the construction of the transistor. In regard to Item c, the saturation voltage is the voltage to which the collector drops when the transistor is hard-on, i.e. at the peak of the RF driving cycle. If the saturation voltage [V_{sat}] is higher, the collector voltage swing will be lower, and therefore the power output will be lower. It is interesting to note that the RF V_{sat} is usually higher than the d.c. value given in the technical sheets. A typical 80V transistor with a d.c. V_{sat} = 0.8V may have an RF V_{sat} = 4V, while one with a 20V rating might have RF V_{sat} = 1V.

It is obvious that for given conditions, a lower BV_{ce} rating will give more power out, but this is limited by item e, dictated by the maximum collector voltage swing; this must be more than twice the supply voltage. 'More than' can be read as a safety factor of 30-100%, depending. Although there is some indication that a transistor run above $f_{\alpha e}$ will have a better-than expected voltage breakdown characteristic [[19, 29]], I shouldn't depend on it if I were you** Remember too, that at high I_c, BV_{ce} decreases.

2. DC Current Gain, h_{FE}. If it increases it means a:
   a. Higher f_T,
   b. Higher power gain, P.G.
   c. Lower maximum P_o.
   d. Poorer linearity [therefore more distortion for modulation, particularly for SSB]

*Miniaturisation is really quite all right for very low power work, but the requirements of tank coils and heat sinks make it not so convenient for powers over a few watts. Compactness is desirable; it is necessary for good RF geometry, particularly with low impedance devices, but that is not the same as cramming everything into the smallest possible space. In the same vein I wonder why people use high power transistors at all for work other than mobile. [[26]] The currents required for powers over 5 watts are considerable, and require heavy duty power supplies which are no easier than HT ones for valves; and it is much much easier and non-critical to use a valve for a high power final. If you use a high power transistor p.a. powered from storage batteries and a charger, how is that easier than a nice simple and non-messy HT mains-operated supply? 50 watts at 12v requires over 4 amps ! The collector load impedance for this would have to be only two ohms! Gah.

**This may explain the apparent 'flexibility' of transistor voltage ratings which have been abused by experimenters operating at high f. There is no such thing as a flexible transistor voltage rating, though it may appear so because of the necessity for rating them conservatively to satisfy the human desire to get something for nothing!

e. Less d.c. bias stability [therefore more base and/or emitter stabilisation to prevent runaway]
f. Less a.c. stability [more tendency to parastitic oscillation]
g. Higher input impedance and higher radiation resistance.

3. RF Current Gain, h_{fe}. You can find it from the data sheets given at a certain frequency, f, where $f_T = h_{fe} \times f$. If h_{fe} is higher, it means:

a. Higher input and output resistance.
b. Lower input inductance.
c. Equal or higher power gain.
d. Lower maximum power output.

Note that h_{fe}, like h_{FE} will increase as I_c increases, up to a maximum, and then will decrease with increase of I_c, as you can see from examining the characteristics curves, e.g. furnished by Fairchild. Above $f_{\alpha e}$ [the frequency where h_{fe} is down 3db from the d.c. value], h_{fe} decreases by 6db/octave; it halves for a doubling of f.

4. Power rating, P_c.

This depends on the construction of the tr, and your ability to take advantage of it depends on keeping the transistor cool. For this reason it is evident that P_c given for case at 25°C is true only for an infinite heat sink and zero thermal resistance [i.e., perfect heat transfer to the heat sink]. If the heat sink is inadequate, the tr will get hotter, with consequences described above. Generally, try to keep silicon transistors below the temperature that feels decidedly uncomfortable, and germanium ones below 'quite warm'. For design, allow at least two square inches of heat sink [including both sides of sink] per watt for silicon; three for germanium. In general, assume a practical operating power dissipation half or less than half of the P_c specified for a given heat sink condition.

5. Frequency rating.

This can be complicated, but if you consider f_T, the frequency at which $h_{fe} = 1$, it is increased by:

a. Higher BV_{ce} rating.
b. Higher I_c rating.
c. Higher h_{fe} rating.
d. Higher V_{cc}.
e. Higher I_c, up to a maximum, then down.

f_T is theoretically somewhat lower than the maximum possible frequency of oscillation [f_{max}], [[32]] but I should not count on it. f_T is also 'not flexible' but may be considerably higher than specified, and explains why some transistors will work at a higher frequency than they 'are supposed to'.

See Ref. 32, P.15 for concise description of frequency parameters. See also Ref. 4: [AN-139] and Ref. 33.

- -

B. Transistor Operating Conditions

1. D.c. Supply Voltage, V_{cc}

a] If V_{cc} is higher it will tend to:

Increase input and output impedances, Z
Decrease output capacitance, C_{ob}
Increase f_T
Decrease Noise Figure, NF
Increase Power Gain, PG
Increase Power Output, Po

b] Consider Safety Factor.

In accord with Item A.1, V_{cc} must be half or less of the BV_{ces} rating [if base-emitter resistance low] or BV_{ceo} [if R_{be} high] if the collector is feeding an inductive or tuned load. If collector modulating, double this safety factor once more. For a mobile rig the safety factor must be high enough to include voltage excursions resulting from the high Q which results from detuning by normal variations in loading, e.g. when the whip touches a low branch!

Safety factor can be placed on a considerably sounder basis if you measure the actual BV_{ce} of each relevant transistor, by methods which have been described in the Grandma's Tests series in the EEB. You will often find that BV_{ce} is higher than on the specs sheets, and that is pleasant.

c] Relationship to f_T.

Although f_T increases with V_{cc}, one will generally chose supply voltage on the basis of safety factor rather than frequency capability. Although f_T can be reduced by very high voltage [[12]] owing to limitations imposed by the maximum velocity of the electrons and holes, I shouldn't think this to

be a practical consideration.

d] Relationship to Power Output.

In general, P_o will increase more rapidly than V_{cc}, but it does not increase by the square as you might think. The actual relationship is closer to:

$$P_o = \frac{[V_{cc}]^{1.4}}{Z_c} \qquad [[29]]$$

For the usual range of supply voltages this can be approximated by

$$P_o = \frac{[V_{cc}]^2}{2.5\ Z_c}$$

and I mention this esoteric fact because it will be used later in this series of articles for calculating matching conditions.

It is worth noting, however, that this relationship shows that an increase in supply voltage is not necessarily the best method for obtaining higher power rapidly, particularly in view of the various problems associated with safety.

e] A practical matter.

Assume a 6V supply. Minimum peak voltage will be 12V. For a safety factor of two, this goes to 24V. If you run high I_c [discussed below] this can raise the rating to 36V. If you collector modulate, that becomes 72V. Well! You see what I mean? See also May 1967 EEB and Ref. No. 35. For germanium, safety factor can be lower.

2. Collector Current, Ic

If it increases,

a. f_T goes up to a maximum, then down.
b. h_{fe} and h_{FE} likewise.
c. P_c increases.
d. P_o goes up or down, depending on f_T, h_{fe}, and impedance matching.
e. With ordinary transistor, PG increases to a constant maximum.
f. With an AGC transistor, PG increases to maximum, then decreases.
g. Z_{in} and Z_{out} decrease.
h. V_{ce}[sat] increases.
i. Noise figure decreases to a minimum, then rises. Interacts with source resistance. See data sheets.
j. BV_{ce} rating is reduced; at very high currents it can be as low as 25% of the pretty zero-current value quoted on the specs sheets.
k. Efficiency decreases at I_c above the point where β is maximum. The waveform becomes clipped, and mean value of I_c is increased: the transistor gets hotter for a given P_o. And modulation waveforms are distorted, particularly for SSB. [[28, 29]]

3. Operating frequency, f. [See Item A.5]

If higher,

a. β constant below $f_{\alpha e}$ for common-emitter, then decreases at 6db/octave [See Item A.3] to f_T.

b. α constant below $f_{\alpha b}$ for common base, then decreases at 6db/octave, to f_{max}. $f_{\alpha b}$ is usually somewhat higher than $f_{\alpha e}$, depending on h_{fe}.

c. P_o and PG decrease above $f_{\alpha e}$.

d. Z-terminations become more reactive: harder to match to loads.

e. V[sat] increases.

f. "Stored charge in a transistor can be rather large in the RF type... Thus as you go to higher frequencies, it becomes harder to turn the transistor off during the reverse half cycle, and it becomes a less efficient switch." [[29]] Therefore efficiency decreases. Efficiency can be improved by distorting waveforms purposely, by adjustment of matching elements.

This latter condition is interesting indeed; it is called "Series Peaking", and can be achieved by ensuring that the matching circuit at the input is tuned to the inductive side of resonance [viz, high]. In an untuned input system this would involve inserting a small coil in series with the base [if common emitter]. But remember that as the wave becomes more spiky the LC in the collector is abused, and Q must be higher. But this increases the chance of high collector voltages when detuned; see Items A.1. B.1. above.

4. Relationships involving loaded Q. It is worth pondering that an amplifier is considered to enter the "Broadband" condition if Q is less than 10 [[4]], but our ordinary design centre for r.f. power amps is Q about 12-15. It seems evident that the harmonic-reducing properties of the Q=12 system are marginal, yet much higher loaded Q [e.g. above 20] results in excessive energy loss in the tuned circuits. It will be remembered that Q is essentially a measure of the energy stored in the tuned circuit, relative to the energy lost in it, and that when the load is removed from a tuned circuit, its Q may go up to 100-600. Since the Z of a parallel resonant circuit is proportional to Q^2, you can see why an unloaded collector tank can shoot up to high peak voltages.

For analogous reasons, do not tune while modulating, at least not with full power applied. For SSB, the pulse systems used to tune valve p.a.'s under high peak currents are useless for transistors, because of the susceptibility of the transistor to transient overvoltages even for a few μsec.

Q will be discussed further under the forthcoming section "Transients & Instabilities".

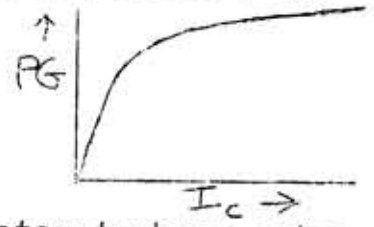
5. Power Output, P_o is increased by:

a. Lower BV_{ce} or I_c ratings
b. Higher V_{ce}
c. Higher Ic, up to a point.
d. Lower h_{FE} and h_{fe} ratings.
e. Lower f_T rating.
f. Lower operating f, where $f > f_\alpha$
g. Higher efficiency, all else constant. But a given stage producing more P_o will usually be less efficient.
h. Optimum matching, all else constant.
i. Neutralisation and unilateralisation, when necessary and possible.

If the RF power output equals/the half d.c. power input [efficiency 50%], obviously the transistor must be able to dissipate comfortably as much power as it is putting out. This comment can be considered to be added to Item A.4, above.
In general, a transistor should operate at relatively high currents for the best trade-off between power and frequency capability [[12]], making sure that the other factors [e.g. reduction of h_{fe} and f_T] do not interfere. Ref. 12 gives practical design considerations, and Ref. 29 much simple theory for squeezing the last ounce of performance from transistors. Note that this is NOT the same as 'squeezing it until it melts'; a proper trade-off is a measured compromise based on these many variables.

6. Power Gain, PG is increased by:

a] Higher h_{fe} rating
b] Lower efficiency [e.g. larger I_c conduction angle, lower base bias].
c] Lower operating f, where $f > f_\alpha$ Above f_α, PG falls at 6-8db per octave, as frequency increases, until at f_{max}, PG = 0db. Note that an amplifier can have PG even at f_T, where h_{fe} [$= \beta$] = 1.0, because there is still a <u>voltage</u> step up from input to output, owing to the different impedance levels. Minimum useful PG is from 4db to 10db, depending on your requirements, 10db of PG will be obtained from a perfectly neutralised and unilateralised amplifier at about $\frac{1}{2}$ f_T [depending on many factors]. For practical purposes, significant PG falls off above $\frac{1}{4}$ to 1/3 of f_T.



d] Higher V_{cc} and I_c
e] Lower external collector-to-base catacitance.
f] Lower P_o, at high P_o levels.
g] Lower C_{cb}, and C_{ob}.
h] Higher operating temperature!
i] Neutralisation or unilat.
j] Suitable impedance matching.
k] Lower emitter L and lower r_b.

When f_T is high, a remarkably small amt of emitter inductance can reduce PG, so that lead geometry and bypassing are quite important for a common-emitter ckt; they are even more critical for a common-base system, because it tends to be inherently less stable.

Appreciable emitter inductance [in a common-emitter stage] can also increase instability, viz, tendency of an amplifier to oscillate, particularly if load is inductive.

Note that the input impedance of a typical 15W [P_o] stage can be as low as 0.5Ω + j2.3Ω.

This can obviously pose problems in matching, and underlines the necessity for keeping emitter inductance low.

ℓ] Low unbypassed emitter circuit resistance; emitter resistance is not necessarily undesirable, it merely reduces PG, though it improves linearity, and protects the base from excessive RF drive.

- -

C. Interactions.

Now I know one thing. If you have been sufficiently interested in this subject to read this far, you are a devoted experimenter. I admit that the above presentation is not simple, but it is a condensation of a much larger body of information on this subject, and does try to correlate it. It does so, however, with too much detail for rapid comprehension. Since, as I say, you are a devoted experimenter, would you like to do us all a favour by preparing a nice set of graphs or charts which summarise the above relationships [all the ones under the heading "On Making Efficiencies"]? Please write to me first to signify your intention, in the unlikely event that there is more than one of you who wishes to perform this service. The whole summary ought to fit nicely on one page if organised intelligently. It should be done neatly in ink, to scale, so that we can simply make an electronic stencil from it, to save trouble. Thank you!

It is worth noting that References Nos. 3, 10, 11, 13, 14, 16, 20, 21, 27, [and 35 to a certain extent] combine fine discussions of design theory with typical examples of complete amplifiers or whole transmitters. Detailed performance data is given. These are well worth reading, to see just how the practical engineers have cleverly balanced the various "Trade-offs" to obtain optimum designs. By looking at the titles in my Bibliography [EEB, April 1968] you can ascertain which subjects would interest you more.

LETTER – Transistors are nice beasts.

. . . Semiconductors are good. Maybe they are plagued by all the horrible variables you mention [in Tr Tx articles], maybe one should love valves and hate transistors etc; so what. Transistors are good fun. The fact that 'old tars' burn out a few is not necessarily painful.

After all the melancholy tears and sorry stories I read in the letters to the Editor, I tender the following: I bought some computer boards, read up on transistors, purchased some parts, built up a 9Mc SSB [heh heh] exciter, turned it on, and it worked nearly perfectly. Found some crystal carrier shift, and regeneration in the last lead I had hurriedly wired in at the end, of course, fixed these without putting a multimeter to the whole thing. Checked it out against my Swan, and the transistorised thing beats it hands down for splatter, VFO drift etc. Maybe its not perfect, it hasn't been through a laboratory, but I'm immensely happy. It only puts out 4mW of power at 3.5Mc, but I'm sure that if I resolutely ignore the frightening messages that the 'Transistor Transmitters' articles convey under such headings as 'Feedthrough' 'Nonlinearity at HF,' 'Derating,' etc, and if I buy a few high power transistors, and press on -- everything will be fine. Incidentally is it really worthwhile devoting half a page to nonlinearity at high frequencies? Is not this transistor property so abundantly self obvious that it barely rates a mention?

Personally, I very much like the technical content, the breezy editorials, and the commonsense approach for the experimenter, in the EEB, but I would like a little more slant towards why it will work, and not the pessimistic approach of 'troubles on troubles!

– R.F. Meany, VK3HA,
Christmas Hills, Vic.

[[Good on ya, mate. Press on! --Ed.]]

= =

FINAL NEW EEB ADDRESSING SYSTEM!

We have been thrashing about during the past 6 months, to find a way to handle a rapidly growing address list [now 400]. Now the Asst Ed has proved his worth by finding us an Addressograph machine at about 8% of its new cost, and the Ed has done his bit by finding Addressograph raw materials at an 88% discount -- its easy, you need only to be desperate. We have, thus, been correlating and cross-checking addresses for a solid month now to make the changeover; the work involved is unbelievable, and nearly unendurable. Thus the rather later-than-usual May issue. By the way, if your name shows up as WINGE rather than WINCH, or AAGH! instead of NASHT, don't blame us. Have you ever considered the idea of writing legibly, hmmmm?

73 MAGAZINE MAY 1962

RF Q Multiplier

Gus Gercke K6BIJ

Q Multiplier at the *if* input is a familiar gadget. What it does (and that is-narrowing your *if* passband) is accomplished by introducing some regeneration at the *if* input making it high "Q".

It does nothing to improve Image Rejection, or to lessen the effects of Crossmodulation (overloading the mixer by a strong near by signal).

Much more logical place for a "Q Multiplier" would be at the rf Section—where it will reject the image and improve or eliminate crossmodulation. Why then is it used in the *if* Section only? Here are the reasons:

1. rf "Q Multiplier" has to be tunable and (at maximum selectivity) will not track as a normally broad rf Amplifier does. This means additional controls.
2. An attempt to use one was made in "Regenerative Pre-selector"—it failed because it had mostly *gain* and not *selectivity* in its design.
3. Nobody tried.

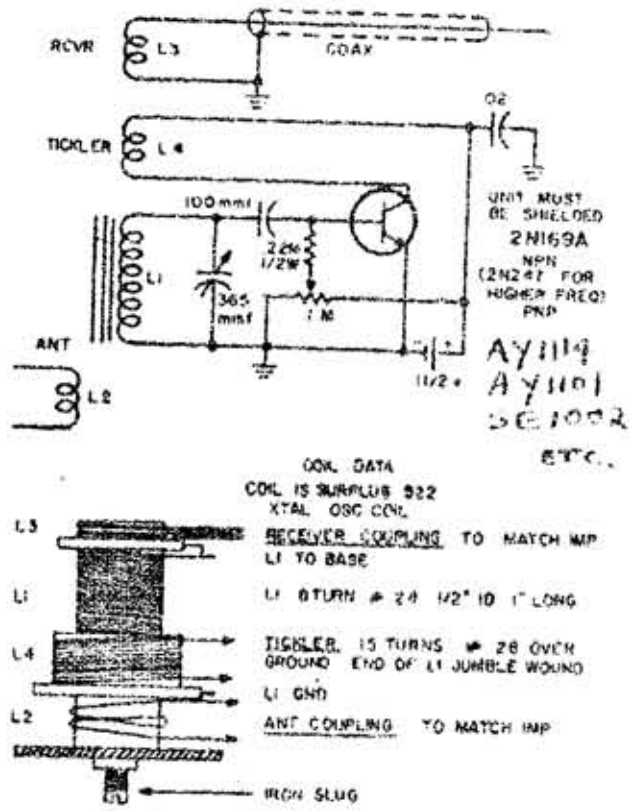
The following gadget was built mostly to prove that it can be done. In order not to dig into the receiver—it was designed as a separate unit, and connects between the antenna and the receiver. It is self powered (drain—50 microamps). With transistor and constants shown it covers both 80 and 40 meter bands.

The theory behind it, though not quite clearly understood, is something like this:

There is practically no coupling between L2 and L3 until L1 is at resonance. Since L1 is a part of a circuit that can be brought close to regeneration—its "Q" is high, and only a sharply resonant signal will be coupled to L3 This results in a narrower bandpass, by a factor of about 25-30, compared to that of an rf Amplifier, and no doubt can be improved further.

Regeneration is very smooth, and even in this crude form it will be a useful addition to many receivers and converters.

. . . K6BIJ



BIBLIOGRAPHY OF Q-MULTIPLIERS -- EEB-- with comments.

ARRL RADIO AMATEUR HANDBOOK, 1964, p. 140: A transistorised i.f. Q-mult, peaking or nulling merely by adjustment of regeneration control. Clever. By 1967, however, this circuit has disappeared, referring [p.111] merely to kit versions, & several references to the fact that Q-multipliers are used in "inexpensive receivers." This is progress? What in 1968?

ARRL RADIO AMATEUR HANDBOOK, 1967, p. 113: Valve version of the r.f. Q-multiplier, a simple oscillator with adjustable regeneration, but coupled directly to the r.f. stage. ARRL makes one good point: The "r.f. Q multiplier is not a cure for a poor inductor" at the r.f. input.

ELECTRONICS CIRCUITS HANDBOOK, Vol I, by Tom Kneitel [CQ publ.], p. 96: usual valve i.f. type. P. 97 uses a crystal instead of tuned coil, presumably giving sharper null or peak.

IBID, Vol II, P. 38: I.f. Q-mult for 1400kc. Peak only. P. 39: I.f. 1500-1650kc, valve type; Presumably could be used in mobile systems in which the car receiver were used as converter.

RADIO ELECTRONICS, Aug. 1967: "Two Interference Nullers," transistorised versions of the i.f. Q-multiplier and the Select-o-ject. The latter phases out or reinforces selected audio frequencies for better CW copy or heterodyne elimination. With these and a noise blanker [QST], a nominal receiver leaves little more to be desired, though a mechanical filter helps. The Q-mult in this article uses transistors, with a separate one for [[continued, P. 54]]

HAM RADIO Revisited

One of the articles I had to postpone for this issue of EEB was a discussion of the impossibility of reviewing magazines adequately, but the second issue of Ham Radio has just arrived, and I must say a little about it. The 87% of EEB subscribers who did not take advantage of the opportunity are probably missing out on a good thing, though the three year rate comes to $US3.33 [$A3.00] so you can get in on it anytime -- but I suggest you do it from the first issue, if still available. BY THE WAY, please stop asking us to get subscriptions for you; that was to help out, but it is too much trouble as a regular thing; merely go to the Bank, buy a $US draft and send it off by post [though you'd best register it if you are sending it through Australian mails].

In fact, I find it depressing to be faced with so many interesting articles at one go. I prefer a couple of good ones each month, as you find with the Australian or New Zealand publications, or RSGB or ARRL or Mobile News, abroad. I think that the flood of articles represents the increasing complexification of our technological environment, and the increasingly depressing situation where the individual is faced by an increasing amount of information which he is impelled to assimilate. It comes through his newspaper, through his Telly & Wireless, through a flood of inexpensive books, through a multitude of advertisements [though this is not quite as bad in Australia], and through a library of periodicals he is obligated or enticed to peruse to keep up with his professional or hobby responsibilities. The growth curve is compound exponential, and is getting worse. It is certain to end in intellectual digestion... I am reminded of a story I once read called, I believe, "A Canticle for Liebowitz" in which a world that had suffered too long at the hands of its amoral scientists [that's us!] had finally rebelled, and persecuted them diligently. The only repository of learning in a world of savagery was in the hands of the Church, and do you know what the Church fathers cherished most amongst their repositories?: Scientific works, and in particular a rediscovered diagram of a transistorised amplifier -- which they embroidered painstakingly in gold leaf, of course. Bah.

Well-- back to the world, the flesh, and Ham Radio; I'm sure that by now Jim is confused, am I with him or against him? Well, if we have to have bulky technical periodicals his is the best I have seen for some time, though it is finding quite a lot of competition now from CQ and even QST. A few technical comments:

There is a lot of stuff on SSB and Linear Amplifier Design, Station control, Z-Bridge, and all that; and a pleasant note on Moonbounce to Australia. In reference to C. Horwitz's article in next EEB, "A Modern Low-Voltage Power Supply with Built-in Short-circuit Protection" [I am enthusiastic about those fully descriptive titles] by WB2EGZ. It will be discussed in the Horwitz "Fail Safe Power Supply," although the main principle is rather different. The HR supply uses the "Crowbar" principle: when you overload the supply, it purposely blows a fuse rather than the transistors. Crude. The Horwitz idea is better, though the HR article is a good one on that particular type of device.

"Another CW Monitor and Code-Practice Oscillator" [I like Jim's honesty in adding that word "another"] by K6RIL, uses a modified multivibrator with a speaker transformer in the feedback loop to "clean up the tone for easy listening". No, you want a nice dirty tone for easy listening. A sine wave, for example, sounds terrible. A sawtooth from a simple relaxation oscillator, or a messy wave like that of our Metronome/Oscillator [c.f. EEB Dec. 1967] is best.

"Replace One Unijunction Transistor with Two Transistors," by K9VXL is, of course, our old friend the PUJT or 'Regenerative Switch' which we have discussed the past few months. It is a truly remarkable device, enabling successful and inexpensive mimicry of tunnel diodes, SCR's and SCS's as well as UJT's. Articles from you on this are welcome at EEB.

"An Improved Transistor Voltmeter and its Applications" by R.S. Maddever of Corio Victoria, is of course, the best of the lot. After reading that, two American blokes

wrote to us in haste, asking for EEB Bound Volumes, back issues, and immediate subscriptions, and clutching fistfuls of dollar bills. Who are we to argue?

Finally, probably the other best article, in my opinion, is a lovely piece on "The Secrets of Long-Tail Biasing in Transistor Circuits" by W2DXH, Jim Ashe. I read it with delight, and regard it as one of the more significant of the recent spate of practical transistor amplifier design articles which have appeared in the literature here and abroad. I shall manfully resist the temptation to comment on it technically, and let you read it in its entirety-- in Ham Radio. Those of you who feel that $3 is too much to spend per year [if a three year sub], should put pressure on your Division of the WIA to subscribe for the Library of that Division, so that you will at least get a chance to see it.

There is an article about the Quemont Circular Electronics Slide Rule, and I must must resist ordering a couple of dozen of them to supply to you people; that kind of thing has kept me excessively occupied lo these several years; if you are interested seriously you can do it yourself.

HR's April feature involved the new UY224 Dynistor Device. Oh I hate those sort of things. As with the recent QST articles, I got taken in fully, and was gleefully planning to write up this latest Development for your elucidation, when the curves looked strangely familiar, and I realised that I had a whole boxful of this remarkable device out in the garage just waiting to be used in Miniature Mobile Equipment. Ceramic Encapsulation, indeed... I prefer Condenser Stew; at least its useful if made carefully......

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IMPROVED SLAVE FLASH UNIT -- L.J. Yelland [VK3]

In the 'Reader-Built-It' column, p. 87 of the October 1967 Electronics Australia, a design appeared for a light-triggered flash unit, useful to run an auxiliary flash-gun from the pulse of light appearing from a main flash unit. The circuit is shown in Fig.1 below. The Light Dependent Resistor, ORP-12 drives an AC-125 amplifier to trigger the SCR. In my own modification of this circuit, shown in Fig. 2, the amplifier has been

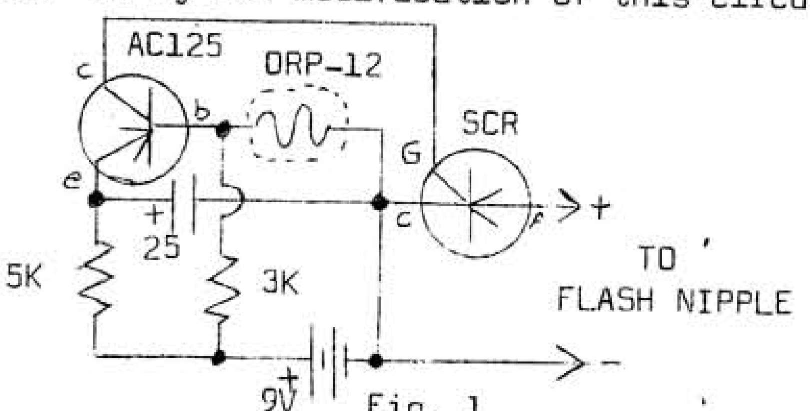

Fig. 1

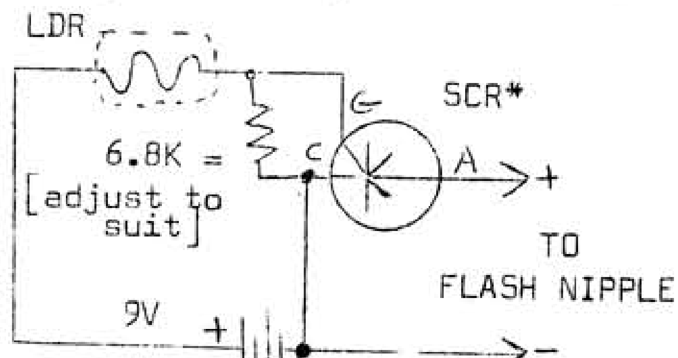

Fig. 2 *Special; see text

eliminated. The circuit is thereby greatly simplified, and the leakage current drain on the batteries is negligible if the unit is stored in the dark. The modified unit depends for its success on the new very sensitive SCRs now becoming available: The G.E. 2N2326A or equivalent [200V/0.8A/≤ 10µA] from Australian Electronics. These remarkable SCR's open up a whole new field of possibilities for high sensitivity control; the order of sensitivity is similar to that shown by Silicon Controlled Switches [c.f.: G.E. Transistor Manual].. Has anyone else found anything interesting from them?

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QUOTE WITHOUT COMMENT

"Many articles have been written on home-brew equipment, most of which dwell on the electronic connections of the various [components]... This article is meant to pass along some ideas on home-brew equipment where the others leave off-- making the equipment look commercially made." From: 'The Commercial Look', by K. Schofield, CQ, March 1968, p. 79.

-- But see "Grumbles" by 'Sam' in CQ, April 1968; he's trying to be funny, buttrue.

ADVERTISING

Personal advertisements free if reasonable length. Commercial advertisements 5c/line, $1.00 half page, $1.50 full page; can be spread over several issues. We reserve the right to omit copy, edit for clarity, etc. We assume no responsibility for merchandise sold through advertisements.

= =

POLYESTER and ELECTROLYTIC CAPACITORS

We have recently been appointed official Australian agents for 'Mercury' brand polyester and electrolytic capacitors. The capacitors are of English make and of highest quality. Because of their price, they are ideal for the experimenters and servicemen.

Polyester, 100WV, radial leads: [all in μF]

7c each	7c each	0.020: 9c	
0.0010	0.0047	10c each	0.050: 11c
0.0015	0.0050		0.068: 13c
0.0020	0.0068	0.022	0.080: 14c
0.0030	0.010	0.030	0.10: 15c
0.0033	0.015	0.033	0.15: 19c
0.0040		0.040	0.22: 23c
		0.047	

Electrolytic, 10V, radial leads.

5μF: 10c; 10μF: 10c; 25μF: 12c; 30μF: 14c; 50μF: 16c; 100μF: 17c; 200μF: 20c.

PLEASE NOTE - Capacitor pack. We will supply 3 capacitors of all the values listed above [23 polyester and 7 electrolytics] totalling 90 capacitors at special EEB price of $8.85 inclusive of postage.

We pride ourselves in the prompt service we provide.

KITSETS AUST - BOX 176 P.O. DEE WHY, N.S.W. 2099

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SPECIAL RESISTORS: 470K 2 Watt, Metallised, High voltage type, non-inductive. 2c each + S.S.A.E. Write: A. Marshall, 37 Radcliffe Crescent, Rosetta, Tasmania 7010.

= =

WANTED TO BUY: About four years ago 'Ham Radio Suppliers' were selling new 'EIMAC' 4-250A Valves at $10 each. I require one of these urgently, and will pay that price + freight if anyone has one of them doing nothing. Please contact:-

Al Rechner, 13 Blamey Ave., Broadview, South Australia, 5083.

= =

RESISTOR PRICES

RESISTORS new, top grade, 1/2W - 5% tolerance, any value between 10 ohms and 1Meg, any amount. Price: 5c each or $4.00 per 100.

RESISTORS new, top grade, 1/4W - 5% tolerance, any value between 10 ohms and 1Meg, any amount. Price: 4c each or $3.00 per 100.

Resistor Packs: We will supply 3 resistors of each value between 10 ohms and 1Meg totalling 171 resistors. 1/2W pack: $6.00. 1/4W pack $4.95. Post free.

KITSETS AUST - BOX 176 P.O. DEE WHY, N.S.W. 2099

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ADDRESSOGRAPH PLATES for sale, for $20 per 1000, plus freight. These plates are in good condition. They were declared surplus when a company changed to a different system. If your firm or a companion firm uses Addressograph mailing lists you can save money. Contact "A", Box 177, Sandy Bay, Tas. 7005.

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Q-MULTIPLIER BIBLIOGRAPHY [[continued from P. 51]]:

peak and null functions. Although this article uses FETs for the Select-o-ject, the ordinary transistorised version appears in recent ARRL Handbooks, at least up to 1967.

— [[Continued next month]] [sorry...]

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====> Miscellaneous: Would the chap to whom I loaned two RSGB Bulletins with TVM circuits PLEASE RETURN THEM? Otherwise I am going to have to look up his correspondence from my rats-nest files, and I shall be exceeding wrothful.

RLG.

The Touch Keyer

This simple circuit allows key-type operation without a key. The operator just touches the grid and taps out the CW with his finger. When you touch the sensor plate, a small current is applied to the gate of the SCR from the battery B1. This turns on the SCR, which supplies half-wave power to relay RY1 to energize the relay. Diode CR1 provides a return path for the relay-induced voltage and is necessary to prevent 60 cycle relay chatter. The SCR triggers when a low level positive current is applied to the gate of the SCR and turns off as soon as the current is removed. The low battery voltage along with the use of an isolation transformer provides no hazard to the operator. . . . David Metzger K8GVK

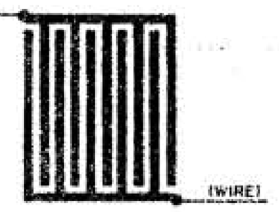
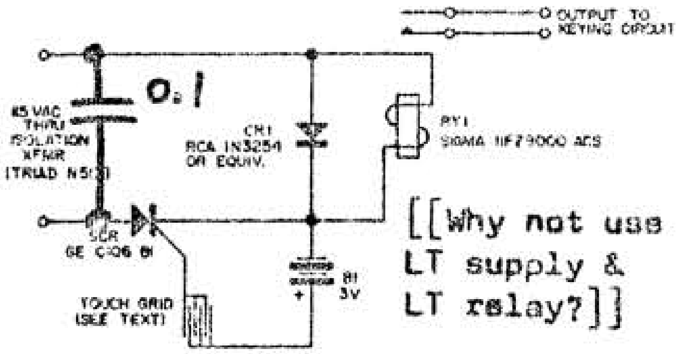


Fig. 2. The touch grid can be made from etched circuit board like this, or can simply be two wires.



[[Why not use LT supply & LT relay?]]

Fig. 1. Here's the ideal substitute for a key: Touching the touch plate with your finger turns on the silicon controlled rectifier (SCR), which throws the relay to key your transmitter.

OCTOBER 1966 Reprint from 73 Magazine P. 29

With the new high-sensitivity SCR's, the touch grid could be very simple, and in some instances merely allow triggering by a.c. pickup by the body.

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A Little Knowledge is a Dangerous Thing.
A Lot of Knowledge is even more dangerous.
-- Anon.

EDITORIAL -- RLG

Beware of Metronome!

Readers of The Australian Experimenter are cautioned to be careful when using the Metronome that appears on P.10 of their February 1968 issue. The circuit is the conventional feedback type using a speaker transformer. As I mentioned in the December 1967 Metronome Article in EEB, I have found this type to be unreliable for timing music, because the sound from an instrument played nearby enters the loudspeaker [which also works as a moving-coil microphone] and may upset slightly the frequency of clicks. This can be simply maddening to musicians.

Far better is the use of a simple regenerative switch, as described in the December 1967 EEB, or the more elaborate double multivibrator of Miniwatt Digest for January1967.

Bound Volume II

is now, at last, out of print, sorry. There has to be a limit to the number of bound volumes we can print each year. All we can say to newcomers is that in due course we shall publish an Anthology [or we'll get rich churning out Vols I & II at $5 a copy]. If some piece of information is really important in context, we'll just have to repeat the fact or statement or circuit in a given current article. At worst we'll have to provide you with photocopies of articles requested from Vols I or II, at 6c per page + post, but we don't prefer it because it complicates life.

There are, however, still a few covers left for Vol II, and you can have them now for the cost of the post, about 9c. Vol III covers are the usual 35c, while they last; helps to keep your loose copies together: Just remove all staples, line up the pages, and glue into the folder with white wood glue.

ATTENTION: New Zealand Subscribers!

Owing to the lack of response by ZL to a couple of years of intensive promotion, and to lack of time by present representatives, we are discontinuing the services of our New Zealand Representative. We should like to express our heartfelt thanks to 'Old Peth' and to Judi Smith for their conscientious service in our cause.

Henceforth all New Zealand subscriptions and all correspondences are to be directed to the Australian Subscription Manager of the EEB, whose address appears on the back page of each issue. Funds will be accepted only in the form of blank British Postal Notes, not New Zealand ones. They take a little while to acquire, but if you like EEB sufficiently, you'll take the trouble. Non-negotiable funds just complicate life, and we've had enough of that.

Help.

Those of you who have written to us in the past year, requesting bound volumes, back issues, photocopies, information, or services may perhaps have noticed that there was often a slight delay, say several months. As the subscription list for EEB grows and grows [now up to 400], and as people are sending in more articles, and as we get involved with silly subscriptions to other magazines, and as my own life becomes more complicated owing to professional responsibilities -- the paperwork here has become unmanageable.

I have been fortunate recently to have found Mrs. B. Tweedie who lives nearby, who will assume a multitude of secretarial tasks, and will manage EEB affairs efficiently, hooray! She will type the stencils, crank the Machine, bind the Volumes, correlate the Address Lists, send out Back Issues, and in general keep all you people happy. Poor girl. We'll keep Mrs. Gothard busy on the Anthologies.

This will leave me 'free' to Edit this rag, and may even result in publishing issues on time, who knows? Rejoice, therefore, and be exceeding glad: EEB staggers on.

Auto Electrics

Ref: 'Transistorised Car Regulator Systems', p. 185/7 of Feb EEB, and 'Urgent Announcements' on p. 24 of March EEB.

Astute readers have pointed out that the electronic regulators in our February issue will work only if the other end of the field winding in the dynamo were returned to the common terminal internally; for Fig. 1 this was the 'E' terminal, and for Fig. 2 it was the 'A' terminal. If it is the other way about [as happens for some units] you have the choice of reconnecting it after disassembling the dynamo, or of using a different circuit. For Fig. 2, for example, Q2 could be NPN in the common emitter configuration [emitter to earth], with collector load resistor to the positive rail. Q3 could be PNP or NPN, still in the emitter-follower configuration. If PNP, Q3 would appear as in Fig. 2, but its base goes to the collector of the NPN Q2, and additional resistor would be necessary from terminals 'F' to 'A' of the dynamo. If NPN, Q3 would simply have collector going to 'A' and emitter to 'F', with base to collector of the NPN Q2. All of this is obviously written so that we do not have to make a drawing here, but if you sketch it out, you will see how it works.

Other readers also demonstrated their interest in the EEB by stating that their car batteries were of the 12V rather than 300V type, as described in March, p. 20.

We understand* that Volkswagen is going to go electronic in a big way. They will have a complicated control system which will adjust automatically a number of operating conditions for optimum performance, involving fuel, valves, and electrical parameters. It sounds like a fascinating idea, but who could service it if something went wrong? And something always goes wrong; that is the First Law of Electronics, no matter how integrated or potted are the components. If VW beat this rule, it would be an engineering achievement of the highest order. But such complexity. Why not electric cars now?

* Radio-Electronics November 1967

Errare sibi devastare ["Authors are people"]

Owing to the lack of honourary officers, and primarily to technical emphasis, this magazine has been remarkably free of the exaggeration of self-interest which is dignified as "Politics." Recently, however, I lost my temper when an author hurt my pride by suggesting that I was able to foist off anything on the EEB readership merely because they took it all in one swallow. Aside from the distinct evidence to the contrary shown on P. 43 of last month's issue [and also, above, this page], this exchange of Pleasantries took place after I had worked quite hard on his manuscript, and had resubmitted it to him for review! So now I've probably lost us a very good article because I don't have enough patience with people, and each of us retires to nurse his hurt pride. In a previous year I might have drawn a cynical conclusion, but now only a sadness about the gulf that separates humans...

