THE AUSTRALIAN EEB

30c. PER COPY.

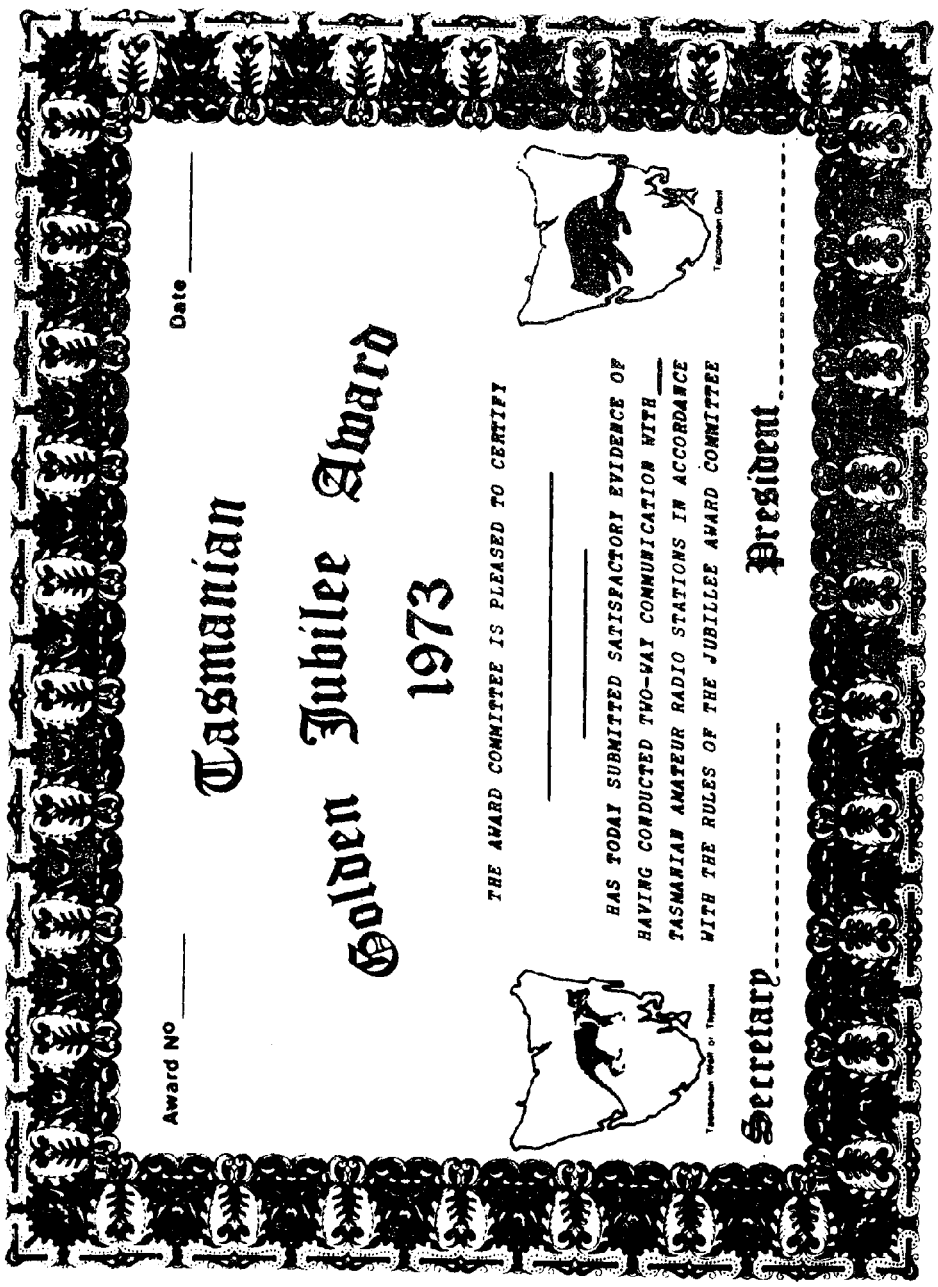
For Subscriptions, etc., see back page.

P.O. BOX 177
SANDY BAY,
TASMANIA 7005
AUSTRALIA

→ Underground Electronics

AN INFORMAL ELECTRONICS EXPERIMENTERS BULLETIN

FEBRUARY 1973 Vol. 9, No. 1 P. 1



CONTENT:

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"APRIL" ISSUE:

Semiconductor Testing -- I.
Digital Instruments in detail; the start of a very nice new series.
Better bitter beer.
VFO's, Stroboscope, P/S, etcetera!

AN AUTOMOTIVE EXHAUST GAS ANALYSER -- Part II

-- by Peter Ward (VK2), with a Squaretable Discussion with the Editors

Extra Notes on Part I (Dec 72 EEB) (PW):

Here are a few extra points to add:

1) Whilst I did not labour the need for the electronic expanded scale version, because it detracted from the simplicity and low cost of the system, it is miles ahead of a simple meter-thermocouple. See fig. 3 of Part I (p. 132). Of course that circuit won't balance unless the thermocouple is in the circuit.

2) A thought re the meter amplifier: A µL914 IC would be a good unit as the basis but I have not one to hand to try.

3) The plain system as a pyrometer is admittedly primitive, sufficient to find the EGT peak, but not stable enough to ensure repeatability at EGT - 60°C. You may have some ideas on this.

4) An adjustable main jet is shown in fig. 4 here below. This is the system I use for the Stromberg carby. The existing main jet is left in position. Do not alter its size.

Should Jets be Adjusted?

RAJR: Other people have also attempted to construct their own adjustable jets. But this is a dubious practice, because the design of satisfactory jetsis a complex and critical art. It is NOT recommended when commercial jets are available.

PAW: Not necessarily. It's the final mixture that counts, not the construction. Your E.G.T. will tell you!

RLG: Fact remains that Rod's caution still applies to a technology as sophisticated as this one. Peter may know what he is doing, but others had best not muck about unless they jolly well know what they are doing -- or be prepared to suffer possible financial and other inconveniences. This is not to say that it cannot be done, but it must be only done by the highly skilled.

PW: I fully realise that many carbies could not be adapted (assuming, of course that the necessary skill is at hand), but considering that Stromberg, S.U. and Solex make up such a high proportion of those around, the project is practical. At any rate it is for competent enthusiasts only. You are certainly right in considering it impossible to pull the carby down to try different size main jets ((this was in reply to other correspondence to him from Rod -- RLG)). I put a lot of time into developing the idea because I was building a fuel injection set up and needed some form of analyser to get mixtures correct; needless to say the fuel inj. is still on paper!

The fact seems to be that to produce a fuel injector that would be of any benefit over existing carby setups, for road use is only a dream. The answer possibly lies in a go at a Bosch electronic type, using their injectors and homw-brew electronics! What I really want now is a supercharger!

To return to the point, I set my Holden and Landrover to run at EGT peak less 30°C at normal no-load cruising speeds. At greater loads the Stromberg Holden carby appears to compensate well, EGT staying below the peak.

RR: Sad to say I can't install the EGT probe on my 383 CID Didge Hard-Top because drilling the steel manifold would be catastrophic. Furthermore it uses a vacuum-controlled twin variable metering system well inside the carby and I have not yet worked out a way to control power mixture on the run! Any ideas?

PW: If you cannot drill the manifold of the Dodge, perhaps you could lay the thermocouple wires in the silbestos exhaust gasket (split with a razor blade). If the Dodge has Carter WCFB 4BBL I have no idea how you could ever get at those metering rods. Perhaps an air bleed?

RR: The carby is a dual Chrysler/Ball and Ball 1-3/4" BBD unit. But I suppose there is no point in bothering, because the Dodge carby adjusts itself according to design criteria. If 7 litres produces 24 mpg it can't be too bad. NB: The valves don't burn.

RG: My VW has a fixed main jet. It would appear that this is not readily adjustable. Anyone have any ideas?

RR: In awkward cases it's probably not worth mucking about -- as in the case of my Dodge.

RG: Isn't the VW an automobile?
RR: Barely.

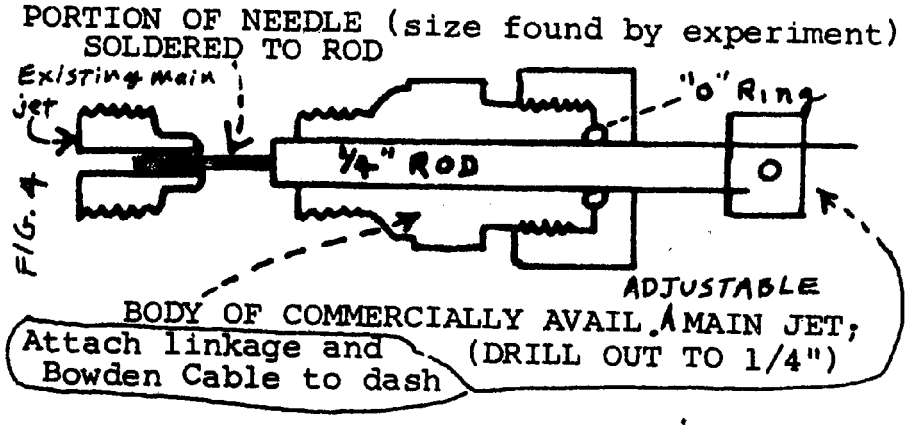

FIG. 4

PW: Do you realise the horrible compromise dreamed up by VW "Engineers" to "overcome" the problem of the cylinder shouded by the oil cooler (running 90-100°C higher than the others). One distributor lobe is 3-4° retarded to help the situation. Otherwise it would possibly run 200°C higher! (These figures come from my head, but I'm sure thats about what I read). The carby is jetted rich too.

The more you read about cars the more you realise what a compromise everything is. For instance for my Holden I get a knot in the stomach everytime I think of the problem of mixture distribution and charge balance in an engine firing 1-5-3-6-4-2 breathing through a 3-port head! ((Peter supplied a chart to illustrate the prob.))

RG: Oh well, the VW has its points; not every car can sound like an unstuck sewing machine with a bad bearing! I suppose I should be content simply with a CD Ignition and Vacuum Gauge. I know that when I had a Transistorised Ignition it helped mileage, though it idled roughly.

Capacitor-Discharge Ignitions?

PW: You might not be too sure about the CDI part.. I have just built my third Capacitor Discharge Ignition unit, and have discovered all at once the problems that can be associated with it: Converter not starting reliably, SCR "latching", excessive voltage drop at high RPM. Perhaps I was just lucky with other units!

RR: Perhaps so. Mine also worked for some while, but finally I had to tear it out. Other people have also had CDI problems, as discussed a little while ago in Electronics Australia. It would seem to be a case of going back to the good old Transistorised Ignition -- BUT with good transistors and proper ferrite coils -- doubtless the reason why Leo's TrIgn system idled roughly, etcetera.

RG: Isn't there anything reasonable I can do to improve me ppoore olde beetle?

RR: You'll get more mileage from optimum running (as shown by vacuum gauge, as per Dec 71 EEB) than you will from fancy gadgets -- at least on your velocipede. EGT adjustment, for example, will work best for proper cars.

RG: You're just jealous.

RR: Ho ho.

PW: Ah well, I play with my common old 179/186 Holden. At least they are cheap to blow up -- or repair, depending on your point of view.

Ignition Timing -- I

RR: I suggested earlier, although somewhat indirectly, that the ignition timing could also be set using EGT. Although I have not tried this I would be interested to hear from anyone who tries this, maybe on the following lines:

Set mixture at peak EGT. Retard timing until there is a sharp rise in the EGT, then advance by a fixed amount to give the correct "One inch mercury (pressure) retard off maximum vacuum at idle" setting. Best of luck!

PW: I'm working on the use of the EGT to set up ignition timing, but there appear to be several complications...

RG: Why not just use the Vacuum Gauge method mentioned in the Dec 71 EEB?

RR: That method is designed to work for idle conditions only and relies on the correct operation of the distributor advance system and on the manufacturer's original design. On the other hand the EGT method should give more reliable results at speed under load.

PW: A rev-counter plus large-scale vac-gauge can be used to monitor horsepower changes under steady load conditions. It is ideal for monitoring changes in H.P. whilst tuning up -- Absolute dyno figures are expensive, and academic. This combination of instruments can also be used to set mixture and timing at any RPM.

Ignition Timing -- II

PW: Talking about Timing, in that Dec 71 EEB article (p. 120), Rod made mention of the use of a timing light with flywheel markings. I prefer, however, to go back to the time-honoured method of "advance until it just pings under full throttle, full load". For Holden this has proved itself, with no piston or valve burning, and is approximately 5 - 7° in advance of setting obtained by timing light (on my Holden, of course). I have also tried "powertiming" -- a setting in advance of even the "just pings" stage. The best auto textbook I ever came across ("MOTOR MANUALS", five or six volume set) suggested that a continual slight pinging was harmless.

RR: No. Ping is caused by impulsive explosion inside the piston and that is bad. It can cause premature damage. It puts extra strain on the actual piston top. The "Motor Manuals" to which you refer are probably quite old and refer to low compression with small bore motors.

Surely I wouldn't trust my 383 Dodge to any impulsive pinging, with its 88 cm^2 of piston top area, even though it is strengthened by internal girders. The normal force on the pistons is upwards of 2000kg!

RG: My VW pings a bit and it doesn't seem

to hurt.

RR: Its only got 77 mm pistons, and the detonation is probably caused by preignition from overheating; refer to Peter's comment above. Besides the motor's cheaper!

RG: All right all right, the VW's unsafe at any speed too, so wot, it runs and it's better than walking.

RR: Barely.