LETTERS -- Valves are Nice Beasts

The first piece of valve equipment I made was a 35W RTVH amplifier. I had to rebuild it, and it is still hopeless. It oscillates [because of high Z circuits], it sparks and ruins the output valve sockets [because of the HT circuits], the output transformer is partly burnt out, and the leads are all mixed up; the power supply uses four stupid OA210's [again because of the HT circuits], and incidentally it is a shambles. Before that I was quite happily working with transistors, and getting everything to work. My advice to all young experimenters is to use transistors -- they are much nicer things. Like the EEB sez, 'You can't run before you can walk'. Good advice.

Well, I'm still using valves, a CRO at last, 0 to 500Kc probably. And because I still hate valves, instead of 2 valves in a Miller circuit I'm working on a circuit using eleven transistors to do the same job.

-- C. Horwitz, Summer Hill, NSW

[[Now I've heard everything -- Ed]]

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SUBSCRIPTIONS to R.A. Walton, 115 Wilmot St. Huonville, Tas., 7109. Uncrossed P.O.'s preferred in Australia; if cheque, an extra 5c would pay for the stupid Stamp Duty. Other countries pay by cheque in your own currency. SUBSCRIPTIONS BEGIN ONLY WITH THE NEXT ISSUE. All other 1968 copies are 13c [Aust] each, or equivalent. Please note.

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FROM: THE AUSTRALIAN EEB
[An informal electronics experimenters bulletin]
P.O. Box 177, Sandy Bay,
Tasmania, 7005 Australia

TO:

R. A. J. REYNOLDS, JAN.
46 JENNINGS STREET,
NEW TOWN, 7008
TASMANIA.

[Registered at the G.P.O., Hobart, for transmission by post as a periodical]

THE AUSTRALIAN EEB

Editor: VK7RG
Assistant Ed: VK7ZAR
C/- P.O. Box 177
Sandy Bay, 7005
Tasmania, Australia

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June 1968 Vol. 4, No. 5 P.59

CONTENT:

TWO YEAR SUBSCRIPTIONS:

Owing to our new Addressograph labelling system, we are pleased to announce that we are now able to take subscriptions or resubscriptions for two years. The Big Mags offer a Discount, and so shall we: 10%. If you subscribe for two years it will cost only $1.782, but if you send cheque [rather than P.O. or M.O.], you'd best add another 5c to help support Tasmanian M.P.'s. No discount on overseas subs, because they are more trouble.

Conceivably you could also subscribe for more than 2 years, if you are optimistic to imagine that overwork won't destroy the Editor before then.

LETTER TO THE ARRL

Dear ARRL,

Your Editorial called "Communications Escalation" in the May 1968 QST was excellent. You have called for "a new dimension to the traditional concept of public service" consisting of "expanded personal communication". You have suggested that we could well afford to talk less about technical trivia, or make "authentic but minimum contact," in favour of truly meaningful communication.. And you ask: " How? "

I should like to suggest that amateurs will tend to communicate more when they have more to communicate. Are amateurs well balanced? Usually, no. Amateur radio is one of the most engrossing hobbies; it grasps a person, young or old, and there is a tendency to devote time to it, to the exclusion of much else. This is a not-unreasonable attitude during the first flush of enthusiasm, but all too often it continues indefinitely, not as a function of discovery, but of escape from more demanding responsibilities. Those responsibilities may perhaps, be classified loosely under the following catagories:

a] Responsibilities to family. Family work is demanding, and often inconvenient. It is easier to disappear into the hamshack, with microphone or soldering iron, than to help with the house tasks, or read someone a story, or help with the garden.

b] Responsibilities to friends. It is often easier to contact the world than face the more intimate and more meaningful challenges of person-to-person relationships.

c] Responsibilities to society. A democracy [or a socialism !] can only function well when individuals are willing to devote personal time to advancing the well-being of the community, however that well-being may be defined in a given society. A ham stuck in his private/public reveries about grounded grids and banal banter may feel comfortable, but his can be an essentially selfish activity, as denying assistance to disaster victims. In a real sense, modern society stands on the brink of a disaster; while community activities require participation by intelligent aware citizens, we babble about QSLs.

d] Responsibility to self. This is, perhaps, the most important, and all of the above points follow from it. When we leave school, how much do we bother to think about the world? How often do we read a book? How often do we discuss matters of personal or social importance beyond a superficial level? How often do we put things behind us with the smug cliche about never discussing politics or religion? In a world crumbling from rotten politics, and loss of understanding of the value of life, we deny the importance of politics or religion !

How are you to expect hams to discuss anything important unless they are interested in, and involved in anything important? How are they to know the meaning of the events of the world about them, when they derive nearly all facts and apparent meanings from newspapers and equally superficial magazines? How are they to examine ideas deeply, so that they can discuss them meaningfully, if they never read a book about them?

And yet, how often do hams find time during the frenzy of 'civilised' life to sit down and read a good book -- and I don't mean an escape-book [for that they have ham radio]? How often do they take time out from their engrossing hobby, to invite a few friends over -- not for an evening of chat about baseball scores or babies or office gossip, but about the things that are really important to everyone: The value of the individual in a world of increasing impersonality, the struggle for meaningful government, the dangers of interpersonal alienation, the meaning of life for children, the meaning of life, the meaning of death.

When radio amateurs are stimulated to think more deeply about the world outside of their narrow hobby, they will be motivated to talk about it.

Yours sincerely,

R.L. Gunther, VK7RG
Editor, The Australian EEB.

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QUOTE WITHOUT COMMENT:

"If you don't mind too much we'll let the other ham magazines stick to being serious. Our hobby may be a service in the eyes of the ARRL, but to me and a lot of others it is enjoyable . . . it is fun. I suspect that as soon as amateur radio stops being fun it is going to fold up, so let's stress the fun side of our hobby. It is fun to build ... it is fun to operate ... it is fun to do unusual things. Let's see what we can do to make as much of amateur radio fun as we can. I always remember a fellow TV director who explained that he used to go in for boxing, then one day he found himself being beaten to a pulp in the ring. He suddenly discovered that he wasn't having any fun and that was the last time he ever fought." -- Wayne Green, 73, Feb. 1968, p. 77.

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A GOOD SAFE SOLVENT: Refer to the Letter by J. M. Withers, P. 67 of this issue.

Rod Reynolds has mentioned that a very good, relatively non-toxic, and non-inflammable solvent is the "CRC" type usually sold in pressure packs for electrical/electronic uses. In that form it is prohibitively expensive, but as a liquid it costs about the same for a gallon as for a pressure pack. Still too dear for washing clothes, but excellent in the workshop. It lifts the grease and floats it off rather than making a soup. Ask for CRC 2-26

IMPROVING RECEIVER RF AND MIXER PERFORMANCE -- R.A.J. Reynolds, VK7ZAR

-- Part I: Equivalent Noise Resistance of Various Valves*

FUNCTION:	R. F. AMP.		MIXER
E.N.R.	Remote	Sharp	
> 200K			6BE6, 6KB 6L7, 6SA7
14-60K			6BA6 [14K] 6BA7 [60K]
10-16K	6K7, 6SK7		
2-10K	6BA6	6SG7 6SJ7 6U8	6AK5 6U8 12AT7, AU7
500Ω -2K	6BY7 [1.5K] 6BZ6**	6AC7[T] 6AG5 6AK5 6CB6 12AU7, AX7	6J6[1.8K] 6U8[T] 7360[1.5K]
300-500Ω	6EH7** 6J6[T] [500Ω, each]	6AK5[T] [385Ω] 6BQ7A[T] [390Ω] 6EJ7 [300Ω] 6U8[T] [295Ω] 12AT7[T] [380Ω]	

("T" = Triode-connected)

I am the proud possessor of an ex-Navy Marconi B-28 receiver. This set is typical of several excellent receivers made during and immediately after the War, having 2 RF and 3 IF stages, along with an excellent crystal filter [provided that it is correctly aligned]. When I acquired this set, I aligned it using a signal generator and output meter. This gave good results, but nothing like those obtained when sweep and marker generators were employed. The subject of communication receiver alignment warrants coverage in these pages or others; I note with pleasure that Ham Radio, the new American magazine, plans to do this in the June 1968 issue [[EEB Ed. Note: We shall be printing an article from Tony Cengia, VK7, on a non-varicap transistorised sweep generator, one of these months]]

The B-28 receiver is very good except in one major respect: between 10Mc and 30 Mc, the sensitivity tails off, and the noise due to the first valve increases. Examination of the accompanying Table shows the reason. The first valve is a KTW62, and is the English equivalent of a 6K7 or 6U7, but with a higher mutual conductance, viz. 2.1mA/V [= "2100 micromhos"]. It has a ridiculously high Equivalent Noise Resistance. The E.N.R. is essentially a measure of 'the noisiness' of a valve; the higher the E.N.R., the more signal you will need to obtain a readable output, and therefore the poorer will be the Signal/Noise ratio. A S/N of 6db is just barely discernable, for all practical purposes. A more useful measure of sensitivity is obtained for S/N = 10db [viz., S/N = 3.16].

The E.N.R. can be given a commonsense meaning, if you examine the voltage you would have to place on the grid of a valve to give you the same signal at the anode as generated by the internal noise of the valve. It can be shown*** that for a bandwidth of 3kc, noise voltages of 1μV would be expected for a 6K7, compared to 0.2μV for a 6BY7, a valve I am about to consider.

The problem was to find a valve that would wire into the existing circuit without needing too many alterations. It would need to be a remote cut-off pentode, having similar voltage and current ratings to the KTW-62, and at the same time having reasonably high gain and low E.N.R. Considerable searching through the valve data handbooks revealed that a valve satisfying most of these requirements is the 6BY7, a 9-pin mineature. It has the one disadvantage that [Continued on Page 62]

* From "Technical Topics" by J. Pat Hawker [RSGB, 1965], P.22 plus my own calculations. See also RSGB Amateur Radio Handbook, 3rd Edition, p.79ff + Ch. 15,

** Semi-remote. very good.

***The actual grid noise voltage, E_n, can be calculated approximately from: $E_n = \sqrt{3kTR\Delta f}$, where k = Boltzmann's Constant = 1.372×10^{-23}, T = Absolute Temperature, degrees, K. R = E.N.R. Δf = bandwidth, cps. From Radio Data Reference Book, by G.R. Jessop [R.S.G.B.]

it is less remotely cutoff than the KTW62, and could possibly give worse intermodulation performance; in practice this was not noticed.

The result was an enormous improvement in receiver sensitivity at even modest frequencies. Details will be furnished in next month's installment, along with a lot of unnecessary gab by the Editor, describing why receiver performance may or may not be improved by substituting a less-noisy RF valve; if more sensitivity results in increased Cross Modulation or in instability, one may wonder what has been gained; intelligent compromise may be necessary in most instances.

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Reprinted from The Microphone [Journal of The Australian Tape Recording Society]

SOLID STATE AMPLIFIER CANNOT BURN OUT

A British company has produced a 60 watt solid state audio amplifier which, it is claimed, offers complete protection against the burning out of transistorised circuits by overload misuse. Patent has been applied for and the company believes that it is the first in the world. The manufacturers say that it is possible to put mains voltage into the input without damage, or to place a complete short circuit on the output under full gain without injury to the amplifier. This is made possible by use of a solid state safety device with a few microseconds operating time - an advance on the practice of using "fast fuses". After tripping, the device can be reset by pressing a button.

The amplifier is expected to be of use in relay and public address equipment, sound reinforcement, laboratory equipment, power supplies and in test equipment where variable power circuits are liable to inadvertent overload. Output of the amplifier is 60 watts RMS between 50 Hz - 20 kHz and distortion over this range is said to be better than two per cent at full output, one per cent at 1 kHz.

The equipment is suitable for operation from 100-120v or 200-250v mains or from a 24v battery at slightly reduced output. Total noise level, including hum is said to be low. Two amplifiers can be coupled in parallel to offer 120 watts. The unit is compact and is built on a standard 19 inch panel, 3 1/2 in. deep for standard rack mounting. Weight is 16 lb.

[[EEB Editor's comment: This is most interesting. Anyone have an idea how it is done?]]

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LETTER - More 2N4250 !

I am ordering another hundred 2N4250 from Fairchild; EEB readers snapped up the last lot rapidly, and I could use some more. It is really an amazing transistor, with superb gain, low noise, and linearity of remarkable degree from 1µA to 50mA.

I was actually considering the TT4250 by STC which appears to have certain advantages, but after several weeks STC still have not given a price, so I shall stay with Fairchild.

Perhaps you may wish to let your readers know about the availability of the 2N4250, on the same basis as described on P.2 of the February 1968 EEB: In this instance, 70c per transistor, plus SSAE, payment by Postal Note only [If Mainland cheque, add 5c]. The stamped self-addressed envelope is necessary. Data sheets provided free. EEB readers should note that these bulk transistors sell very rapidly; if they do not order within two weeks of receiving this issue, there is not much point in doing it later. Order will be filled sometime in July, if received from F.C.

-- D.J. Bedford, 59 Central Ave., Moonah, Tasmania. 7009

[[We have had similar treatment from STC, only we have been trying to get their prices for over a year, so that we could describe their transistors. Obviously they don't lack customers -- Ed.]]

BIBLIOGRAPHY OF Q-MULTIPLIERS -- EEB Staff -- with comments
Part II, Continued from May, P. 51, 54.

RADIO HANDBOOK, by W.I. Orr [Editors and Engineers], from the 15th Edition on, in the chapter on "Radio Receiver Fundamentals". The standard valved Q-mult. One might hope that the next edition will not merely repeat the same thing for the fourth time, but will transistorise it, and perhaps show a double transistor [or FET] version for couble peaking, nul and peak, or double nulling simultaneously.

RECEIVERS, by Jim Kyle [73 published], p. 18: Complete Q-mult, standard. Also "The Simplest Q-multiplier," being an i.f. stage with adjustable regeneration, heh. This is an excellent book on receivers, though if the print got any smaller it would vanish.

RSGB AMATEUR RADIO CIRCUITS BOOK. An excellent compendium including many lovely ckts, though it has the maddening British practice of omitting the index; you make your own. P.22: Valved Q-mult: peak, null, or BFO; and transistorised too. Also T-notch etc etc. A new Edition has been printed; See RSGB Bulletin for details.

RSGB AMATEUR RADIO HANDBOOK, 3rd Ed., P.91: Principles. P.112 Valved i.f. standard type.

SHOP AND SHACK SHORTCUTS, compiled by Don Stoner [CQ publ.], p. 93: Q-Multiplier modification for 915kc, for BC-348 receivers. [by RLG !]

TECHNICAL TOPICS, by J. Pat Hawker, p. 26: The same RF Q mult as in ARRL Hdbk, but in an interesting ckt using a beam deflection mixer. [More about that in our series on optimising Front End Designs.] Note that anode load is L, not R. P. 33: The cleverest Q-mult circuit I have yet seen, which uses the i.f. transformer of the radio, instead of separate coils. P.34: Transistorised Q-mult, presumably able to peak or null if adjusted as for the ARRL circuit. Also regenerative i.f. stage, plus a great quantity of other absolutely delectable circuits in the typical TT manner.// New Edition of TT now out, called "Amateur Radio Techniques", via R.S.G.B.

73 MAGAZINE, April 1968: "Use of the Q-Multiplier to Increase Intelligibility of Received Voice Signals," by R.C. Ives. Very clever [can also use a bridged T-notch filter]:
1] Tune signal in, exactly. 2] Remove heterodynes by filters, another Q-mult, etc. 3] Tune Q-mult to null signal exactly. 4] adjust null depth for maximum intelligibility -- usually just below point where male voice starts to sound "tinny". 5] Retune Q-mult slightly. Result is to increase effective % modulation, improving mid frequencies.

Those of you who think that the selectivity provided by Q multipliers is old fashioned because of double-conversion techniques, would do well to look at the January 1968 QST in which is presented a single conversion superhet using a mechanical filter, having enormous performance for selectivity and sensitivity. "The double-conversion receiver may be on its way out... " ! because of its higher noise/signal ratio, birdies, etc. This receiver outperforms double conversion models for Signal/noise, with comparable selectivity. I knew there would be some good reason for my having put off that double conversion of my BC-348, but it does need a mechanical filter-- the best invention of the 20th century... I think that it is now about time to print an interesting bit on Exalted Carrier reception, soon in the EEB.

I might add that although T-notch filters are described in most of the references cited in the Q-Multiplier Bibliography [EEB May-June 1968], they will work well only if considerable care is used in their mechanical and electrical construction, with experimentation for best nulling. As far as I am concerned, a T-notch filter is a beast to construct, because the various components are all connected together so strangely that it is impossible to arrange them for optimum isolation of input and output !

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LITERATURE REVIEWLETT -- RLG

As I have mentioned, faced by the utter hopelessness of reviewing the Literature meaningfully, I herewith mention something interesting that has caught my fancy: THE MICROPHONE, the Journal of the Australian Tape Recording Society. I was originally merely going to say that this looks like a nice thing for tape recorder enthusiasts, but in their June issue there were a number of really interesting items, one of which is reprinted in this EEB.

The ATRS appears to have links with several overseas tape recording organisations, and printed letters from a few of them. I find the enthusiasm and spontaneity of these music/communication enthusiasts refreshing, and in marked contrast to the complacency of the radio amateur fraternity. It appears that the ATRS has achieved some international fame. The 'Jazz Unlimited Tape Club' in the U.S.A. says "This is one of the finest tape journals of its kind anywhere.." ATRS has various discounts on tape and equipment, a recording library, and various other benefits; write to them if interested, at P.O. Box 9, Crow's Nest, N.S.W. 2065. It seems that imported tape has recently suffered a drastic increase in duty, but ATRS is selling it at the old rate. I am mystified why Australia needs to import such things at all; surely with the degree of sophistication of our Industry, there are numerous things like that which we could make ourselves -- at a saving in price and in foreign exchange.

"The World's First Portable Neutron Television System" turns out to be a review about a standard TV receiver used in conjunction with a small accelerator to produce neutrons; the neutrons scan an object to be investigated, then hit a fluorescent plate which gives an image which is magnified 50,000 times by the System, and which is shown on the TV screen! It is made by Toshiba, and will be used for inspecting nuclear fuels, rubber tyres, cable insulation, boiling point phenomena, or liquid levels for liquid gas cylinders. It says that "the use of a special television system eliminates the danger of gamma rays", but hope they have also eliminated any stray neutrons floating out of the device too. Neutrons are a particularly vicious type of radiation, and are immensely penetrating.

"Music for Parties" describes in considerable detail how to use a tape machine to provide entertainment of all kinds for parties. It appears that there is considerable advantage in recording music from records onto tapes for this kind of occasion, and I had no idea how involved it could be to do it properly; I'll file this away for future reference. I must throw a party once in a while, or this ruddy EEB will drive me up the wall.

"Loud Loudspeakers" describes a new amplifier developed in the U.S.A., which can produce "loudspeaker outputs as loud as thunder. Such enormous volumes of sound [up to 5000 watts] can be produced from experimental models only half a cubic foot in size". It doesn't say where one obtains a loudspeaker to handle 5KW of sound, but I presume it is supplied with the Amplifier. Ignoring the question of what on earth one does with so much sound-power, the Amplifier itself is claimed to operate at some 90% efficiency owing to its use of our old friend, Pulse-width Modulation. Even so, I shudder to think of the power supply if the Amp is transistorised: 12V at 416 Amps?

There is also an article on techniques of head alignment, of interest to tape enthusiasts.

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The U. S. "Citizens" Band: "HOW LUCKY WE ARE" -- VK5BS [condensed from VK/ZL QRP Newsletter June 1968]: Word of the chaos existing on the U.S. Citizens Band. Every "licencee" is issued a callsign, allowed 5W input [frequently exceeded!--RLG]. The callsign is rarely used, in favour of childish pseudonyms, contacts are frequently made on 27Mc long skip with South American AMATEURS, etc etc. Barry says: "Methinks that our authorities have made a wise move in keeping tight reign on our 'Walkie Talkie' band" in VK & ZL. So true.

-- "A Conservative is a Statesman who is enamoured by existing evils. A Radical is one who wishes to replace them with others."

EDITORIAL -- RLG

Subscriptions, concluded

I am getting tired of this subject: look, it takes an age for subscriptions to overseas magazines to be processed and copies received at this end of the world. Please do not write in [yet] complaining that you have not received issues for the various overseas mags ordered through us, at least not for a couple more months. We have probably got everyone down on the list, and you may expect your copy in Due Course. We are informed that Break-In subs will be retrospective to the beginning of the year, so you won't have to worry about missing anything. Note, however, that all renewals to those mags must be engineered directly with them; get your own $US draft from your own bank.

Diathermy

One of our correspondents is interested in r.f. heating phenomena. It is a subject that has always fascinated me, and I have offered him the loan of the literature on the subject from our files. Hopefully he may produce an article for us one day. I have a few 304TL valves and some big transformers which have been collecting dust in anticipation of that kind of activity, but as I get older I get busier. By helping another at least I can live vicariously.

The latest item in this field has just caught my eye: 'Heating with Microwaves' by H. Pueschner, published by Philips. Costs $10.12, but maybe available in the library. Microwaves appear to be particularly suitable for heating non-conductors, but require a variety of plumbing, magnetrons, and such items not readily available from disposals sources. They have a virtue of avoiding TVI etc?

PMG, concluded !

As I was musing over the non-delivery of a certain fraction of our November 1967 mailing [complaints are still arriving, and we have had to make a reprinting], I read that the PMG had explained the incredibly late delivery of a Telegram by the fact that it "had been sent at ordinary rates, not urgent". I have also once received a telegram after a letter sent at the same time [explaining the telegram].

Suddenly, in a blinding flash I realised what all of this nonsense has been about; those extra postal rate increases I was predicting have already arrived, but without publicity. All you have to do to ensure that a given First Class item is delivered reliably and promptly*, is to double the ordinary first class postage, and add an extra 3 /oz for air service. All you have to do to ensure that a given Parcel will arrive at all, is to add a mere 5c for "Certified" or 20c for "Registered" post, or send it by the Special Service First Class [the 10c/oz rate]. All you have to do to ensure that a telegram will beat a letter, is to pay exactly double for it. Very simple. And very expensive. I'd move to a South Pacific Island, except that I'm already there ! Besides, I like it here, wretched PMG and all.

At the present level we can just break even, but if the PMG rate doubles [explicitly] again, or if the good old Tasmanian Labour Government doubles Stamp Duty on cheques [again !], we're going to have a problem. I suppose all this is just so that we can blow Vietnamese people to pieces to save them for Democracy.

A good use for SSB.

Kayla, the Editor of 73 has made a superb suggestion in the April 1968 Editorial: All SSB operators should hold their QSO's as near as possible [Cont. on Page 66]

* This matter of reliability and promptness is no joke; ref EEB, March 1968, p.20. Still more letters containing Postal Notes have not reached EEB; maybe ? And a friend had a cute little story about a book ordered from Melbourne; the bookstore posted it promptly the order was received, and the book arrived in Tasmania one month later. But a replacement sent by the store to replace the presumably missing first one never did arrive !

to the frequencies being fouled by broadcasts from China, Russia, America, Britain, etc. when those frequencies fall within an amateur band. This is perfectly legal: we belong there, they don't, but we'll never convince the ITU of that if we let the propaganda stations have it all their own way. A bit of SSB can make hash out of any AM, and what better way to employ this unfortunate mode than in cleaning up the bands? The average bloke tuning his shortwave receiver isn't likely to listen to speeches about the glories of toil for the State, or about glory of sacrificing young men for Democracy, if it is overlaid with ducktalk. This suggestion is so marvelously simple and practical, that it is sure to fail; what good idea ever suceeds in human society?

Addressograph

As we mentioned last month [P.50], we have been forced to go over to the marvellous Addressograph system. It will simplify book keeping, hasten changes of address, and provide the Poor Old PMG with more legible addresses. And all it costs is money ! I described last month how we managed that. And the Addressograph people have proven their sterling worth [is that a compliment nowadays?] by accepting our custom even though we shall have somewhat less than 1000 entries per month.

All of this plus the Secretary runs us slightly in the red, but never mind. It costs no more extra than any other hobby, and is a lot more fun. I refuse to raise the subscription price unless the PMG raises theirs again, so please don't mention it any more in your letters. Likewise concerning the price of the bound volumes [P. 56]. A rag like this ought never to cost more than $o.99 per year, although offers up to $1.05 will be accepted to help support our dear Labour Government; remittances above that are credited toward subscription -- another bit of flexibility allowed by the new address system.

If you want to help, you can get us more subscribers by telling your friends, posting notices, and mentioning it on the air. If we get big enough we should be able to attract meaningful quantities of commercial advertising. By the way, don't forget that personal adverts cost nothing, and they tend to be effective too; why aren't you taking more advantage of them? They do take up a bit of space, but they can convince you that our adverts are useful, and that may be useful in the long run.

Published Late Each Month

People write in ordering a subscription of '12 Issues of EEB'. I refuse to be intimidated by this. Nowhere will you find anything about 12 issues, only that 'we guarantee nothing', and that we should like to have about a dollar every year from you. Ideally I should turn out one issue per year, but it would have to be a good one, and its easier to turn out about a dozen mediocre ones. Most of us take off for holidays during December or January, so there is usually no January issue, and the February one is late. By about June we usually catch up, though the situation has been complicated by the dreadful address changeover. But the only reason we publish monthly at all, is because we have so much stuff to publish now. If ever it gets scarce, we'll go to an every-other-month schedule, thereby doing us both a favour - or don't you already receive enough stuff in the post to read?

The Australian Experimenter [concluded]

I see in the June issue of a sister publication a lengthy unfavourable discourse on the abovementioned magazine, edited by Clive Witchell. I had a technical criticism about an article from T.A.E. in last month's EEB, but that was all. I decided not to print a long analysis of T.A.E. and its ill-fates predecessor, Transistor Kits, because I wanted and want to avoid Politics in the EEB, except perhaps for a few comments about the Australian Post Office. It is useful and interesting to attack the foibles of Established Authority. It is useless for the Small Operators to criticise each other. Who is perfect? There is already enough strife in this world. Clive seems to mean well, and he is creative. If his Magazine is overly commercialised and sometimes stilted, some of his projects are mildly interesting. It is my [Cont. on P.67]

personal opinion, which I have relayed to Clive, that his talents would be far more usefully occupied by a cooperative effort with a good beginner's mag like Coryra, but I don't really think it matters. His publication, printed on Blotter Paper [like EEB] isn't worth the high price asked for it, but I don't think it is particularly harmful, and if you want to waste your money there are probably worse ways.

This Issue of EEB

Owing to some overly fat issues this year, and the considerable delay of last month's EEB because of the address changeover, this issue is thin, in case you are wondering. We are going to stay within the quota of pages per month, because we have a Secretary to support, and because much of the purpose of the EEB [whatever that may be] is diluted by too many words. If you have contributed an article to us, please be patient; it will get printed in due course.

If you wonder why we have 'continued next month' articles, it is to allow as much diversity as possible, to satisfy those people who don't want to suffer entirely on a diet of e.g. Transistorised Transmitters, and on the other hand, to keep those people happy who like nothing else.

If you are discerning, you may notice in this issue, an extra page, 107/108 from 1967. It is included because the original was printed when we were learning how to do Electronic Stencils. Now we know, and this copy is much more readable. I'm still hoping to review the Silicon Power Circuits Manual mentioned in it, if ever my supplier sends it. Tear out the original p. 107/108, and substitute this one. If you have a Bound Vol. III already, that's no problem, tear out the old page [it will come out easily -- heh], apply a thin line of white wood glue to the new page, and insert it deftly. [[Val: Please do not include 107/108 extra in Vol IV Bound]]

If you think that these Editorials are too long, let me know. I think they are, but I have so much to say, of such earth-shaking importance, and besides all my friends say the Editorials are the only parts they read; they merely admire the others.

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LETTER - Civilisation is wonderful

In Proceedings of the IREE it seems to me the writers try to outdo each other in monotonous repetition of such words as 'Interface' and 'et al' etc. Although the data inbetween the words is valuable, the words are overused; they remind me of a Picasso painting. Ugh.

By the way, p.44 of Apr. EEB is upsidedown. Or is it the right way up and all other pages are upside down?

In reference to hot PTFE [Teflon] plastic, p. 40 of April EEB, I am wondering about those 'Teflon' coated non-stick cooking utensils. Am wondering if the housewives are aware of such dangers. I doubt it. They could put a frying pan on the stove to warm up, then forget it to answer the door or phone.

I myself take great care with PTFE, also carbon-tet, which I haven't used for some years. But I would certainly like to know of an effective non-inflamable, non toxic, non corrosive, etc solvent for cleaning up. They all seem to be dangerous in some way. - - J.M. Withers, VK3ZCO, Heidelberg, Vic.

[[Picasso actually did some lovely paintings when he first started out, in his "blue" period, I believe. On looking at some of them, I realised for the first time that he really is a good painter.

Yes, I was astounded when I first saw PTFE advertised as coating frypans; I'd sooner take a snake as a pet for the children, at least they'd know he was dangerous. Fortunately, Carbon Tetrachloride is no longer used for reputable fire extinguishers, but if they are of the liquid type they are still not particularly good for you. The best are the powder type, but have you seen what they cost??

Ordinary home lighting-kerosine makes an excellent general-purpose cleaning solvent. It is certainly flammable, but not very, if you are reasonably careful. It, like all other organic solvents, is toxic by touch [and deadly internally], but not as bad as some -- for instance Xylene {tends to induce cancer / is carcinogenic. -- RLG]] See Also P.60

[[Val: This side up]]

[Registered at the G.P.O., Hobart, for transmission by post as a periodical]

FROM: THE AUSTRALIAN EEB
[An informal electronics experimenters bulletin]
P.O. Box 177, Sandy Bay,
Tasmania 7005, Australia

TO:

R. A. J. REYNOLDS, JAN.
46 JENNINGS STREET,
NEW TOWN, 7008
TASMANIA.

RAMBLINGS: "Olde Peth" [ZL1]

The American magazines are full of talk and details about their new Incentive Licensing programme. Frankly I am amazed by some of the muck being thrown at the American Radio Relay League. I wonder what would be the reaction of those who bellyache about the "tough" Advanced and Extra exams would be if they were told that these exams were of comparable level to most overseas basic exams! For example, how would the average W/K fare on the VK exam?

Earlier today I sat down and 'answered' the sets of questions appearing in the recent QST. I reckon I answered 47 "Advanced" and 53 "Extra" questions sufficiently to get full marks. I'm just an ordinary sort of bloke theorywise, but of course the actual exam question format is different, and there are examination 'jitters' to consider. Even so, I doubt that I should have much trouble getting the necessary pass mark. On the other hand, 20 wpm cw may be a little steep, especially for a 'phone-only man'. [[Ed. Note: Peth has his full ZL call.]]

In regard to "homo Micronesis" in the March EEB, I believe that IC's do have a legitimate place in the scheme of things, in logic circuitry, and its derivatives. Just think how complex the "Electronic Dice" or the pulse generator in recent issues of Electronics Australia would have been without them. Then there is the cost angle. One of the IC's used in the above projects contained [I think] 13 transistor elements, all for less than $2. On the other hand I feel it is cheating a little to use IC's to replace conventional circuit groupings [such as AF, IF, amplifiers, etc]. I believe that one should use the component most suited to the job in hand. You weren't there on the occasion when my ol' unkle Henry Q. Lomb clutched his Coherer to his chest and declared that Flemming and De Forest were Nuts, and that the vacuum tube wouldn't last. [[-- Well, did it? -- RLG]]

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SUBSCRIPTIONS TO R.A. Walton, 115 Wilmot St. Huonville, Tas., 7109. Uncrossed P.O.'s preferred in Australia; if cheque, an extra 5c would pay for the stupid Stamp Duty. Other countries pay by cheque in your own currency. SUBSCRIPTIONS BEGIN ONLY WITH THE NEXT ISSUE. All other 1968 copies are 13c [Aust] each, or equivalent. Please note.

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July 1968 Vol. 4, No. 6 P.69

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CONTENT:

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NEW FOREIGN SUBSCRIPTION RATES

With the information that we may be receiving some publicity in Radio Communications [formerly RSGB Bulletin], the time has arrived to put our foreign subscription levels at a realistic value. We have no bulk mailing privileges for foreign mail, alas, and the solid 5c per item has to be added to basic expense, in addition to the extra manipulations necessary. By the way, that $US1.65 stated as an afterthought in last month's heading was another result of my sticky slide-rule. 15/- × 1.2 = $US1.80, of course.

I am not actively soliciting foreign subs, at least until a substantial number of VK/ZL entries have been made, but they do flatter the ego.

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TRANSISTORISED TRANSMITTERS, Part VIA -- RLG
-- Performance of a typical amplifier

This instalment of this series will be considerably shorter than anticipated last month, because my copy of RCA's Silicon Power Circuits Manual has arrived [Ref. 9b April EEB]. I gasped when I saw it, because it contains much of the wealth of RCA's whole programme of transistorised wisdom, including 105 pages on r.f. power applications of transistors alone. I look forward to reading it with a mixture of ecstasy and horror; page after page of immensely practical stuff, but oh migawd when am I going to find time to read it all ! Well, I'll make a stab at it, and make any necessary modifications to my previously prepared text, as appropriate next month.

In addition, the current literature contains the following relevant article which should be considered an additional reference to add to the April and May Transistorised Transmitters Bibliography [p. 37 and 45]:

38] CQ, May 1968, p. 78: "Using a T Network " by J.J. Schultz.

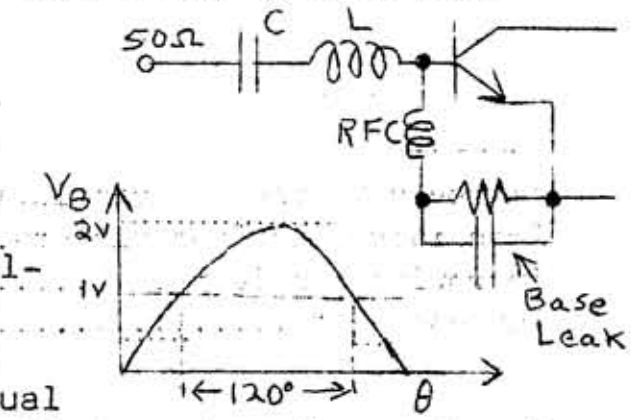
39] Radio Communication, Feb. 1968, p. 96: "Design of T-Networks for Series Tuned Transistor Power Amplifiers ", by M.M. Bibby, G3NJY.

Reference 40 will probably be a forthcoming article or series on coupling networks to appear in Ham Radio. This field is expanding at an amazing rate. Indeed, it appears as though I'll never catch up, now that Jim Fisk is in on it; it looks as though I'll have to start publishing some of the practical designs pretty soon, and climb off of my soapbox.

That Mullard 14Mc Power Amplifier. Ref: EEB Vol III, P. 150; and Ref. 7 from April Bibliography.

Although the BD123 transistor appears to be 'temporarily withdrawn', one presumes that any other 45W [at 25°C] 85Mc transistor would suffice. The SE3030 or RCA units [see EEB, P. 120] would suffice with lower power input, but the coupling networks would have to be altered suitably -- as I shall discuss.

In the article by Mullard I notice that when their base self bias [by a base-leak] increases from 0V* to -0.55V, the collector circuit efficiency goes up from 60% to 75%.



This is not inconsiderable for a transistor [where anything above 50% is High Performance], and gives one something to think about,** in reference to my dire warnings in the Aug and Sept 1967 EEB's, concerning dangers of overdriving epitaxial mesa r.f. amplifiers. With a 12V supply, the -0.55V extra base bias in the base of the Mullard amplifier, added to the inherent reverse base-emitter drop of 0.5V meant that the signal had to exceed at least 1V or so before any collector current could flow. The actual amount by which the peak drive exceeded this potential would depend on the angle of collector current flow; for 120° this would mean a peak drive of 2V, which is less than the 4 or 5V BV_{ebo} zener danger level. On the other hand, with a 28V supply [and 3 times the output power][but lower efficiency], self bias is -1.3V, and for a 120° collector current conduction angle [method of computation of this covered in a previous article in EEB], drive would be about 3.6Vpeak; this is approaching the danger level, and drive would have to be controlled reasonably carefully. A smaller angle, attempted via higher bias to give greater efficiency would worsen this situation, and would raise the requirement for the Q of the output tank circuit, as discussed previously.

This point is discussed further in Sept., when I shall examine in some detail the subject of "Transients and Instabilities". This is a very pregnant problem with Transistorised Systems - and it can be a suddenly expensive one too, as several correspondents have attested. I apologise to them and all, for the delay in publishing this material, but it can get complicated, and I want to make it as accurate and useful as possible. The total amount of material available from the literature on this subject is staggering - a good indication of its importance - and it needs to be boiled and boiled until tender.

JULY 18th: The May/June Mullard-Australia "Outlook" has just arrived with interesting information, as at left. Mullard's Pout values tend to assume optimistic efficiencies, but they still look good, particularly below $0.1f_T$. This ought to be good news for transmitter enthusiasts, if the prices are reasonably competitive with the other good semiconductor material available here [e.g. c.f. EEB, Sept, 1967, p. 120; also June, p.69]

f_T	TYPE	P_{out}	FREQ.	P_c[HOT]
450Mc	BLY 34	3.0W @ 175Mc!		2W
450	BLY 55	4.0	175	6
450	BLY 36	13	175	10
1300Mc	BLY 38	1.8	470	--
700	BLY 53	6	470	--

* which Mullard persist in calling 'Class B' even though the conduction angle is appreciably less than 180°. See EEB, Sept. 1967, p. 114.

** I saw one article in a British constructional magazine, in which 90-95% efficiency was claimed for a transistor transmitter of quite ordinary apparent design, although it was difficult to tell, because no data were given. I wrote to the author requesting more information on how this most interesting efficiency was obtained and measured, but never received an answer ... One possible clue is given by Ref. 29 [Part I, P.8]: if emitter inductance is high, part of the drive will appear added to the output, giving a spuriously high apparent efficiency!
See also Item B.6 k under: "On Making Efficiencies " EEB May 1968.

IMPROVING RECEIVER RF AND MIXER PERFORMANCE -- R.A.J. Reynolds, VK7ZAR

Part II: Performance of a low-noise pentode, and a word about Front-end Stages in general. [courtesy, The Editor]

R.F. Noise

Comparison of noise-factors of a number of pentode valves revealed that some were considerably more suitable for r.f. stages than others, as illustrated in the chart published in Part I, last month [P.61]. Although the sensitivity [viz, signal/noise ratio] of sharp cut-off or triode valves tends to be higher than remote cut-off types, it is desirable to choose the best of the latter available, because of the conflicting requirements of sensitivity and linearity -- as will be discussed in these pages. One of the best valves in this regard is the 6BY7 [British equivalent EF85], a good remote cut-off item, with Gm of 6.1mA/V [at maximum slope], and ENR of 1500Ω. The 6EH7 [= EF183] has ENR only 490Ω with a remarkable Gm = 12.5mA/V [12,500 micromhos], but it is only 'semi remote cut-off', and we are here approaching a limit where the sensitivity is so good that we may well start to consider as more important the problem of the consequences of high sensitivity coupled to strong interfering signals. The same may be said of the 6EJ7 [= EF184], with Gm of 15.0 mA/V, and ENR = 300Ω.

The 6BY7 is therefore the best compromise from many points of view, and has a 9 pin miniature base which can fit easily into my Marconi B-28 receiver*, or for simple conversion in any other receiver. The results of replacing the KTW62 [similar to 6K7] by the 6BY7 were remarkable. It must be remembered that the Marconi B28* is a pretty good receiver as it stands*, and this simple modification makes it virtually unbeatable*.

Tests on the 6BY7

The following tests were performed on good equipment, and the results can be relied upon as being accurate within the nominal tolerances for experimental work. The tests were conducted under conditions of a 40% modulated 400 c/s a.m. input, fed to the receiver on a matched 75Ω line. The output was measured using a calibrated VU meter connected to a 600 ohm point in the audio output. See Fig. 1.

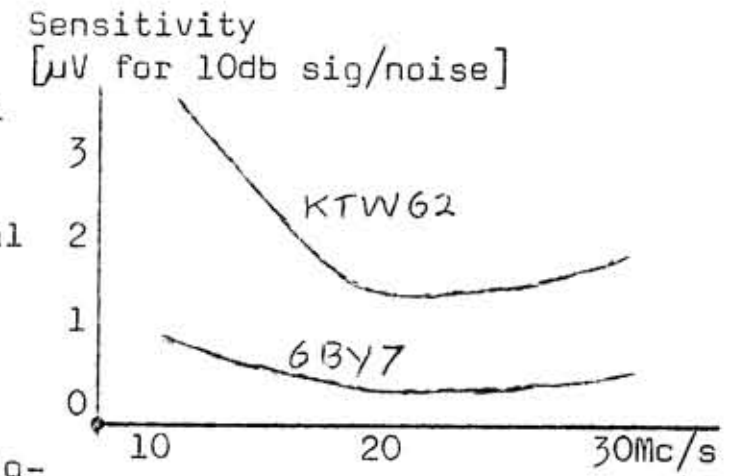


Fig. 1.

Owing to the limited range of the signal generator, measurements at frequencies below 10Mc were not possible. Although it is at the higher frequencies that interest in signal to noise ratios lies, both the shape of the graph and the performance of the receiver indicate that the sensitivity is improved at lower frequencies too.

The sensitivities all correspond to a signal to noise ratio of 10db. The low results at 11Mc are due to the band arrangement of this particular receiver. Note that these input voltages are on a 75Ω line, and when referred to the more usual 600 or 1000Ω, these figures for the 6BY7 reduce to the order of 0.2μV. Even under good conditions, the background noise on a high impedance aerial is higher than this.

And all this for the change of one valve.

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*When Rod sits down and starts talking about his Receiver, a gleam comes into his eye, he spreads out the entire wiring diagram [about two feet long] which he just happens to have brought with him, and promptly launches into a description of its glories. I sit here staring mutely at the good olde BC348-P [Modified] on my desk, and ponder the meaning of life. Never mind, I'll have my pound of flesh; we can expect lots of articles from Rod describing the various technical attributes of his Marvel, so that you can all build them into your own establishments ! -- Ed.

However, one comment: In the case of a receiver with only one r.f. stage, reduction of noise of the first valve may be of little value if the converter noise is high - as is frequently the case. The reduction of mixer noise is a far more difficult problem, although not impossible. It is most easily done by using a simple triode mixer such as the long-tail pair found on P.12 of the May 1968 issue of Amateur Radio, or P.24 of Technical Topics [Ref.1]*. It must be noted, however, that this predisposes the mixer to easier overloading from input signals, than if the more remote characteristics of a pentode or pentagrid valve were employed. Thereby hangs a long tale, about which RLG is certain to enlighten you as follows:

Mixer Nonlinearity.

Thank you, RAJR, I am honoured, particularly as much of this was possible only after long discussions with you; I am merely the mouthpiece.

I have been doing a lot of reading on this subject, and I am impressed by the speed with which the design of front-end stages of receivers is progressing. It can be followed easily and to excellent advantage in the series of articles by Pat Hawker every month as "Technical Topics" in Radio Communication [formerly RSGB Bulletin]. Indeed, through an oversight, the RSGB delayed sending this year's worth of that worthy magazine until relatively recently, when they all arrived at once. I have been reviewing them avidly, with a good case of conceptual indigestion as a reward. Consequently, some of this Report on Receivers will have to wait until I have assimilated the new information, and added it to the pages of jumbled notes already taken on the subject.

At this point, however, it appears that the main problem is that of linearity in mixers, and that this may well be on the way to being solved by doing the obvious: mixing linearly. But this seems to involve some rather esoteric devices: beam-deflection valves, parametric amplifiers, or hot-carrier diodes. It would appear that the good old De Forest Valve did not last after all [EEB, P.68]. For this important matter of linearity, transistors are generally hopeless unless used with ample inverse feedback, although FETs seem to be somewhat better in this regard.

Linearity vs Noise

Why worry about linearity? The ordinary valve mixers tend to be shockingly noisy, due to this and that.[Reference 4]. Reference to the Chart on P.61 last month illustrates this: the 6BA7 which is such a popular favourite is worse as a mixer than the bad-old 6K7 as an r.f., and that is pretty bad; the commercially popular 6BE6 is even worse. No other pentodes [not even the 6BY7] are much better, and the rest of the chart is full of triodes, except for the 7360 beam-deflection valve about which more will be said later.

Triodes, however, even so-called variable-mu types have a relatively low dynamic signal range. That means that when too large a signal is fed to the signal grid, it tends to drive it into the nonlinear part of the grid characteristic much worse than in the operation of remote cut-off types [Fig. 2, 4]. The result is cross-modulation, intermodulation, and desensitisation, all of which are bad. They have the same effect as a badly overmodulated signal, but in this instance the fault lies not at the transmitter but at the receiver. Before you say nasty things on the air, turn down your r.f. gain or reduce the antenna signal; if the "overmodulation" disappears, it was your fault, not his. This cross-modulation obviously increases the difficulty of reading weak signals in the presence of nearby strong ones.

The Reason for Cross-Modulation

The more observant will enquire at this point: how can that be? A mixer must be

*Note that this circuit couples the oscillator via a cathode follower to the cathode of the mixer. When the coupling occurs capacitatively to the grid [Ref. 3], an r.f. stage is needed to prevent oscillator radiation to the antenna -- which is a different matter entirely. Modern circuitry avoids this nuisance.

nonlinear to mix at all. This is true, but the nonlinearity is a special kind which is introduced purposely as a consequence of the combined effort of the control and oscillator grids.

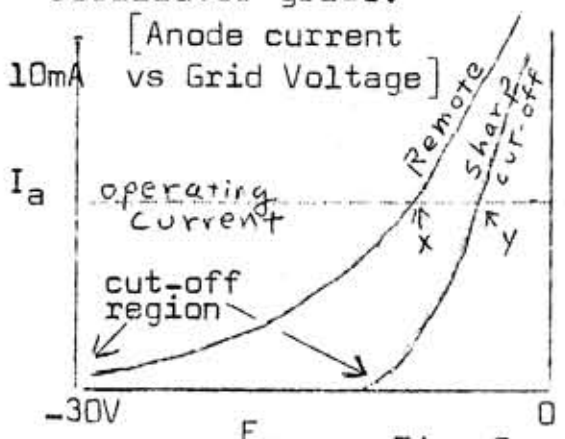

Fig. 2

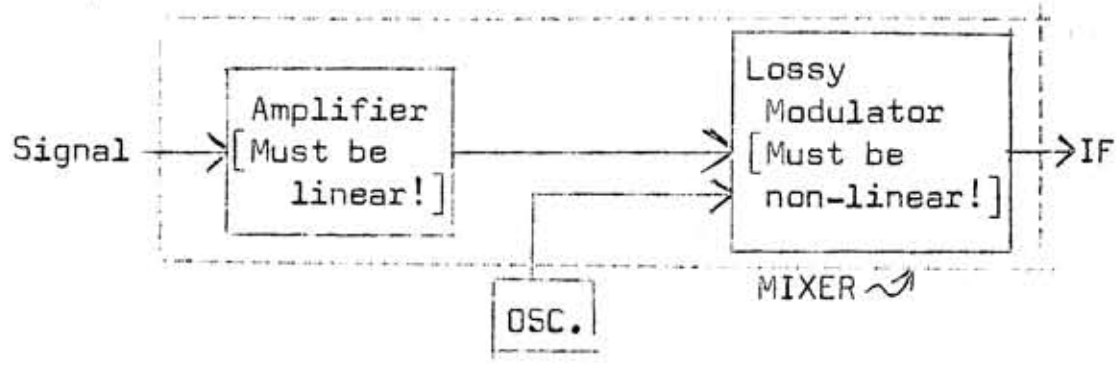

Fig. 3a: Hypothetical equivalent mixer stage

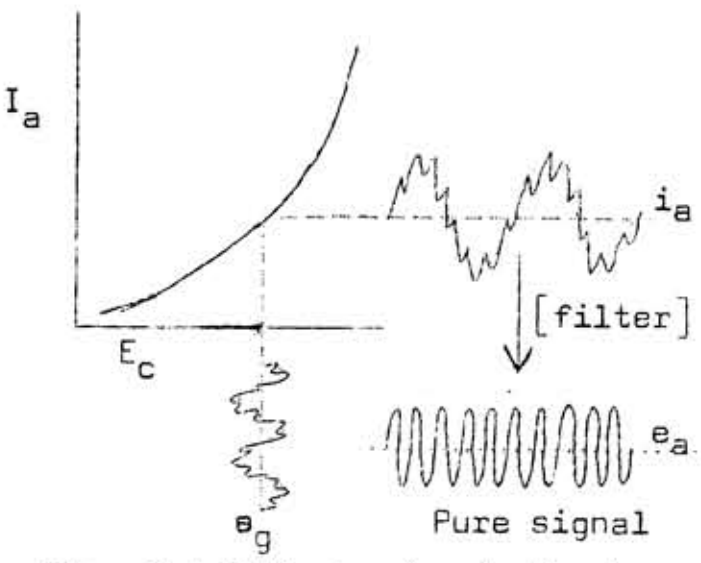

Fig. 3b: Effect of relatively weak interference [the lower frequency component] on Amplifier part of Mixer.

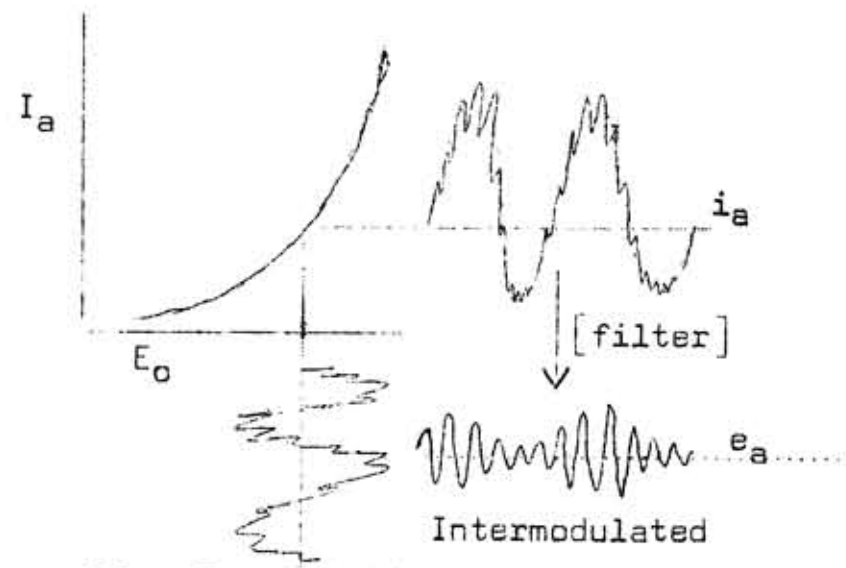

Fig. 3c: Relatively strong interference

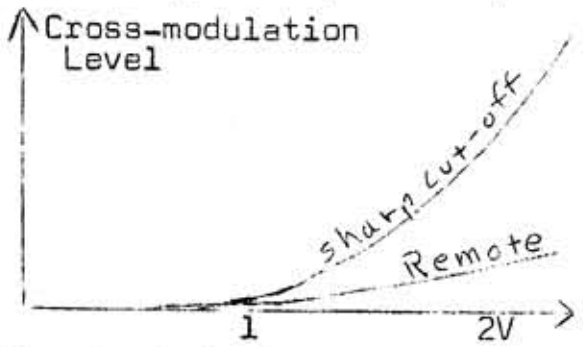

Fig. 4: Interfering signal at control grid [May be as much as 30V]

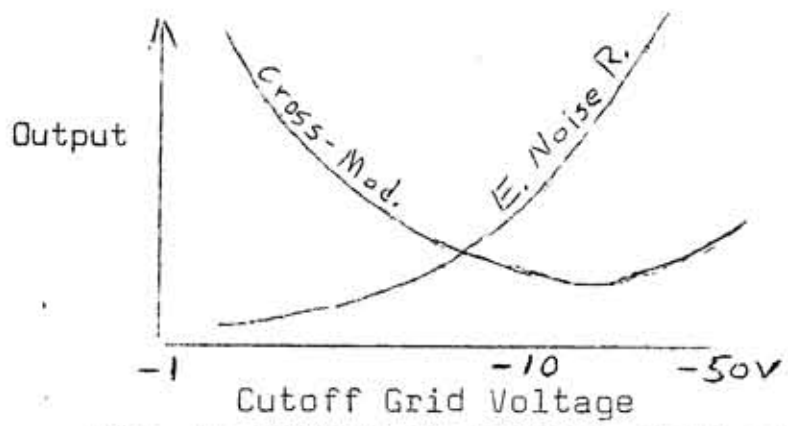

Fig. 5: Effect of control grid cutoff characteristics on linearity and noise.

The control grid function itself, must be as linear as possible. It is possible to consider a mixer to be made of a linear amplifier and a purposely nonlinear modulator, as shown at Fig. 3a. The important point here is the fact that the amplifier function of the mixer must be as linear as possible, so that the signal and interfering frequencies are mixed independently with the oscillator, in the modulator and never with each other. They may then be separated by the i.f. filters. The characteristic of amplification in the amplifier-function of the mixer is shown in Fig.3b for a reasonable level of interference, with small signal input; the curvature of the Ia/Ec characteristic has been exaggerated purposely to make a point.

If, however, the interference [shown here as the low frequency component] is very strong, the amplifier-function is nonlinear, as you would expect from extreme excursions of the signal into the cutoff-region of the grid voltage [c.f. Fig. 2],

and results in mixing of the signal and interference. This leads to the situation shown in Fig. 3c, where the desired signal has actually been amplitude modulated by the interference. This results, as you know, in a great mess of sidebands; if a 1kc audio signal gives you 2kc of sidebands on a 1Mc signal, imagine what you get when the modulating signal is 900kc ! These sidebands cannot be separated by the i.f. because they lie within the required bandwidth for the signal, no matter how narrow the i.f. bandpass. This is what is meant by cross [or inter-] modulation.

I have gone into these reasons for cross modulation, because they are usually not well explained in the various texts, and I didn't understand it either very much until Rod explained it in words of two syllables. His is the unusual talent of being able to think like an engineer or experimenter, and we may be thankful for it - if we don't happen to have to be the one doing the correlating and typing.

Relationship between Cross-modulation and Noise.

If you make the mixer grid more positive, the grid [itself] becomes more non-linear, and tendency toward modulation by an interfering signal becomes greater [fig.4]. For this reason multigrid valves are better than triodes as mixers, because the screen allows you to run the grid closer to cutoff, particularly if the shape and spacing of the grid are suitable. In a triode of ordinary construction, the grid bias cannot be high enough to avoid the space-charge region by very much [Fig.2, Point Y], so the range of voltages the grid will handle is relatively small before running into grid-cathode nonlinearity [Figs. 2, 4].

Since triodes and sharp cut-off pentodes are less noisy than remote cut-off pentodes, you can see right away where the conflict lies: the lower the noise factor [E.N.R.] the higher the tendency toward cross-modulation [Fig. 5]. Furthermore, for any valve, as the grid bias is decreased and as the grid characteristic [itself] consequently becomes less linear, the valve noise decreases. This is the conflict, with a vengeance. When you look at it in this way, an important reason for lower noise in a triode is the fact that the grid must be operated farther from cutoff than for a pentode in mixer service [Fig. 2].

What to do about it.

In practice, in conventional systems* two principal approaches are possible:

1] Use triodes for mixers, to obtain the high signal/noise characteristics desired, and use negligible or no r.f. gain in front of them [make it up in the i.f. or even a.f.]. Since it is desirable to use at least one r.f. stage, for reasons I shall discuss, this could mean using low coupling between the stages, to reduce to a minimum practical the r.f. voltage fed to the mixer grid. But the problem is still not really solved with very strong interfering signals unless the r.f. selectivity itself is greatly improved, and the problem becomes quite intense when the mixer is the second one in a double conversion set, [Refs. 1, 2]. Antenna signal attenuators are now becoming popular to reduce the cross modulation problem, but they are awkward to use, and they reduce desired signal, and they introduce some noise of their own.

2] Use sharp cut-off pentodes. These suffer from the same tendency to nonlinear grid performance with strong signals, and in addition tend not to work as well at moderately high frequencies [e.g. above 20Mc]. They do have an advantage that their control grid may be made semi-remote by putting a large resistor in the screen grid circuit [Ref. 8, p.11]. The advantages of using triodes for low noise, or remote or pentagrid valves for better linearity tend to squeeze out the sharp cutoff pentodes for most modern designs.

3] Remote cutoff pentodes or multigrid mixer valves. I shall not discuss here the special case of the multigrid converter employing oscillator and mixer in a single valve. The performance of the latter is inferior, and should not be considered for

*W1DX has suggested, with tongue in cheek, that one solution to the linearity problem would be to use transmitting valves in linear Class A ! [Ref. 2]

serious communications design. The multigrid valves are considerably less subject to cross-modulation problems, but are much noisier. The conventional way to handle this is to feed a relatively large signal [e.g. 10μV] to the mixer grid, by virtue of r.f. amplification, so that the signal level is appreciably higher than the noise level. This is a brute force method, but it works. The trouble with this is that as you provide more r.f. gain, the tendency increases to saturate the mixer grid by strong interfering signals, and we are back where we started with triodes. For this reason, a fully remote cut-off valve is more desirable than a "semi-remote" one even though the latter may have lower noise. Note too, that some valves are noisier than others, even when they all bear the same type number. Therefore it can be worthwhile to plug in a number in your circuit, to find the best one.

Limitations of R.F. Amplifiers

As you provide more r.f. gain, you also increase the tendency toward noise contributed by the r.f. amplifier itself: you have introduced noise in the stage which you added to reduce the effect of noise in the mixer ! Obviously this is the reason for the search for the low-noise r.f. valve which prompted Rod to start this article in the first instance. Note, however, that it presupposes that the mixer is reasonably unnoisy to begin with, and that any additional r.f. amplification will not necessarily increase the problem of mixer grid overload. If that extra r.f. amplification does cause overload, it must be reduced; the best way is to reduce interstage coupling, but a somewhat more flexible one is to control the r.f. gain by cathode bias. On the other hand, when the gain is reduced by biasing, the noise goes up. Therefore the r.f. stage should be operated at the maximum gain consistent with avoiding overload. For this reason, the r.f. stage, at least the first one, should not be controlled by the A.G.C. system. If it is so controlled, modify it, even though it may mean tearing into your chromium plated darling [Ref. 1, 9a].

It should be noted that many of the considerations I have discussed for mixers also apply to r.f. stages. Triodes are less noisy than pentodes, as shown by the chart in last month's article, but are subject more easily to overload. In city areas where amateurs or commercial stations may occur nearby, several volts of r.f. can appear on the aerial, and cross modulation can occur right in the first [and certainly second] r.f. stage. This is particularly nasty, because you have negligible r.f. selectivity to keep the offending signal out of the r.f. stage's control grid, and the only proper cure is to use a more linear valve. That is why Rod chose a 6BY7 [see chart, p. 61], rather than 6BZ6 or the otherwise excellent 6EH7.

On the other hand, one sees triodes used successfully as r.f. stages, particularly in the cascode configuration. This is necessitated by noise considerations at VHF, where noise becomes more important than linearity, and where high power transmitters are not as frequently employed as at the lower frequencies. It is possible to use triodes at lower [e.g. ordinary H.F.] frequencies, if you are willing to bother with antenna signal attenuation to reduce cross-modulation if necessary, but a good pentode is a lot easier. In addition, there is little point in raising sensitivity to a point where it is appreciably better than the noise resulting from the antenna or from atmospherics [see Ref. 5]. Furthermore, the control of gain in a triode worsens the linearity problem: when bias is increased, the region available for signal is reduced most uncomfortably; see Fig. 2, the curve for sharp cut-off. Even with specially designed triodes with somewhat variable mu grids, the situation is still not as good as with a good pentode. Below 30Mc or so, there seems little point in using triodes. Furthermore, and this is important, if you just plug a triode r.f. stage into an already existing circuit, the much lower impedance will load the r.f. coils excessively, reducing both gain and selectivity. With a pentode, this trouble is not encountered [if the circuit was designed for a pentode], and you still have the advantage of low noise -- therefore net sensitivity will be higher than with the triode.

If a triode needs to be used, a cascode is better than a long-tailed pair.

A friend wrote that he used the long-tail pair circuit from Amateur Radio, May 1968, p. 12, in an r.f. stage, "with good results," but this is less linear than a cascode, has a much lower frequency capability, and introduces more noise and intermodulation when gain is controlled by varying cathode bias.

Why R.F. Amplifiers??

Since an r.f. amplifier would appear to introduce more problems than it solves, you might well ask: why bother with an r.f. amplifier at all? Why not use a low noise mixer, with sufficient r.f. selectivity to reduce interference to acceptable values? The answer is that this is a good idea, but not always practical with conventional designs. With the systems with which most of us are stuck, the problem is to reduce noise, consistent with acceptable linearity using conventional circuits.

This compromise is usually best achieved with the noisier mixer, with r.f. stage[s] added.* This requires the best design of the r.f. system, to provide a small but definite amount of gain [to produce about 10μV of mixer signal for 1μV input], and also as much r.f. signal frequency selectivity as possible. Since the latter requires tuned circuits, it can become awkward, and special lattice-filter systems are better -- though rather complicated [Ref. 9b]. In my opinion, 'broadband' r.f. systems are to be avoided like plague. Q-multipliers in the r.f. have limited though definite usefulness, as we shall describe next month.

The main reasons for the r.f. stage[s] are, then, to provide some gain to the mixer, and some selectivity. It is possible to cascade tuned circuits without a valve between, but the Q with the valve is appreciably better. The r.f. amplifier can also help to compensate for low gain in the antenna, particularly with poorly matched antennas, inefficient coupling at the receiver, or miniature antennas. Since these conditions will also tend to reduce radiated transmitter power, and since indoor antennas will increase pickup of man-made interference, it is obviously better to depend on a good antenna to provide signal, when possible, than an r.f. stage.

There is quite a lot more to this story, methods for reducing r.f. stage noise, considerations of optimum bandwidth, new and better systems for mixing [Rod is going to try one of them and let us know], and these will be discussed in a future article in this series -- after I get through moving. What a horrid task; a new workshop will have to be built, not to mention a proper Den to house EEB, but at least it will be my own -- for the first time. Until then, I do earnestly suggest that you take a searching look at as many as possible of the following good references:

Some References:

1] "Technical Topics" by J. Pat Hawker, G3VA [RSGB, 1965], p. 21+. [It is also worthwhile to obtain or read any and all current articles on "Technical Topics " in monthly issues of the RSGB Bulletin or Radio Communication]

2] "Some Thoughts on Home Receiver Design" by B. Goodman, W1DX, QST, May 1965, p.11. "Noise Considerations in Receiver Design" by J.K. Boomer, WØVDC/8, May 1965, p.24.

3] Radio Handbook, by W.I. Orr, W6SAE, 17th Ed [or prior]: Radio Receiver Fundamentals. Not as good as RSGB for this subject, but good background.

4] Radio Data Reference Book, G.R. Jessop, G3TRP [RSGB, 1967]. A tremendously useful book for practically everything else too, full of charts, graphs, and nomograms on a wide variety of relationships of interest to the experimenter. From RSGB, or Melbourne bookshops at an inflated price.

*This will generally mean using a multigrid, or at least pentode mixer for the ordinary H.F. frequencies, but if you live in an area well away from strong interfering signals [where is that?] -- amateur or commercial, by all means use a triode mixer, as discussed by Rod at the beginning of this article. If that yields cross-modulation, reduce r.f. gain, preferably by looser coupling between the coils of the r.f. transformers, or by antenna attenuators; some control can be effected by the usual resistor in the cathode of the r.f., but this introduces noise -- and that is what you are trying to avoid.

5] RSGB Amateur Radio Handbook, 3rd Edition, p. 79+, and especially Chapter 15: Noise. Either the British are ahead of the Americans on this subject, or they are more vocal. If you are unfortunate enough not to have obtained this book, the 4th Edition is scheduled to appear in a few months: watch for announcements in Radio Communication. See your local Division of WIA or NZART.

6]. ARRL Radio Amateur Handbook. Chapter on Receivers: "Improving Receiver Sensitivity". Several good and practical points, though weak on theory.

7] Radiotron Designer's Handbook, 4th [and last, alas] Edition, by F.Langford-Smith [RCA, 1953]. Ch. 2: Valve Characteristics; Ch. 9: Tuned Circuits; Ch. 23: RF Amplifiers; and Ch. 25: Frequency Conversion and Tracking. The worth of this basic text is shown by the fact that now, 15 years later, it is still a fundamental and remarkably current reference. Well and simply written too, with numerous charts and graphs, yet equations to satisfy the fastidious.

8] Receivers, by Jim Kyle, K5JKX [73, probably about 1962]. Quite good, with numerous useful circuits, but the section on Front Ends is outdated, and should be read in conjunction with this article [EEB].

9a] "Strong-Signal Interference" by E.H. Conklin, K6KA, 73, Dec. 1967, p.22.

9b] "Front-End Receiver Filters" by E.H. Conklin, K6KA, QST, Aug. 1967, p.15.

10] B28 Receiver Handbook: BR 1430 [Admiralty]. C.f. RSGB Bulletin, June 1966, p.371

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IMPORTANT ANNOUNCEMENT

We have just received word that subscribers to Ham Radio in VK/ZL have not received their March [No.1] issue for the good reason that they ran out of them. A reprinting will be made toward the end of this year, and subscribers will receive their copy. The publishers regret the delay, but this is all they can do.

For our own part, we are gnashing teeth because a package containing several copies of that issue was posted from America four months ago, and is still enroute. Isn't that sweet? Good old PMG, Good old U.S.G.P.O.

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LETTER -- Good News !

The Australian EEB is very much appreciated here. I like the practical approach to the various subjects that you cover. We are overwhelmed with theory these days. A comment in reply to one of your comments [EEB, April 1968, p.39]: The Fourth Edition of our [R.S.G.B.] Handbook. It is to be known as The Radio Communication Handbook, and will be available in October next. It has been completely rewritten. The new Edition will consist of 832 pages compared with 560 of the Third Edition. It will, of course, be a hardback. The Price...?, not yet determined, but as low as we can economically manage.

Hope that by now you will have seen the new edition of the Amateur Radio Circuits Book, again completely revised with many additions. We make no extra charge for the inverted block, but did the printers suffer!

A new one, Amateur Radio Techniques, will be available in some 8 to 10 weeks. This is the old Technical Topics, now expanded to 160 pages. Page proofs on my desk at this time. Another new one, available in October: the VHF/UHF Manual. About 250 pages, selling at about 25/-, we hope. That is about the story on our publications. Thought you might like to know, as we usually get many orders from VK and ZL...

R.F. Stevens, G2BVN, Romford, Essex.

[[I haven't seen such a lovely packet of good news in a long time. In this devalued breathalysed world, it is a pleasure to see a gang such as R.S.G.B. churning out so much stuff of high quality, eminent usefulness, and reasonable price. The publications mentioned here are four of the best in the world. I don't have the time to stock them for our readers any more, but I earnestly encourage you to order them for yourselves; prices will be listed in Radio Communication, when appropriate.-Ed.]]

[[The Circuits Book has just arrived. Review of it next month]]

EDITORIAL -- RLG

After all the gab of previous issues I vowed I would shut up for awhile, but here I am. Aside from the fact that we are in the middle of moving house, and that things are incredibly more frantic than usual, and if the August issue doesn't appear you'll know that the Manuscripts probably got into the pile of my junk which the YF has been trying to throw out for years -- aside from all that, I have had some contacts recently with some experimenters who have given me food for thought. These were experimenters at various stages of proficiency, but many had one thing in common: they preferred to potter about in the workshop rather than waste a lot of time at books.

I am afraid that this subject intrudes into the one mentioned in my June "Letter to the ARRL" [I wonder whether they'll print it?], although in a different vein. Amateurs and experimenters generally, not only do not read enough good material about the outside world, they don't even read enough about their own hobby. This is lamentable.

My friends have been needling me gently for several years that I am the chap who does a lot of talking, and that's about all. Although time has been pressing, I have to admit that this is true, but with qualifications. I first became enamoured with practical theory when I had to study some of it to build some stuff for research in my proper work [biophysics]. I built it, and to my amazement, it worked first-go. It was the first time in my life that had ever happened. When I was a teen-ager, nothing ever worked at all, and I look back with wonder at the dedication which could survive such catastrophes.

When I became interested in the EEB my reading increased considerably, and so did the success of ventures [Occasionally] into the workshop; it seemed to be a good [though unexpected] investment. It even worked with some knotty problems involving a Pulse-Width Modulated amplifier, though I have to admit that I had to pick Rod Reynolds' engineering brains for that. I might add at this point that the only reason that amplifier is still lying on the bench is the one of time to get back to it, and I take this opportunity [again] to apologise to the bloke involved. Things were getting better recently because of the Secretary for EEB and the diminishing stock of A.E., when this darn moving happened. But I digress.

The types of non-readers I have met so far seem to fall into these categories:
1] The young enthusiasts who would greatly prefer to pick my brains on Saturday mornings, than to read material I thrust into their hands.
2] The avid experimenters of all ages who simply don't have time for the books; it is so thrilling to be in the workshop [and so secure?].
3] The dedicated experimenters who have read a bit, and have gone off half-cocked, to do a good but difficult job of it.
4] The commercial "amateurs" who couldn't be bothered.

Now, some of this problem arises from the apparent complexity of electronics. I am not an engineer, and I can appreciate that, but at the same time I think that there is quite a lot of commonsense approach which can be used by anyone. The reluctance to learn even this technique is the quality which seems to me least admirable. Commonsense, Grandmas Tests, types of presentations have been made in virtually every publication, including EEB of course, and are now available [as they were not when I had to start out] from a wide variety of commercial publications, notably by the large semiconductor manufacturers. I have referred, and shall refer to them frequently in these pages.

Some people plead lack of time. Nonsense, you know perfectly well that we all find time for things we really want to do, even I; its just that there are so many things I want to do! But the truth of my statement is illustrated by the fact that you are reading this now, even though my wife is muttering darkly about all the " junk " which has to be crated up. You know, that reminds me, the other day I was passing by a surplus electronics place and admired the junk in the shop when it came to me with a shock that I had more stuff than they did. If I don't get out

there and start using it, I might as well give it away -- but first there is a remarkable book I have to read.... [It is the 'Silicon Power Circuits Manual' by RCA].

Some people plead they are too old to learn new tricks. Nonsense. I have one friend, a retired chap, who has recently passed his examinations for the Youth Radio electronics course. Another friend, well into retirement, started to paint pictures five years ago, and is now exhibiting them with some success; he is too poor to buy proper oil paints, so he uses ordinary house enamel, with the result that he has developed a new technique, and turns out remarkable paintings.

Some people are satisfied with their accomplishments, and see no great need to guild the lily. This is the most difficult argument to meet, because it is true, in one degree or another. But the simple fact still remains: when it is relevant, an hour spent on the right literature can save you three in the workshop. How many hours have I spent substituting resistors and condensers to obtain a workable circuit, when a few minutes with ohm's law would have at least got me within the right order of magnitude. It was transistors which taught me this; it is a lot easier to design with them than with valves -- in my opinion.

Perhaps I am not being entirely fair. A great mound of technical books of all types have found their way from my office into the libraries of experimenters all over Australia. Good, but lets not stop there. First, don't let them sit on your shelves to be admired, use them. Secondly, don't stop searching for good books just because I won't be selling them. You can find good books in libraries, from the W.I.A., and from overseas at reasonable prices. The latter are available from the sources discussed in last September's EEB. You will find reference to the suitable books in EEB articles, but a basic library might involve the U.S. Government publications and the basic texts provided by RCA, GE, Philips and Mullard, and the others. And of course I should say that virtually anything published by the Radio Society of Great Britain is worth owning, and reading. The 1968 ARRL HDBK is said to be better than usual.

There you are. Lets have our own individual incentive programme. It isn't enough to learn how various bits of equipment can be stuck together. You must learn the elementary methods by which they can be designed, using the simplest relationships. If you don't find a circuit which does just what you want, start with a reasonable prototype, and work out the details yourself. Then go into the workshop and get it to work to optimum performance.

Then write to the EEB and tell us what you did, and the results. I am not against practical circuits; I enjoy publishing them. Merely that you will save yourself a lot of trouble if you build from a knowledge of the subject rather than in cookbook fashion. And if you have some useful thoughts on commonsense design, by all means let us know, preferably organised into a logical order. We receive many fascinating letters, but I must do too much work to extract publishable material from them. Why not write the letter, then pause a day or two, and rewrite it again with the thoughts better organised? It will clarify your own thoughts [and practice], and make my job easier.

Correction, Etc.

On P.43 of EEB a few months ago, we referred to the transistorised 80M phase-shift exciter [SSB] which appeared in the February CQ. Readers interested in that subject should note a correction to the phase-shift portion of that [CQ] circuit, described on p. 10 of the May 1968 issue of CQ. Even simpler one in N.Z. "SPECTRUM" of May 1968, by ZL1TBL.

Pecunia vincit omnia ["SSB is ruining the Bands"]

The commercialisation of "amateur" radio in America & here gallops on. One reads technical articles and comments about the various and clever methods for modifying such-and-such gear to achieve Results without Ruining the Resale Value, or [worse] the "possibility of disturbing a circuit function". This kind of thinking is well reflected in an article in the abovementioned CQ, on the use and abuse of an otherwise excellent surplus audio filter. The circuits presented are innocuous enough: an

oscillator type CW Monitor [though the diode-switched type is better], and a speech compressor. But the thing that caught my eye was the comment that commercial transceivers are difficult to use with audio-selectivity devices, because of what amounts to cross-modulation, worsened by the a.g.c. action. Now this is a terrible problem for transceiver-owners who don't want to reduce the resale value of their Equipment. Not only are they unable to improve the R.F. Selectivity or put a better valve in the receiver mixer, but they are not even allowed to disable the a.g.c. system! [See EEB Receiver articles].

God help us if Australian/New Zealand technical levels ever sink to that level.

And then there is the serious suggestion by a reader of some importance, [CQ,May p.8] that the U.S. Government ban all radio equipment which did not meet its rigorous specifications. It works on Citizens Band, you see [SEE AGAIN: EEB last month, p.64]. Can you imagine anything more ludicrous than federal control of equipment whose operators are too stupid to build [or even buy] competently? I'm not particularly picking on CQ. As I demonstrated elsewhere, it has some excellent features, as do the other magazines [although even QST joins the Club with an article in May on building R.F. Attenuators so that power from an SSB Exciter can be dissipated when it is too great to feed a given converter!], but it reflects also the 'State of the Art' in a decadent and materialistic society. Is that the society that Australia wants so much to copy?

Lest you believe that this is all merely one more tirade from Reactionary Old VK7RG, cast your eyes to the right on to the piece extracted from "Technical Topics" in Radio Communication, May 1968, p.298; Pat Hawker, G3VA has demonstrated enormous good sense and technical competence in this monthly feature, and his words are well worth pondering, as usual.

SOMETIMES one wonders if the time will come when we shall have almost completely " non-technical " amateur radio; when the hobby will be pursued solely for the very real attractions in operating rather than for any interest in developing the " black boxes " that make it all possible. This supposes always that the powers-that-be will continue to make available frequencies for this purpose.

As one who came into the game, as a schoolboy in the 'thirties, largely as a would-be " operator " but yet with some vague, though decidedly non-professional, interest in the techniques of radio communication, I for one regret that the trend still seems to be strongly against the old-time belief that the amateur should at least have a reasonable knowledge of, and interest in, the gear he uses—or would like to use.

Yet the signs from across the Atlantic—where the sheer weight of numbers inevitably determines the broad outline of the hobby—are not promising. One notes that even those amateur radio publications which a few seasons back were making strong claims to be concerned only with technical features now seem to fill many of their pages with transient " happenings " and the percentage of technical material continues to fall.

It is necessary to keep a balance in these matters but since a market research operation on behalf of ARRL a few years back seemed to reveal that interest in technical matters was waning, the weights have increasingly come down on the non-technical side of the fulcrum. One can no longer be certain that forward looking views on communication techniques can be found regularly in the journals reaching the vast majority of all amateurs.

It will surely be a loss to the hobby if the one-time half-humourous label of " plug-in appliance operators " should come to be revived in all seriousness.

In fairness to the land beyond the seas, I must note that the ARRL was largely instrumental in the recent upgrading of amateur licences, and that their recent editorials have been examining the question of technological competence generally. My "Letter" in the June EEB was a consequence of this. Although the ARRL has been embroiled in politics, the fact remains that they are still the single major voice of amateur radio in America, therefore of the world. If they are making an effort, can we expect more?

Perhaps we can: For example, the June QST introduces semiconductor electronics to beginners with a receiver using an FET -- and an Integrated Circuit. What a way to introduce electronics: to replace a simple a.f. amplifier by a prefabricated Thing with 12 leads. Other portions of the magazine describe various modifications of commercial "amateur" equipment, and a long review of a Jap transceiver [also on the way to VK]. To be sure, ARRL redeem themselves [for non-beginners] with several fine articles, but the trend pointed out by G3VA is there, and all responsible journals ought to fight it.....

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JAN.