The Vacuum Gauge is Still Better

RG: Fact is that in that DEC 71 article, Rod added the comment after talking about the use of the ignition light method,:-

"Better, however, it is worthwhile fitting a vacuum gauge on the intake manifold (NOT on the vacuum line to the distributor!), adjusting the distributor position (i.e., timing) for maximum vacuum -- and then retarding the spark to decrease the vacuum by 1" Hg gauge. The same meter can also be used to set idling mixture accurately: adjust for maximum vacuum. AND the same vacuum gauge can be used to monitor engine performance and petrol economy; run to keep vacuum high. Obviously therefore, a vacuum gauge is far more useful machine than is a dwell meter."

And from all this discussion it would appear that it is also preferable to an EGT system for us ordinary non-engineering mortals.

Other Automotive Matters

PW: Please yourself. The latest probject at this end is a Fuel Consumption Meter -- a Flow Meter. With the electric fuel pump, idling produces about one "click" every second. The problemis to turn those clicks into a display to give relative fuel consumption. Quite a problem, but it may be a useful instrument if I can sort it out. The best I can think of just now is counting clicks in a 60 second sample period and display total, with a new total coming up every 60 seconds. Not good enough. Any ideas?

RG: Maybe install a rotating vane system in a glass jar in the fuel line. One of the vanes would have a magnetic strip at the periphery, and the other vanes would be suitably counterweighted by non-magnetic material. Just outside the jar would be a pickup sensitive to a varying magnetic field, triggering a flip-flop with integrated output fed to a meter at the dashboard. With some ICs hooked up to the odometer (miles recorder) and suitably electronically-blended with the fuel flow output you ought to be able to come up with a miles-per-gallon direct readout! I recall some discussion on this topic some time ago in EEB letters but so far no one has told us about a practical system. → Feb. 1972, p. 8.

PW: Hmmm.

A while ago I took a lot of trouble to port and polish (and have planed) several Holden "179" heads over the last few years and I know what a lot of difference it can make. I often feel that you can put too much polish on chambers etc. High shine is not necessary, as the boundary layer of air "sticks" anyway. The main thing is to take off obstructions to smooth air flow.

A real trap I have found is that with two stock production heads ("179") I compared, one had 0.10 more off than the other. Incredible! The reason would appear to be that the green castings warp, and each one is planed just enough to get a true surface. Thus some production heads are naturally hotter than others.

Lastly, I have got interested in the practical application of,

$$\frac{d_c}{d_h} = \frac{273 + T_h}{273 + T_c}$$

where d_c = cold air density, d_h for hot, and the temperatures are in absolute degrees, centig. In practical automotive terms it means that a high underbonnet air temperature is killing power (whether or not it has other advantages).

Take a situation where the underbonnet temp is 40°C, outside air temp 15°C. If you add a cold air intake to the carby,

$$d_c = \frac{273 + 40}{273 + 15} \; d_h = 1.09 \; d_h$$

We have gained a 9% increase in air density, and power increase will be the same -- and free. This is nothing new, of course but I had never considered the difference so large. Next time someone swears their car performs better at night I won't be at all skeptical.

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REFERENCES (Remainder cont. on p. 11)

E.G.T. Story, "Plane and Pilot", Mar 1969.
E.G.T., "Aviation", Plane/Pilot Annual 1970

And Advertising Brochures from the following firms contain usefulinformation, some of which we have used for our technical discussion:

Radair Inc: 8500 S. Perimeter Rd, Boeing Field, Seattle, Washington 98108, USA. (Aust. wholesale agents: Van Dusen Aircraft Supplies Ltd, 8-10 Halsey Rd, Niddrie, 3042

Alcor Aviation Inc: 5420 Bandera Rd, P.O. Box 28299, San Antonio, Texas 78228, USA (Aust. agents: Western Air Navigation Ltd,

THE KØNL DIGITAL FREQUENCY METER -- or: "Precision for Pennies" PART I

-- by R. V. Anderson (KØNL) and R. A. J. Reynolds (VK7ZAR)

Requirements

One of the requirements of any Amateur Radio station is that it has a frequency meter capable of measuring the frequency of any transmission. Accurate frequency measurement is also highly beneficial for receiving too, whether it be to monitor the other chap's signal, or for simple Short Wave Listening. Although the type of meter most used for these purposes is the heterodyne type, usually of the LM or BC221 style, these meters (when available) are quite pricey, and as most are of either WW2 or thereabouts vintage their accuracy may be questionable.

Heterodyne frequency meters have been the subject of home-brew efforts, but the mechanical problems as well as electrical ones almost always associated with stability, are immense. Modern requirements and modern technology have brought about many changes in the world of instrumentation, and one of these areas is the Digital Frequency Meter or "DFM". The DFM is a simple unit in its basics, being a counter operating at the input frequency which literally counts the number of cycles* that are fed into the instrument in a given time, and then displays this number on a readout; e.g. Nixie tubes, LEDs or whatever.

Now, commercial DFMs are rather high priced items as far as the average amateur is concerned, as the manufacturers are more aligned to the reliability and appearance requirements of industry. The basic building blocks are available, however, and there is no reason why the amateur fraternity should not make use of them to construct DFMs for what turns out to be a very low cost, provided that a few simple economies are observed. These we shall consider here.

A Low Cost Digital Frequency Meter

This series of articles will describe the construction of a DFM, with only one principal criterion, and that is minimum cost. The result is a counter which will count to a little over 20 MHz with an accuracy of the order of one Hertz. If the "junk box" is used for a few of the parts the project costs a little over $20 plus a few hours work. The unit may not be as pretty as some of the commercial units, but it is as functional: it will read frequency accurately, and display the result in a numerical form. Who wants more?

Before launching into a description of the construction of the unit, we shall describe its operation, developing the final circuit in several steps. But we invite any improvements which the builder will wish to include.

The Basic Unit

As suggested earlier, the basic description of the circuit is simple; it consists in its simplest form, of a counter and an input gating circuit operated by a one second pulse;see fig. 1. Such a DFM would work. Its operation would be as follows: Set the counter to zero, connect the input signal and apply a one-second pulse to the other input on the gate. At the conclusion of the count period, the number of cycles in the gating period (i.e. the number of cycles per second) would be displayed on the counter readout, whatever form this might be. Problems: to read to 20 MHz there would have to be 8 decade stages in the counter, and resetting the counter to zero each time would be a messy business.