TO:

FROM: THE AUSTRALIAN EEB
[An informal electronics experimenters bulletin]
P.O. Box 177, Sandy Bay,
Tasmania 7005, Australia

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THE AUSTRALIAN EEB

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August 1968 Vol. 4, No. 7 P.83

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CONTENT:

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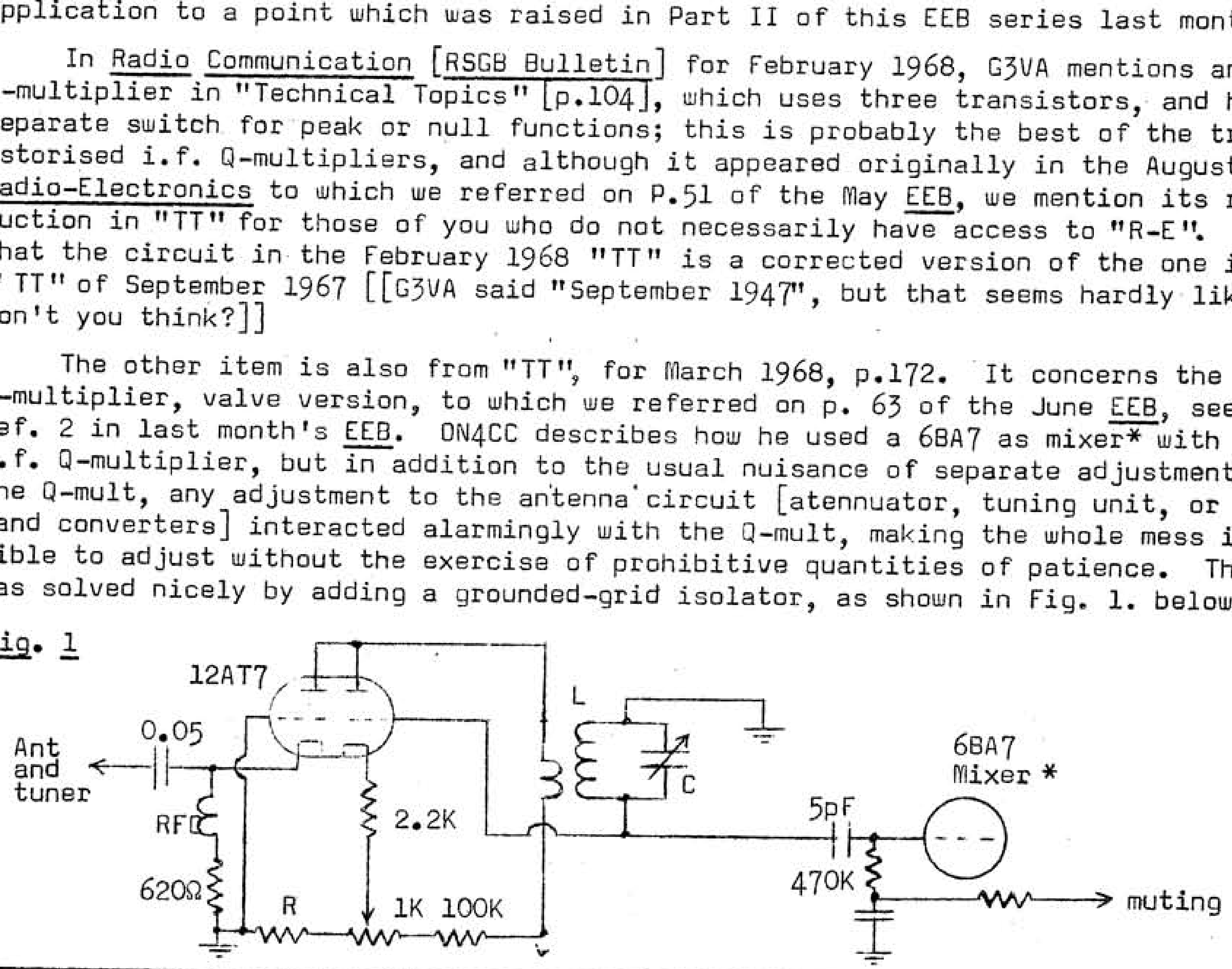
IMPROVING RECEIVER FRONT-END PERFORMANCE -- Staff
Part III: Q-Multipliers: Some Improvements and Limitations.

We thought we were finished with this subject, but the current literature brings to our attention two notes of interest, one of which we shall discuss a bit in application to a point which was raised in Part II of this EEB series last month.

In Radio Communication [RSGB Bulletin] for February 1968, G3VA mentions an i.f. Q-multiplier in "Technical Topics" [p.104], which uses three transistors, and has a separate switch for peak or null functions; this is probably the best of the transistorised i.f. Q-multipliers, and although it appeared originally in the August 1967 Radio-Electronics to which we referred on P.51 of the May EEB, we mention its reproduction in "TT" for those of you who do not necessarily have access to "R-E". Note that the circuit in the February 1968 "TT" is a corrected version of the one in "TT" of September 1967 [[G3VA said "September 1947", but that seems hardly likely, don't you think?]]

The other item is also from "TT", for March 1968, p.172. It concerns the r.f. Q-multiplier, valve version, to which we referred on p. 63 of the June EEB, see also Ref. 2 in last month's EEB. ON4CC describes how he used a 6BA7 as mixer* with an r.f. Q-multiplier, but in addition to the usual nuisance of separate adjustment of the Q-mult, any adjustment to the antenna circuit [atennuator, tuning unit, or broadband converters] interacted alarmingly with the Q-mult, making the whole mess impossible to adjust without the exercise of prohibitive quantities of patience. This was solved nicely by adding a grounded-grid isolator, as shown in Fig. 1. below.

Fig. 1



* See also July EEB, P. 72. The 6BA7 is a very noisy mixer valve.

The valve is 12AT7, and you will note from June EEB p. 61 that this type is well down on the list for noise. The first half of the valve is the isolating amp, and the second half the feedback amp. The circuit could certainly be used with an r.f. stage instead of the mixer shown, as long as the coupling condenser is kept down to about 5pF. Or it could even be used to feed directly into the antenna terminals of the receiver by using an additional small coupling coil wound on the torroid. It would use the minimum number of turns which would give adequate signal strength [compare with some standard signal].

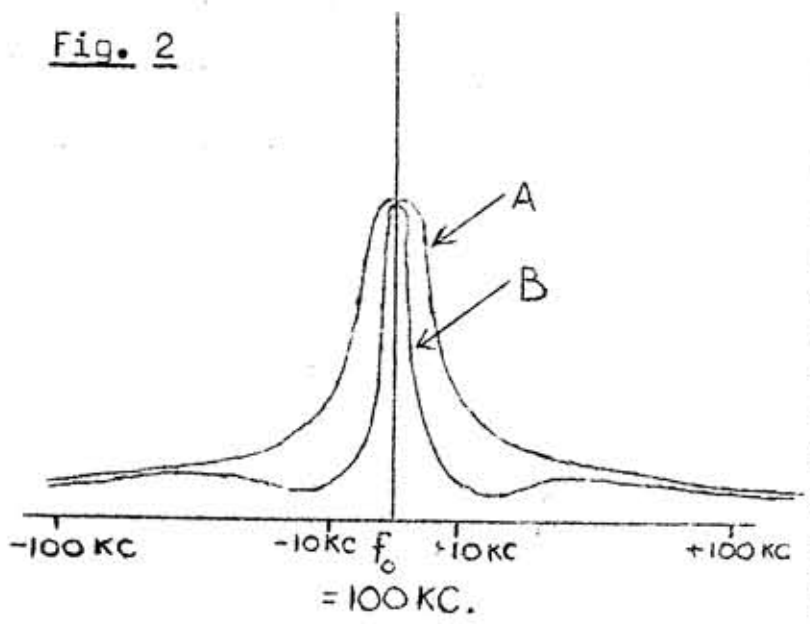
In the circuit shown, the coil is wound on a dust iron torroid core; the primary is 6 turns, and the secondary to resonate C. R is chosen so that the 1K regeneration control covers the critical region of feedback; as regeneration is increased, so is selectivity, but of course the stage must not be allowed to break into oscillation.

" Now the regeneration control needs practically no adjustment during operation, and the setting of the 50pF tuning control [[C]] is so critical that it requires a vernier control." "The signal gain is amazing..."

This is a fine idea, and if you are willing to tune the extra control it will help to give you a lot of selectivity where you need it most: up front, particularly above 10Mc. It will certainly reduce cross-modulation interference by adjacent strong signals, though it will not increase the overall selectivity of the receiver greatly if the i.f. system is adequate. If the i.f. is single conversion, one i.f. at 455Kc, overall selectivity will be increased somewhat. The above comment about " amazing" signal gain, however, was undoubtedly caused by the need for more r.f. gain, and perhaps better matching in ON4CC's system. For a receiver of nominal sensitivity, the principal advantage of the r.f. Q-multiplier will be that of improved isolation from adjacent-channel interference. This follows directly from our discussion of receiver noise factors [the series on "Improving Receiver RF and Mixer Performance"]: If you have achieved a good signal/noise ratio by suitable choice of r.f. and mixer valves and operating conditions, you won't increase sensitivity by adding another stage or by adding regeneration. You will reduce it, because both processes add noise, particularly regeneration. You will see this in practice as you use the r.f. Q-multiplier: as you increase the regeneration to reject a cross-modulating signal, you will find it progressively more difficult to copy a very weak desired signal. Obviously the optimum results will depend on judicious juggling of tuning, r.f. gain, [which ought to be quite separate from i.f. and a.f. gain], regeneration, selectivity [i.f. and/or a.f.], and luck. That's what makes receiving a skill, and enjoyable. Note that a passive filter is better than an active filter for the same overall result.

If your system does not have optimum sensitivity, you may well find an improvement with the circuit of Fig 1, or similar. We should, however, like to correct a persistent error which has crept into the literature onthis subject, and which has been repeated several times by G3VA: An r.f. Q-multiplier will improve selectivity of a resonant circuit for a reasonable range, say 50kc. It will NOT "overcome. image response" problems in a receiver with inadequate image selectivity. Examination of Fig. 2 shows why. Curve "A" represents the nominal amplitude response of the r.f. tuned circuit, assuming Q=100, and fo = 1000 kc. Curve "B" represents the higher selectivity characteristics from a Q-multiplier introducing positive r.f. feedback. It improves the selectivity considerably for, say 20kc, but beyond that point it

Fig. 2



approaches the ordinary selectivity curve. At 10,000kc, selectivity would be ten times poorer ! [See Ref. 1]

It is well known [e.g. Refs 3 - 7 last month's EEB] that the image frequency of a desired signal represents the frequency of an interfering signal removed by twice the i.f. frequency. Thus, if the signal frequency, f_o, is 1000kc, and the i.f. is 455 kc, a receiver with poor image discrimination will pick up appreciable signal at 1000 + 2 × 455 = 1910kc, or at 1000 - 2 × 455 = 90kc. Now, if curve "A" of Fig. 2 cannot discriminate sufficiently against a signal 910kc away, it is obvious that curve "B" will not do significantly better.

Therefore, although a single r.f. Q-multiplier will improve adjacent frequency selectivity considerably, it will have negligible effect on image response. The r.f. tuned circuits cannot, in general, be depended upon to provide sufficient selectivity for high frequencies unless there are more than three of them [e.g. more than two r.f. stages] or unless the i.f. frequency is higher than 1000kc. At VHF the i.f. frequency must be proportionately higher. This subject is discussed briefly but well in Ref. 7, and in the Handbooks. See + Footnote for Addendum ↓

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INCENTIVE CONFUSION

Aside from the philosophical implications of the new American frequency allocations, people in this part of the world will be interested in the actual details and some consequences, for the obvious relevance they have for operation and DX. We take, therefore, the opportunity to reprint two useful pieces which have appeared in the recent literature:

FCC Release on Frequencies *

On 16 April 1968 the American FCC released a correction of the 29 August 1967 announcement of frequencies reserved for holders of Advanced and Extra Class licences.

Extra Class [>22/11/68]: 3500-3525 kc 3800-3825, 7000-7025, 14000-14025, 21000-21025, 21250-21275,

Extra Class [>22/11/69]: 3500-3550, 3800-3825, 7000-7050, 14000-14050, 21000-21050 21250-21275.

Extra and Advanced Class [>22/11/68]: 3825-3850, 7200-7225, 14200-14235, 21275-21300, 50,000-50,100.

Extra and Advanced Class [>22/11/69]: 3825-3900, 7200-7250, 14200-14275, 21275-21350, 50,000-50,250.

De-centive Planning? -- by G.H. Goldstone, W8MGQ **

From what we observe, the nets which operate below 3900kc are changing frequency to spots in the 3904-3966 range. The existing nets -- those which have always operated in that range are running into more QRM than ever before; nets are piled on nets ! It looks as though the upper half of 75 will become a General/Conditional ghetto. The other side of the coin will be an area between 3800 and 3900kc which is bound to attract those hams seriously interested in a QSO.

By "QSO" we mean continuous radio communication between two amateur radio stations, which is NOT carried on through the intercession of a master of ceremonies, sometimes, called "Net Control Station". Then, we predict, a real incentive will become apparent to those who at this moment prefer to step back into the cave, rather than take a step up the ladder.

* From Collector and Emitter, May 1968

** From Auto-Call, May 1968, P.9 in part.

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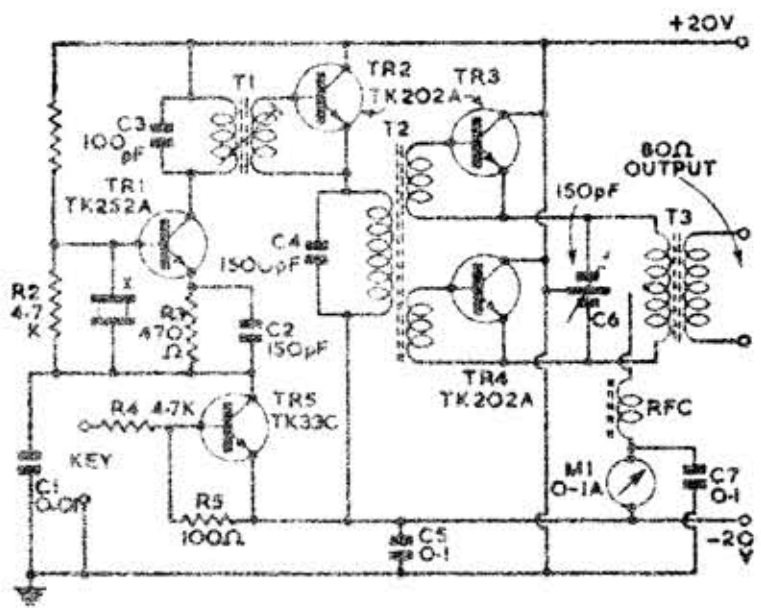
+ In June Ham Radio a converter uses the new 3N128 & 3N141 tetrode MOS FET's. Claims noise, sensitivity, and freedom from cross modulation comparing favourably with valves. Very interesting, but how favourably?

ADVERTISING

Literature Review:

AMATEUR RADIO CIRCUITS BOOK, 2nd Edition. Editor: G.R. Jessop, G6JP [R.S.G.B., 28 Little Russell St., London W.C.1, England. Stg 10/6 plus 1/6 post].

This little book in 1968 is the same excellently presented compendium of delicious circuits as its predecessor [1964], but bigger. It has more circuits, although some have disappeared too, alas. For example in a fine section on Transistorised Transmitters, the item shown here at the right has been omitted. Well, it can be added to the book along with the other material here presented. [Please note: The Resistor directly above R2 is R1 = 4.7K]. The new section on transmitters includes an extra valved one, one for 28 Mc transistorised, 70Mc transistorised exciter, a section on linear amplifiers, and the previous transistorised Tx for 3.5Mc [15W], 70Mc, and 144Mc. This is typical of the kind of expansion found in this second edition. For another example, the section on converters has been expanded to include many new and worthwhile circuits, though I wish they had not replaced the balanced beam deflection mixer with the unbalanced one. I must admit however, that the balanced one is better only if it is truly balanced, and that may be difficult. In any event, you can still find it in one of the RSGB's other lovely booklets: Technical Topics [Stg 10/- plus post]. [no more at A.E.]



Circuit of an 18 watt transistor transmitter for 7 Mc/s.
RFC, 20 turns, 24 s.w.g. enam. copper, on Stanferite ring type WP/3809/SF7.
T1, pri: 15 turns; sec: 5 turns; 26 s.w.g., enam., ⅜ in. diam., with dust core.
T2, pri: 4 turns; sec: 2 + 2 turns; 18/47 s.w.g. Litz wire on Stanferite ring type WP/3810/SF6.
T3, pri: 8 turns centre tapped; sec: 8 turns; 36/47 s.w.g. Litz wire on Stanferite ring type WP/3809/SF7.
TR1, TK252A *n-p-n* silicon epitaxial planar.
TR2, 3, 4, TK202A *n-p-n* silicon epitaxial planar.
TR5, TK33C *n-p-n* germanium alloy transistor.
X, 7 Mc/s parallel resonant crystal.

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This book consists simply of a large number of circuits. A few of them include comments on operation, but most have only parts lists. I find this refreshing after the manifest padding that accompanies most technical articles in the big magazines. One might hope that the example of the RSGB will tend to be followed by other magazines publishing anthologies [including the EEB?]. On the other hand I might comment that the RSGB presentation in this instance might have been a bit too terse. When you are faced with a multitude of obviously fine circuits, which do you use? In part this has been solved by presenting representative circuits as suitable for various bands, various powers, etc, but the penetrating experimenter will want to adapt them to alternative uses too. Perhaps the next edition can have a brief paragraph of comment for most of the circuits, even at the risk of increasing the number of pages.* The costs of RSGB publications are always modest, and some expansion could be tolerated.

The presentation includes a nice blend of transistors and valves, each used as appropriate rather than as a matter of fashion. As before, the book has no Table of Contents, and this is frustrating, although the Index at the back of the book is good. I take this opportunity, therefore, to review the book and do you a favour by presenting a Table of Contents which can be inserted right into the book. If the sheet is folded in half, it ought to fit in just right, or with minor trimming. For those souls who refuse to butcher their precious EEBs, extra sheets will be available for an S.A.E.

* Perhaps a brief reference might be made to the source of the original circuit?

AMATEUR RADIO CIRCUITS BOOK, 2nd Edition
-- Edited by G. R. Jessop, G6JP, RSGB, 1968

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Although rŏom has prècluded more detailed listing of these circuits, the index is organised in sufficient detail, with exact listing of all circuits under each major topic heading.

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Other RSGB publications are as useful and relatively inexpensive as this one. A list of current titles may be found in any issue of <u>Radio Communication</u> (Formerly <u>RSGB Bulletin</u>), the monthly technical journal of the Radio Society of Great Britain -- from which many of the circuits of this book are obtained.

£ Stg may be obtained easily in VK from any large bank, e.g. Bank of New South Wales. In ZL, consult with the NZART, or pray for federation with Australia -- hi.

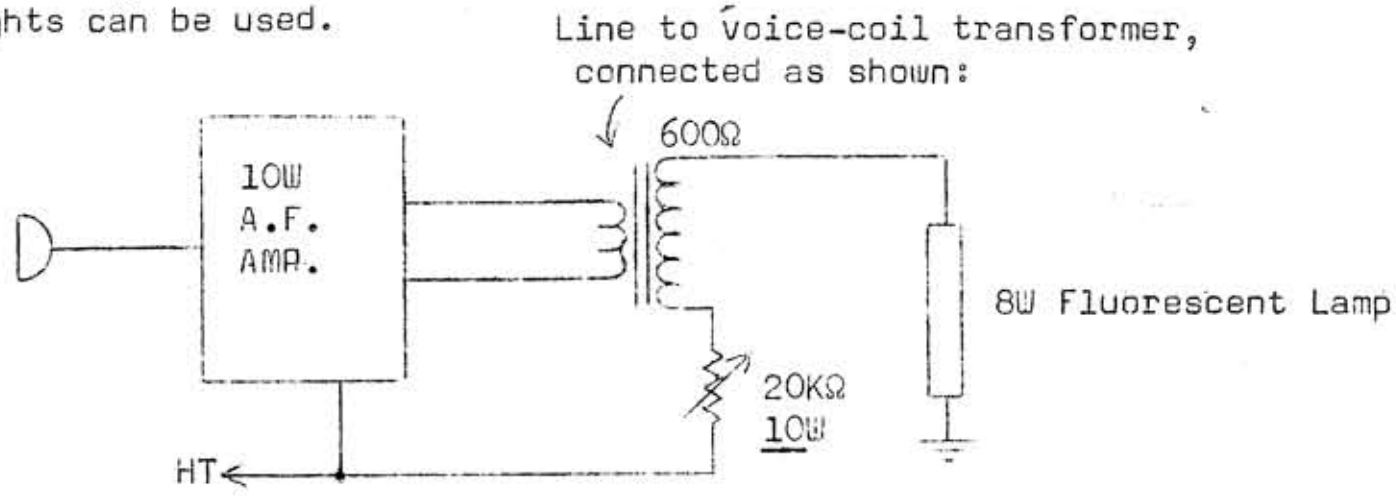
MODULATED LIGHT COMMUNICATION -- by K. Burlinson, with R. Averay [VK5]
[Transmission of messages by intensity modulation of light]

There are three methods which I have investigated for intensity modulation of light without using lasers or similar equipment.

1] Varying the current in a fluorescent tube by transformer coupling it to a power amplifier.
2] Using the fluorescent tube as the cathode load in a cathode follower circuit.
3] Altering the intensity of a beam of light by passing the beam through a "modulator " of some type.

I have been mainly concerned with the first method, whilst two of my friends are working with the other methods.

Personally, I feel that the third method is the most promising because high power lights can be used.



I have chosen to use a fluoro. because it will respond to audio frequencies and the quality of speech transmission is very good in regard to the frequency response of the system. An incandescent light will not usually respond to modulation greater than a few hundred CPS.* I used an 8 watt fluoro. because physically larger tubes pose problems when designing the reflector.

A constant D.C. voltage is applied to the tube to prevent it from extinguishing. Once it goes out, a large voltage peak is necessary to restart it. This causes serious distortion. To light the tube initially, turn up the amplifier volume until the tube lights. The series resistor should be variable, and adjusted so that the tube nearly extinguishes on negative peaks. This will give the maximum modulation. The light intensity will thus vary with the applied voltage.

Attempted measurements of the fluoro. impedance have shown the impedance to be between 0 and 1000 ohms. The best modulation was obtained by using the 600 to 2 Ω transformer, but modulation can be achieved by using many other transformers. The fluoro is a constant voltage device and an 8% change in voltage causes about a 50% change in current. This drawback makes it very hard to try and drive the fluoro. by this method, and a well-stabilised power amplifier serves best as driver.

By using the tube in a cathode follower circuit the loading of the tube should not be so critical. By altering the grid bias of this stage the fluoro. can be prevented from extinguishing.

The third method of modulation allows the use of incandescent lights. This leads to higher powers and more practical reflectors. The only method of modulation I can find to do this is to use polarised light and a Kerr cell. This method is not so simple or cheap. Using the transformer coupling method I have covered 500'.

The fluoro can be driven by any 10 watt [or larger] power amplifier.

For a receiver I have used both valves and transistors. In the Transistor type I used an OCP71 phototransistor followed by a 5 transistor amplifier. This was used as the receiver over a 500' distance. At this distance the high noise level from the phototransistor became troublesome.

* An incandescent will work if driven very lightly; see footnote, p. 91 -- Ed.

The amplifier used had 2 voltage amplification stages, followed by the driver transistor and a push-pull output stage. The first 2 stages used computer board transistors. These have a good gain and a reasonably low noise level. This amplifier gave ample performance. [Fig. 2]

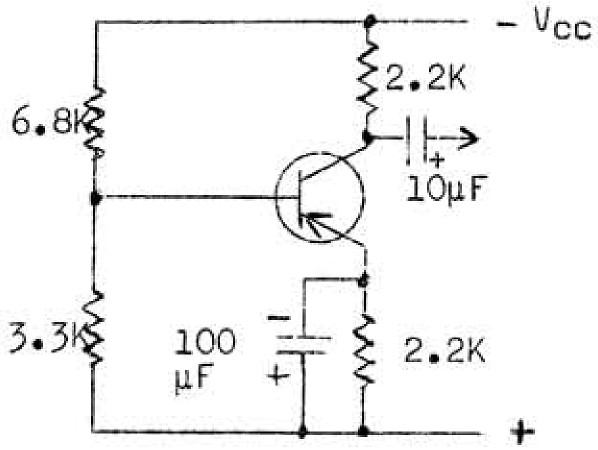


Fig. 2

The phototransistor can be an OCP71, or OC71, OC44 etc. with the paint removed.

A serious disadvantage of the phototransistor is its very small sensitive area. This makes the reflector alignment quite critical. I have also used a valve receiver, which was much easier to line up because of the larger area of the photocathode. Hiss problems are considerably reduced, but microphonic valves limit the amplifier gain. Also, the receiver is now dependent on a mains outlet which is inconvenient when experimenting.

I used a 929 vacuum photocell, but gas filled types can also be used. The vacuum types generally can be operated on 250 volts, but most gas types run on about 90 volts. [Fig. 3]

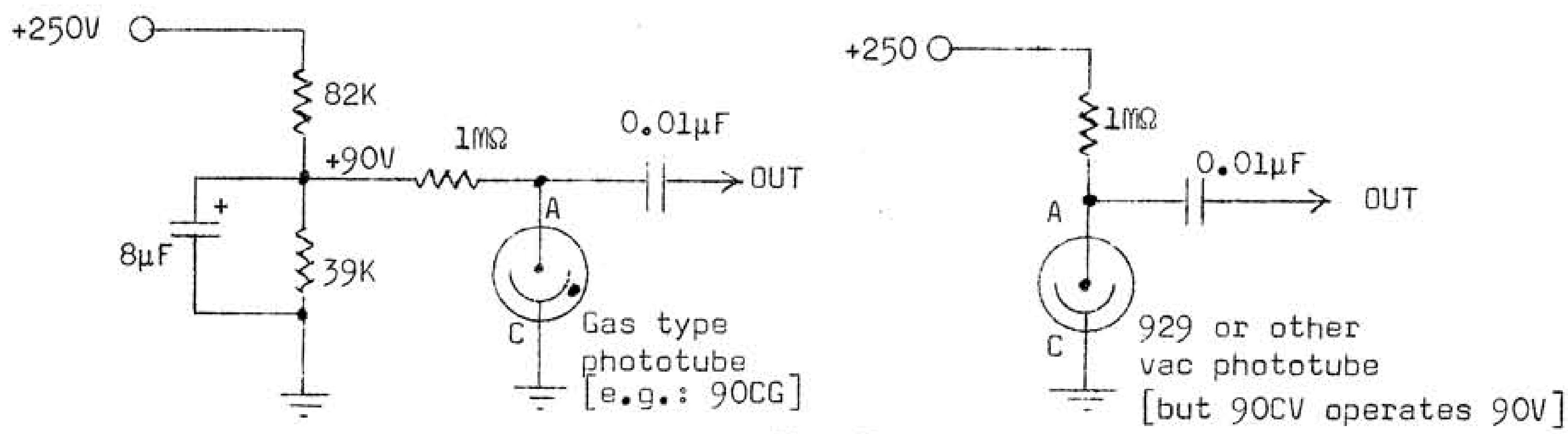


Fig. 3

The plate load resistor can be made so large because the plate current is almost negligible. The amplifier used with it contained 2 pentode-connected 6AU6 valves and a 6AQ5. It was used quite successfully over 150 feet. The transistor receiver is more useful when experimenting over larger distances because it is portable.

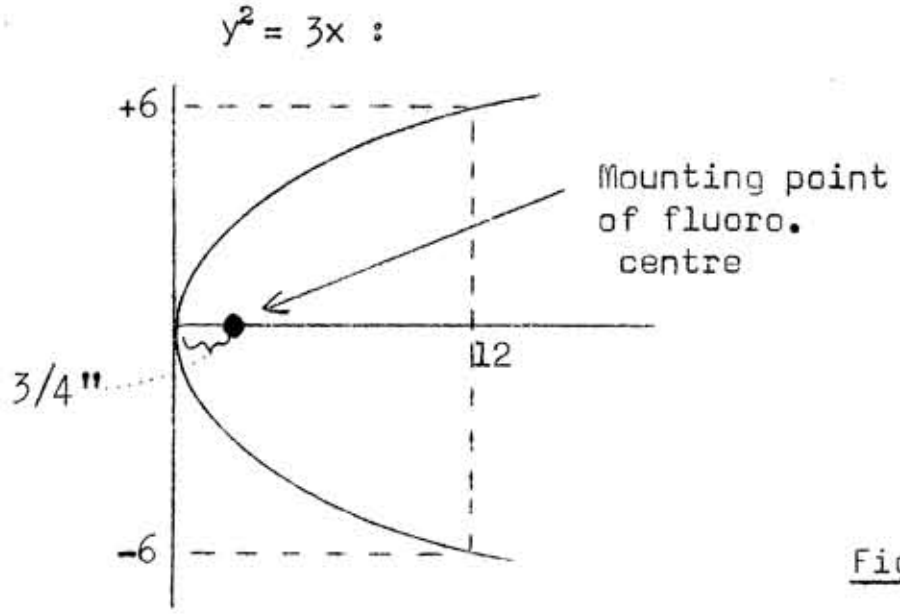
The reflectors are essential for distances much over 10 feet. An 8 " spherical reflector was obtained from a Metal-spinner and used at the receiver end. The parabolic reflector for the fluoro was easily made from a sheet of aluminium. It is best to polish the sheet with a buff before bending it. A car headlight could be used on the receiver by mounting them phototransistor where the globe filament used to be.

To make the parabolic reflector, draw the graph of the function $y^2 = 3x$. [Fig 4, not to scale !] Such that it is 1 foot deep with a 1 foot mouth [work in inches when drawing the graph]. Cut this shape in 2 pieces of 3/4 " pyneboard. [or similar timber]. [See Fig. 4, P. 93]

=>

Lowering Crystals

If you're looking for different ways to lower the frequency of a crystal try sodium silicate, sometimes known as 'liquid glass'. Available in drugstores and hardware stores at very small cost, successive coats can be brushed on or washed off as the case demands. ... WØHKF, [Reprinted from 73 Magazine, January 1961].



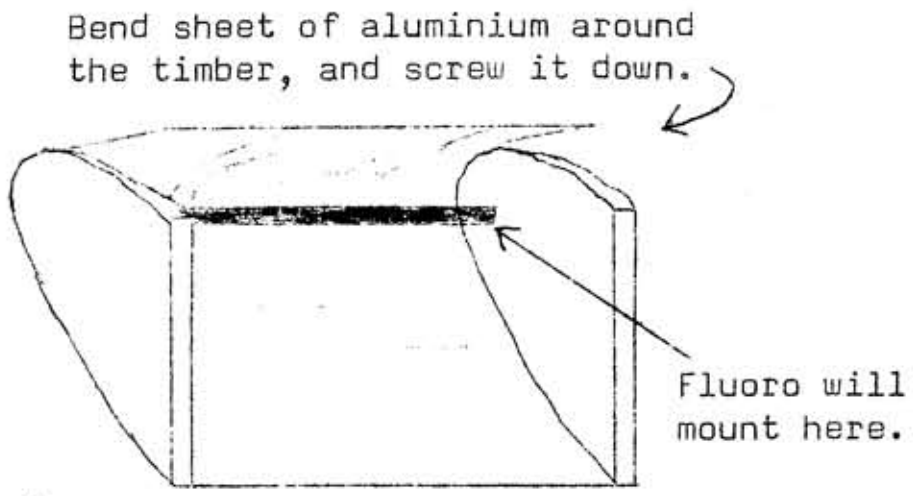


Fig. 4

PARABOLIC REFLECTOR
[not to scale]

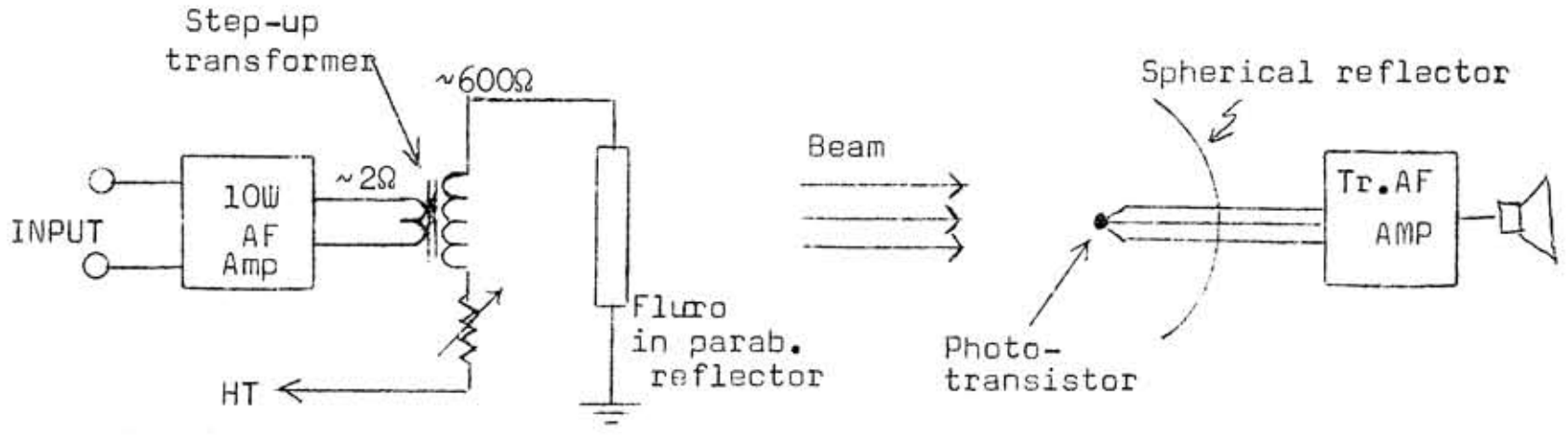


Fig. 5

The width of the reflector is governed by the type of fluoro used. Conventional fluoro. sockets can be used to mount the tube. This reflector gives a reasonable beam having a spread of 4' at a distance of 30'. It is advisable to use a small thin fluoro. to get a good beam from the unit. The electrical installation of the lamp is shown in Fig 5.

Make sure the power supply can stand another 60 mA drain imposed by the fluorescent tube. Experiment with various transformers to find the best ones. Recent experiments using the flouro both as a plate and also a cathode load have not been properly tested, but have given promising results up to now.

Addendum. Subsequent experiments have yielded a range of one half mile when a photomultiplier was used as the sensitive cell. Some difficulty was obtained from power supply hash - may go transistor soon.

- - - - - - - - - -

Editor's Note Readers may also be interested to look up the following article: "Talk Over a Light Beam " by V.L. McCarty, Radio-Electronics, April 1966, p. 34. McCarty used an incandescent lamp [a lantern type] driven from a 6v battery, and modulated by the audio taken from the speaker terminals of any low power audio amplifier. Flicker is negligible, and frequency response is up to 15kc as long as modulating voltage is<1% of the d.c. voltage '.

A silicon solar cell was used as the receiving photosensor. The "Solar Systems type 10 - 8L " has high output, but many other types can be obtained inexpensively on the American or British surplus market. The cell was fed into a 1 : 100 turns

ratio transformer, and thence to a high gain amplifier. Simple magnifying optics were a shaving mirror using the concave side several feet behind the photocell. The transmitting unit was mounted on a tripod. Total range appeared to be less than 50', though the author was not very explicit on this.

= =

LETTER - More applications of sensitive SCR's

In reference to your discussion of the uses of sensitive [e.g. gate current less than 10µA] Silicon Controlled Rectifiers, you may be interested to see another application: The SCR may be triggered directly by sound input to a crystal microphone: a handclap is sufficient. A 36K resistor from gate to cathode was sufficient to prevent self-triggering.

Although the microphone connected directly to the SCR is sufficient for triggering, I found it expedient to use a small auxiliary amplifier to ensure reliable operation under wide variations of climate and sound intensity. The application itself is interesting too: these units are used for athletics. They are placed on an elevated stand near the starter. When the gun if fired, the flash is triggered and provides a good timing signal for the timekeepers. The rules say you must time from the flash of the pistol, but to get any sort of flash in bright daylight you must use large cartridges which are too expensive. With the electronic flash you can use much cheaper cartridges and you get a better flash. Because of the fact that the starter blows a whistle to warn that he is about to start a race, I incorporate a simple differentiating circuit between the amplifier and the SCR so that only a sudden pulse of sound will fire the flash. The completed units have just an ON-OFF switch and can be left on all afternoon without any attention if either the quiescent current drain of the amplifier is low or if the amplifier can be powered by the flash unit battery. I use Ni-Cd batteries for the flash.

I am also working on a crystal controlled stop watch at the moment which I hope will be superior to mechanical ones, and I have a notion that it might be possible to make an electronic wind gauge with no moving parts, based on acoustic feedback effects.

- - D.H. Sofer, St. Kilda, Vic.

[[Readers are cautioned not to put a crystal mike directly across gate to cathode, but rather to use an isolating condenser, because d.c. potentials can ruin crystal cartridges. Otherwise this sounds very interesting, and we look forward to some articles from Mr. Sofer on his ingenious projects - - Ed.]]

= =

LETTER - How to Write Articles [almost]

Its been a long time since I sent you an article. Problem is I'm only home for a short time at weekends now, and that's the only time I have in the workshop... I have the proximity relay article in front of me: 3 foolscap pages and I haven't reached the circuit. I also have a partially complete article on a long-distance earphone sort of thing [as for James Bond, etc.] using an AF amplifier with about 11 transistors straight. It has some gain, but many bugs in it still. Then I'm working on a fuel consumption meter -- saw a design in a Yank magazine, but I lost the mag; must start from scratch. If I ever get time to buy a postal note. I'll get a Volume 2 EEB; good stuff.

-- D. Brown, Gosford, N.S.W.

[[Too late ! -- Ed]]

= =

Rust Preventative per quart

Borax [$Na_2B_4O_7$ 10 H_2O]	:	0.2 oz.
Sodium salicylate [Na $C_7H_5O_3$]	:	0.15 oz.
Sodium Nitrate [Na NO_3]	:	0.04 oz.

Dissolve in hot water, but cool before using. Use 2 oz. per gal. of water. This makes approximately twice the recommended strength.

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Please note the new address; do NOT send orders to the View St. address !

August 1968: [The following stock will not be replaced; limited quantities]

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RESISTORS: → If we can find it under the mess after moving.

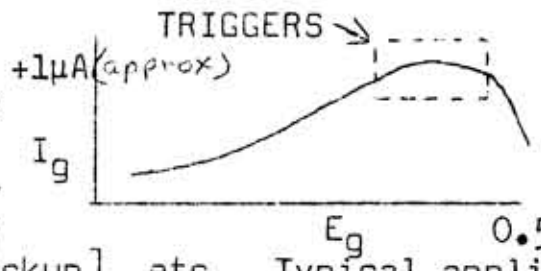
[no more 1000Megs]

WELWYN Glass-encapsulated, new high-stability resistors: 125MegΩ, 10,000 MegΩ: $0.65 ea. Last stock of this type of resistor. Originally $10 each, new.

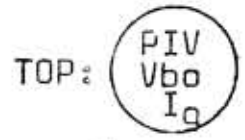
SILICON CONTROLLED RECTIFIERS: [SCR Technical Note included with each order]

PIV/V_{bo}	Fwd Amps	Max I_g	Price
> 200	0.8	<2mA	1.10
> 300	0.8	<2µA	1.40

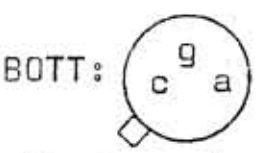
The 300V SCR's are a phenomenon. Their typical firing characteristic is shown in the figure to the right. Their high sensitivity allows control of a relatively large amount of power with practically nothing: control by RF, static charge, proximity effect [a.c. pickup], etc. Typical applications are discussed in the May 1968 issue of The Australian EEB. This is the kind of sensitivity you expect from a Silicon Controlled Switch [Ref: G.E. Transistor Manual], but in this case there is only one gate [the usual Cathode Gate].



Silicon controlled rectifiers may be used for motor speed controls, lamp dimmers, battery chargers, tachometers, electronic ignitions, remote control, model railroad control, photo timers, flashers, etc ! Good coverage of this subject is afforded by the G.E. and R.C.A. SCR Hobby Manuals, the IRC SCR Handbooks Vols I and II, and the G.E. SCR Manual, 4th Edition, Obtain from the big Mainland bookshops, or order from the American sources specified on P. 126 of the September 1967 issue of the EEB, for considerably lower cost, but slower service.

TOP: 

[I_g as mA]

BOTT: 

[cathode, gate, anode]

FOR DIODES AND SCR'S, BE SURE TO ALLOW A PIV SAFETY FACTOR OF AT LEAST 1.5-Fold; this is discussed more fully in the Diode and SCR Notes supplied with each SCR order. If you do not have a copy, ask for it. The latest SCR Notes also describe how to use the 300V SCR's in series to apply directly to 240V Mains.

BOOKS:

It is quite impossible to include here sufficient information adequately to describe the technical books we stock, so we are not going to try. If we stock a book, you can be certain that it is a good book for the subject, and furthermore that it is sold at a reasonable price, an unusual happening in Australia. On the other hand, we have prepared a detailed description of a number of the books we stock, which ought to make it considerably easier for you to purchase by post. It involves a number of foolscap pages, and is more fun than browsing through a bookshop [and likely cheaper too, because you won't be as likely to buy by impulse]. If you want this Giant Packet, please send a largish SAE, marked 'PACKET'.//POSTSCRIPT: "PACKET" NOT AVAILABLE UNTIL SEPTEMBER. ←

The following books are now in stock, although quantities are limited, and these books will not be replaced:

[P.T.O.]

73 Books: [Stock very low]

Ham RTTY, Teletype; Special:	1.25

Sams Books:

Diode Circuits Handbook	3.25
Transistor Circuit Manual	5.25
Handbook of [more] Tr. Circuits	5.25
101 Ways to use VOM/VTVM	2.95

Motorola Books:

Zener Diode Handbook: Many circuits, applications, characteristics, power supplies.	2.00

U.S. Government Books:

Introduction to Electronics	1.15
Basic Theory/Application of Tr.	1.75
Theory/Use Electronic Test Eqpt	1.30
Troubleshooting/Repair Eqpt.	2.65
R.F. Power Measurements [Free with any other order of U.S. books if specifically requested]	0.25

Techpress Books: [Stock low]

Principles of Amplitude Modulation:	1.95
Princ. Electronic Oscillators	1.95
Princ. R.F. Power Amplifiers	1.95
Princ. Transmission Lines	1.95
Ant Princ. and Wave Propagation	2.95
Fundamentals of A.F. Amplifiers	3.95
Power Supplies and Regulators	2.95

R.S.G.B. Books [Stock low]
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Service Valves/Semiconductor Equivalents; very useful.	0.50

[Sorry, no more Technical Topics or Data Book. Send directly to RSGB.

SSB Equipment	0.30

THE SELECTED SEMICONDUCTOR CIRCUITS HANDBOOK, by S.Schwartz. Soft cover, bound, 450pg, 8+ x 10 in.
$3.05, post free.
This useful book contains a remarkable collection of semiconductor circuits of basic design. The circuits are those of systems most likely used, some simple, some complex, depending on performance required. This is not just 'another circuits book', although it seems one can never get enough of them. It includes an introduction to each section, consisting of 'Design Philosophy', being

[Selected Semiconductors, continued:]
a discussion of basic aspects of the subject, at an intermediate level.

And each circuit is accompanied by a working description, in some detail. The transistors are American, but equivalents here are now no longer a problem, since high quality semiconductors can be obtained inexpensively to cover a wide range of applications; you need only examine the circuit to see the approximate frequency and power ranges involved, and voltage if relevant.

The 'Contents' illustrate the range of subjects, eleven pages of them!
Sections include:

I: INTRODUCTION [including preferred list of transistors, abbreviations, etc]

II: DIRECT-COUPLED AMPLIFIERS

III: LOW-FREQUENCY AMPLIFIERS

IV: HIGH- FREQUENCY AMPLIFIERS

V: OSCILLATORS. VI: SWITCHING CIRCUITS

VII: LOGIC VIII: POWER SUPPLIES

IX: AC/DC POWER CONVERTERS

X: SMALL SIGNAL NONLINEAR CIRCUITS [including modulators, mixers, converters, detectors, reactance modulators, frequency multipliers, frequency dividers].

A further sheet of description of this book is available with the 'PACKET'. Circuits do not overlap those of other books. Now available in the low priced paperback edition, in limited quantities. Compare with Mainland Prices for equivalent, unbound.

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EDITORIAL -- RLG

Deep in the throes of moving house. This has obviously prevented preparing any extra material in addition to that already available. Paradoxically it also allows us to catch up ! Best of all, you are spared long philosophical harrangues.

Next? month: That darn Transistorised Transmitters for sure, meter shunts, an SCR pulser, and perhaps room for another favourite sine wave transistorised oscillator - using only R and C.//August 16: All the files are buried somewhere down in the basement, I think under two tea chests of transformers and several heavy shelves. Whence the Sept EEB?

Valves are Nice Beasts

In the June Electronics Aust is a pretty article showing how to convert a 12 hr clock, electronically, into a 24 hr. one. Aside from the clever idea involved, it ought also to represent a considerable saving of money, if the prices I have seen for 24 hr clocks are to be believed.

Interesting, too, is the fact that Electronics chose valves rather than transistors for the power-multivibrator, because of the considerable circuit complexity which would result from a transistorised system suitably protected from transients.

I suggest valves [but ever better] will be with us for a long time, showing their usefulness in AF, Power, and R.F. circuits where transients would complicate semiconductor circuitry unduly.

The Transistor Radio Handbook

We have received several copies of this very popular work by Stoner and Earnshaw [published by "Editors and Engineers "], to which we recommend you highly. You may obtain it at our cost, $4.50, post free while they last, by sending to EEB. A 33% discount on The Australian Bookshop price. First come first served.

Shoes and Sealing Wax.

This is being typed in a lull between packing boxes and boxes of Junk -- 20 years worth. The more I pack, the gloomier I become. What is the use of it all? Alice says: "Now that you have help, EEB takes only 3/4 of your spare time. You'll never get back into the workshop until you improve on that ". Aren't women fiendish? She suggests gently that it could be worthwhile to reconsider the possibility of a bimonthly schedule of publication. After all, Mullard 'Outlook' and STC Components Review' do it, and several other mags too. And I'll bet more would like to, too.

On the other hand, there are SO many articles to publish, my own and others, so much to say, so little time to say it. But am I not 'kidding' myself? If this is a hobby, who is the master? Will the world care very much if a circuit or thought is published here sooner, or later? During this musing, the YF intrudes with typical feminine logic: "Don't people already get too much technical material to read in the mail? " Hmmm, profound thought. Say, that doesn't sound like her; where have I heard that before? Oh, in one of my Editorials which she must have read.

I'll reconsider this matter at the end of this year.

The Uses of Output Meters

The latest article on R.F. Output meters [c.f. 'Dummy Load', EEB* March, April 1968] appears in CQ, May 1968, p. 22, by YV5ACL. The r.f. voltage on the transmission line is divided, rectified, and read on a meter some distance away. The meter is a 'VU' type, and is particularly appropriate for this kind of application [I always wondered what they were for]. It has very good dynamic characteristics, with low overshoot: when driven suddenly to full scale, it will not overshoot >1.5% nor <1%. This allows you to interpret modulation levels of SSB or Controlled Carrier systems. If the output of the dummy load is also appropriately demodulated, it can be used as a nice modulation indicator for AM as well. But it would appear that AM is a dying art. Ah, the perogatives of a decaying civilisation.

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LETTER

Just a short line to inform you that I no longer wish to subscribe to the EEB when it expires next month [my Sub. that is, not the EEB]. My reason is that I have recently changed my interest to another hobby.

However, I wish the bulletin every success and who knows one day it may have a cover and appear on book stalls everywhere.

My thanks to the Editor and staff for a few years of interesting and helpful subjects during my association with the Bulletin.

-- W. McMahon, Bendigo, Vic.

= =

QUOTE WITHOUT COMMENT

"One of the biggest problems holding back the expansion of amateur radio in most of the Asian and African countries is the lack of equipment. We can get hold of a 50 kilowatt station easier here than some chaps over there can get a simple transceiver. We have tons upon tons of used gear sitting around in our garages, attics, cellars and in closets that could make a world of difference in a hundred countries. They don't care it if works or not . . . you get the gear to them and they'll get it working. When a transformer burns out in India they don't send for a new one, they take it apart and rewind it.'"

-- Wayne Green. Reprinted from 73 Magazine, April 1967 P. 110

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September 1968 Vol. 4, No. 8 P.95

CONTENT:

IMPROVING RECEIVERS, IV -- J. Lilly [VK9]

I found your article on receiver front ends very interesting, and would like to add a few thoughts of my own.

It is unfortunate that this subject does not come up for discussion more often, because the design of a receiver depends as much on front end performance as it does on i.f. selectivity. It is a fact that many people tend to forget. A look at a few of the older books shows that the trend was to run the front end flat out and hang the cross-modulation; the AR88 handbook is one of these, and I feel the B-28 [also known as CR-100] would be the same.

The modern trend is to aim for approximately unity gain in the first stage, and rely on high gain after that*, i.e., in either a second r.f. amp, or the converter and following stages. The front end coils are of high Q, and Sinclair have apparently used this theory in their Micromatic [broadcast band] receiver to enable them to use a TRF design, the first one I have seen for a long time. Ferrites make this type of design easier, as the d.c. resistance can be held to a very low figure compared to the radiation resistance of the coil; I use the term radiation resistance for want of a better word, but the same idea can apply to transmitters and receivers.

In a place like Madang, where the nearest [English] broadcasting station is in Port Moresby, the inherent weaknesses in front ends become very obvious. The spate of transistor sets using oscillator-converter front ends leave a lot to be desired in performance - interference [adjacent channel, harmonic], selectivity, and sensitivity. Most of the sets with more than one wave band have very poor sensitivity figures for the short wave bands, typically 30 μV for 50 mW output. While this figure is acceptable for the broadcast band, due to the fact that the set is normally not going to be used where the desired signal strength falls below this, it is certainly far from suitable for the higher frequencies, where the signal level will ordinarily be barely operating the AGC. Another downfall of this type of set is the stability, particularly with the continued popularity of the transistor used in

*Editor's Note: This subject is discussed to good advantage in "Technical Topics" to which reference has been made in the July EEB [p.76]. There is also a strange bird called a 'Synchrodyne' which depends entirely on a.f. selectivity for a remarkable performance figure, and perhaps Rod Reynolds will tell us all about it one day?

the front end, namely, the OC170/171 genre. Stick a good length of wire on the front end of your transistor set, switch to short wave, tune in a broadcast station of weak strength, and after the set has warmed up for about a quarter hour [enough to keep the station in tune without retuning], listen to the harmonics of the telegraph stations warbling up and down across the music.

Although FET's have been on the market for going on three years, there don't seem to be too many articles on front ends using them,* the one reprinted in Amateur Radio from the Short Wave Magazine being a very notable exception. Sherwood and Fisher price themselves a bit above my income bracket, even if I were buying.

I think the statement "A S/N of 6db is just barely discernable" is a bit misleading. I take it that the input would be 1µV, which is one way of quoting S/N, the other being µV for so much audio output,*** but a receiver which will give 6db for 1µV is not to be sneered at. A bit low by today's standards, but don't knock it. I did some sensitivity tests on the AWA 3BZ I used to own and got 6db for 1µV, and I thought it was a pretty hot receiver. The main problem with it was that the front end was like a barn door. It used a 6U7 in the RF stage. The AR88 doesn't claim any better, although its selectivity is much better, and look at the number of the faithful who still have AR88's, largely unmodified. The statement that sensitivity falls as frequency rises, however, holds for the AR88 as much as for the B-28.

Incidentally, the front end of the AR88 can be taken out fairly easily. Anyone [apart from myself] ever thought of putting a Deltahet in there? Chassis is about the same size as the Deltahet front end.

Finally, and leading on from this subject, one of the references, QST, Oct., 1965, contains a 7360 front end with 6C4 Q-multiplier, for which the author claims fantastic sensitivity. Must try it some day. **

Further References of interest:

1. Radiotron Designers Handbook, 4th Edition, 1955, p. 1262, 1307-9.
2. "Recent Trends in Receiver Front End Design" QST, June 1962 [Reprinted in Amateur Radio, January 1964]
3. Determining Mixer Current for Better Receiver Performance"; Short Wave Mag., Feb. 1963 [Reprinted in A.R., Sept 1963]
4. "Considerations in Receiver Front End Design"; CQ, July 1963 [A.R. March 1964]
5. "Noise in Radio Receivers", Electronics Aust., September 1963
6. "Noise Generators, "E.A., October 1963
7. "Silicon Diode Noise Generators" E.A., November 1963
8. Technical Correspondence, A.R., April 1964
9. "Receiver Front Ends and the Coils they Involve", E.A., Feb. 1965.
10. "Some Thoughts on Home Receiver Design", QST, May 1965.
11. "Noise Considerations in Receiver Design, Part I; QST, May 1965. [Unfortunately I can't find Part II, probably June 1965]. [I can't either, because of house moving -- Ed.]

Of necessity, a lot of the above articles contain the same information, but if it is all read and absorbed, a greater appreciation of the problem should result, with insight on its solution. References 9 and 10 are not directly concerned with noise problems, but they are included for interest.

* But see June issue of Ham Radio and discussion in August EEB. -- Ed.[[Also P.102 here]]

**See August EEB. Mr. Lilly's communication was received before that issue reached him, but it is interesting that his mind runs along the same direction. I have quite a lot more notes to write up on this subject, concerning the use of linear mixers, but it will have to await a more peaceful month. Perhaps it can occur when Rod builds up a linear mixer for his B-28, with printable comments. -- Ed.

*** The audio-output-only method is most misleading, and not a good criterion of receiver performance, becasue the noise will also produce audio ! Sig/Noise much better. -- Ed.

CALIBRATORS AND COUNTERS, THE EASY WAY -- E.H. Conklin, K6KA

The J-K Flip-flop

There has been considerable interest in obtaining more frequency check-points from receiver frequency-calibrators. Multivibrators to accomplish this have been proved tricky and bulky. Here is one field where the EEB Editor's antipathy to microcircuits may give way to sweet reason*. If you dislike I.C.'s [Indiscrete Components], consider separately the linear and nonlinear types before rejecting that wonderful device, the JK Flip-flop. One of these little gems can divide by ten in its decade form with nothing but input, output, and power supply. Furthermore, other frequency divisions are available from it too.

Available from Disposals

In Ham Radio for August 1968, John Meshna Jr** advertises dual JK Flip-flops similar to a flat-pack pair of Fairchild 923's, along with other IC's like the Fairchild 900 RTL series, for $US1.00 each, or $US10.00 per dozen. Quad 2-input gates similar to a pair of Fairchild 914's are available. Thus, a decade divider can be had for $US1.66, with about 200 components in it. This cannot be approached with constructions involving discrete parts.

Typical Application: A Frequency Divider

A typical application is illustrated by a unit I built up on a 2-inch board which fits below my receiver calibrator valve socket. It contains its own rectifier for 6.3V for its power, and can change the 100kc oscillator into 50, 25, 10, and even 5kc calibration points in the receiver. If the receiver dial has 1kc points, the 5kc output is fine. An article on this unit may appear in a forthcoming 'Gimicks-and-Gadgets' column in QST.

A simple improvement like this may still present a crystal stability problem until the receiver warms up -- particularly in cold Australian homes in winter. A small crystal oven can help a lot to avoid this. Stan, VK3TE, found a surplus oven in Melbourne, which he is now using in a separate calibrator.

Excitation

Many I.C. frequency-dividers require a fast fall time in the exciting signal from the crystal oscillator. This is often furnished by Schmitt triggers, either with separate transistors, or using the ones in 'gate' I.C.'s. This is described in Motorola Application Notes AN-239 [electron-coupled logic], and AN-408 [diode-transistor logic and resistor-transistor logic]. Motorola is at P.O. Box 13408, Phoenix, Arizona, U.S.A.*** However, the Fairchild 9093 dual JK Flip-flop operates on sine waves without any special input circuitry. Motorola states that their MC838P decade [$US7.55] should work directly on an input between 40kc and 15Mc, which includes the common 100kc and usually more stable 1Mc crystals. The inexpensive [$US2.00] Motorola MC790P dual JK flip-flop must be driven by a signal that goes negative in a time interval of less than 100 nanoseconds, which corresponds to a minimum frequency of 2.5 Mc.

A Square-Wave Crystal Oscillator

Another approach in simplifying a calibrator is to drive the divider with an astable multivibrator, using a crystal as the internal coupling device, resulting

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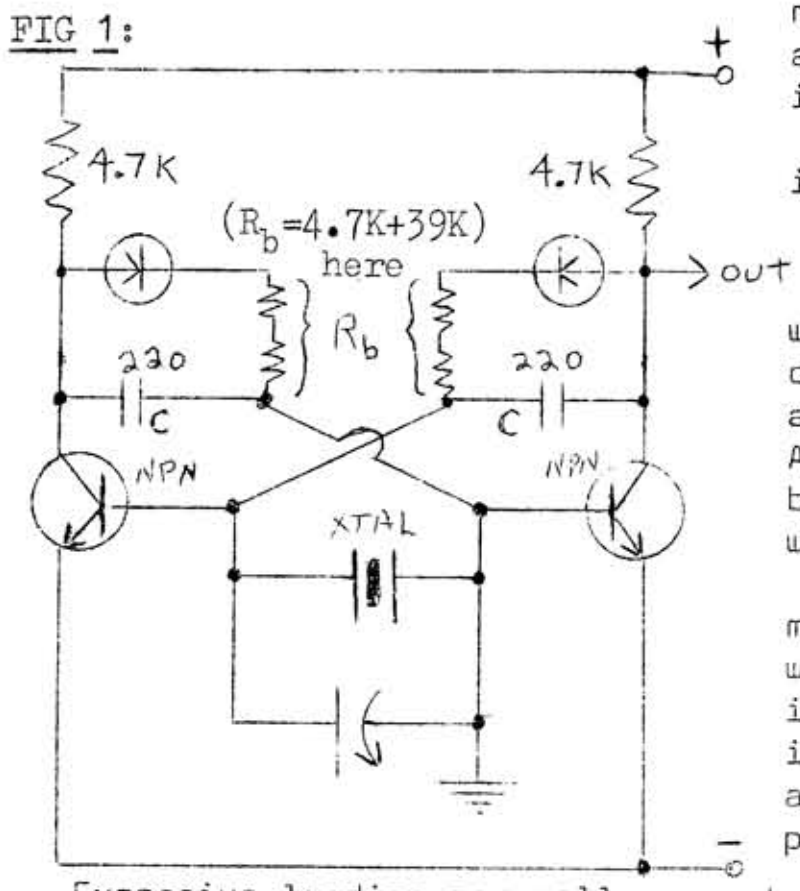
* ... How did I ever get talked into this ?? -- Ed.

**P.O. Box 62A, East Lynn, Mass., 01904, U.S.A. If this material is not available economically in Australia, look up this advert., but see Appendix at end of this article -- Ed.

***Motorola USA will refer you to Cannon Electric in Melbourne, who are fine people to deal with, and should be approached for all Motorola requirements. Even if they have to import the stuff, it will cost you about the same — after Duties. The alternative is to work through a friend in the USA, but that is difficult.—Ed.

in a square-wave crystal oscillator. This could be obtained by the circuit of Fig.1 modified from Ref. 1 to reduce the hand capacity of the trimming condenser by grounding its adjusting screw.

FIG 1:



The value of the feedback condensers, C, is given by:

$$C = \frac{1}{1.39 R_b f}$$

where C is in farads, R_b in ohms, and f in cycles per second. For 100kc, this gives about 163pF with resistors [R_b] of 43.7kΩ. As used in Ref 1, the frequency should be below that of the crystal, so 220pF condensers were selected.

In Ref 2 it was pointed out that a load much less than 10 times the collector resistor will affect the frequency. If your load is in that range the values may have to be modified if the circuit is to oscillate at all; a simple emitter-follower would solve that problem if the load has low impedance.

Excessive loading may well account for troubles experienced with published designs [Refs 3, 4]. Then, too, some circuits may require crystals ground differently, or gradually rising voltage to put them into oscillation.

Frequency Measuring and Calibration

A frequency-measuring article is scheduled for the October 1968 issue of Ham Radio; a follow-up article in November will present a general discussion of the subject of crystal calibrators used as time-base generators to "gate" a string of decade dividers used as a counter. This results in the very useful function of electronic counting: the sampling of a signal having a given frequency, counting it for one second, and indicating the frequency on a digital readout lamp [or binary-coded decimal]. Other references on this subject can be found as Nos 5 to 14.

Counters

Counters once took a relay-rack full of parts, but now a handful will do it so simply that a wiring diagram is unnecessary except for control switching. Instead, a simple logic diagram, with blocks for the IC's is used. Two circuit boards 3 x 6 inches will handle the calibrator and the counter, with a good bit of the space taken up by terminals for leads to the power supply, to switches, and to count-indicator lamps. With a good temperature-controlled crystal oscillator, errors in frequency measurements never greater than one cycle can be expected, even on the 14Mc band.

If you are interested in further comments on this subject, you are welcome to join Stan and me on 28,690kc [alt: 21,290kc] at 2330 GMT every Tuesday, which is Wednesday in Australia and New Zealand.

References

1] 73, Feb. 1968 p. 24: '100kc Thin-line Pulse Generator,' by J. Ashe.
2] Electronics World, Feb. 1965 p. 52: 'Design of Transistor Multivibrators' by L.E. Franzel, Jr.
3] QST, July 1968 p. 22: 'Integrated Circuit Frequency Dividers', by J.W. Staples K9CPZ.
4] 73, Jan. 1967, p. 6: 'Integrated Circuit Crystal Calibrator', By E. Jorgensen, K1DCK.
5] 73, Nov. 1965, p. 50: 'Modern Frequency Standard,' by R. Wilson, W5NUW.

6] 73, August 1966, p. 42,: '50kc Marker Generator,' by H. Olson, W6GXN.
7] 73, Dec. 1966 p. 20: 'Electronic Counter for Amateur Use,' by P.C. Brassine, K7UDL.
8] 73, Feb. 1968, p. 6; June 1968, p. 74: 'Integrated Circuit Electronic Counter,' by G.W. Jones, W1PLJ.
9] 73, June 1967, p. 58: 'Micrologic for Nonlogical Users,' by H. Olson, W6GXN.
10] 73, Aug. 1967, p. 12: 'Frequency Calibrator for the DX Man,' by H. Olson, W6GXN.
11] 73, Nov. 1967, p. 6: 'Cheap and Easy Frequency Counter,' by R. Suding, W8NSO/WØLMD.
12] QST, July 1965, p. 11: 'Transistor Frequency Standard,' by J.H. Grigg, W9ZQT.
13] QST, June, 1966, p. 28: 'Transistor 100kc Standard and Harmonic Generator,' [no author specified]
14] QST, Aug. 1968, p. 22: 'Digital Counter with Teletype Print-out,' by R.G. Simmons, W2RBN.

APPENDIX -- by The Editor

Australians can easily obtain foreign exchange cheques from their nearest Bank of New South Wales at the prevailing rate, about $US1.00 = $A0.90 plus about 25c service charge per cheque. New Zealanders can't, unless they know someone outside of ZL. It is, however, a good idea when dealing with American firms [but usually not British ones] to record the serial number of the cheque, and to send the cheque with your order by registered post. If you hear nothing within three months, write a polite but very firm letter of enquiry, sent by air. Do the same thing one month later. If this still gets no results, tell us. Foreign buying can be a great convenience, or a first class headache, believe me. And note that 'prepaid' policies always evaporate when merchandise crosses a national border; include about 5% for post of small stuff, 10% for large. Don't send too much, for post; you are hardly likely to get it back. And remember that 100% or so duty on electronic stuff from America. These IC's are probably a good bargain even after the duty, but you ALWAYS want to check the Australian or New Zealand price before sending abroad. Prices here have come down considerably on numerous semiconductors, and you may be surprised. Furthermore, surplus merchandise can be of questionable quality; new merchandise is far better unless it costs more than twice the price of the disposals equivalent; this allows you the possibility of a 50% yield on the latter !

On the other hand, there are certain Americah firms which deal in reasonably good quality surplus material, and who are scrupulously honest. Among those from which I have had favourable results are Solid State Sales, Brooks Radio, Alco Radio, and Transistors Unlimited. Electronic Components Co and General Sales Co used to be excellent, but it appears that they have stopped selling to Australia. I have tried most of the other main firms, but their omission here does not necessarily indicate that I recommend against them. You can find out about reliability for yourself most simply by sending a small order first and see what they do about it, and how good the merchandise is; one must NEVER order surplus material unless one is willing to test it thoroughly, a subject which has been covered in some detail during the past few years in EEB.

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Since the above was typed, we have received a letter from a British firm offering the supply of various types of equipment including numerous semiconductors. It is true that their prices involve only a few bob on a number of items, but the Australian manufacturers have fixed us with Customs on that, by imposing a minimum Duty of 38c or so on each semiconductor, with only a few exceptions. On the other hand, I'm not so sure anymore that this is wholly undesirable. It stimulated big firms like Fairchild to turn out inexpensive stuff for domestic consumption, sothat now many of our semiconductor prices are the same or lower than overseas !

"Rejoice: today is the first day of the rest of your life."

EDITORIAL -- RLG

Harranques

I notice that following my various philosophical dissertations in recent EEB's resubscription rates have fallen off substantially. I suppose that that is what is meant by 'voting with your feet'. Please come back, I'll be good, I promise. Maybe.

This strange issue

Well, you see, its like this: we have endured the most difficult move we have ever made. The new [old] house is enormous in size, but the piles of Junk and Papers are also large. And nothing can be shifted until the Alterations are completed for the lovely new Den etc. There will be a room for Den cum EEB office, another for electronics workshop, another for mechanical workshop, and four rooms to store parts, equipment, and timber. And all this in addition to seven rooms upstairs, and an attic spacious enough to fill with another couple of rooms [or more]. The garden is enormous, and ends in a lovely meandering brook. And all this cost a quite modest sum because the house was Old. From what I have seen of the flimsy crowded construction of the glittering New creations, I'll take this old one and give it a coat of paint.

In any event, in consideration of the Chaos existing, I think we had better take the easy way out and bring you this issue consisting principally of "Abuse" which is pure Gunther anyhow, so how different from nominal EEB's? It is reprinted from "73" Magazine of several months ago, so you want to be sure to send Kayla your subscription. Actually, the mag is still pretty good technically, and now that Wayne is chasing Saucers, he is more tolerable. As one wag wrote us: "who ever heard of a Martian suing anybody?" As far as I'm concerned, the superior civilisation of the Saucermen is well demonstrated by their extreme good sense in avoiding contact with us.

I wish to apologise to those few souls who have bought "Abuse" from our bookshop auxiliary. When we first ordered the reprint we somehow thought that they were going to cost about 5c apiece. When the cost price came to something like five times that, it seemed more prudent to try to sell them separately instead of including free with EEB, to try to recover our losses. After many months of considerable promotion, we sold a whole fifty or so. That still left us with about 450. Rather than try to whittle at that pile for the next five years, we give it to you free. If you have already bought one, won't you be forgiving, realising that it went for a Good Cause, and give the extra to a friend? You can also tell him about the following remarkable offer:

Big EEB Promotion: Take Note.

We have been talking to a chap who seems to think that the EEB will never grow unless it acquires a lot of subscribers. The same idea had occurred to us too, but we were going under the assumption that money was an object. Now we have been taught by the abovementioned experience that this was an illusion; if we are going to waste money, we might as well do it intelligently instead.
Namely: You get us one two-year new subscriber, and you get a year of EEB added to your own subscription. Very simple. Just show him some back issues, and thrust the coupon into his hands [tactfully torn off the text]. Be sure to fill in your own name only; he sends us the coupon and money, and you get another year of Gunther, Reynolds, and Associates.

Act now, before we wake up and truncate this arrangement forthwith. Coupon at end of this issue.

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Guest Editorial -- by John Lilly [VK9]

In reference to your "Letter to the ARRL", how can we have more about which to communicate when we are fairly strictly limited by the Amateur's Handbook published by the P.M.G.? It says, roughly, that discussions must be held to technical topics, and are not to be of a nature that could be used to earn revenue, i.e. by using the phone, writing letters, etc. It specifically bans the political, religious, sociological and neo-anthropomorphic discussions beloved of us and this is one regulation which I am glad exists, as everyone's opinion of everything is, of course, far inferior to my own, and we all know that

$$\frac{\text{Political Discussion}}{\text{Knowledge of Subject}} \longrightarrow \text{Heat}$$

I feel that this will also hold true of discussions of philosophical matters.

I might also mention that I have also wondered about the use of Teflon on frying pans and saucepans, after reading all the warnings in various magazines. Only two days ago I told my wife that I'd prefer her not to buy one, as I thought they could be very dangerous. This also brings to mind a recent issue of "Choice" I saw, reviewing electric irons. Not one mention was made about the poor quality of the flex and its likelihood of fraying at the point of entry to the body of the iron. Most manufacturers seem to prefer the contra-wound cotton-covered rubber-sheathed flex, which I have found short-lived and shoddy-looking for most of its... life. It is also in my opinion dangerous as it wears very quickly where the cord rubs against the ironing-board or table, and wears down to the rubber sheathing in a very few months. The PVC flex is much stronger and longer-lasting.
[[Asst. Ed. Note: Manufacturers use that stuff because the use of plastic is not permitted; the asbestos sheath etc. is deemed necessary for safety. In any event it is essential not to connect the flex to the hot sole-plate, since PVC melts with the heat. Beware !]]

How to Be Intelligent -- back to RLG now: [[John is plenty intelligent ! You know what I mean, don't quibble.]]

John tends to overlook the fact that one can talk intelligently on the air even under a dictatorship, whether by the PMG or the Central Committee. And conversely, to be sure. It is not necessary to confine oneself to wholly technical matters, at least in demonstrable practice. One can certainly talk about one's family, one's life, one's aspirations, and through that and more will be manifest the expression of what one thinks important about life. But that will only happen if one's conversation reflects thoughts that have some content, and that can be acquired by broadening one's horizon to include many ideas other than radio, and books other than technical.

Furthermore it is absurd to assume that one is going to pick up the telephone and talk for an hour to a bloke on another continent, and that amateur radio thereby deprives the Establishment of revenue. If the Establishment ran itself with a modicum of efficiency it would have more revenue than it could use, without picking on the perogatives of its citizens.

"Choice" tends to be an excellent magazine in many respects, but it tends to emphasize low cost, sometimes to the exclusion of performance. For instance they had a recent article on the suitability of various typewriters, all in the low-price range. From my own experience, the Adler and Hermes models they described are wretched machines, good only for occasional correspondence, but both of these firms manufacture excellent models in the $80-120 range. The text you are reading was typed by the Adler Gabriele-10,* and it is a machine giving high performance and reliability for only a bit more cost than the very cheap model. Economy is not always the best policy.

*. Australian Representative: Grundig Business Machines, 143 Franklin St., Melbourne, Vic. 3000.

Advertising, etc.

We apologise to our advertisers and other Authors for omitting their copy this month. Next month will resume schedule as usual, whatever that may be. The articles in this issue happen to be what arrived in the current mail. The other stuff is well buried, as described.

Incredible !

I was stunned to see on the cover of the August 1968 issue of QST: a girl -- well, a woman. It might be imagined that this could happen on the Journal of International Banking before appearing on the cover of an august radio magazine. As everyone knows, amateurs are interested in far more important matters than girls... Good on you, ARRL, keep it up.

That same issue of QST also features a nice transistorised 2-metre transceiver, and although it uses an audio Module, it redeems itself by giving the complete circuit diagram of the Module. It seems like the least a conscientious author can do in this age of convenience and artificiality.

While I am about it, I might as well comment on a few other items in this issue. There is a 'Simple Transistor Receiver for 20- and 75-Meter Sideband' [by VE2IB] at which I frowned because there was only a single ordinary bipolar transistor mixer, no r.f. stage, and I had the recent EEB receiver articles still going round in my mind, concerning images and cross modulation. Well images are presumably taken care of by choice of 9Mc [sic ! not Hertz, heh heh] i.f. frequency, with a 9Mc trap in the antenna. And the author swears that the emitter-follower mixer suffers from no cross modulation, though perhaps this might be less of a problem in VE2 than in W6 or VK2. No r.f. shielding is used, because torroids are used for all the r.f. coils. Interesting.

'A Transceiver Monitor Using Transistors' by W4BX uses the first sensible idea I have seen for a long time, for a CW monitor, and it may even be used with equipment other than a commercial 'Transceiver'. Instead of using the r.f. from the Tx to power [or trigger] an audio oscillator, it beats with a local VFO to produce a simple audio beat tone, viz. a simple b.f.o. receiver. One might well ask: why not merely feed the signal into a regenerative detector and do the whole thing in one stage? This would be fine on only one band, but the mixing system has the advantage that it can be used on numerous bands, because the harmonics of the V.F.O. can be used to heterodyne the signal up to high frequencies !

QST Backslides, however, with the 'FET Preselector', using an ordinary MPF104 FET regenerative r.f. amplifier. See my handwritten note, bottom p. 85 of last month's EEB. As far as I'm concerned, transistors are simply noncompetitive with valves for r.f. service unless they are as good or better for linearity, viz., freedom from cross modulation. Bipolar [viz, ordinary] transistors can be improved with emitter degenerative feedback [c.f. above], FET's are better, but tetrode MOS FET's are still better, and now that they are available there seems no excuse to print a circuit employing anything less in an r.f. stage.

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FET CONVERTERS

Quite a lot has appeared on this subject, relevant to the above paragraph, in the recent literature. In addition to the interesting piece in the June 1968 Ham Radio, there is also an excellent coverage in the July and August and probably the September issues of HR too; that magazine appears to be getting off to a good start.

Then there is material on this [e.g. in June 1968 issue] and much else of interest to experimenters in the fine New Zealand experimenters publication 'Spectrum' [P.O. Box 5268, Auckland, $1/yr]..... And last, but by no means least there is a marvelous

article on 2 Metre FET Converters, by VK5ZFQ buried in the September 1968 issue of the S.A. Wireless Institute Journal; Rick discusses two complete converters using readily obtainable transistors, one of which uses the new Tetrode type. He compares many important aspects of the circuits, and his article is well worth reading.

Since the article is not generally available to the Public in its present form, and since reprinting it in Foolscap form would disturb our Bound Volume format [we are not about to redraw two large diagrams], we shall make EEB readers a special offer:

If you are interested in the use of FET's, and modern design of receiver semiconductor front ends, please send us a 4x9" envelope with your name and address on it, and bearing a 5c stamp [Foreign: please do not affix stamp to envelope]. Do not include any other correspondence [such as EEB renewal, etc] with it. We shall then send you a reprint [or more than one copy if you request] of Rick's FET article. If you are interested in this, it would be appreciated if you sent your request within a month, so that we can obtain a reasonable estimate how many to print up.

This September EEB was actually ready two weeks ago, but was delayed in order to make the necessary arrangements for the above offer; I'm sorry about the delay, but I believe that it is well worth it.

--RLG

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ANNOUNCEMENTS

--If anyone is interested in sharing bulk buying of FET's, say 2N3819, please get in touch [but send no money yet] with: John Stone, VK4NZ, c/- ANZ Bank Ltd, Mount Morgan 4714. John, you can put me and VK7LL on the list to begin with. Anyone else?

--D.J. Bedford, who offered slightly used valves through EEB at a reduced price a month or two ago, says that they have been selling very well indeed. The KT66 have all gone, and would pecple please stop ordering that type from him? 2N4250 also out.

--The Editor would appreciate the return of his 'Radio Parts' Catalogue; it would cost $7 to replace it from the Melbourne firm. Who has it? But said Editor is also going crazy with house alterations, and cannot answer specific enquiries for information in books until the books get unpacked. An appalling experience.

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STOP PRESS:

Ham Radio subscriptions are now available in N.Z. for $NZ 5.05 p.a. from R. Hill and Sons Ltd., Ideal House, Eden St., Newmarket, Auckland 1, Congratulations to ZL1BDF who engineered this feat.

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A NOTE TO RENEWERS

If you subscribe for two years please send $1.78, [$1.83 if by cheque] not $2.00, otherwise we have to give extra sub. credit and it complicates our records excessively.

= =

SUBSCRIPTIONS TO R.A. Walton, 115 Wilmot St. Huonville, Tas., 7109. Uncrossed P.O.'s preferred in Australia; if you send a cheque, please add 5c for the stupid Stamp Duty. Other countries pay by cheque in your own currency. SUBSCRIPTIONS BEGIN ONLY WITH THE NEXT ISSUE. All other 1968 copies are 13c -- or equivalent foreign. Please note.

BOUND VOLUME III [only] $A1.75, $US2.20, Stg 18/6. Vol III or IV covers, 35c; please be sure to specify. Everything post "free."

STAFF: Editor: R.L. Gunther. Assistant Ed.: R.A.J. Reynolds. Secretary: B. Tweedie. Art Work: I. Eadie. Assembly: V. Nichols. Subs: R.A. Walton, Associates: R.S. Maddever, D. K. Madden, J.A. Hill, A. Gregory, etc, etc.

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POSTAL RATES ARE GOING UP AGAIN ! THIS ANNOUNCEMENT OUGHT TO HAVE A BLACK BORDER. TAKE A LOOK AT THE BILLIOUS YELLOW CARD JUST ISSUED BY THE PMG DETAILING THE FULL SCHEDULE OF NEW CHARGES. AS USUAL, THE INCREASES ARE SUBSTANTIAL: AT LEAST ONE CANNOT ACCUSE THE PMG OF HALFWAY MEASURES. WOULDN'T IT BE STARTLING IF SERVICE ALSO IMPROVED SUBSTANTIALLY???? INCREASED CHARGES FOR POST ARE VICIOUS BECAUSE WE MUST ALL USE THE POST, AND THEY ARE UNNECESSARY, FOR REASONS WHICH HAVE BEEN DETAILED AMPLY IN THESE PAGES. Bah. Snarf.

THE AUSTRALIAN EEB

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Asst. Ed: VK7ZAR
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See also P. 124

October/November 1968 Vol. 4, No. 9

ANNOUNCEMENTS:

We have been informed that British Postal Notes can no longer be redeemed here; British subscribers should, therefore, send ordinary cheques made out to R.L. Gunther, and crossed 'Non Negotiable'. They are sent back to an acct in the U.K.

As far as we have been able to ascertain, N.Z. subscribers can still renew via New Zealand Postal Money Orders in Australian funds, made out to Australinn EEB.
I have scant hope that we shall get many new N.Z. subs, because EEB is not popular over there, but perhaps we can hold the ones we have.

By the way, congratulations are in order for Craig and Letti Williams, who were largely instrumental in stimulating reciprocal licencing in New Zealand. In the October issue of Break-In they have written an appreciation telling about it. They held the calls WA2NAZ and WA2NAY, now ZL2ATL and ZL2ATK. They came to New Zealand about the time we came to Tasmania, and we are all well satisfied. [Ref. EEB, Dec 1967, p. 168]

We have received word that the well-known author, E. H. [Bill] Conklin, K6KA may possibly be operating from Norfolk Island on November 17-23, or November 24-30, the uncertainty being caused by various tour arrangements. He will be taking Collins equipment to the island, and his call sign will be VK9AK. DX-enthusiasts take note [if EEB gets published in time]. Thanks to Stan Dixon, VK3TE, for filling us in on details. Stan and Bill normally maintain a schedule every Wednesday on 28,690kc at 0900 [our time], and there is your chance to ask questions on receiver design [see this issue, P. 116 and 112] if you don't want to fight the DX-pileup with VK9.

I am pleased to see that the Wireless Institute is now handling a wide range of good publications and subscriptions, as detailed on p. 26 of A.R., October 1968. Since the Institute is one of the few bodies one can trust, the mark-up in prices must go to pay for the postage. In any event it is easier to order through your own Division than to bother with foreign correspondence and exchange.