* CYCLES? They're Hertz-seconds now, ! -- RLG

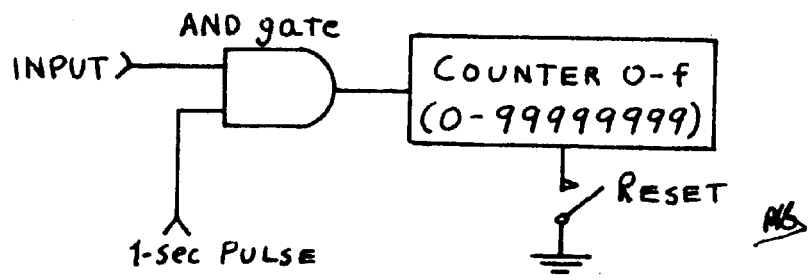

FIG. 1

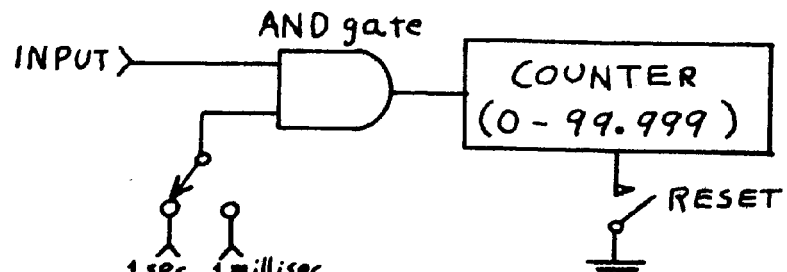

FIG. 2

Note that the signal required would be a very small one which could be obtained from the transmitter (to be discussed), or from the receiver. For the latter you could take it from the local oscillator and add (or subtract) the first i.f. frequency; the latter is accurately known from the crystal or mechanical filter. The situation with receivers can, however, get complicated; for full details see Ham Radio in early 1973.

The number of stages in the counter could be reduced if the count were conducted in two operations. Consider the frequency 12.345678 MHz. If the count period were 1/100,000 sec, the number of cycles counted would be 12345678/10000 = 1234 and a bit left over that would not be displayed. Hence the first four figures of the frequency could be read. Now if the gating period were the original one second, the whole 12345678 would be counted, but for interest the last four figures (5678) would be displayed in the same positions as the figures 1234 were in the 1/10000 sec count period. So, if the counter were equipped with a pulse or timebase generator having 2 counting outputs, then an 8 figure readout could be obtained using 4 decade counting ranges only. Taken to its limit, one decadeof counter is all that would be required if a timebase with counting periods of 1, 0.1, 0.01,... up to 0.0000001 seconds were used. Messy....

A Practical simplified Unit

The design which will be described employs 5 decade counting stages, and 2 timebase ranges of 1 second and 1 millisecond. This gives one-range readouts of the 12.345 MHz and 12.345 kHz type, or for a 12345678 count, a readout of 12.345 MHz and 45.678 kHz. This gives a 2-figure crossover check for very little more money. The block diagram now looks like fig. 2 (bottom of previous page).

This is still an awkward unit to operate, requiring manual resetting and pulsing. It is, however, not too difficult to do this automatically. Say that we replace the one-second pulse with a square wave of 1-sec on and 1-sec off, and coincident with the first count we pulse all the decade counters to zero in such a way that the first count is not lost. We would then have a counter which, left to itself, would count for one second, stop counting for the next second, but would display the previous second's count for that second, then cancel that count and start again. E.g., a frequency input of 12.345 kHz would show on the readout as a flickering display for one second, a steady display of 12345 for the next second then a flickering display and so on. This might sound messy, but it is quite easy to read and above all it is automatic. The MHz range is treated in a similar way in this project except that for each one-millisecond count period, a 1-sec hold and display period is used. The result on this range is that as the flicker periodis only one millisond, it is almost imperceptible and the display appears quite steady. See fig. 3.

Cleaning up Details

This, believe it or not is our final functional diagram. There are, however quite a few details to be cleaned up. The timebase must be generated with as high an accuracy as required, and for the readout limits of this instrument, an accuracy of one part in 10^8 would be nice, but not economically possible if the total outlay is to be anything like $20. As can be seen from fig. 4 (next page) the time base is controlled by a 1 MHz ceystal, which has a fine frequency control on it. An outside standard can be used to set this oscillator to almost any accuracy desired. For example, if the 20th harmonic of the 1 MHz osc is listened to on a receiver it will beat with the time and frequency standard WWV at 20 MHz. Adjustment of the fine control so that there is no more than one beat every second, and this is quite easy, will give an accuracy (for a short time anyway) of one part in 2×10^8. This may be monitored continuously if required. Lower reference frequencies will require longer beat periods for

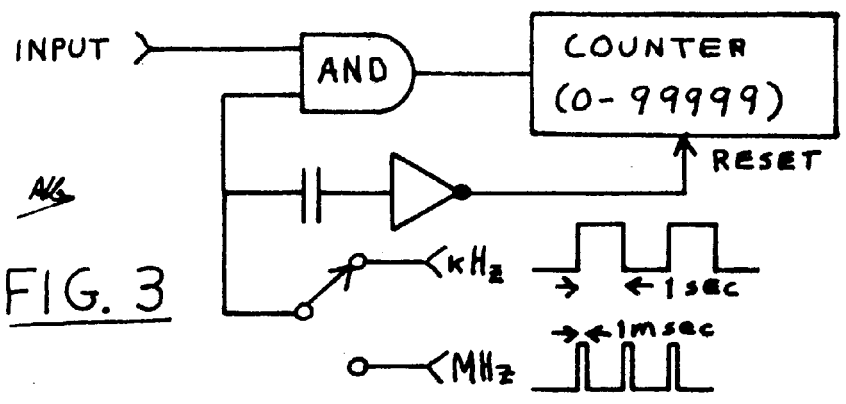

FIG. 3

the same timebase accuracy. Hence we have an accurate one-MHz signal which must now be used to derive the gating waveforms required. Whilst it may be possible to use the 1 MHz source to trigger 1 sec and 1msec generators, a better direct method is available at low cost.

In the field of integrated circuits there is a class known as Transistor-Transistor-Logic, or TTL which is useful at speeds up to 20 MHz at quite low cost; for example decade counters at about $1.50 through trade sources and 90c or so from disposals. Thus TTL would appear to be very suitable at this point in time, and from the point of view of power supplies and component interface, TTL is used throughout this project.

Back, then, to the timebase. The waveforms are generated by means of six 7490 decade counters in a divide-by-10 configuration. It can be seen that after three stages, our 1 µsec pulses (ie from the 1 MHz oscillator) have counted to 1 msec pulses, and after the six stages the output is 1 sec pulses. The 1 sec output is used to drive an RST flip-flop in the toggle mode to produce the 1-sec on, 1-sec off waveform for the kHz range, and the 1 msec waveform applied to the R terminal of the ff will produce the 1-msec on, 999-msec off waveform required for the MHz range. Remember that the off-time is immaterial, it being only a viewing time. The switching of 1 msec pulses through a mechanical switch has problems so an AND gate is used.

The counting unit consists of five of the 7490's with their binary coded decimal (BC) outputs wired to 7441 BCD to Nixie decoder drivers. At this point, latches to eliminate the flickering count could be installed but this is considered an unnecessary luxury. "AND" gates, which in the TTL system are amplifiers, are used in the timebase oscillator and input circuitry to produce a reasonable waveform to present to the counter chain.

PART II will cover:

What type of readout?
Extension to read up to 35 MHz.
Modification to read Xtal Freqs.
Modifications to the input circuit.
Extension to read up to 200 MHz!
Construction, etc.

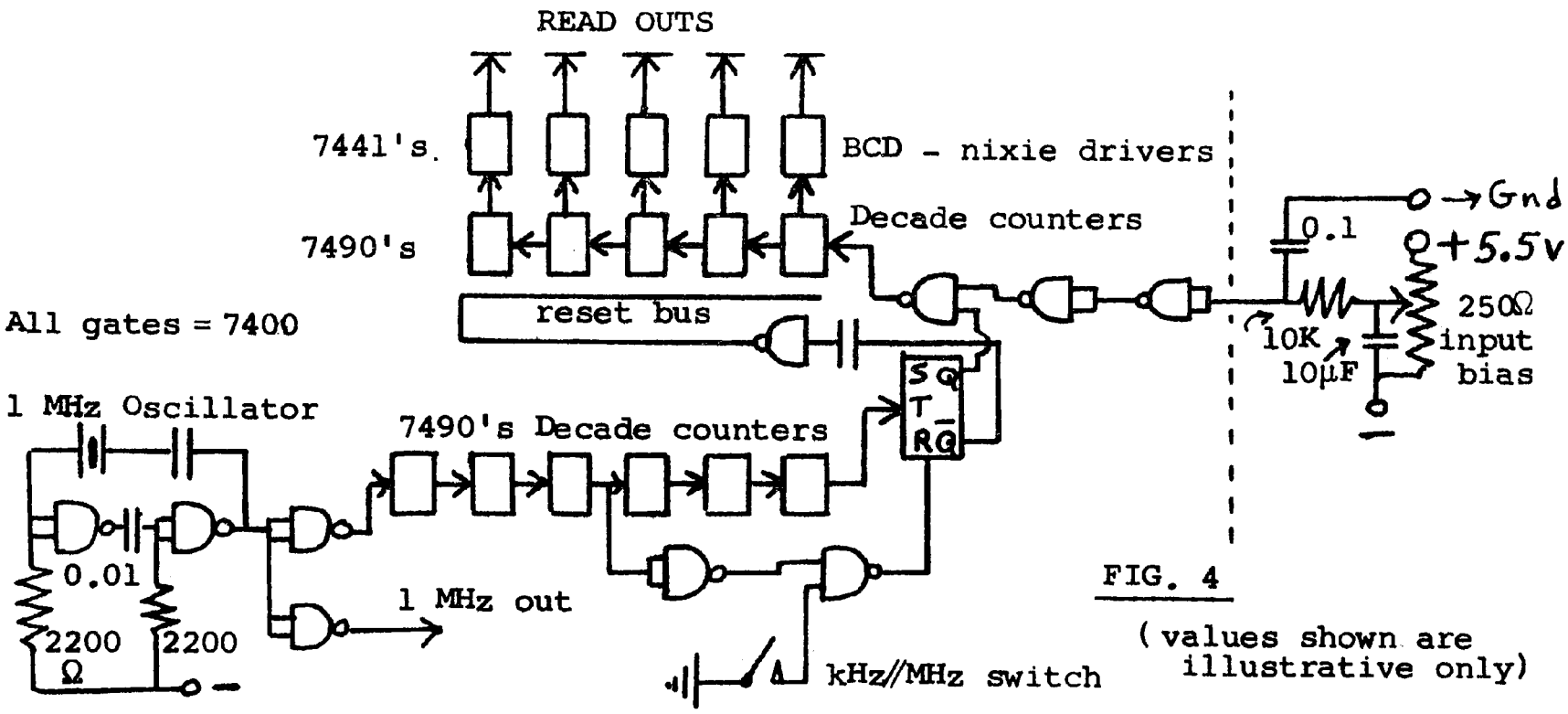

FIG. 4

(values shown are illustrative only)

Ed. Note: I'm having to do the draughting, so the above is traced from Author's copy. I hope there's something left of it after photoreduction!

FIXING THE DECIMAL POINT IN SLIDE RULE CALCULATIONS USING THE LOGARITHMIC CHARACTERISTIC METHOD -- by K. T. Andrew (VK2)

In April 1971 EEB published a Circular Slide Rule about which I commented in the December 1971 issue:

"Having gone to so much trouble, couldn't you do better than a 'rough calculation to know where to put the decimal point"?

to which the Editor replied,

"...?? How else does one use a sliderule?"

I have somewhat hesitantly reached the conclusion that this means that you know of no other (practical) method of determining the position of the decimal point in slide rule calculations so, at the risk of trying to 'teach my grandmother to suck eggs' I describe herewith details of the method using logarithmic characteristics which I have always used.

The "rough calculation" approach is often tedious and can itself be a source of error where a number of terms are involved, particularly if these are less than unity. The log characteristic method, on the other hand, is reliable, precise and easily mastered.

The system is based on simple logarithmic calculations, remembering that the rule is merely adding or subtracting the logarithmic mantissae during the multiplying or dividing operations.

If during a multiplying (adding) operation the product is read "down scale" from the multiplicand, this means that it has passed to the next higher power of 10, and a note must be made to adjust the decimal point accordingly. Similarly, if during a dividing (subtracting) operation, the quotient is read up-scale, the reverse applies.

Subject to these corrections, the logarithmic characteristics of the terms inthe calculation are algebraically summed to give the logarithmic characteristic of the answer, thus:-

Rules:

(1) Sum, algebraically, the logarithmic characteristics of the terms in numerator.

(2) Sum, algebraically, the logarithmic characteristics of the termsin the denom.

(3) Subtract (2) from (1) above.

(4) (An Indicating Cursor is most useful for this operation):

Determine correction factor based on movements of the slide during calculation on the rule, as follows:

(a) For multiplication where the result, or product, is read "down-scale" from the multiplicand, add 1.

(b) For division where the result, or quotient, is read "up-scale" from the divident, subtract 1.

Thus obtaining a net correction factor from the algebraic sum of these individual factors.

(5) Adjust the characteristic obtained in No. (3) with the factor obtained in No. (4) above. The result is the logarithmic characteristic of the answer.

Example 1:

(The figures directly above or below the numbers represent the log characteristics)

```
  +2     +3      +2     +2      = +9
(243) (3210)  (405)  (830)
   (91)  (710)  (3)                 } = +6
  +1     +2     +0      = +3
```

Slide Rule Movements Relevant:

(1)	243 x 3210 = 78 (Result is up-scale, no correction).	CORRECTION= 0
(2)	78/91 = 855 (Up Scale)	-1
(3)	855 x 405 = 346 (Down Scale)	+1
(4)	346/710 = 487 (Up Scale)	-1
(5)	487 x 830 = 405 (Down Scale)	+1
(6)	405/3 = 135 (Down Scale)	0
	SUM OF CORRECTIONS=	0

Corrected characteristics = +6 - 0 = +6

Therefore answer = 1.35×10^6
= 1,350,000

Example 2:

```
  +1      -2       -3      +2      = -2
(93)  (0.041)  (0.0085)  (605)
   (2.63)  (383)  (0.0014)              } -2-(-1)
   0       +2       -3      = -1          = -1
```

Slide Rule Movements Relevant:

(1)	93 x 41 = 381 (Down)	CORRECTION=+1
(2)	381/263 = 145 (Down)	0
(3)	145 x 85 = 1232 (Down)	+1
(4)	1232/383 = 322 (Up)	-1
(5)	322 x 605 = 195 (Down)	+1
(6)	195/14 = 139 (Down)	0
	SUM OF CORRECTIONS=	+2

Corrected characteristics = -1 +2 = +1

Therefore answer = 1.39×10^1
= 13.9

Ed. Note:

The "rough calculation" method used by my colleagues and myself is merely to add and subtract powers-of-ten. This is essentially the same as Mr. Andrew's log-characteristic method, but his movement-correction method is indeed additionally useful.