To the abovementioned list might be added two important pieces of information:

1] The latest in the excellent line of RSGB publications is now available, the long-awaited Radio Communication Handbook, being the fourth edition of the 'RSGB Amateur Radio Handbook,' and will cost about $A7.55, post free from Britain. [order through W.I.A.] The Third Edition was rapidly oversubscribed, so be sure to get the Fourth while you can. It now has 832 pages, and is probably better than ever; review will appear in a forthcoming EEB. British EEB reader writes that new Edition vy good.

2] Ham Radio Magazine now offers a subscription of three years for $US10.00 [about $A9.20 through the Institute], which makes it not only one of the best, but the cheapest of the international amateur magazines, in spite of its horrid title. From what I have seen of time and events in these years, this price will undoubtedly increase substantially in due course. Take note. STOP PRESS: The first issue of HR, March 1968, has been reprinted, and will be sent; see EEB, July 1968, p.77.

You may not be able to afford the money or the time, but certainly every radio club, and every Division of the WIA and NZART ought to subscribe to the major English language technical magazines. If a member sees a reference to a very good design in the literature, he is not being properly treated unless he can lay his hands on the wanted article. All Institute Divisions should have complete Ham Radio from No.1, at least.

Transistorised Transmitters held over again until next issue. Some people have said they are tired of the subject; so am I. Most of this issue seems to be Gunther again; how can one man have so much to say? But authors must not despair; your articles are sitting here, calling loudly for attention! [Next month]

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LETTER: A Wider Outlook!

I don't know how I came to be on your mailing list - some kind fellow must have paid my sub. for me. I want to tell you how much I enjoy your articles and discussions on a wide variety of topics. Particularly do I feel you are right when you advocate a widening of outlook. It is a pity so many of us can [or will] only discuss the technical side of radio - fascinating as this subject is.

After all, Radio Amateurs are people - yet many of our practices tend to separate us from our fellows. Our language is often unnecessarily 'jargonised' to the detriment of communications generally. The indiscriminate use of phonetics and 'Q' signals in phone communication are commonplace and do much to obscure meanings rather than enhance them.

The devious words often used to describe the brand or the maker's name of a product, and the use of 'DeeBees' to mean Dollars, are other components of this Ham Jargon which, to the ordinary citizen, must make us sound like a bunch of 'nuts'.

The contention that the use of plain language, when discussing such things on the air, constitutes advertising and is against regulations appears to me ridiculous. In any case the devices resorted to, do nothing to hide a name or sum of money to the ears of any one over the age of six.

I make a plea for more plain language as a contributing step towards the more difficult goal of more meaningful communication - which I think is the essence of your paragraph 'How to be intelligent' p. 101 EEB Sept. 1968.

Getting back to the subscriptions, I have a few friends who apparently have not been exposed to the regular philosophies and technical information contained in EEB. I would like them to share in these delights and so am sending a list of names and addresses together with the necessary cheque to Mr. Walton.

[[Good on you, mate!-- Ed.]]

C. Smyth, VK3ACH
Doncaster East, Vic.

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QUOTE WITHOUT COMMENT [['Disa and Data' reprinted from the LERC Amateur Radio Club Bulletin, September 1968 [Editor, W6DDB]]]

The National Bureau of Standards has proposed a change in the basic value of the volt, the basic unit of electromagnetic force measurement. As of 1 January, 1969, the new volt would differ by 10 parts per million from the present value, to 1.00001. The NBS hopes that the International Committee on Weights and Measures will approve their suggested change at their October meeting; the last change [1946] shifted the value 330 parts per million.

AMATEUR RADIO TECHNIQUES -- A review

[Published by R.S.G.B., ~~28 Little Russell St.,~~ 35 Doughty St., London W.C.1. 12/6 stg + 2/6 post and pack]

This is the second edition of G3VA's magnificent 'Technical Topics'. It is divided, apparently unimpressively into:

SEMICONDUCTORS	AUDIO AND MODULATION
COMPONENTS AND CONSTRUCTION	POWER SUPPLIES
RECEIVER TOPICS	AERIAL TOPICS
OSCILLATOR TOPICS	FAULT-FINDING, AND TEST UNITS
TRANSMITTER TOPICS	LIST OF I.F. FREQUENCIES

The wealth of Good Oil in this book is simply staggering; it is well worth getting this second edition even if you have the first. Our normally taciturn Assistant Editor comments: 'yes, quite good'.

The one criticism I might make of the Second Edition is that all new material is merely tacked onto the end of the relevant chapter, whereas it could have been inserted more appropriately into the body of the text. The same applies essentially to the chapter 'Semiconductors' which contains much material that ought to be included under specific chapter headings; as it is, there are fine semiconductor circuits in that chapter, and in the others too. On the other hand, the organisation of text was probably arranged to save money, and the price is certainly most reasonable for a book of this size and quality.

We don't have room for the several pages of EEB which would be required by a good review of this book, but I might mention merely a few of the items which have been added in addition to those of the first edition:

1] Semiconductors: Transistor RF power amplifiers and design. Lots of them. Low power transistorised transmitters, parametric amplifiers, FET's and Applications [5 pages, newest ideas].

2] Components and Construction: ALC with Light Dependent Resistors, I.C.'s and applications [ugh], Varicap tuning, etc.

3] Receivers HF Xtal Filters, Transistor Q Multiplier, Detectors and ANL's, RF Att Attenuators, Transistorised Communication Receiver topics, Frequency synth, Forward AGC vs Cross Modulation, Transistors vs nuvistors vs FET's, typical FET Front-end Circuits, The Synchrodyne receiver! [Ref footnote, P. 95, September EEB], Paramp up-converters, Mixer and Premixer Designs.

And so forth. It occurs to me that 'Technical Topics' [appearing every month in Radio Communication, RSGB], now known as 'Amateur Radio Techniques', is just what I wanted to do with the 'Literature Review' I tried a year or two ago in these pages: an intelligent comment on the best articles of the latest literature. In my case, it degenerated into a long list of articles which interested no one. As you may see, much of the EEB does seem to be a commentary on recent literature sometimes, so my hopes are not dead. But they don't have much effect beside the thoroughly professional treatment G3VA brings to TT and ART.

Amateur Radio Techniques is one of the most generally interesting books on subjects of interest to hams, I have seen in years. Now, go buy it.

Try to get your local branch of the WIA or NZART to get it first, because it will be easier, and won't cost much more [See P. 26 of A.R. Oct. 1968]. Same applies to the nice Amateur Radio Circuits Book reviewed in the August EEB. If that is not practical, send directly to R.S.G.B. for it at above new address. Get a draft in sterling from your Bank. The conversion works out at about $A2.016 to the Pound Sterling. North Americans can obtain it through Communications Technology, Book Division, Box 592, Amherst, New Hampshire 03031. New Zealanders can probably get RSGB material from NZART, or maybe from the firm mentioned on P. 104 of last month's EEB; show them this announcement if they need convincing. [Peth, could you please ask them if they would be willing to handle EEB for N.Z.? would save a lot of bother]

LETTERS TO EDITOR

The FET Converter [ref. EEB, P. 109]

In reference to FET converters, I think one of my designs could be relevant, which appeared in A.R. for July 1968, using dual gate MOS FET's. I should like to comment on cross modulation performance without getting involved in exact figures. The lack of cross modulation in that converter proved to be quite superior to any valve converter put up against it, including the ABP type 2 metre converter which I will use as a comparison; most VHF'ers know of it, and how well it performs.

The NF of the 5 units I have measured varied from a minimum of 1.0db to a maximum of 2.5db, in comparison to the ABP having approximately 8 db. The gain showed to be somewhat less than the ABP type, but still quite adequate to feed the normal communications receivers [but not to feed, say a dual wave mantel set]. I hope these comments may be of interest to you and your readers.

Of interest to readers interested in FET's will also be a series of articles commencing in Amateur Radio of **Nov. 1968**, on all-band, do-it-yourself SSB solid state transceiver, using about 80% FET's. [[Part I looks good, with more to come--Ed.]]

I might mention that circuit boards and/or complete kits or made-up units of the 2 Metre FET Converter described in AR are available from VK3AFQ, H. Hepburn, 4 Elizabeth St., Brighton, Victoria, 3186. Equivalent units for 20, 15, 10, or 6 Metres are also available from him.

-- K.Nisbet, VK3AKK. Springvale, Victoria.

[[The October 1968 issues of 73 and QST have FET front ends, but generally they have higher noise figures than that of Hepburn and Nisbet in July AR; but October Ham Radio claims 1.2db for Motorola MM5000 bipolar! --Ed]]

but more cross-mod.

Inexpensive Tetrode FET's Available

I have discovered an excellent source of MOS FET's abroad, and you may like to tell your readers about it. For some years I have been dealing with a chap in the U.K. who has always given me a very fair deal. At present he has RCA 40468's at stg 10/3, or stg 8/5 each for 5 or more. Stg 6/- for airmail brings them back in about ten days, all brand new, never a dud. Sea mail would, of course, cost less.

His name is: G.W. Short, 396 Selsdon Road, Croydon, Surrey, CR2ODE, England.

He also has very nice sockets for them, and reports also having 3N140 and 3N141 types now being used in converters. They are Stg 20/- and 15/8, respectively. Sockets are Stg 1/7. Other transistors available are BC168 for Stg 2/3, BFY51 [2.8W, F_T 50Mc] for Stg 4/9, 2N3707 for Stg 5/-.

The characteristics of the RCA 40468 are available in the RCA Transistor Manual, which is well worth getting also for its circuits, but for your benefit here are the brief characteristics: Silicon N-channel, 7500μmhos [yfs] at 100Mc/s, 100mW, 20V [DS], Gate Leakage 200μμA, max.

-- D.C. Tovey, Mordialloc, Victoria

[[Sounds lovely, but readers should order a sample lot first to see what Customs are like in your area .... -- Ed.]] P.S.: See also this issue, p. 118.

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QUOTE WITHOUT COMMENT [Ref article on Receivers, this issue]

-- Frequency Modulation, by Peter, ZL1TBL [Reprinted from Spectrum, N.Z., 5/68]

I have carried out NBFM tests with ZL1TAT Mobile, and found that when things get sticky on AM, FM just comes through nicely .. just like using a land-line [using an FM detector in receiver]. NO ignition noise on anything, just modulation. I think it is time we threw out our high powered Modulators and saved some battery power, or use the rest in our Class C final. I have often wondered what I will use for a modulation transformer for AM. As you can see, FM is cheaper to get going, less battery power, more efficiency, no noise in the background, no modulation transformers. The modulator in my FM rig consists of one double triode valve and a crystal mike.

MORE ABOUT FIELD EFFECT TRANSISTORS AND THEIR BEAUTIFUL APPLICATIONS -- Editor
-- with a note about Antennas !

There was such an enthuseastic response to last month's offer of information on FET converters that it is evident that I ought to have gone ahead and printed it all up in the EEB, but this is not practical, and we'll go ahead with the original plans. But I decided to add a number of other FET items from our files, thereby making quite a nice packet of information. We are working on the enlarged Packet, and it should be available in Due Course. If anyone else is interested in FET's, sources of information about them, and some nice applications, send your SAE. Don't blame us if you miss out on this. FET's will solve some problems shared by transistors or valves, and may well be the Device of the Future, at least until they are replaced by I.C.'s.

Current Literature

I wish to apologise for omitting in last month's discussion of FET converters, several important articles by local talent; it was caused by the confusion during the recent Move, and I am only now digging through the Pile.

In the July 1968 Amateur Radio, H.L. Hepburn, VK3AFQ, and K.C. Nisbet, VK3AAK, have a very nice all FET 2 Metre Converter, using the latest technology, so you can certainly say that Australia is up with the Rest. See also P. 108 here, letter. See also Oct. Ham Radio P. 77 for neutralisation of 3N141 in 2 metre converters.

In the same issue, G.S. Byass, VK3ZWA has an interesting note too, on a 6 Metre Converter. These authors are EEB subscribers too, which is not remarkable, since authors receive our Promotional Material -- hi. While I'm at it, I might once more point out to all prospective Authors, that EEB material is not copyright, and you are perfectly free to print your articles Elsewhere afterwards, for wider and/or more lucrative coverage. If you are in a hurry, say so, and we'll advance the usually-slow publication date. If your article is biggish, you might just send us a nice summary of it, with block diagrams and performance figures, and saying where the Full Details will appear. Why should you do all of this? I don't know, but I thought I'd mention it. Maybe because EEB is such a pitiful sight that it needs sympathy?

(See Feb 1968 EEB, P. 8-11)

A valved converter appears in the October 1968 AR, and is discussed elsewhere here [P.112]. Although the various FET articles claim that FET's can actually outperform valves for noise and linearity, my conservative instincts favour valves anyhow. In any event, certainly not ordinary bipolar transistors [but see EEB, Sept 1968, p. 102]. [and Radio Communication, June 1968, Technical Topics, p. 370: A Common-collector mixer with low cross modulation and low noise.]

Although not local talent, very good indeed was also 'Solid-State Modules' by D.R. Dryden, G3BKQ in AR, June 1968, p. 8, reprinted from Short Wave Mag., of Dec. 1967. Sundry very nice techniques for replacing valves directly by FET's; I nearly missed this one because of that word 'Modules'. A Module is not necessarily an Integrated Circuit. EEB article by I.N. Kallam soon, on FET-ising a receiver.

As you can see, Amateur Radio is a respectable technical publication, and the WIA is a worthwhile organisation. You can have both; details from P.O. Box 36, East Melbourne, Victoria, 3002. Applies to foreign readers too.

References

For readers who are not terribly interested in the sophisticated material which will appear in the FET-packet mentioned above, you could do worse than to read up a bit of fundamental stuff on FET's. I might suggest the following good references:

1] FET Principles, Experiments, and Projects, by E.M. Noll [another EEB subscriber, heh heh !], published by Sams, 1968. Since we just received our copy from abroad,

it will probably be about six months until it percolates to VK, and then at an inflated price. If you want yours sooner and/or much cheaper, write to The Bookstore, FAA Aeronautical Center, Postal Station 18, Oklahoma City, Oklahoma 73169, U.S.A., enclosing about $US5.50 [including postage]. Tell them to give you a Credit Slip if there is a refund, and we'll buy it from you if you send it to us with SAE. While you are about it, if you like Transistorised Transmitters, send for the RCA Silicon Power Circuits Manual at the same time [about $US2.20] and the RCA Transistor Manual [ditto]. . . They sell all kinds of other technical and non-technical books too.

We intend to review the FET book properly sometime, and to reprint one of their interesting QRP FET transmitters, but I had to let you know about it now.

2] 'An Introduction to the Field Effect Transistor' by G.S. Byass, VK3WA, Amateur Radio, May 1968, p. 6. Very good.

3] 'The Field-Effect Transistor' by F. Johnson, ZL2AMJ, Break-In, May 1967, p. 103. This article describes a 2M FET converter, and gives a long Bibliography on FET's and their applications, Break-In is the New Zealand equivalent of AR, and includes membership in the NZART, for $3.00 for all practical purposes; Box 1733, Christchurch, N.Z. You must not send Australian or American currency, because then they could use it to buy what they needed abroad, but you could get a Bank Draft in $NZ to send to them instead. Same applies to Spectrum [P.O. Box 5268, Auckland, N.Z.] which is also very good, $1.

4] 'Keeping up with Semiconductors -- FET's,' Electronics Australia, Feb. 1967.

5] 'Field Effect Transistor Primer' by Jim Fisk, W1DTY, 73, Dec. 1965, P. 54. And so forth and so on. There are equivalent articles in QST of high calibre, and probably in CQ too, but I don't have any more time to dig around in the Mess.

6] Applications Notes by the semiconductor manufacturers, e.g.
  a] 'Applications of the Silicon Planar II MOS FET,' Fairchild APP-109.
  b] 'Understanding FET, and Parameters,' Motorola AN-205, AN-206. Etc etc.

A Note on Antennas ----> 7] See October 1968 Ham Radio, p. 42+ for basics, troubleshooting.

The reason for this is that on the back of the article by G3BKQ in the June AR, there is another, "Some Thoughts on 'V-V' Beams for 14 and 21 Mc', by C. Whalley, VK6KK. From his enthusiasm, and from that of the authors of similar articles in CQ [and I think in QST of recent date], it appears that the V-Beam Yagi or V-Beam Quad appears to be about the best of the usual antennas, in the search for the Perfect One. A point well worth remembering. Now how about someone sending us [or other mags] an article on a Folded V-Beam for apartment-dwellers who like to work DX on 160?

I thought that 'The World with a Triangle,' by Wal Salmon, VK2SA, in the October 1968 Amateur Radio might have been just that. It wasn't, but it was just as intriguing. I recommend it to all Antenna Enthusiasts, along with its predecessor in AR of April 1967.

On the same page as VK2SA's article is an announcement about 300Ω open-wire line now available in Australia. I have used similar, and strongly recommend it to those antenna-users who are plagued by the high wet-weather loss of solid dielectric transmission line, or by the all-weather loss of coaxial cable, If anyone needs convincing about the latter fact, take a look at 'Coax vs Open Line' by B. Roberts, 73, Nov. 1962, p. 67, or other similar treatments of the subject.

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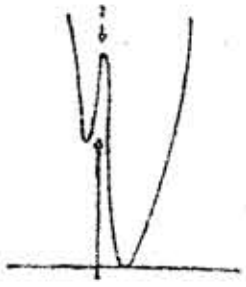
[Reprinted from 'Auto-Call'] Modern version of: Who was that lady I saw you with last night? That wasn't any lady, that was my 15 year old son !

[[We've got them in VK too]]

EXALTED-CARRIER RECEPTION FOR AM -- by Cal Hadlock, W1CTW *

(Number one hundred ninety-two of a series)



In radio the unconventional may be the cause of luring one from the well-beaten path of daily habitat. Thus, it was that the hope of listening to a S.S.S.C. signal found us the other evening tuning across the 75-meter 'phone band far from our usual stamping grounds on the VHF bands.

It was interesting to see how the other end of the ham world lives. A couple of S.S.S.C signals were found and tuned in by following the unique technique of receiver tuning and adjustment recommended for use in their reception. The AVC was turned off, R.F. gain retarded, A.F. gain advanced and the tuning dial turned very, very carefully. Pastafazool! It works!

After there were no more S.S.S.C. signals to conquer, we continued tuning around with the receiver in conventional manner. Of course, the band was crowded. Two meters was never like this! The crystal filter was quickly put into action to obtain sharper selectivity; this seemed to leave something to be desired, though, as the readability suffered as side-bands were cut. Plenty of "lows," but the "highs" that contribute most to readability were down. Somehow, this didn't seem to be the right way to tune in these signals. We were keeping the carrier intact and clipping our sidebands. Now, the chief purpose of the carrier is to move the S meter while the intelligence comes from the loud-speaker. Of course, to many hams the S meter is the more important of the two anyway. Did you ever stop to think that, even at 100% modulation, we are transmitting twice as much power to swing the S meter as we are to actuate the loudspeaker?

What to do about it? The most favorable spot on the selectivity curve is the nose which is the point of least attenuation of the desired signal. Let's get the carrier off of it and put one of the sidebands there. The other sideband disappears, but so what? You don't need a mirror to see what the other fellow looks like. So we detune the receiver so that the carrier is, say, 1000 cycles off the nose. It doesn't sound good! The reason is simple; We have reduced the strength of the carrier, while those components of the side-band on the nose of the selectivity curve are now un-attenuated so we now have the equivalent of a very badly over-modulated signal. What to do now? Let's get rid of the carrier and substitute a new carrier of ample strength in its place. The carrier is easily eliminated by adjusting the phasing control to a setting that phases the carrier out. At least 80 db. of attenuation should be possible in a properly designed crystal filter. Egad! What is happening to the S meter? As the proper setting of the phasing control is approached, the S-meter reading will go to zero if the carrier is unmodulated. But if the carrier is modulated, (as practically all 75-meter 'phone carriers are!) the S meter will dance wildly up and down as it is now actuated only by side bands which are far from steady with most voices. If you can stand such desecration of ham convention and can steel yourself to the fact that from now on we are going to ignore the S meter, we are ready to proceed further. Since the S meter is now useless and there is no carrier to develop AVC, let's turn off the AVC, retard the R.F. gain control and advance the audio gain control. Notice that this preceding sentence is the technique advocated for reception of S.S.S.C. signals. Now we need to turn on the BFO to generate the carrier that is needed to replace the transmitted carrier that was previously phased out so that demodulation can be accomplished. More S.S.S.C. technique! The BFO knob must now be adjusted so that its frequency is identical to that of the extinguished carrier (and we really mean identical — to within 10 or 20 cycles). This can be accomplished by ear by turning the BFO knob very slowly until the noise emanating from the loudspeaker sounds human. Now we have the final result. All this while the tuning knob has remained untouched. We can now tune the receiver to any signal in the band adjusting nothing but the R.F. gain control to compensate for a change in signal strength. This is similar to exalted-carrier operation and can be called S.S.E.C. Or is it S.S.S.C.? As you tune into a signal, a beat note will be heard between the carrier (not yet phased out) and the BFO. Simply tune this down to zero beat at which point the carrier lands on the phasing notch and disappears and the BFO knob should be carefully adjusted for best quality. S.S.S.C. signals can be tuned in similarly except that no heterodyne will be heard as the carrier has already been suppressed at the transmitter. Perhaps you just can't get the S.S.S.C. to make sense at all. This means that the wrong side band has been suppressed and it will be necessary to reset the phasing notch and BFO on the opposite side of the selectivity curve to receive it.

The system described above seems to be far more effective than the usual "on the nose" system of tuning but it requires very careful tuning. Give it a try but don't give up too soon. It will take time to get used to the technique and it will require considerable will power to tear yourself away from old habits.

A couple of hints may help to make the initial adjustment easier. To help set the BFO to the carrier frequency, detune the phasing control slightly to let through a little carrier. The BFO knob can now be adjusted to zero beat. Now the phasing knob can be reset by off-setting the BFO knob to get the same heterodyne with the carrier. The phasing knob can now be adjusted for minimum heterodyne strength after which the BFO knob may be returned to the "zero beat" position.

The above operation will give the equivalent of single sideband exalted-carrier reception with only the necessity of acquiring the proper operating technique. It is not necessary to pay out a couple hundred bucks for additional equipment; everything necessary was provided when you bought the receiver.

How to eliminate a heterodyne now that the phasing control has to be used for carrier suppression? A Select-O-Ject will do this for you, of course.

Cal Hadlock, W1CTW

* REPRINTED from QST, April 1950, p. 77, by permission of the publishers, The American Radio Relay League, and the Advertiser: National Radio Co, Melrose 76, Mass., U. S. A.

NOTE: The Select-O-Ject is found in the 'Receivers' Chapter in all ARRL Handbooks after about 1952.

RECEIVERS AND UNWANTED SIGNALS; Is SSB really necessary? [RLG]
-- An Addendum to the article on the obverse page.

Although the abovementioned article is somewhat dated, and although we now have better devices for obtaining selectivity and for producing local signal injection, the main idea bears some thought, and reflects some interesting implications for modern design.

A further note on Sensitivity and Cross Modulation

Reference the EEB articles on these subjects, June-Sept. 1968. The subject of improved receiver technique is vast, but I have always been intrigued by it, in the same way Antenna Enthusiasts feel that there must exist somewhere the Perfect Antenna. As our recent series on Receiver Front Ends has shown, the situation is not necessarily simple, and compromises are indicated.

Certainly best sig/noise is obtained with triodes, and with sharp cut-off valves in general, but these give more trouble from cross-modulation; no good to have plenty of signal if you have too many ! Antenna signal attenuation is one answer; E.H. Conklin, K6KA writes that he doesn't favour that: it attenuates weak signals too much. He makes the same point in the interesting articles on trapping strong signals, in 73, May 1967 and August 1968, and points out that it does not help much either to turn down the r.f. gain control, or to use limiting diodes across the antenna terminals. He has had good results simply by placing a series-resonant tank across the antenna terminals. I have also found this very effective, particularly with a parallel-resonant one also used in series. The interfering station[s] can be nulled out nicely, with negligible effect on the desired one. With reasonable Q of the tuned circuits, you can obtain so much selectivity that you can remove the carrier from a signal, leaving only the side-bands. This, of course, suggests a different method for accomplishing what W1CTW does with a crystal filter. On the other hand, it also explains why pre-r.f. resonant traps may not necessarily eliminate cross-modulation entirely, if the interfering signal is overmodulating; we have an interesting example of that here, with a commercial broadcast station which sometimes puts a trifle too much into its sidebands.

For really good pre-r.f. adjacent-signal rejection, the ideal method involves special filters of sophisticated design, as described by K6KA in QST for August 1967.

See also 'A New Approach to Receiver Front-end Design' by W.K. Squires, W2PUL, QST, Sept. 1963, in which he describes the use of the Beam-Deflection Valve as a mixer, to provide improved linearity. The subject is also treated interestingly in the 'Receivers' section of Technical Topics, or Amateur Radio Techniques, by Pat Hawker, G3VA, [both the bound volume and the monthly articles in Radio Communication]. See also: 'Designing Low-Noise r.f. Input Transistor Stages' by W.A. Rheinfelder, Motorola Application Note AN-133.

In Amateur Radio for October 1968, R.D. Champness, VK3UG describes a nice 6 Metre Converter using a 6EH7, recognising the desirability of low noise, and is a welcome departure from the 6BE6/6AK5 school [Ref EEB, June 1968]. One might look for a 6BY7 for more remote cutoff, but the 6EH7 is a good valve. A foreign correspondent has complained that the 6BY7 is not available elsewhere; its British equivalent is the EF85, and surely some VK or G radio amateur will collaborate in making it available . . . I would argue only with VK3UG's use of AVC on the r.f. valve, because it degrades signal/noise, but he does say that delayed AVC could be used for better weak-signal performance, so he is forgiven. An r.f. gain control [independent of i.f. gain] is, in my opinion, better.

Selectivity

Once you do get the signal inside your Black Box, the fun begins: it must be

nurtured carefully, signal separated from ignition noise [preferably early in the i.f., to avoid wave sharpening by selective filters !], and from other signals. There are also esoteric techniques for providing 'Squelch' or 'Muting,' an article on which will appear soon in EEB.

The 'separation from other signals' is indeed a problem, and one of the arguments for SSB is supposed to be an improvement in that property; it suffers other qualities, however, as we shall see. Traditionally improved selectivity has been achieved by introducing more tuned circuits, or in modern times more tuned circuits at lower i.f. frequency [because 1kc is 2% of 50 kc, but only 0.2% of 500kc]. The latest techniques involve crystal lattice or mechanical filters. Pat Hawker comments on p. 47 of Amateur Radio Techniques [c.f. EEB this issue, p. 107]:

> The only real advantage of a 1pw i.f. is that it permits good selectivity to be obtained with conventional tuned circuits; but against this must be put the difficulty of avoiding 'birdies' and other types of spurious response [and dependence on stability of more oscillators ! -- RLC] as well as susceptibility to cross modulation unless steps are taken to reduce these problems.
>
> Certainly, any receiver not containing either a mechanical or a crystal filter and with a final i.f. of 450kc/s or more cannot be expected to provide the degree of selectivity needed today. But a great deal has been learnt in recent years about the design of symmetrical and single side band filters, so that there is now no fundamental reason for a low final i.f. except that of economy.

So -- SSB has done some good after all ! A recent issue of QST has made the same point by publishing a good single-conversion receiver with selectivity comparable to multiple-conversions, and with much lower noise or spurious signals. The whole question of selectivity has been covered quite adequately in the various references appearing at the end of this EEB article.[Next month, sri]

Selectivity vs Intelligibility [See also, P. 111, here]

When you have separated a signal satisfactorily from all possible interference, you can still have troubles. Haven't you noticed that an attempt to reduce the passband may reduce interfering stations, but it also reduces intelligibility of the desired signals by taking out high frequencies that aid communication? You can hear him clearly, but you can't make out what he is saying ! The effect is worsened by the tendency to use high pass audio filters in the transmitter to eliminate low frequencies that 'waste power without increasing intelligibility'. It is a myth carried over from an earlier day. It has been pointed out in an article I read sometime ago: If the transmitted signal cuts out all audio below 1kc, and the receiver cuts out everything above 1kc, the net result will be zero. Evidently the best intelligibility can be obtained for a given selectivity, by providing as much sideband signal to the detector as possible. This requires good shape factor of the i.f. passband, and suitable manipulation of the signal. This is done most effectively by chopping off one of the sidebands entirely, along with the carrier, if any, and treating it as an SSB signal, as W1CTW points out.
EEB readers who are interested in technical matters only should now skip quickly to page 114, bottom.

Talkpower?

In the same vein, however, SSB enthusiasts point out that since the most effective receiver techniques involve filtering or phasing out sidebands and carriers, it might as well be done at the transmitter, allowing "twice as much talkpower to be transmitted for the d.c. Power Input". Therein hangs a ragged tail.

Twice as much as what? If merely twice the power, that gives only a negligible increase in signal, and look at all that trouble. Enthusiasts claim that

effective talkpower does, however, exceed the amount expected on the basis of more power, and this is true. But if talkpower is the only important thing, one could also use Narrow-band FM [which also eliminates TVI and most noise], CW* [a sadly forgotten art], the telephone [particularly for chats across town], or as much radiated power as possible.

I suspect that much of this boils down to the whole question of the use of Power. I should hazard a guess that it tends to be abused as much on the air as it is in the councils of Governments, and I daresay for the same reasons. To blast through QRM with high power, or worse, to talk to the chap across town by using hundreds [or more?] of watts is -- shall we be charitable and say that it is not the mark of a gentleman who is proud of his father?

Is SSB Necessary?

Arguments for 'talk power' of SSB belong in the same kennel.** If the object is to communicate efficiently the trivia which passes for 'contact' on the amateur bands, there are other modes, as mentioned above. SSB could be one, but it is astounding that it has achieved the 'popularity' it has; the other operational advantages of SSB appear to be the convenience of break-in, the absence of heterodynes, and the saving of band space. The first two items can be achieved in another manner, as I shall describe, not to mention the usefulness of CW [with vast 'talk-power']. Single sidebands will not solve the real problem of 'space on the bands'. Assuming that 100% more space is available on the average [which is not true], what will you do when there are 100% more signals on the air, even assuming they are all SSB, and that they are all 'properly adjusted' [ha ha]?

Since SSB is stripped of the uniqueness of its power-prevailing and space-saving advantages, it may be seen for what it is: An unnecessary and expensive and unnecessarily prestige-inducing complexification of our lives. It is also a prestige stimulus for a profit-hungry commercial market of 'amateur' electronic equipment,*** and a convenient method for establishing communal 'nets' presided over by the most aptly named 'Master of Ceremonies'. Thus, 'Amateur' Radio participates in the depersonalisation of the individual, the characteristic contribution of the 20th Century. Who needs it?

The case has been put with the most elegant simplicity by G3UGD on p. 34 of this year's EEB; I suggest you refer to it at this time. WA9TJT also returns to the subject in next month's EEB.

Are Carriers Necessary?

Now that I have antagonised about 80% of my readers, I shall back into a corner and admit that there is some desirability of removing part or all of the carrier. Partial removal results in 'Controlled Carrier' AM, and when combined with screen grid modulation [lets see you do that with transistors] provides a very neat and quite effective mode of communication, and does not unduly antagonise receivers.

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* both of which are easier to adjust properly, and are therefore generally adjusted better. Wherein, therefore, lies the "State of the Art"?

** At least for anyone who uses more than ten watts of SSB [i.e. 20W PEP]. To be magnanamous, allow 20W for AM or DSB. Many are the craftsmen who have worked the world with less than 10W.

***Sideband Electronics and other reputable manufacturers need not write angry letters of protest. I am not attacking them, only the System. If the System were different, they would be selling you other stuff, equally reputably. In any event said System originated Elsewhere, presumably with the tacit blessing of the big organisations said to guard the best interests of the Amateur.

Complete removal is 'DSB', which eliminates selective fading and carrier phase distortion and heterodynes, makes speech clipping easy, involves nothing critical, is easier to adjust properly than SSB, and avoids unpleasant Class B linear [if you're lucky] amplifiers. CW is even better, but requires skill and an appreciation of Finer Things, so we need pursue that no further.

As W1CTW points out, you can receive AM better if you remove its carrier, and preferably one of the sidebands too. But you can't receive DSB at all, for all practical purposes [without elaborate equipment] unless you remove one of the sidebands. But this is not difficult with modern receiver techniques, and in any event it is desirable to improve selectivity and improve signal/noise ratio. And it gives you a choice of sidebands; down with the stupid 'convention' about USB and LSB! Said technique is described very nicely in the article:

'That Unwanted Sideband' by Jim Kyle, K5JKX, 73, Oct. 1965
P. 92-101 [73 Magazine, Peterborough, New Hampshire, U.S.A.]

and it could well be worth sending a [U.S.] dollar for the requisite back issue; if they can't supply the mag, ask them at least to photocopy that whole article. Cost ought to work out about the same.

One of the nicest ways I know of doing this, was the 'Signal Slicer' which appeared in the G.E. Ham News, now alas, out of print. We have received permission to reprint this article, and will do so one day. It is also described in QST for July 1948, and briefly in the Kyle article. See also Ref. No. 8 at end of this EEB article.

DSB is very easy to generate, and does eliminate heterodynes; with suitable receiving equipment it has all of the advantages of SSB, without the onus. With humble apologies to Jim Fisk, DSB also avoids all nonsense about Transmitting Converters, and avoids Linear Amplifiers with their problems and rotten efficiencies.

The Receiver Deceiver

Related to the W1CTW article, there is one more receiving technique of interest. If you are receiving a carrierless signal, you usually inject the carrier by BFO methods of greater or lesser elegance. There is another method: inject the carrier before it enters the receiver! This is not a new method* but is well described in:

'The Receiver Deceiver' by F. Haines, W2RWJ, 73, 1/64, P. 30-35.

This consists simply of providing a stable VFO with variable output at the signal frequency, and mixing it at the antenna, at low Z. I may add the caution here that this ought to include a cathode follower to isolate the antenna from the VFO, so that you won't transmit the carrier you are supplanting!

W2RWJ uses a cathode follower with pot in the cathode for variable output, to isolate the VFO from receiver, not emitter follower, for the good and simple reason that emitter followers didn't provide sufficient isolation, even when cascaded threefold. Transistor enthusiasts take note; but FET's ought to work, as indeed in virtually every application using valves at low power.

Advantages of external BFO

Haines claims these advantages for front-end carrier injection:

1] Independence from internal BFO characteristics. And dependence on the stability of only one oscillator. You can make that oscillator as stable as you like, which cannot always be said for the receiver's H.F. or IF oscillators.

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* e.g. See Ref. No. 8 here.

[[-- Concluded next month]]

LETTERS TO EDITOR:

Improving Commercial Amateur Equipment

Here is a problem which may interest you. When the Collins 75-S3 receiver is tied to the 32-S3 exciter for transceive operation, the exciter sometimes 'sucks out' the signal from the heterodyne crystal oscillator of the receiver. This calls for some method to reduce loading of the receiver oscillator, to allow sufficient drive to the exciter, while maintaining injection of the crystal oscillator into the receiver.

Some ZL's have verified this on their equipment, and found that the 21Mc and 28Mc bands 'came to life' when the heterodyne crystal oscillator coax [which looked like 19Ω at 19Mc] was shortened to 16 inches. Even better results were obtained when the exciter's own crystals were used [not in transceive]; these require slight realignment.

So, we need a device with an input impedance of at least a couple of hundred ohms or more, which will take a couple of volts up to about 35Mc, and couple it to a 50Ω coax at the same voltage level. No gain needed. Perhaps one of those broad-band r.f. amplifiers with FET input and emitter-follower second stage would do it if the FET were not overdriven. This is a world-wide problem that very few have recognized in Collins S-Line equipment. A nice little design jobbie for some chap in your area.

-- E. H. Conklin, K6KA, La Canada, California

[[Ed Note: Although I don't become excited by the commercial equipment used by amateurs, or by its problems, I must say that K6KA has earned the right to use it by his fine experimental work; an 'appliance operator' is one who operates his appliance without this experimental insight.

For the Problem, what's wrong with a cheap and dirty ordinary transistor emitter-follower using something with an f_T of a few hundred Mc, e.g. Fairchild 2N3642 or Texas Instrumen TT-3642, or any 0.7W/250Mc equivalent?]]

Transistors and Transmitters

At this stage I am breaking into the transistor field, using 2N697's as my basic transistor for P.a.'s, with a pair of 2N384's as the V.F.O. Using this VFO into a three valve transmitter, input to the final not exceeding 5 watts, I have managed to contact 32 countries on 15 and 20M; with 10M opening once again I feel there is quite a future for the even lower power available from transistors. From my experience in this field, I doubt whether I can see the virtue in using, say a pair of PADT 50's or similar [e.g. AUY10] for 20-odd watts, where the difficulty of supplying such power input is quite a problem. I have my doubts that the relative efficiencies of transistors and valves don't put valves ahead on points at this wattage. This line of thinking may, however, be outdated by the availability of modern transistors.

-- J. Andrews, VK2BO, Goulburn, N.S.W.

[[No fear! See EEB, May 1968, p. 45-46 -- Ed.]]

◇◇

WARNING! dangerous poison: FLUORIDE

In the October 1968 issue of Break-In appears an article WARNING about the dangers of using hydrofluoric acid and ammonium bifluoride for etching crystals. We had a similar piece in EEB a few years ago, and it is well worth repeating the warning: strong fluoride compounds are very dangerous, and should be used with extreme care. The dangerous part is the fluoride, not the acid, so it does not much help to neutralise it with bicarbonate. You must not depend on rubber gloves, because a pinhole may be disasterous. If spillage or contamination occurs, do use the bicarb, but also plenty of water. If you get any on your skin, and if it is not removed immediately, you should seek medical attention... On the other hand, numerous people have used fluoride for etching, with success, but one must be very careful.

Note also 73, July 1968, p. 50: A 'Rust Remover' named 'Whink' has dilute fluroide in it. It might not be dangerous if sufficiently dilute, but you don't know; take care.

MULLARD R.F. TRANSISTORS REVISITED

[Ref: Transistorised transmitters, VIa, EEB, July 1968, P. 70]

We had the useful idea to send Mullard-Australia a copy of the abovementioned article analysing one of their circuits. The results were gratifying: Mullard/Aust sent the long-delayed symposium for which we have been pining: " Mullard Practical Planar for Transmitters," being the proceedings of the meeting held in U.K., 1967: " It had been our fond hope that some 50 sets of papers would be forwarded to us, but in fact only two copies were received which resulted in a rather expensive photocopying exercise." Again Australia is the Orphan, presumably of the marriage between the International Commonwealth and U.K. Industralisation, both deceased. Never mind, we have the material now, and are most grateful to Mullard-Australia for sending it. It consists of 58 pages of simply lovely articles on transistor transmitter design and applications, including design and construction of a variety of systems.

The only thing we can do with it at this time, is to use the information as possible in the continuing series of articles on design and application of Transistorised Transmitters, but the more practical aspects in our forthcoming Anthology.

In interim, the material can be made available on loan to any member of the Tasmanian Division of the W.I.A., but not outside of VK7, please. My experience with loans of all kinds has been phenominally bad, though I seem ever hopeful.

In the same post, Mullard also included a comprehensive price list for their semiconductors, and it is interesting indeed. Its also nice to find a manufacturer who is not afraid of stating his prices; compare with another firm which informed me that if I wished to let them have specific type numbers they would see about giving prices. On that basis how can one choose a compromise between performance and price?