THE "PARTS AVAILABILITY CRISIS" -- DOES IT EXIST ?? -- R. A. J. Reynolds (VK7ZAR)

I) THE CRISIS... ?

A) We receive Letters claiming that the crisis is real and experimenters are encountering real hardships. And we receive letters denying this, and claiming no real difficulty. And published articles differ; see Summary of all this, Augtober 1972 EEB, p. 81ff.

B) The various magazines here and abroad are bursting with advertisements featuring electronic goodiesof all kinds, "surplus" and "new".

C) American amateur equipment manufacturers are dropping like flies; c.f. Autocall 9/70.

D) Mail order (parts etc) firms abound here and abroad.

E) Articles proliferate telling what to do about the Parts Crisis, from general suggestions in QST, to practical details in CQ (e.g. "Surplus Sidelights" and "Maths Notes").

F) Across our desks pour a flood of Catalogues from firms announcing a wide availability of components and equipment.

-- RLG Note: These even come to EEB! For instance the latest here are a thick and very nice Catalogue from WHK Electronics (see advert in Augtober 1972 EEB) presenting computers, IC, Modules, and various components; and Dick Smith Electronics presenting just about everything; and Warburton Franki with ICs, SCRs, Diodes, Optoelectronics, and the new Fairchild TO92 series of cheap good bipolar transistors; Laser Electronics (in Queensland) selling every aspect of that esoteric field; a Barry Electronics (USA) Green Sheet; a John Meshna Jr. Electronics (USA) with every imaginable type of surplus component; and finally -- the NZART Amateur Radio Call Book (Break-In for June 1973) showing that there is certainly no Crisis in New Zealand!

SO???

II) PARTS FOR LARGE CONSUMERS -- It helps to be BIG.

A) Manufacturers make specific components for specific needs of large systems manufacturers. To promote the component manufacturer these components are voiced loudly in the trade literature. Experimenters and small users see these adverts and try to press them into experimental service. The quantities are of only nuisance value to the manufacturer.
And: A lot of the Application Notes directly or indirectly promote a particular component rather than the circuit. Experimenters try to obtain it and face the same situation as in obtaining the advertised material.

B) Components may be made to specific order in vast quantities. These make their way into the Data Books and the experimenter literature and into disposals overruns for a BRIEF time. But long enough to whet appetites which can become frustrated when the stuff runs out.

C) Cost vs availability for quantity; and the matter of quality and reliability. I have a suspicion that a good portion of this "crisis" is a matter of cost rather than of availability. Nobody wants to pay $12.90 for a part widely advertised at $1.29 in 1000-up quantities, and which may take 6 months to deliver!
The mechanism for obtaining small quantities must exist at high distributor costs, remembering that a major company acts purely as a wholesaler for its own products, hence has to show a profit. It may be considered that profit is an important part of the capitalistic enterprise. In this the experimenter does not rate highly.

D) The plight of the small electronics manufacturer. How big does he have to be to qualify for preferential treatment by the giant corporations. We are not at liberty to be specific in this instance, but obviously the big manufacturers run their businesses for the benefit of their principal customers -- and the small businessman does not rate highly in this heirarchy.

III) PARTS FOR SMALL CONSUMERS -- Exercise cunning.

A) The situation with regard to supply:

1) Byproducts of materials made for large consumers. Ref. above, Items I) B, D, and F.
2) End Runs. Also in suppliers of I) B,D.F, above.
3) Seconds (viz., "surplus" or "new" parts having low reliability). Important difference!
4) Purchase by suppliers of material at large volume to resell good quality stuff to small consumers but at a substantial cost. Reference Item II.C., above.

B) The attitude of the suppliers. Suppliers are reluctant to stock small lots because of

1) Obsolescence. No supplier is going to stock all parts which might be used (and there is a vast number of them possible!). And this does not necessarily mean only the older types. I have two front ends in use on 50 MHz. One uses a new FET that should be a

beaut, whilst the other uses bipolars that were designed in 1962 and assembled in 1964. Guess which one has been getting me all those contacts on 6 M? The bipolar unit is quiet, largely free of intermodulation, etc. Newer is not necessarily better.

2) Prices are changing rapidly -- mostly downwards. Under such circumstance it would be very difficult for a parts supplier to put in a stock of current items.

3) Demandis potentially uncertain. By the time a supplier has put in a certain item (and this may take 6 months) the manufacturer has come up with a new item that people think does the job better (and it may well do so) and at lower cost. Result: dead stock!

IV) AN OVERALL VIEW -- The situation looks promising

A) Parts are generally available.

1) You may have to look around a bit for it, but that's what adverts are for, etcetera.

2) You may have to pay for it. NB: the days of cheap overseas labour are effectively at an end, because that labour is now technologically skilled.

B) Sources of Supply:

1) Local Distributors 2) Mail order distributors (viz., big locals). See adverts.

3) Manufacturers Distributors:

a) Read adverts and articles to find manufacturers relevant to a given line.
b) Write to their Sales Agent on Company Stationery (this is essential).
c) Send them an open/limited cheque limited to a reasonable amount, and invite them to fill in the cheque as appropriate. This can have surprisingly salutory results, and fears of being overcharged grossly are generally unfounded. In any event....

4) Import. It is certainly possible for big industry or their subsidiaries to cater for the requirements of small industry, amateurs, etc, but at what cost? It will be high compared with the large industrial rates. Therefore, as Arthur Adams has pointed out (June 1972 EEB), an alternative is for the small consumer to press for cheaper imports. These will not appreciably affect the large manufacturers because they have what amounts to an assured market in any event. It will be more effective for consumers to apply appropriate pressure through the trade societies, through the Wireless Institute, and so forth, than to act individually. Onlookers can read the results in Amateur Radio and other journals, as the news happens.

One could note that reduced customs duties will reduce Government income, but the original reason for tariff protection was to protect local manufacturers in the first instance! Remove the need and the Federal Government will manage on the rest of its publick monies...

C) The situation as of this month is described in Electronics News (Aust.):

1) Now Large Industry is beginning to suffer because of an incredible boom in electronics construction generally -- particularly for anticipated colour TV sales, e.g. seven million sets in Europe/USA by 1975.

2) This is even affecting the USA adversely. Vis a vis Aust. there are conflicting ideas.

3) What does this mean for the small consumer? If big industry can't get the stuff, what hope have we? Dick Smith, in Electronics News points out the obvious consequence: There are times now when he simply cannot obtain garden-variety components, e.g. 1KΩ 1/4 W resistors. Furthermore he says that Industry is even coming to him looking for a few hundred items "to complete a production run"!

4) Neville Williams in that same publication points out the obvious conclusion:

a) This is promoting cooperation between business rivals, and therefore,
b) We may well find the long-needed standardisation of component types and values e.g., "capacitors, transformers and other items where there has hitherto been only diversity. The aim is to focus attention on a lesser number of components, which hopefully can be stocked in greater numbers."

5) PROGNOSIS: We are very pleased to read this penetrating observation from the Editor-in-Chief of Electronics Australia (and which parallels a similar statement I made and which RLG should have published 6 months ago!). The obvious result of the envisaged standardisation will be that for a while the Parts Availability Crisis may in fact appear to worsen (if indeed it exists at all in your area and for your tastes), as obsolete lines become unavailable. The most obvious victims of this trend will be valves, transistors, and as already evident -- some early types of Integrated Circuits! It is indeed a fulfilment of the prognoses made by Bill Orr (see EEB, Dec. 72 No. 5a, p.107+).

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A MISCELLANY (RLG can't waste a mm): "A Maximum Australian populationof 30 million is expected to be recommended to the Federal Government... The Spokesman said the 30 million estimate had wide acceptance among scientists." -- News Report, 15/11/72. Ah, Science!

EDITORIAL "Bettor late than never" -- Ancient Folk Saying

Here we are (?)

I must admit that this publishing matter has got more out of hand than usual, but I have organised all of the articles for 1973, and the majority of them are typed up. I vow to catch up by the end of the year, so there! This years worth of EEB starts lo in October, so you'll have a lot of reading to do these next few months. You'll also likely be receiving renewal notices rather soon, so you will have to decide whether you like our fare, sporadic as it may be (this year). If you do, and if you receive a renewal notice please do renew rapidly. Please?

EGT References (continued from p. 4)

Alcor Aviation address continued: Hanger 3A, Eagle Farm Airport, Brisbane, Qld.

K.S. Avionics: 18145 Judy St., Castro Valley, California 94546, U.S.A. (Aust. agents: none as yet).

WIA GOLDEN JUBILEE CERTIFICATE (c.f. p.1)

Well, you still have time to get this if you hurry! Qualifications:

DX must work at least 5 VK7 stations.

VK/ZL must work at least 20 VK7 stations

in the period between 1/1/73 and 31/12/73. Cost: Return Postage (e.g. 15c) or IRC equivalents (two).

Submit logs to:

Awards Manager, Tasmanian Division
Wireless Institute of Australia
P.O. Box 869-J, GPO, Hobart, Tas. 7001, Australia.

To help assauge our guilt for spreading the EEB word so late, stations outside of VK/ZL can write to EEB (at Sandy Bay) if you have much difficulty finding a VK7, and I'll try to arrange a sked for you. This issue will be going by air to North America, and to Roy Stevens in UK; perhaps he'll spread the word there....

This Issue

All kinds of things here.

I went to paste up p. 19 and it wasn't there! Somehow I alloted too much space for Rod's article, so I grabbed some of the big "Filler" from the already-done file, and the results you see. If it offends anyone I apologise for the political flavour, but who could take politics seriously in the first instance? Especially Nixon — the greatest clown of the century.

Whilst I'm putting my neck forth I might as well point out to the ardent promoters of a Republican form of Government to Australia, that it has its drawbacks, many of which dwarf the comparatively trivial problems of the present Parliamentary one. That's my opinion, in any event.

In this Issue, another Frequency Meter. Wot, yet another? Yup, but this one is cheap and ingenious, and in Part II (in preparation, Rod assures me) Rod will extend it to countless millions of Hertzeses. Besides, it uses ICs...

"Is Amateur Radio Necessary?" in this issue, by which we shall manage equally to outrage those who think it is, and those who on the other side would like to see more rain gauges and automobile ignitions and hifi in EEB... Still and all, if you'll look over a couple of issues at a time I think you'll have to admit that we do manage to cover a variety of subjects; recognise please that the subjects which please you less only appear to appear more frequently.

In this regard on p. 15-16 I've finally replied to our critics on the contentious matter of Literature reading & Reviews. If I may say so myself there's some keen wisdom therein, so read it in spite of the mice type.

New Photographic Process

In that vein I hope you will all notice that the quality of the print is substantially better in this issue than in the last one. It's not merely that Chris's presses were well oiled this week, but that I have FINALLY achieved the goal of lo these many years: a good photographic reduction process!!!!! Me poore YF can testify to the many long nights I have spent developing it (the camera has no shutter so all photography must be done after dusk), but it was worth it. The main elements of this result have been: the right kind of lens (provided kindly by Rod Reynolds — along with the copy camera itself!), the right kind of photopaper (we use paper negatives, to keep cost down), the use of 20,000 lumen Quartz-iodine lamps (2), and the right kind of developer. I also managed to build some developing tanks, and now can develop 10 items at a time rather than one -- oh frabjous joy! But migawd those tanks gobble up expensive processing solutions; I think I'll try making them up myself from chemicals. As one wit egregiously pointed out, my Profession does have something to do with Chemistry.

NEW ADDRESS FOR SUBSCRIPTION MANAGER: (PTO)

ADVERTISING

This Page: Personal = FREE   Commercial = (ENQUIRE)   We guarantee nothing................

THE AMATEUR RADIO MOBILE SOCIETY facilitates amateur operations in Europe, and publishes a very nice magazine, the ARMS News featuring news and technical articles of interest to all amateurs involved in mobile operation. Send for a sample copy and see for yourself. Write: Mr. N. A. S. Fitch, 40 Eskdale Gdns, Purley, Surrey CR2 1EZ, England, U.K.

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88 millihenries TOROID INDUCTORS for sale, unpotted. Magnificent for audio filters, teletype, etcetera. 55c each; five for $2.25, all postpaid. Write: Basement Electronics, 32 Waterworks Road, Dynnyrne, Tas. 7005.

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TRANSISTOR SOCKETS: 3 pin round, ideal for experimenters, builders using diodes, transistors, FETs. Reuse your transistors without risk of heat damage, try different units in a circuit for best results, etc. And of course these are ideal for short-lead transistors such as computer board types. Price much lower than available elsewhere in Australia: 20c each, 10 for $1.30, all postpaid. Basement Electronics, 32 Waterworks Road, Dynnyrne, Tasmania 7005.