With reference to the transistor types mentioned in EEB, 1967, p. 150; and 1968, p. 70, the following obtains:

BFY 90	$4.68	BLY 34	$6.48	BLY 53	"Expesnive"	2N3926	$14.18
BFW 16	6.41	BLY35	31.97	2N3375	$14.18	2N3927	17.28
BLY 17	37.73	BLY 36	29.83	2N3632	17.28		
BLY 33	6.48	BLY 38	" Expensive"	2N3924	4.18		

These prices are "Trade"; add 25% for sales tax, plus postage if relevant, though your local agent can probably order them if not in stock. Prices subject to change, etc etc. Retail prices are dearer, but if you look convincing I suspect you can get 'Trade.'

The main characteristics of these transistors have been described in the above mentioned references or in the others referred to therein; these will be readily available to interested EEB readers, so no need to take up space here. There may be some difference in price between the above and the RCA items listed on p. 120 of the 1967 article, but I doubt that it would be significant now; it seems unlikely that the prices from the big firms would be appreciably different for the same item. In any event, the above is a guide, and most of you will have to add the 25%.

Remember that you can often save quite a lot of money if you obtain the cheaper transistor in the TO-5 [or similar] case, and build it into a sturdy heat sink or heat sink adapter + heat sink -- keeping in mind the maximum limitations on current [and voltage]. To be done most efficiently, this requires the use of a lathe to bore a hole of just the right size for press fit into a block of copper or aluminium [details one day in the EEB], but even a strip of metal about the case can improve dissipation a lot. The heavier it is, the better, but good thermal contact with the transistor is also important. Silicone grease between surfaces is also useful. Rule of thumb: one sq. in. [total] of area for each watt for each degree centigrade temperature rise above ambient; derate power for temperature, as per specs. sheets.

ADVERTISING

Personal advertisements free if less than about five lines. Commercial adverts 10c per line, $1.50 half page, $2.00 full page; can be spread over several issues if desired. We reserve the right to edit copy as appropriate. We assume no responsibility for merchandise bought or sold through our advertisements.

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CHOICE TRANSISTORS: 2N3819 MOS FET's, 70c each. 2N4250 high gain low noise PNP transistor [see EEB, June + July 1967], 80c each. Pack and post 15c. No S.A. sales.
-- Custom Electronics, Box 1452-L, G.P.O., Adelaide, S.A. 5001.

SPECIAL SALE: IBM COMPUTER CIRCUIT BOARDS from the Wireless Institute of Australia, Tasmanian Division, P.O. Box 851-J, G.P.O., Hobart, Tasmania 7001. See P. 86 of the August 1968 EEB for details; Technical Data Notes suppaied with each order.

Ordinary TO-5 Alloy Junction transistors [f_T < 12Mc] or TO-18 Mesas [f_T < 500Mc, depending on type; low voltage] on Boards:

1-99 transistors: 15c per transistor
100-499 : 12c per transistor
500 and over : 10c per transistor

ALL POST PAID

Prices for special boards [described in August] remain the same. 'Diode-ridh' boards still available, but mainly on 13 and 17 transistor boards. We also still have some of the 015/065 types [Diffused Junction, f_T < 100Mc, BV < 100V] at 20c per transistor, 15c each over 100-lots.

= =

FOR SALE: 1000 Addressograph Frames, with cards and used plates. $20, freight paid. A print-out machine is also available at a greatly reduced price. Write EEB.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

PART-PAC SPECIALS, KITSETS AUST.,
Box 176, P.O., DEE WHY, 2099, N.S.W.

PART-PAC 68: Comprises 6 quality assorted knobs, 1/4" shaft; one crystal earpiece with cord; four plugs/sockets, assorted sizes; fifty 1/4W 5% tol. resistors, good values; fifty 1/2W 5% tol. resistors, good values; twenty assorted 100WV polyester capacitors [values between 0.001 and 0.47µF]; twenty assorted 10WV electrolytics; six assorted tag strips. A total of 161 items, worth more than $25.00 at normal prices. OUR SPECIAL PRICE: $7.95.

PART-PAC 66: Comprises one capacitor each of the complete polyester range between 3.3pF and 0.47µF [45 different values], plus one 10WV electrolytic of each of the following values: 5, 10, 25, 30, 50, 100, 200, and 500µF. Plus one 25WV electrolytic of each of the following values: 5, 10, 25, 50, 100, 200, 500, and 1000µF. A total 61 capacitors. SPECIAL EEB PRICE: $6.45.

PART-PAC 56: Comprises three 1/4W resistors of each value between 10Ω and 1 Meg.Ω; 57 different values, totalling 171 resistors. PRICE: $4.95.

PART-PAC 59: Comprises three 1/2W resistors of each value between 10Ω and 1 Meg.Ω; 57 different values, totalling 171 resistors. PRICE: $6.84.

ELECTROLYTIC CAPACITOR PRICES: [25WV]

5µF = 16c	100 µF = 25c
10µF = 18c	200 µF = 29c
25µF = 20c	500 µF = 40c
50µF = 21c	1000 µF = 60c

ELECTROLYTIC CAPACITOR PRICES: [10WV]

5µF = 12c	50 µF = 17c
10µF = 13c	100 µF = 19c
25µF = 14c	200 µF = 25c
30µF = 15c	500 µF = 33c

RESISTORS: 1/4W, 5%tol, 4c each or $3.00 per 100. Any standard value between 1Ω and

6.8 Meg. 1/2W, 5% tol, 5c each or $4.00 per 100. Any standard value between 1Ω and 10M.

Please Note: The abovementioned components are all new, and their quality is guaranteed by us. All orders over $1.00 are post free. Under $1.00 allow 10c postage.

KITSETS AUST.,
BOX 176, P.O.
DEE WHY, 2099, N.S.W.

[[Apology by EEB: The Blotch on some copies of the previous page is " 10WV" -- Sri]]

→ CORYRA PUBLICATIONS AND CANBERRA YOUTH RADIO CLUB: PARTS FOR SALE

AY1116/AY1117 Complementary pair: 90c. [Circuit details: 5c]

AY1101: NPN Silicon 400Mc [f_T]: 50c [Short-wave converter circuit: 5c]

Ex-computer Needle Relays: 6 Contacts/12 Contacts changeover: $1.20.

EX-COMPUTER CIRCUIT BOARDS: 15c per transistor,
100 transistors worth of Boards for $12.00.
All Postpaid. Minimum $2.00

For these, and details of lots of other parts, send to:

CORYRA [Publications]
BOX 649
CANBERRA-CITY, A.C.T. 2601

→ WANTED: EEB Bound Volumes I and II. Will pay double the new price. -- F. Sibson, Box 195, Mareeba, N. Wueensland 4880 [[Let us know if you get more than you need from this advert; there are several other people who also want, e.g. Asst. Ed!]]

→ VK4SS CLEANING OUT: 866's, mercury vapour rectifiers, new in carton: $1.50 [plus pst] Auto Transformers, 240/110V a.c., 100W: $2.50. Power Supply Unit, 250V/180mA; 300v/100mA; 100V bias; Filaments -- Suit single-ended SSB Rig: $20. AR7 Communications Receiver, Box A missing, otherwise A-1 order; complete with P/S: $55. SR-600 Ham Band Receiver; DX-100 Tx Rig, both in mint condition: Offers. Also other Power trannies and lots of gear.
-- Write: A. Shawsmith, 35 Whynot St., West End, Brisbane, Qld, 4101.

→ SELL R.C.A. Indicator Unit type ASB-4 with Intensity, Focus, Vert Shift, Hor Shift, and Gain Controls. Includes one 1802P1 C.R. Tube in full length Mu-metal shield, four 6AC7 and three 6H6 valves. No power supply. NEW and unused. Plus two 5BP1 C.R. Tubes in original cartons for $20.00, the lot, plus freight.
-- Write: A. G. Murrell, Penola, S.A. 5277.

→ FOR SALE: 100 excellent quality silicon power transistors, TO-3 case. Maximum ratings Collector power, 115W [25°C case], Collector volts 100, Collector current 15Amps, Beta 40 at 4 Amps I_C. These transistors meet stringent military specifications. Data Sheets and graphs supplied with each order. PRICE: $2.00 per transistor, postage included. Minimum quantity per order, 2 transistors. Please indicate if mounting hardware is required.
-- E, S, and I Co., Pty. Ltd., 81 Prospect Road, Summer Hill, N.S.W. 2130

[[Editor's Note; In addition to the transistorised automobile ignition system which we published in Vol I, we have another one coming up, of novel design. The above transistors are likely similar to 2N1100, and are probably excellent for such transistorised ignitions, particularly if you test the actual BV_{CES}. This looks like a remarkable bargain, but of course EEB guarantees nothing.]]

→ WANTED: Powell universal hobbing head for lathe with 48 D.P. hobb. Metal shaper, Atlas 6" or similar. Beaulieu or Camen Standard 8mm Reflex Camera. -- E. Kershaw, 5 Merlyn St., Footscray, Victoria 3011.

SPECIAL FROM KITSETS AUST.

750mW Transistor Amplifier: Beautifully made, these amps are constructed on a printed circuit board, 4-3/4" long, 2" wide, and 1" high. Very handy amplifier. Specifications: Supply voltage 9V; semiconductors: 4 PNP transistors; Output impedance: 15 Ω. Input sensitivity: 50mV. The volume control is included on the board. SPECIAL PRICE: $5.80 plus 20c pack and post.

Electrolytic Capacitors: New, top grade for printed circuit mounting. Guaranteed. We have recently increased our range, as follows:

5µF 10WV	: 12c	100µF 10WV	: 19c	5µF 25WV	: 16c	200µF 25WV	: 29c
10µF	: 13c	200µF	: 25c	10µF	: 18c	500µF	: 40c
25µF	: 14c	500µF	: 33c	25µF	: 20c	1000µF	: 60c
30µF	: 15c	1000µF	: 49c	50µF	: 21c	2000µF	: 95c
50µF	: 17c			100µF	: 25c		

Miniature 2-1/2" round, 8Ω speakers, $1.20 each. Post 10c

Resistor Special: We shall supply three resistors of each value between 10Ω and 1 Meg, 57 values, a total of 171 resistors: 1/2W, $6.84; 1/4W, $5.13 [5% tolerances, both]

Resistors: Our resistors are of top quality. Carbon film with a tolerance of ± 5%.
Prices: 1/2W, 5c each or $4.00 per 100.
1/4W, 4c each or $3.00 per 100
We supply to your individual lists, and our range is from 0.5Ω to 10Megs.
Note: the total quantity may be made up of different values to take advantage of the quantity buying discounts.

POSTAGE: Due to the recent increases in Postal Charges, we now find it economically impossible to give a post free service on the capacitors and resistors for any order under $1.00. It is now necessary to charge a 10c post and pack fee for all orders under $1.00. Thank you. [[Editor's Note: Postal rates have gone up as much as 300% in some instances, recently].

SERVICE: We despatch all orders promptly. If the order is received in the morning mail, we despatch the order that afternoon.

-- KITSETS AUST., BOX 176, P.O., DEE WHY, 2099, N.S.W.

BOOKS FROM AUSTRALIAN ELECTRONICS, 32 Waterworks Road, Dynnyrne, Tasmania 7005.

Sams Books:

Diode Circuits Handbook	$3.25
Transistor Circuit Manual	5.25
Handbook [of more] Tr. Circuits	5.25
101 Ways to use your VOM/VTVM.	2.95

U.S. Government Books

Introduction to Electronics	1.15
Basic Theory/Application Transistors	1.75
Theory/Use Electronic Test Eqpt.	1.30
Troubleshooting/Repair Eqpt.	2.65
R.F. Power Measurements [Free with Order]	
Selected Semicon. Ckts [Schwartz]	3.25

Techpress Books:

Principles of Amplitude Modulation	$1.95
of Electronic Oscil.	1.95
of R. F. Power Amps.	1.95
of Transmission Lines	1.95
Fundamentals of A.F. Amps/Valves	3.95
Power Supplies and Regulators	2.95

G.E. Book:

Silicon Controlled Rectifier Manual [4th Edition]	3.50

[Everything about SCR's, including all typical characteristics of G.E. units]

-- We highly regret that we can no longer offer the special EEB discount specified in the August Catalogue, because of much higher Postal Rates. We still have 125Meg Ω high stability resistors, $0.70 each. All material is post 'free', and of course the lowest price in Australia for comparable merchandise... To those who have enquired, yes, we may be obtaining some low cost special avalanche HT diodes. Next month's EEB.

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[[Ed. Note: we have seen their publication, and it comes to over more than 30 pages, duplicated. Most impressive. Seems like an excellent thing for DX-hounds]]

"I agree with you that money is unimportant, but who can do without it?" --LJY

EDITORIAL

Australia's Festive Season

My favourite shopkeeper looked startled the other day when I said 'Merry Christmas.' I guess he didn't connect the Event with the gay display of Christmas slogans he had all over the shop at the beginning of November. " Commercial holiday, y'know," I explained. He grinned weakly. Never mind, this is only to say that if Australia's Postal Union decides on the usual Christmastime Annual Strike, and if the December EEB is late [so? what's new], I wish you a pleasant Birthday [Christ's, that is].

Quo Vadis ["You can't win"]?

In response to popular appeal, you will notice that I now provide a handy translation when I employ a foreign phrase. Malcontents have noticed that the translation is always quite loose, but you just can't please some people.

EEB is late [again]

Readers may wonder how it can take a person three months to move in and get an office set up. But then, readers who have seen my awful pile of junk have no further questions. To our Scientology-enthusiast friend, and to our foreign subscribers generally I hasten to add that the delay is not altogether under my control. As you may have heard, the pace of life in Australia can be sedate, easygoing. Althoughthis does not necessarily apply to Australian passion for increased wages for less work, nor to athletic enthusiasm, nor to control of an automobile, nor to enthusiasm for fighting other peoples wars -- it does apply to the pace at which things Get Done. Many are the stories, some humourous, some tragic, which I could relate, but Tradesmen are a proud lot....

On the other hand, I have found out many interesting things, and as a non-tradesman I stand in awe of that remarkable profession. I do hold in contempt the characters who act arrogantly and unintelligently, but I marvel at the skill and creativity of the craftsmen who create things out of wood and metal. There is some of each type, and unfortunately it is possible to discover them only by experience. If I may draw a hesitant and qualified conclusion, it might be a Bronx Cheer at the young bods who act as apprentices or offsiders, but this may merely be the result of insipient old-age setting in. On the other hand, the Tradesmen themselves complain of the increasing difficulty of obtaining dedicated apprentices, because of the lure of high wages from more transient occupations. One can already see results of this situation, in the incredibly inexact standards of some home construction manifest in recent years.

Around the Shop

THE OFFER OF FREE SUBSCRIPTIONS mentioned in last month's Coupon is hereby terminated. Whew!

Readers may have noticed some difference in the heaviness of print of the past half-dozen pages or so, unless I can coax special performance from the Gestetner. The reason is the fact that I have been typing them myself. Our highly efficient Secretary got so bored at home that she went out and got a proper job, and because she is intelligent she got a lot of money for it. Rather than insist that she continue typing at night, I took pity, and the rest of the pages of this rather long issue. Just as well, however, perhaps, maybe, because she has been working on one of those lovely electric typewriters, and it ruins one's touch for these mechanical monsters. So now we are looking for a typist again. But at least the printing will be done; the Editor of the Tasmanian Numismatic Society has volunteered to turn the crank. We have been printing his monthly Bulletin, and now he can do it himself, along with EEB, hooray.

We have received two requests for a long list of the actual address and subscription rates, etc, for the various magazines we have mentioned in these pages. I shall compile the list, but will publish it in EEB for the benefit of all, when I uncover the mags

The present list is: AR, A-C, B-I, C+E, C, CQ, EA, E-W, HR, MD, MO, PE, QST, RC, R-E RC, 73, S, TAEEB, TAE, WW. If you have any others you want mentioned, please let us know their name, address, cost, and two descriptive sentences for each.

A correspondent wants information on testing transistors. This subject has been covered in recent issues of Ham Radio, 73, CQ, Electronics Australia, Amateur Radio, Radio-Electronics, Electronics World, and probably all the rest. If he never sees any of those, he might look at the 1967 issues of EEB dealing with diode and transistor testing, and the 'CRO for Diodes,' and the September 1968 EEB, not to mention the G.E. Transistor Manual and Motorola Power Transistor Handbook. I can't imagine a subject which has been covered more thoroughly. In a forthcoming EEB we hope to present a compendium of circuits for transistor testers, with comparisons, and a very useful and ingenious idea for a tester, by friend Les Yelland. Les is one of those people who has sent us enough material to entitle him to EEB subs likely after I'm gone, so I've just stopped counting.

We have been sent an interesting request from an overseas reader. He wanted us to print an Advertisement warning that the Day of Judgement was approaching, and that further information could be obtained from him what to do about it. I have scant doubt that he is right, and that we humans are doing our best to hasten that event, but it seems to me that it would be best for us to live in our Fools Paradise for now, and to fill the pages of the EEB with trivia not directly related to that cataclysm. I admit that I discourse occasionally on non-electronic matters, and that I love to present my own ideas on how to save the world, but after all I'm the Editor, and surely there must be some compensations for the job? [Malcontents: no one forces you to read Editorials]

To wit:

A Funny Thing Happened to me on the way to the morgue:

I had a nice idea to get some pretty heading material properly printed up for a cover, and an improved format for the bits and pieces of information on the back page. So I took it to a so-called Printer to make a nice-looking proof copy from which I could get an electronic stencil made. After much delay he turned out a rotten job, for which he charged handsomely. Somewhat discouraged I took the copy to another shop and got a much better looking copy, better organised [i.e., the way I wanted it], and at a tenth of the cost because it was done on an IBM instead of an expensive printing press.

Then I spent several hours putting it all together, and the result was handsome. The new PMG Regulations require a 'POSTAGE PAID' imprint, but they allow you to provide your own design if you want. Ian had made up an attractive one for us [somewhat better than the one appearing here, obverse], and this was included. Then I took it down to Gestetner who made up a lovely electronic stencil from it, the expensive kind because I wanted really good copy.

Then I put the folder containing the stencil and original in my pocket and proceeded happily on my pushbike. There was quite a heavy wind, part of the charming weather we have been enduring, and gusts were up to 50mph. One of them snatched the folder from my pocket, and I looked back in horror to see the lot disappearing at 50mph into heavy traffic and numerous bushes which line Hobart's attractive Brooker Highway.

I spent two and one half hours looking for it while the evening wind screamed about my ears. Then I sat down on the bicycle and looked at the angry clouds boiling over lovely tranquil Hobart. In the distance children laughed pleasantly. For the first time in many years I felt like crying.

FROM:
THE AUSTRALIAN EEB
P.O. Box 177,
Sandy Bay, Tasmania
Australia 7005

POSTAGE PAID
Sandy Bay, Tas.
Australia, 7005

[Registered at G.P.O., Hobart, for transmission by post as a periodical]

TO:

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NEW TOWN, 7008
TASMANIA.

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THE EEB is a thoroughly informal electronics experimenters bulletin, published six times per year, beginning with February, but we reserve the right to publish more issues if we feel like it. EEB attempts to explore matters of general and specific technical interest, with comments. The emphasis appears to be primarily on semiconductors, but anything interesting on valves [or other] is also welcome. The EEB is for everyone's enjoyment [maybe]; if you have a technical fact or opinion, this is your opportunity to tell it to others.

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CONTENT:

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METER SHUNT DESIGN -- J. Muntz, 12 Voumard St., S. Oakleigh, Vic. 3167.

The most common type of meter used by experimenters is the moving coil ammeter. Because the current must be carried in and out of the moving coil by fine flexible leads, this type of meter is not normally built to measure currents greater than abt 10mA; larger currents would require flexible leads which would require an excessive torque to deflect the meter. The usual method of measuring d.c. currents larger than the rated current of the meter coil is to place a shunt in parallel with the coil, to carry the amount of current in excess of the meter rating. Complications arise, however, because of the considerable variation of resistance of the ammeter coil, which is wound with copper wire.

The use of Swamping Resistance

The most practical way of arranging shunts is to make alterations to the meter so that it has a fixed resistance with variations of current. This is accomplished by placing in series with the coil a resistance of 10 to 15 times the resistance of the meter coil. The resistance of a copper meter coil may increase by up to 10% from the cold value, after full rated current has passed for sufficient period of time. When a resistance is added in series with the coil, the variation of coil resistance becomes negligible compared to the total resistance.

The extra resistance is made of some material which has a negligible temperature coefficient of resistance,ie, its resistance does not change with variation of room temperature, or with variation of current up to the rated current of the wire.

The added resistance is called a 'swamp' and the meter with 'swamp' is said to be 'compensated.' A meter with a series resistor less than about ten times the coil resistance is said to be poorly compensated, i.e., the variation of reading with room temperature, or with the time of current flow, or the magnitude of current, is rather more than is expected. Of course, for average use, these variations are relatively unimportant, but you now have some idea of the possible errors which can arise if you wish to make an accurate reading of current. It also explains why a seemingly 'useless' resistor is used internally to increase meter resistance.

Typical compensations

A 0-1mA meter is usually compensated so that about 50-125mV appears across the meter. In general, meters which have a high sensitivity [e.g. 50µA FSD] have rather higher voltage drops, as the meter coil must be wound with many turns of extremely fine wire. This means a high value of resistance, and consequently a high value of 'swamp.' The AVO Model 8, for example, requires 0.5V for full scale deflection of the 50µA movement. This comparatively high voltage drop can make measurements of current difficult in low voltage circuits, e.g. valve filament currents. The only practical way to reduce this voltage drop is to use an amplifier, so that a smaller voltage drop will supply the current needed to run the meter; transistorised amplifiers have been discussed for use with meters, in various issues of last year's EEB.

The Meter Shunt

Our 'compensated' meter now requires only a stable low value resistor, a 'shunt' in parallel with the coil, to measure currents higher than the FSD of the movement. This resistor is usually made of a resistance material having negligible resistance variation with current or temperature variation. Because of the low resistance value, the material most also not develop a thermal EMF. Although it is tempting to use copper wire for the shunt resistance [and this is even recommended by some Handbooks], its poor temperature stability makes it a very poor choice. The best material is manganin, but it is rather difficult to solder, and unless care is taken, the resulting shunt is little better than one made out of copper. It is, therefore, worthwhile to consider the construction of a proper mounting system for the shunt wire.

Construction of a Shunt

The construction of a shunt is simple. The materials needed are:

1] Sufficient resistance wire to carry the current. For currents above 10Amps, usually one wire is allowed for each 10 Amps [I can suggest suppliers, on receipt of a stamped self-addressed envelope].

2] Two copper blocks, of sufficient size to carry a large terminal for the current to be measured, a small terminal for the lead to the meter movement, and sufficient room to drill holes for the shunt wires. See Fig. 1:

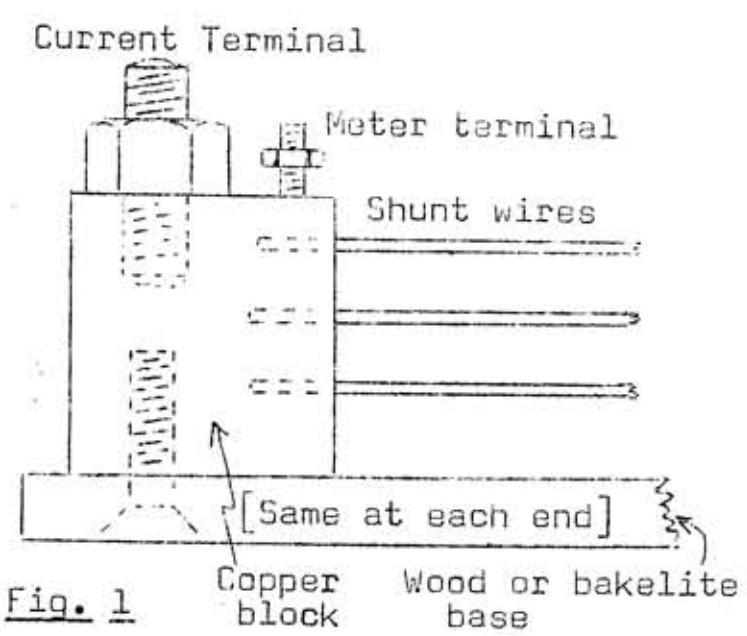
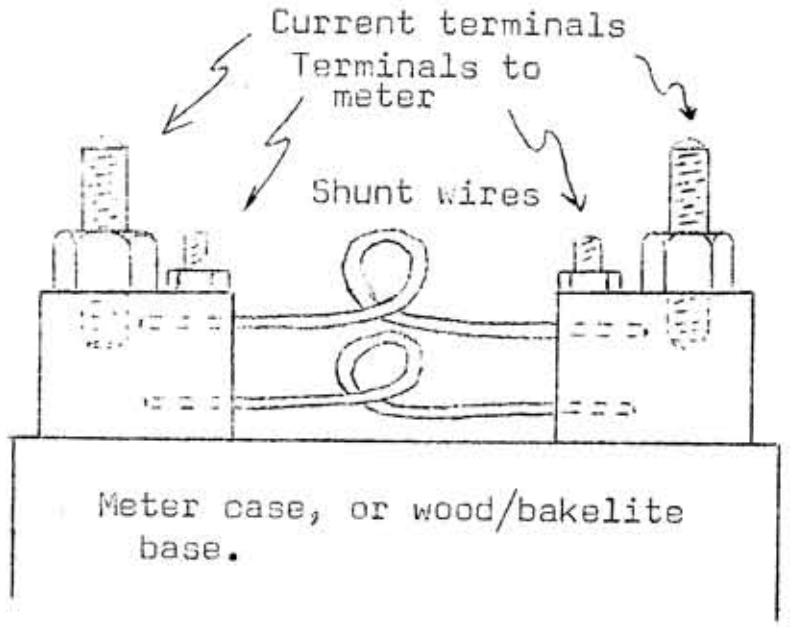


Fig. 1

OR:



Copper is best drilled with kerosene as the lubricant; 'dry' copper 'grabs' severely. Silver solder is the only really suitable material for attaching the resistance wire. Poke wires in holes, and 'sweat' the joint with silver solder, suitable flux, and enough heat; obviously this operation must be carried out removed from the meter. It is VITAL to use separate terminals for the measuring meter, as the meter movement is easily burnt out if its leads are connected to the main current terminal.

In any case, the only accurate way of measuring the true voltage drop across the shunt is by using separate terminals. By the way, we are now measuring voltage drops, and calling the voltage drop a current by applying Ohm's Law.

Alternative Methods of Shunt Construction

[[A Note by the Assistant Ed: At this point we can hear people saying: oh I have used copper, with good results. Or: Oh I have used resistance wire soldered to switch terminals directly. Or, most relevant: I have simply fastned the resistance wire down between two nuts on a bolt. All of these methods have been used, and all work -- up to a point. It must be realised that methods short of the one described by Mr. Muntz will be inadequate, either from the point of view of temperature stability, or of durability. And manganin wire which is not silver soldered simply does not have the long term stability needed even for modest accuracy. You can say 'I can always calibrate the ammeter again another time,' but which time? When can you stop relying on it?

[[The only lesser method of any value is the wire-between-nuts one, and then only with the following modification: Cut the resistance wire an inch longer than needed on each end. Silver solder the leads going to the movement [or to terminals] to each end of the shunt wire. Then clamp the wire down with the nut/bolt arrangement on each end. In this manner, the electrical continuity is good where it matters, to the meter, and poor where it is less important: in series with the current source.]]

Calibrating the Shunt

To calibrate the shunt you must first obtain a meter of sufficient accuracy [e.g. AVO-8] to use as a 'master.' Place this meter in series with the shunt, and adjust the current through the shunt to the required value. Attach the meter you intend to use with the shunt, to the shunt, and check the deflection. The meter ought to read rather less than the true current [If it reads more, you have too much resistance in the shunt; you will have to dismantle it and add an extra wire in parallel, or shorten the ones already in place]. Now lightly file the shunt wire, keeping a careful note of the increase of meter current; remember it is easy to file material off, but hard to put it back on. Toward the end of the adjustment, tap lightly the calibrated and test meters to ensure accuracy. High quality shunts have roughly constant thickness of material taken off the wire. It is considered poor practice to make a small narrow cut [See Fig. 2]

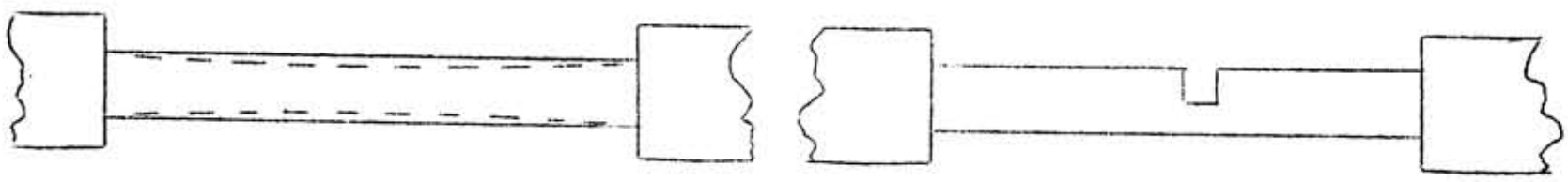


Fig. 2 GOOD PRACTICE POOR PRACTICE

Now recheck the master meter to see that it is still reading the required current.

To finish the job properly, you should now measure the voltage drop across the shunt, and mark this and the rated current on the shunt copper block. This shunt may now be used with any meter with the required voltage drop and current rating.

Use with Other Meters

If, with this shunt, you wish to use another meter with the correct voltage drop, but an unknown value of current rating, you may do so if you know that the meter movement takes less than, say 10mA. If you have, say a 1 Amp shunt

designed for a 1mA 100mV meter, and you wish to use it with a 100mV 10mA meter, the actual current flowing at full scale will be 1.009A instead of 1.000A; a negligible error compared with other inaccuracies. Of course this idea must be approached with caution for shunts of below one ampere.

Multirange Shunts

The most reliable and accurate multirange ammeters for relatively large currents use a 10mA meter and shunts for every range. 10mA to 3000A is quite feasible with the method described above.

It is possible to make combination shunts [Fig. 3] too, but this introduces the problem of selecting between the different ranges. If a switch is used, it must be used very carefully, because the resistance of switch contacts varies from one contact to another, from one type of switch to another, and with time [and corrosion, etc]. The 'Palec' 10A switch is satisfactory up to about 5A. Paralleling must be used with caution, as the paralled contacts may have varying values of contact resistance, and unequal heating etc may result.

A very good but expensive switch may be obtained from the Australian Solenoid Co., 76A Chapel St., Windsor, Victoria 3181. Typical prices are: Single pole, eleven step with off position: $5.20 for 16A rating, $13.80 for 25A rating; all plus sales tax, and as at January 1967.

Editor's Note

Switching problems may be avoided, particularly for currents over 1 Amp, by using good plug-in terminals. This is more trouble, but more reliable for ordinary switches, and in any event cheaper.

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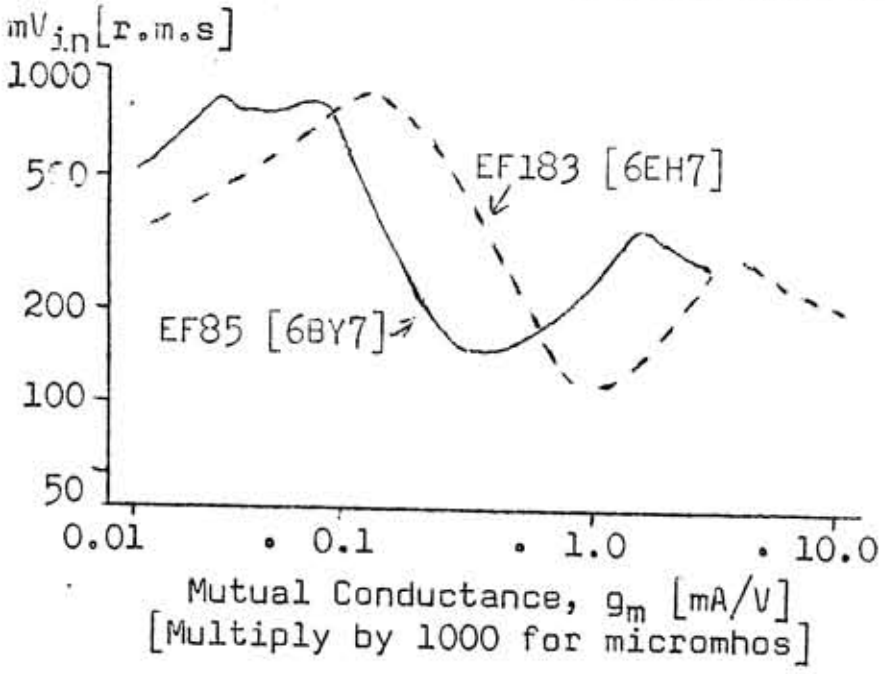
LETTER: Relative Merits of Low-noise Valves

I enjoyed the article 'Improving Receiver RF and Mixer Performance' in your July issue. Concerning the merits of the 6EH7 [EF183] versus the 6BY7 [EF85], you may be interested in the data shown here, from the Mullard data sheets. The solid line is for the 6BY7, the dotted line for the 6EH7. I have tried both in a Collins 75A3. Without extremely good equipment for testing, I believe that both tubes perform quite well.



Hope to get to Tasmania one of these days.

-- W. H. Sayer, WA6BAN, San Mateo, Calif.

[[Ed. Note: Yes, both will perform well, but the more remote grid characteristic of the 6BY7 allows better control of gain, e.g. if coupled to the AVC system. Although the EF183/6EH7 has twice the cross-modulation at intermediate gains, it certainly appears to be better for very low or high gains. Indeed one strives for high gains for low noise behaviour, and it appears that cross-modulation follows similar rules. With either of these good valves, the performance would certainly be limited largely by the characteristics of mixer and/or i.f. valves. From this point of view, the valve of choice for mixers is definitely the 7360 beam-deflection type, described in AR Techniques [Tech. Topics], AR Circuits Book [both RSGB], Radio Communication Handbook, latest ARRL ['Misers Dream'] and Radio Handbooks, October 1968 issue of 73, Sept. 1963 issue of QST and several subsequently, etc.... Love to see you in VK7, but not much more here than you'll find in Yosemite, though closer at hand. Good place to live...]]

PRINTED CIRCUITS, Part VI

-- C. Witchell [VK3]

I had some rather rough notes prepared on photographic production of printed circuits for the amateur, when I saw an article along the same lines in the November 1967 issue of the EEB. Although not many amateurs are likely to carry out photographic Printed Circuit Board production, it seems worthwhile for me to re-present the main theme of the EEB article at this time, from my point of view.

This article makes several relevant points. Even if you have no intention of using photographic assistance, you should be [at least slightly] amazed at the number of stages needed to produce a board. C. W. Roberts-Wray [in the November 1967 EEB] has taken a great deal of pains to collect the names of materials required, which can be bought by experimenters, to produce a really high-class result.

This method needs more outlay than the conventional bituminous paint method, but thenceforth produces boards for an approximately equal rate per unit area.

Artificial Negative

The photographic method requires a negative which can be a camera negative or a mock-up negative, sometimes called an artificial negative. It is made by drawing on clear polyester film with Indian Ink. The most suitable film available for this is matt-finish temperature-stable drawing film. It takes ink very well, and corrections are very easy; Ink can be removed with a damp rag before drying, otherwise with a soft rubber. Paint the image onto the film leaving clear the areas that are to be copper on the finished board. The black areas must be absolutely opaque for best results.

Resist Application

The copper must be cleaned thoroughly before coating, either with an abrasive cleaner or steel wool. Use a solvent to remove grease. The board should then be warmed slightly, ready for the resist application. There are many methods of coating, but I have found the easiest is to place the board in a small plastic tray on a turntable set to 78 rpm. Place the board off-centre and spill a pool of resist on the inner edge. This will quickly run over the warmed board due to centrifugal force, to become an even, thin, layer. The board should then be placed in an airtight light-tight box, in a vertical position, to allow the excess resin to drain off, and the surface to dry. This will take about two hours. Care should be taken to avoid dust settling on the wet resist. It is most important that the layer of resist be uniform, as the thickness affects the exposure time.

Exposing and Developing

The effect of exposing the resist to light is to change its properties to become insoluble in the developer solution. Thus it is important to keep the board from any incident light until ready. Place the negative on top of the pre-sensitised board, and fix in position with tape. Exposing should be carried out in a vacuum box so that the negative will contact the resist layer evenly all over. For the experimenter, however, it will be adequate to use a sheet of clear glass pressing firmly onto the negative. Illumination can be obtained from a 100 watt globe placed about two feet from the board. Exposure time will vary greatly with source of illumination, and with thickness of sensitised layer, but 7-10 minutes should suffice.

A developer bath is used to remove the unexposed resist, and will take a full minute of agitation to achieve this. Washing under running water for a further minute will clean-up the board. Do not touch the resist during the development process, as it is soft until it has been washed and dried. The board is now ready for etching in the usual way; articles on etching techniques have appeared in The Australian Experimenter, The Australian EEB, and most other magazines. After etching, the resist can be removed with thinners.

To avoid the trouble of applying the troublesome resist coating, pre-sensitised panels 3" x 6" are available through C. W. INDUSTRIES for 80c*. Since many of the

construction articles include a size:size layout of the board, this makes home manufacture much easier. C. W. Industries can also help with negatives by photographing layouts from magazines. Costs here will depend largely on the size of the negative. A reproduction 3" x 6" costs $1.10, while 6" x 6" costs $1.60.*

Chemicals Required*

Kodak Printed Circuit Resist, 500cc [about a pint]	$4.20
Kodak Printed Circuit Developer, 500cc	2.10
Kodak Printed Circuit Resist Thinners, 500cc	1.40
Matt Finish Polyester Film, 6" x 6"	0.55
Pre-sensitised Panels, 3" x 6"	0.80

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Ed. Note: As this was being typed we received word that C. W. Witchell's magazine, The Australian Experimenter has ceased publication, owing to problems of support and finance. We hope that Clive will continue to contribute his talents to the Australian experimenters community by contributing his articles on beginners kits, transistor techniques, chemical experimentation, etc., to the national magazines which remain. We also encourage you to patronise his firm for the supply of the above items. His merchandise is said to be reputable, and he could use the income to make up for losses suffered from his magazine. Well do we know those kinds of problems!

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REVIEW: The 1968 ARRL Radio Amateurs Handbook -- R.A.J. Reynolds [VK7ZAR]

The ARRL advertises their latest Handbook as being " A new look, a new book" and one reads that there are "many changes, improved coverage of semiconductors. . . a big improvement over last year's issue." [EEB, April 1968]. And the July 1968 AR describes various improvements in format, more emphasis on solid state devices, making etched-circuit boards, new transistor data tables, etc. And the June 1968 Radio Communication lists various improvements, " and the genuine experimenter will be interested in the changes..." And other reviews, in the same vein. I concur with much of this, but should like to look at this book rather more critically, with some dissenting opinions. Although the 1969 edition should be out soon, I believe that these comments are of general applicability, and should provide a practical basis for evaluating future editions.

A critical evaluation

Yes! there are 35 new projects in the new edition, but at the expense of more elaborate valve projects. Classical theory is slowly drifting out, giving way to gadgetry. I estimate that there is about 10% less theory, although the size of the book increases by 1.5% over the previous year, and 4% over 1958, as far as text.

As I thumbed through the pages, I got the general impression that the Amateur Operator should buy his basic station [preferably a sideband transceiver], and then if he were really adventuresome or really broke, build some extras so as to impress other people -- and then only as long as there were precise working drawings to follow.

Once upon a time, a budding amateur could buy a copy of the ARRL Handbook, and learn enough to build a complete station consisting of a double change superhet, a 200W plate modulated AM transmitter, and all associated gear, with bare components and a soldering iron, without referring to another book; but no longer. Even though radio technology has increased over the last few years to an amazing extent, relatively few of the recent refinements are reflected in this volume, except for the

[continued, P. 132]

* Available through C. W. Industries, 2 Ethel St., Moorabbin, Vic. 3189. Post 45c per item. [[Ed. Note: These prices were specified before the recent postal increases; we recommend that you contact C.W.I. if interested, for possibly revised costs.]]

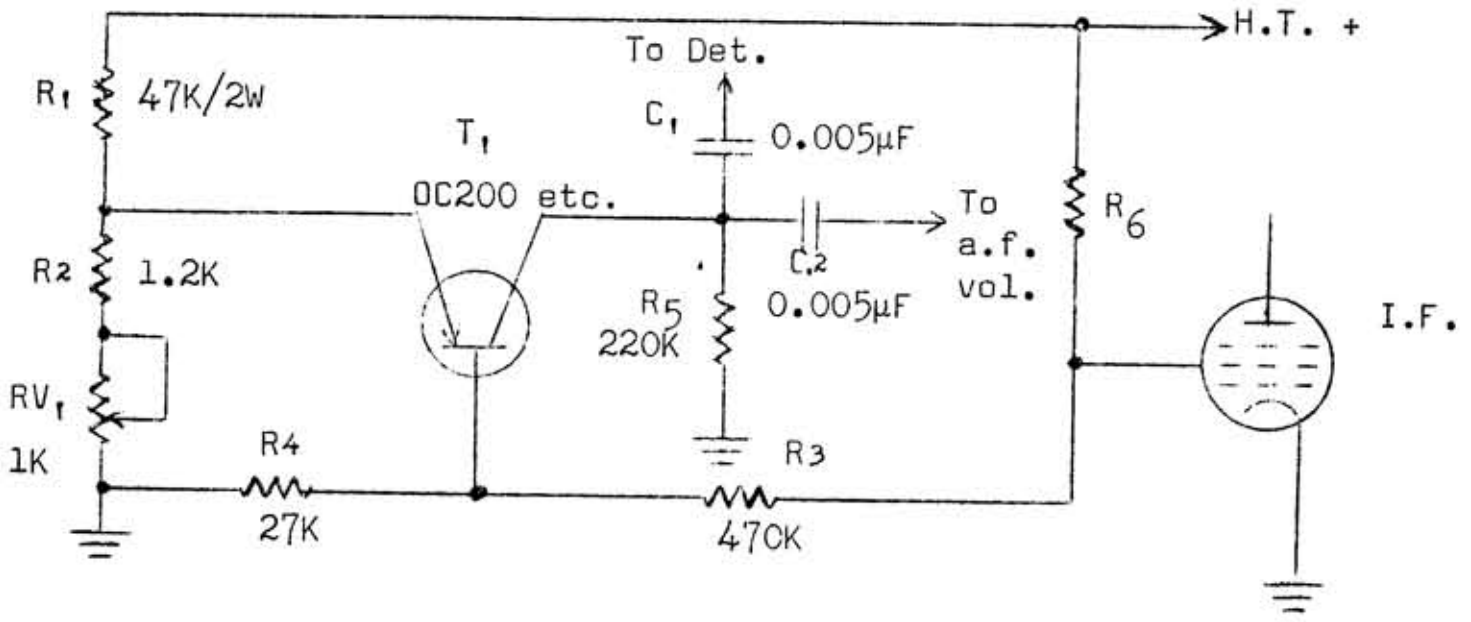
TRANSISTOR SQUELCH FOR VALVE RECEIVERS

-- Don Harvey [ZL1BBR/VE3FGQ]

To those unfortunates as yet unenlightened on the mysteries of VHF communications this article may, possibly, be tossed aside. I hasten to add, however, that to the man who works with VHF equipment, be he amateur or serviceman, it may well be the answer to heretofore unheard prayers.

Why Squelch?

While the VHF bands are relatively free of the usual static and man-made noises knee-deep on the HF bands, one particular annoyance does stand out. I refer to the white noise ever present on all bands above 25Mc. One particular local taxi driver, driven to distraction by living with this noise every day, finally called 'help,' and the circuit of Fig. 1 was my solution to his problem:



The set was a Pye Reporter Mk III, but any set with an AGC controlled I.F. stage will operate the device.

Operation

In the absence of a signal, T_1 is biased on, shorting the receiver audio line via the emitter-collector circuit and R_2 and RV_1 to earth. When a signal arrives, AGC places a negative bias on the i.f. stage control grid, and I_p and I_{sg} decrease. Thus, E_{sg} rises, and the base of T_1 is biased to cut-off. This opens the short on the audio line, allowing the signal to pass through C2 to the audio amplifiers.

In this case, HT was 170V, and resistor values were chosen to suit. Should it be necessary to adapt the circuit for use with any other value of HT, only R_1 and R3 require adjustment. The idea is to set up the R_1-R2-RV_1 and R3-R4 dividers so that, with no signal the emitter voltage is about 1.0V, and base voltage 0.7V. This adjustment should be made with RV_1 near half resistance. RV_1 may then be used as a threshold sensitivity control.

When a signal appears at the set, the screen voltage will normally rise by a few volts per µV of signal. The resultant small change at VT_1 base is sufficient to cause cut-off. In the case in question, 0.5µV was plenty of signal to operate the squelch reliably, so even weak signals were not lost.

R_6 is the original screen dropping resistor, and should be a relatively high value to give a good voltage swing, especially if AGC action is not all it should be.

Installation

The unit should be installed in a low power, high impedance circuit, preferably just after the detector, by breaking the line between detector and volume control.

When properly adjusted, the device will mute the receiver for any noise level up to several microvolts, yet readily admit any signal above that level.

The prototype has been in operation for over a year now, without a snag, and has put our taxi driver back on an even keel once again. It could also be used on a communications receiver used with VHF converters, or converted surplus gear not employing any such facility.

Build one!

[[Ed. Note: Squelch action is also useful on the LF bands. For ideal operation, the classical " Twin Noise Squelcher" provides both squelch and very effective impulse noise limiting, but OM Harvey's circuit can be a great convenience where this would not be relevant. I also have a long list of references to various Squelch systems which have appeared in the periodical literature, and will present it in a forthcoming EEB, probably.]]

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ARRL HANDBOOK REVIEW [continued from P. 130]

one rather dubious topic of SSB.

There is a distinct and notable lack of modern theory even on a simple basis. I do not recall anywhere in the book seeing an analysis, for example, of product detection, or modern concepts of receiver front end design. One has only to look at discussions of these subjects in the RSGB Handbook to realise this. Or: they do use FET's in design, but with hardly a word on their function. The ARRL work is like a book which describes a dual conversion superhet without describing the theory of operation of single conversion. They are far too ready to describe the construction of elaborate [though minor] equipment, without presenting the fundamental theory involved.

Their attitude can be summed up thus: the field has expanded, but space available in the Handbook can not keep pace. Therefore the reader is expected to consult alternative sources for much theory. This is all right, I suppose, but it is hardly the 'experimenters bible' we once knew. Moral: keep your old copies!

They have scrapped the whole section on Klystrons and Magnetrons and Travelling wave Tubes. But in fact these methods are still the most economical and efficient way of generating power at frequencies > 5Gc. If they expect amateurs to be in the forefront of SHF experimentation, they are providing no incentive or readily available information.

How to meet the wail: 'no space?' Well, they could start by cutting out the very high power amplifiers -- which serve only to worsen the shocking American QRM problem [c.f. last month's EEB, p. 114]. Why not publish in two volumes, and charge more? After all, the Radio Handbook charges about three times the price, comes out less frequently, and does not lack for purchasers. Or: Why not provide a separate book of theory and of practice, the latter being published in more frequent editions than the former? Presumably because it is politically unsound: sales would drop?

A Conclusion:

In spite of the above critical comments, this is an interesting volume, including many up-to-date transistorised circuits, and well worth having for the material it does cover. But it should be backed up with an earlier edition for more fundamental equipment, as well as the current editions of the Radio Handbook [Editors and Engineers] and Radio Communication Handbook [RSGB].

RECEIVERS AND UNWANTED SIGNALS [Concluded]

Last month we presented a general discussion on the techniques and benefits of Exalted Carrier Reception, with words about interactions of selectivity with intelligibility, sensitivity vs cross modulation, and some unkind words about Single-minded Snob Behaviour [SSB]. As might be expected, there were howls of outrage, but as yet no publishable refutations. Is it possible that a Cow so Sacred needs no defence? Before submitting any manuscripts, outraged readers should reread carefully the nature of the arguments presented, and answer them directly, not necessarily dragging in a lot of classical points concerning this unwholesome subject.

In any event, let us continue in a more technical vein, with the benefits of using an external BFO to inject carrier into a carrierless signal:

Advantages of External BFO

In the January 1964 article from 73, W2RWJ claims these advantages for front-end carrier injection:

1] Independence from internal BFO characteristics. And dependence on the stability of only one oscillator. You can make that oscillator as stable as you like, which cannot always be said for the receiver's HF or IF oscillators.

2] Allows ordinary AVC to be used, and r.f. gain at normal setting. In addition to allowing use of the Sacred S-Meter, it also improves signal/noise ratio, for reasons which have been described recently in these pages.

3] The receiver may be adjusted for optimum performance [Cross mod, selectivity, intelligibility] without affecting voice pitch. Anything that would increase the intelligibility of Ducktalk gets my hearty vote. I find the garbling properties of SSB distasteful, and scarcely adequate on even the best [sic] receiving equipment. Now, honestly, can you really tell what an SSB-only contact sounds like unless you meet him? From some of the stuff I have heard, you can have trouble separating the men from the girls. Heh.

4] This arrangement allows better use of the selectivity controls of the receiver, however that selectivity may be generated.

5] Carrier injection amplitude can be adjusted for optimum desired-signal level, particularly when interference comes from AM signals. Here is a clear case of the superiority of this system even when compared to product-detected internal BFO's of fixed amplitude. Of course, you could insert an amplitude control in the internal BFO -- How about someone trying that and letting us know?

6] This method can be used without altering the receiver.

More Comments:

A[I don't think much of the argument " don't modify the commercial receiver because it will lose trade-in value," for reasons which will be obvious to all true experimenters here and abroad. This leaves you free to install 'the Receiver Deceiver' directly in or on the Black Box, for better mechanical arrangement -- and electrical too: there may be some advantage to experimenting with mixing the signal directly in the r.f. stage, perhaps in the cathode/source?

B] It is worth trying this method temporarily, even on receivers supposedly 'adequate' for SSB reception. You need only a Signal Generator; results may surprise you.

C] To generate a really stable signal, you will find it of advantage, though more complicated, to generate the main signal with a crystal-controlled oscillator, say at 6500kc, and beating it in a local mixer, using the VFO to tune say, 500kc upwards, to cover the 40M band. This also allows multiband operation with the same degree of stability, simply by changing crystals.

Needless to say, the use of a VFO covering the commercial Broadcast Band will require the abovementioned antenna isolation from the oscillator, and good overall shielding. But of course this is only good technique in any event, and it does not hurt to be forced into it.

A V.X.O. for S.F.I.

A recent article describes a variation of this technique:

" SSB Reception with Signal Frequency Injection," by L. Walrod, VE7BRK, CQ, August 1968, p. 64-65.

VE7BRK uses a Variable Frequency Crystal Oscillator [VXO], transistorised, of conventional design [e.g. see EEB, November 1967], working into an emitter follower, with output controlled by varying the supply voltage of the whole lot; not a word about interactions, presumably because of the greater stability of the crystal osc compared to VFO.

Signal is also injected directly into the antenna, and my comment remains about the desirability of isolating it from the surrounding countryside. Similar advantages are claimed: improved stability for modest communication receivers, and much less 'control juggling' in the others, in the effort to grasp the elusive signal. Harmonics are available from the VSO, to the 8th, and of course the range of frequency variation will increase with each harmonic.

Circuit Diagrams

EEB readers who clamour for more 'constructional' articles have again been disappointed by us. All of the techniques and circuits discussed here are available from various periodical or standard texts; more references are included below. I see scant reason to clutter up our pages with circuits which repeat those available elsewhere, at least unless there is some pregnant reason for it.

References, with comments, of course.

In addition to those mentioned in this article, the following items [1-8] might be useful for designing or building good stable VFO's:

1] 'Practical designs for High Stability Variable Frequency Oscillators,' by P. Harris, G3GFN, RSGB Bulletin, Feb. 1964, p. 89; March 1964, p. 156. Involving the Vackar Oscillator, a design which has also been described manytimes in 'Technical Topics' by G3VA, and has been quite popular in Europe. It has been largely ignored in the American literature, with the exception of a brief mention in the ARRL Handbook several years ago [but not subsequently], and a brief one in QST a few years ago, but with a rebirth in:

2] 'Stable Transistor VFO's' by J. Fisk, W1 DTY, Ham Radio, June 1968, p. 14. Jim describes the very stable Vackar and Seiler configurations, transistorised. It appears also in the July article by K2ZSQ in the same magazine [p. 10], and again:

3] 'New Life for an Old Circuit,' by D. Thorpe, 73, Oct. 1968, p. 40. Thorpe says "The Vackar circuit for some unknown reason has not received much attention in ham radio publications, so it is hoped that this reintroduction of the Vackar configuration to the ham radio ranks will breathe new life into an old circuit that has much to offer." Huh, you think you're the first?? And I'll bet the RSGB Bulletin would be surprised to find out that it isn't a ham publication. Here's more:

4] 'The Stability of Transistor Variable Frequency Oscillators,' by A.D. Mac Donald, RSGB Bulletin, Sept. 1967, p. 578.

5] 'Oscillator Topics' and 'Receiver Topics' too, in Technical Topics or Amateur Radio Techniques, by J. Pat Hawker, G3VA [RSGB]. See last month's EEB for Review.

6] 'Oscillators' in Military Standardization Handbook, Selected Semiconductor Circuits,

[actually the same as volume edited by S. Schwartz/ Wiley], Ch. 5.

7] 'Stability in the VFO' by J. W. Campbell Jr. [The science-fiction editor!]; and 'Transistorised VFO' by W. M. Scherer, in the CQ Anthology, Vol. II. Somewhat dated now, but main points still valid. Stable construction is always important.

8] '6 Meter Exciter' by K. W. Robbins, W1KNI, 73, Sept 1968, p. 52. Describes a heterodyne VFO. Also several nice refs to heterodyne VFO's, transistors or FET's.

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And the following references for oscillators in general, receiver techniques, and various selectivity methods, etc; all very useful:

9] Ten articles on Receivers, in 73, October 1968. Quite interesting, showing a growing realisation of the necessity for linearity in front-ends, although there is only one oblique mention of the necessity for limiting impulse noise well before it gets to the detector. See particularly:

a] 'A Collection of Thoughts on Receiver Design,' by C. Klinert, p. 6. Use of the Beam Deflection Mixer, mechanical filter, and audio-derived AGC.

b] 'More on Receiver Blocking,' by E. H. Conklin, p. 72. Relatively uninteresting problems with commercial transceivers, but useful comment noting that maximum sig/noise not necessarily when r.f. stage alighment is tuned for max signal, nor when the valve is used which gives highest gain. He recommends the 6FV6, but our 6BY7 or 6EH7 is likely better because of more remote cutoff; see EEB, June, July 1968; this issue p. 128.

c] 'Improving Frequency Stability in Older Receivers,' by A. Wilson, p. 94. Put a zener on the oscillator heater fed from rectifier off of the filament winding.

d] Plus several FET Front-ends, but these generally have higher noise figures than the one by Hepburn and Nisbet in the July 1968 Amateur Radio. See also our comment on Nisbet's letter, p. 108 of last month's EEB.

10] Receivers, by J. Kyle [73 publ.]. Dated, but interesting general review of receiver techniques, some of them quite ingenious. Excellent background reading.

11] New Sideband Handbook, by Don Stoner, W6TNS [CQ], Ch. 3: The Filter System, Ch.5: DSB, Ch. 7: Receiving Sideband. P. 172: Front End Carrier Insertion. P. 175: Signal Slicer. P. 177: Filter Slicer, etc etc. Note also: P. 203: "A Driftless VFO"!

12] Single Sideband [ARRL]: Similar to the Stoner [CQ] Handbook, with variations.

13] G.E. Ham News Sideband Handbook: Very good, but alas out of print.

14] 'Single-sideband Filters,' by F.H. Belt, Ham Radio, Aug. 1968, p. 40-47. An excellent description of the properties and perogatives of crystal lattice vs. mechanical filters. See also:

'A Survey of Crystal and Mechanical Filters' by P. G. Martin, Radio Communication Aug 1968, p. 514. Conclusion: "The more one is prepared to pay for a filter, the better it will be." Beware bargain mechanical filters. He shows why.

15] 'Crystal Filter Lattice for a Communications Receiver' using Disposals crystals, and 'A Mechanical Filter for the Communications Receiver,' P. 103-5 of The Transistor Radio Handbook, by Stoner and Earnshaw [Editors and Engineers].

16] 400 Ideas for Design [from 'Electronic Design' Magazine], published by Hayden Book Co., N.Y. [about $US9 from FAA Bookshop, Oklahoma as described in these pages]:
P. 16: Selective Amplifier uses Bridged-T Control [and two transistors.
P. 30: Transistor transmitter has high level DSB Modulation.
P. 128: Forward Biased Diode Gives Protection for Crystal Filters.
P. 129: Novel Notch Filter is easy to tune for null. See also: 'Electronic Design,' Feb 1968: 'Improved untuned crystal oscillator' with two transistors, reviewed in 'Technical Topics' of Radio Communication, June 1968. Also EEB soon.

17] Electronics Circuits Handbook, Vol. II, by T. Kneitel [CQ]; T-Notch Filters, p.39. Vol. I: Sharp L-C BandPass Audio Filter, p. 95; Crystal Lattice Selectivity Filter, Q-Multiplier, etc, p. 96. See also EEB, May, June 1968 abt Q-Multipliers.

18] 'Parallel-T Network Design' by Jim Kyle, 73, Sept. 1968, p. 30. Also similar article in CQ, May 1968.

19] 'CW Selectivity for the SSB Receiver,' by B. J. Kirkwood, ZL4OK, Break-In, Oct. 1968, p. 284. Just put an ordinary crystal in series with the i.f., after a cathode follower!

20] Plus much more of same, and sometimes better, in the various standard Handbooks and Manuals published by RSGB, Editors and Engineers, ARRL, G.E., R.C.A., Motorola, Sams, Ryder, etc!

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LETTERS

Improving Receivers, etc.

Was surprised to see one of those integrated circuit gadgets in EEB. Don't get me wrong. I approve highly, and must compliment K6KA on his presentation.

Also noted your comment about the YL's photograph on the cover of our august magazine, QST. Not the first time old boy -- I thought there was a gal on the cover during the war, and I was right -- it happened several times. But even more interesting, there was a gal's picture on an even earlier number -- September 1939! Her name is lost forever, just listed as assistant op to W1DQ, but shot is most certainly bordering on cheesecake, short-shorts and all...

I've been following your discussion of receiver front ends with interest, and don't know if you've received the November issue of QST yet [[no -- RLG]], but there's an interesting approach to this problem with a double-balanced mixer [c.f. Ham Radio, March 1968] in the front end with an oscillator and simple audio amplifier. The double balanced mixer is used as a product detector with conversion directly from the antenna circuit to audio. Author claims good stability and sensitivity, mentions selectivity not the best [as to be expected] but doesn't mention cross modulation. I suspect that it should be quite low. Anyway, it's a simple approach that deserves more investigation.

-- J. Fisk, W1DTY, Greenville, N.H.

[[You weren't any more surprised than we were about IC's in these august pages -- and yet more is at hand from K6KA. Sometimes I wonder about that old saying that principles are like swords: you can do anything you like with them except sit on them.

K6KA Visits Australasia --RLG]]

Subject to possible cancellations, my wife and I will visit the South Pacific area starting February 15th. Hotels listed 'or comparable.' Here is the schedule for the first of the trips for which we have paid:

Arrive Sydney 1055 UTA from Papeete Saturday 22 Feb, Hotal Chevron or Menzies.
Sydney to Canberra Wednesday 26 Feb., Canberra Rex.
Canberra to Melbourne Friday 28 Feb, Southern Cross. Visits probably in the hands of VK3AKB and VK3TE. Melbourne to Christchurch Monday 3 March.

Not much going on here now except for Intruder Watch Work... May be in the CQ DX CW Contest this week end to observe what effect the new incentive subbands have -- my guess is that DX stations after running dry in the incentive subbands will move on up into the unrestricted subbands.

It seems that my counter does not vacillate by a count of one, because I don't use a Schmitt trigger ahead of it.. I still use the counter a bit for frequency meas. Good to identify BBC from other intruders on 7Mc!...

-- E.H. ['Bill'] Conklin, K6KA, La Canada, Calif.

ADVERTISING

Personal advertisements free if less than about five lines. Commercial adverts 10c per line, $1.50 half page, $2.00 full page; can be spread over several issues if desired. We reserve the right to edit copy as appropriate. We assume no responsibility for merchandise bought or sold through our advertisements, but we would very much appreciate it if you told advertisers where you saw their advertisement.

We had quite a large number of choice personal advertisements here last month, and we do recommend that you look at them again at this time.

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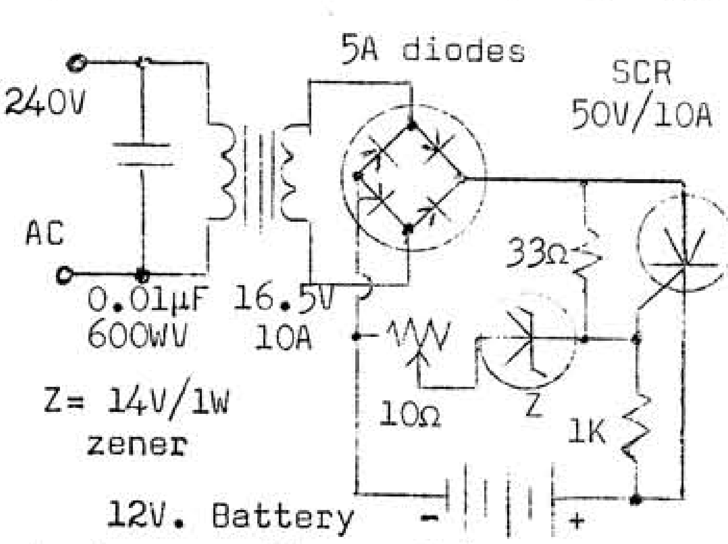
SCR CONTROLLED BATTERY CHARGER -- D. Horgan [VK4]

In most cases the usual approach to the controlled charging of a battery for use with electronic equipment follows along the lines of a voltage regulated power supply which is current limited. The current limitation is important to avoid destruction of the equipment when the load is high during initial charging, and voltage regulation is necessary to bring the battery up to the final desired voltage.

An SCR and zener combination can be arranged simply to perform this function reasonably well. A 14V zener is connected between gate and negative side of the battery, as shown in the diagram. The battery itself is connected to the cathode of the SCR. When the battery charges up to the zener voltage, the triggering action of the pulsating d.c. from the bridge rectifier [and NO filter] promptly ceases. Maximum current is limited, because the 33Ω gate resistor limits the maximum gate current, therefore cathode current. The value of this resistor could be adjusted to give other maximum currents, depending on SCR, etc.



Some increase of the final voltage is possible if the zener point is padded a bit by using some series resistance with the diode. This virtually rounds off the zener turnover point, as well as allowing adjustment of the exact maximum charge voltage. This resistor should, however, be not too high resistance, or the precision of terminal voltage regulation will be lost. [[Ed. Note: A half-wave power rectifier could be used instead of the bridge, if Xfr rating were a bit higher. Other battery charging methods are also described in the G.E. SCR Manual, and in tr ckt books]]

SOME SCR TECHNICAL NOTES: -- RLG

These are 'some' SCR Notes, because the rest are either in the A.E. Diode Technical Notes [of which you ought to have a copy], or in my file of articles awaiting publication in the EEB. Never mind, a little is better than none.

There is no point in going into the function of SCR's here; that has been done with much clarity and thoroughness in the references given in the current A.E. Catalogue, and in the Diode Notes. I might mention in regard to the gate current sensitivity curve given in the Catalogue for the 10μA [max] I_g units, the value shown is an average of several SCR's tested, and actual response can be somewhat different. The shape of the curve at the top will also depend on anode voltage, load, gate voltage supply, and circuit impedances. When conduction does start, gate current appears to reverse direction; remember that when the gate is fed from an a.c. source there MUST be a diode in series with the gate.

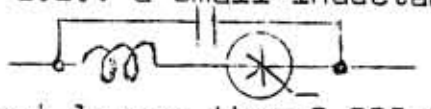
Be sure to use a resistor [not larger than 56K] between gate and cathode, to ensure reliability of control. The high-sensitivity SCR's are so sensitive that they can often be triggered by their own anode-gate leakage current [if the resistor is not used] !

While I am discussing triggering, I should like to point out a grievous error on P. 23 of the G.E. SCR & Transistor Hobby Manual. When an SCR is fed from a d.c. source [anode to cathode], it can be triggered by a positive impulse at the gate, but when the trigger is removed, the SCR will continue to conduct unless the anode voltage falls low enough to make I_a fall below the Holding Current. Thus, when you take the gate lead off of the anode, the lamp will continue to glow, until you disconnect the anode supply battery; G.E. ought to have known better, and indeed they say as much on the previous two pages. Otherwise the book is very good indeed. Except that every time they use a Unijunction Transistor, keep in mind that if a UJT is not readily available, a PUJT or "Regenerative Switch" will serve admirably, as used frequently in the RCA SCR Hobby Manual.

To ensure reliability as protection from transient overvoltages, put a condenser across the a.c. input. For HT, 0.01μF, for LT 0.1μF; if no transformer is used, these values can be increased tenfold.

The 0.8A SCR's will get hot with 0.8A, therefore need good air circulation for maximum current [American rating 1.5 Amps!], or a simple metal strap to hold them down to a piece of metal. The higher current ratings need an appropriate heat sink, silicon grease, etc. At least two square inches [total] per watt to be dissipated, assuming a forward voltage drop [anode-cathode] of about 1.5V at maximum current.

The forward current rating of SCR's should, as with diodes, be derated 25% if operated into a capacitative load, but in the case of SCR's this is less likely as an application, because of the considerable difficulty of gate control when load is capacitative; there are elaborate methods, described in the Manuals [e.g. in Sams' Regulated Power Supplies, and in various circuits handbooks] for effecting such control. On the other hand, if you do want controlled HT d.c. output, you can achieve it with a relatively simple system if you can sacrifice supply impedance: a largish resistor can be placed between cathode and the filter condenser; the SCR then thinks it is working into a resistive load.

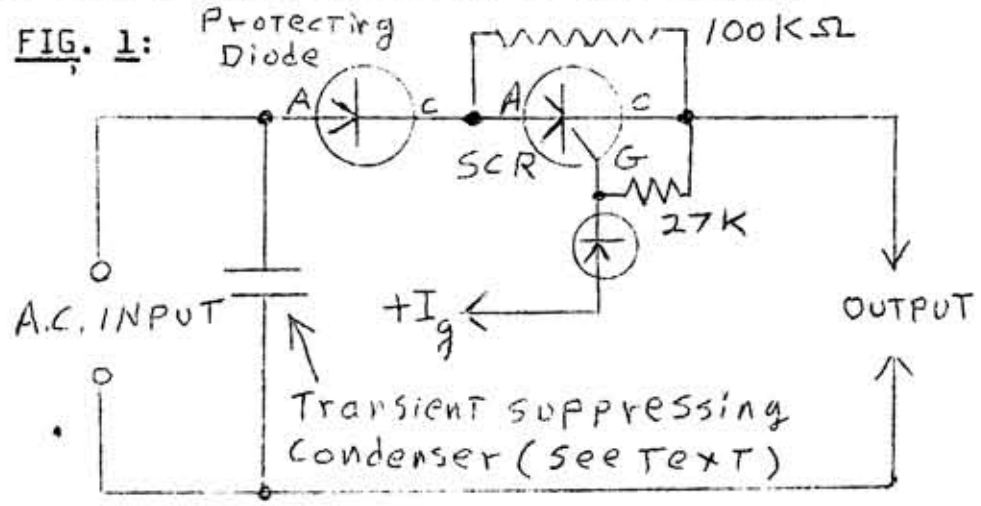
If an SCR-controlled system produces radio noise, and most of them do, the ONLY cure is the one proposed by G.E.: a small inductance in series with the anode, and a small condenser around the two:  The inductance can be a dozen or two turns around any convenient piece of ferrite; the condenser can be 0.001, but definitely not larger than 0.005uF. If, in attempting to get rid of the noise, you put the condenser directly across the SCR, or if you put it across the output [at the cathode], you are courting disaster, I guarantee it. In the latter instance, one must not forget that an SCR behaves like an ordinary diode rectifier in many respects: If you run a diode as a half wave rectifier, twice as much PIV will appear across it if it is loaded by a condenser, as compared to a pure resistance load. The implications are obvious.

JUST ARRIVED AT A.E.: BASIC ELECTRICITY, U.S. Govt Publication, 448pg, 7-1/2x10" , full of the same excellent style as 'Basic Electronics'. A clear but authoritative presentation of basic RCL circuit theory and practice for half the book, plus many details on generators, motors, transformers, servos, safety, etc. With many drawings and diagrams. A beaut, for $3.90 including extortionate post -- its heavy. W.A. can add 10c.

Voltage Safety Factors:

For SCR's in general, you need a PIV [reverse] safety factor of about 2-fold, but the forward breakover [or 'blocking'] voltage need only have a safety factor of about 1.2-fold or so [i.e., 20%]. A.E. rates SCR's according to PIV or V_{bo}, whichever is the lower. This can work to your advantage. If PIV turns out to be higher, this will increase your PIV safety factor. If V_{bo} is higher, you could use the SCR with a higher peak input voltage if the PIV of the SCR were protected by a series diode, e.g., according to this scheme: Sometimes this relationship can also save money. If you can obtain a 400V SCR, the V_{bo} will be amply above the 330V peak of the Mains, and the PIV can be protected by the use of a series diode [as at the right, here] of PIV 600V or more, and of course the same or better current rating than the SCR.

FIG. 1:



In the case of commercial SCR's [which are now becoming quite easy to obtain in Australia, e.g. Cannon Electric, G.E., and the others], it always pays to test the PIV and V_{bo} yourself, because the chances are good that one or the other will be higher than specified, with obvious advantages in design and application. Methods for doing this have been described in the EEB, but briefly, you can test PIV of an SCR exactly as you would for any diode, if gate is shorted to cathode: Apply reverse voltage gradually until current starts to go up sharply, but it is imperative that the current be limited to some low value by a series resistor [e.g.≤100uA]. For testing V_{bo}, the polarity of the test voltage is reversed, still with gate shorted to cathode, and this now-forward voltage is increased until the SCR conducts suddenly. Obviously the forward current must be limited in this instance too, consistent with the forward current rating of the device. Actually, the forward current will not increase in a perfect step-function, but will rise slowly to perhaps several mA before it takes off in a rush.

SCR's in series: [e.g. use two 300V SCR's in series for 240V RMS mains operation]

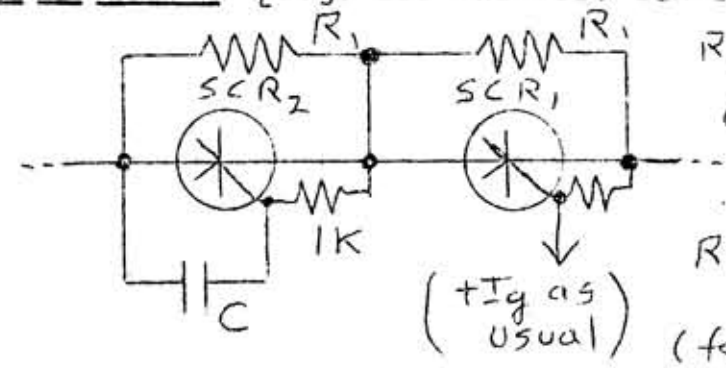


FIG. 2

R_1 = 100K 1W (for example)

R_2 = 20Ω or so (for small SCR's)

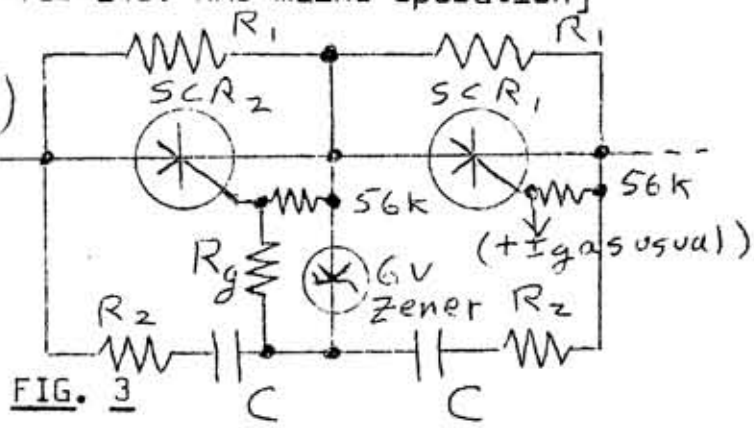


FIG. 3

Although the book doesn't really condone it, we have found that 'slave' triggering of SCR_2 can be achieved by the use of the circuit of Fig. 2. C is chosen for the minimum value which will trigger reliably, usually 0.005 to 0.05μF. The operation is simply that when SCR_1 is triggered, it places SCR_2 directly across the supply, and the sharp pulse of current flowing through C triggers the slave SCR_2. The more elaborate system of Fig. 3 is taken mostly from the big G.E. SCR Manual [4th Edition, p. 120], and is certainly superior in regard to reliability and safety of SCR ratings, if that matters. I_g = gate current to trigger. If I_g = 1mA, R_g = 1K or so. If $I_g \leq$ 10uA, R_g = 47K to 100K. C should be the same on each side, and should be chosen for the minimum value which will trigger both SCR's reliably. It will be between 0.05μF and0.5μF if I read their equations correctly, but the experimental determination of C would be the best method. It will take less time than to figure out how to make sense out of the equations. Exact values of R_1 not critical, but must be equal for equal PIV ratings; otherwise, values of R_1 are proportional to SCR PIV's.

THE Australian EEB. Vol IV [1968]. TABLE OF CONTENTS [*Small discussions, letters]

The Australian EEB: INDEX FOR VOL IV [1968]

Brackets indicate the month in which a given item appeared.*

[* There is a bit of ambiguity in the designation of a few items, because this Index is being prepared in November; the Secretary is doing the current month's issue, and next months consists of a great pile of papers on this table, surely not all of which will fit into a single issue. EEB Staggers On.]

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[[Please send EEB Subs to EEB, Coryra Subs to Coryra; we're completely separate]]
[Sorry for the light print on obverse; we are experimenting with stencil methods --Ed.]

Promotion

Remember: -- our offer for free subs for new subscribers [September] no longer applies. From the generous response to this offer, it seems that there exists a wealth of admiration and goodwill for EEB which we happened to tap -- hi.

We'd like still more subscribers, thank you. Maybe you could perhaps show a copy of EEB to your radio club, friends, or young enthusiasts? The young enthusiasts may not always dig all this stuff about signal/noise ratios and transients, but they will hear about Coryra in our pages [e.g. P. 138], and will be grateful. By the way, the November 1968 issue of Coryra contains as good a circuit as one might wish for a 'Deluxe Transistor Tester' [c.f. last month my comment about transistor testers], and it is most unusual in that it tests not only gain, but voltage rating as well. My only criticism is that it ought to have a separate switch gang allowing more convenient selection of the different kinds of BV for transistors [See EEB, Aug,Sept 1967]

If you ever happen to receive an extra copy of EEB perhaps you might be so good as to pass it on to a potential subscriber? Thank you.

Vol IV

After the holidays Mrs. Nichols or her lovely daughter will put together the copies for 1968, and glue them into a nice cover. We should, therefore, appreciate it if you would order now any 1968 separate back issues, so that we can clear up our files. All back issues ordered to Dec. 1st have been sent out; if you have not received yours, please let us know.

The Index and Annual Contents [P.141-142] were made up last month; could you please add to them anything appearing in this issue, if not listed therein?

Break-In

Some months ago we took in a number of subscriptions for this fine New Zealand mag. If anyone [except P.G.] has not received his, please contact Mr. G. Walker, Gen.Sec., N.Z.A.R.T., P.O. Box 1459, Christchurch, N.Z., and please send us a carbon copy. I know full well how difficult it is to keep subscription lists in order!

Promises

An interesting conversation was heard on the air. One of our supporters was extolling the virtues of EEB, but the chap at the other end said he had stopped his sub, because the Editor promised articles which never materialised. Now I can think of several reasons for shunning EEB, but that seems the least likely! It is true that I have not always followed through on promises [?], but perhaps that is because something else came up which caught our interest. But the notes are in my bulging files, and the article will [probably] appear sooner or later, so what?

In 1968 we have had practical articles on Automobile Voltage Regulators, Dummy Load/RF Wattmeter, Modulated Light Communication, Q-Multipliers, SSB Exciter, and several useful applications of SCR's, etc. And we have had technical discussions on a wide variety of subjects as you can see on P. 141-142 here, including a reportedly popular series on the design of effective receiver r.f. and mixer stages.

What more? The EEB is neither a textbook nor a construction manual. It is a simple and ingenuous romp through technology, and sometimes a bit more. It is often highly disorganised, and frequently late. So what? In a world of compulsive propiety it is, I believe, somewhat unique, and if you like its general approach, that is all that matters. If you do, please resubscribe promptly when the renewal notice comes.

Readers who renew promptly in December will receive our bonus Frapnuary issue, which will [probably!] contain [oh wonders] practical designs for transistorised Tx's, a review of the fabulous RSGB Radio Data Reference Book, information on diode protection, thermistor linearity, heat sinks, and a curious Antenna Feedline Paradox.

EEB Stumbles into 1969!

We have solved the problem of renewal notices sent to parties not deserving it, by adding the year of renewal to the Plate when relevant. And we appear to have picked up all omitted address entries which got dropped somewhat in the changeover to Addressograph. We are still simplifying addressing and back-issue methods, and are learning as we go. Certainly the Addressograph System makes it all much easier, and the local Addressograph people have been most cooperative. Unfortunately, it has turned out to be not quite so simple, and editors of sister publications will be interested in the tale which will unfold in next month's Editorial. Bah.

Next month's Editorial will also mention a very clever and useful idea we heard from Auto-Call, for using typed CW as an aid to communication for blind people.

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The contributions of numerous correspondents are herewith gratefully acknowledged,

BOUND VOLUMES [1967 now, 1968 in early 1969]: $A2.00, $US2.50, Stg.1.0.0*. Printed covers for Bound Volumes available separately for 40c; specify year required. Everything post 'free'. Sorry about higher prices, but post has increased -- again.

THE EEB is a thoroughly informal electronics experimenters bulletin, published six times per year, beginning with February, but we reserve the right to publish more issues if we feel like it. EEB attempts to explore matters of general and specific technical interest, with comments. The emphasis appears to be primarily on semiconductors, but anything interesting on valves [or other] is also welcome. The EEB is for everyone's enjoyment [maybe]; if you have a technical fact or opinion, this is your opportunity to tell it to others.

* New Zealanders please send New Zealand Postal Money Orders made out for $A, to be drawn at Hobart, Tasmania, made out to Australian EEB. U.K. or U.S. send personal cheques; they will be returned eventually to country of origin for various purchases.