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WANTED: Techpress books 01CH1, 01CH2, TSSH3, TSSH3S and DSS. Radio Electronics Mag. Jan 69, May, July 72. Practical Electronics Jan 65, Jan 68. 73 Mag Jan, Feb, June, Aug and Oct 70, and prior to 1970. Vol. 2 Coryra. Any EEBs prior to 1968. Please state condition and price, to: R. Martin, P.O. Box 151, Chester Hill, NSW 2162.

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WORLDRADIO is a non-technical newspaper for radio amateurs interested in the international friendship and humanitarian aspects of amateur radio. For a free copy write to 2509 Donner Way, Sacramento, California 95818, U.S.A. For a years subscription send $A3.00 and name and address clearly printed, to EEB; because this rate is lower than the American one, this offer is limited only to Australia and New Zealand ($NZ3.50).

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ANY PUBLICATION PUBLISH ED BY CQ MAGAZINE (including subscription to the magazine itself) is available through EEB. Send $A in the same numerical amount as indicated for $US in the magazine. Difference in exchange goes to run EEB.

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AMERICAN DRAKE EQUIPMENT AVAILABLE (and some other equipment too). Send directly to the U.S.A., bypass the middleman and save a fortune — even after Australian customs duties! All major Drake gear, as well as major and minor accessories of all kinds is available — including calibrators, blankers, crystals etc — as well as a wide variety of manuals and publications. All postage and freight extra, of course. Customs formalities at this end can be handled by a Customs Agent, or you can save money by doing it yourself if you fill in some forms; details from your local Customs Office. WRITE: EEB Accessories, P.O. Box 32064, Oklahoma City, Oklahoma 73132, U.S.A.

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BOOKS BOOKS BOOKS BOOKS, publications of all kinds published in the U.S.A. available at prices substantially lower than in Australia. Includes any technical or non-technical publication. No customs duties. EEB Accessories, as above.

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BACK ISSUES OF HAM RADIO MAGAZINE: Approximately 48 issues, from Vol. 1, No. 1. All offers will be considered before final sale is made. Only the whole set is available. This is your opportunity to obtain many excellent issues of this fine magazine. Write: D. Bedford, 59 Central Ave., Moonah, Tasmania 7009.

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THE CANADIAN AMATEUR RADIO TELETYPE GROUP publishes the "RTTY-News" monthly at a cost of only $2 p.a. This is a MUST for anyone interested in or potentially interested in the fascinating world of radio teletype. For example, in the September 1972 ...

... publishes the "RTTY-News" monthly at a cost of only $2 p.a. This is a MUST for anyone interested in or potentially interested in the fascinating world of radio teletype. For example, in the September 1973 issue appeared an article "RTTY in VK Land" by VK3KF, advertising for much RTTY equipment (and remember that an Australian $ will buy about $1.40 worth of Canadian), the article "Overmodulation? Who Me?" by VE3FJJ, DX News, and information on the Fourth World RTTY Championship. Send subscriptions ($C2.00) to: CARTG, 85 Fifeshire Road, Willowdale, Ontario, Canada M2L 2G9. Or $A1.90 to EEB (covers air mail postage and cheque bank charges).

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THE RADIO BULLETIN of the Eastern/Mountain District Radio Club is a lovely magazine, duplicated every month or so. For instance the Auguts 1973 issue contained the following items:

- RTTY Group News.
- A Stable Transistorised VFO.
- BOOK SALES — all kinds.
- A 144-432 MHz Varactor Tripler
- High-Performance FM-i.f. Amplifiers using the uA703.
- Introduction to SSTV, Part III: The Flying Spot Scanner.
- Pages from the Past: 3BD; An Experimental Station 50 years ago.
- Disposals News — lots of real goodies at lovely prices!

and in most issues "Circuit Ideas" provides highly useful hints and ideas. Classified adverts are available to Members. All this is available to anyone in the world by post, and in addition members in Victoria can attend monthly lectures given with speakers from Industry, Government Departments, and other clubs giving talks on all aspects of radio. Classes are provided to study principles of radio needed to pass the PMG exam. Numerous social outings are held. HOW COULD YOU RESIST JOINING? Join and attend these activities, or at least join and receive the Radio Bulletin! The annual Membership Fee is $3.00 with an additional once-only 50c joining fee. Juniors have a special rate. Send for a Membership Application Form to:

The Secretary, Eastern and Mountain District Radio Club, P.O. Box 87, Mitcham, Victoria 3132, Australia.

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THE WIRELESS INSTITUTE OF AUSTRALIA Offers fellowship at branches located throughout Australia, a wide range of lovely disposals components at minimal prices, and of course the outstanding technical journal "Amateur Radio". Further information from: The Executive, P.O. Box 150, Toorak, Victoria 3142.

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THE SOUTHERN TASMANIA ELECTRONICS CLUB is affiliated with the Youth Radio Clubs Scheme of Australia, and offers many opportunities to young people interested in learning about electronics. Theory lectures are given by the staff of the Tasmanian College of Advanced Education, and practical sessions are conducted by members of the Wireless Institute of Australia (see above). Technical notes are provided as well as a range of good "junk" components as available, plus useful items such as solder and computer boards obtained from membership fees. The fees are 10c per week, and membership is open to anyone interested. If you or a young person you know is interested ring Leo Gunther, Hobart 237-670.

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EDITORIAL (continued from p. 11)

Please ignore the address for Bob Walton in the Essential information on p. 24 here, and note that the following address applies for all subs, renewals, bound volumes, etc:

Mr. R. A. Walton, Subscription Manager
396 Rokeby Road
Howrah, Tasmania 7018, Australia

This & That

The PMG is at it again. Over the next couple of yrs our postage is going to double. The PMG never does anything halfway. Since 1967 their rates for us have gone up by 2500% during a period when the Cost of Breathing rose by 30% according to the Bureau of Senses & Sadistics; I reckon that our costs have risen rather more than that since paper goes up some 5% per year, our normally very restrained Printer has gone up 20% this year, and Brenda for her heroic efforts (and always at short notice) deserves rather more than the pittance we have been providing. But 2500%?? A plot of the data proves amusing; the postal rate for us went up quite exponentially until 1971 and then levelled off sharply until Labour got elected and then again started reaching for the sky. Labour say they want to abolish our special magazine rate altogether, and that might already have happened but for the opposition of — you'll never guess who — the Democratic (?) Labour Partie. /"Vote DLP and Save EEB" Yegad what a thought.

Lest you think I whinge excessively about this I recently received a communication from another Australian Editor, "I might point out that you are not the only editor who suffers from the 'bloody PMG', as you so aptly describe them. We lose (a considerable number of) copies a month in the mail..." etcetera. The continuing rape of the magazines by the PMG should do wonders for inflation, not to mention what has happened to ordinary postage....

LETTER: Power Supply Protection

The local Electric Authority operates a VHF two way radio system and the transmitter/receiver is remotely controlled per PMG pair. The gear is operated from a 12V supply regulated, of commercial manufacture... The controlling devices were 4-only 2N3055 transistors in parallel (with the appropriate separate emitter resistors of course) & the voltage applied to the collectors averaged about 30V under receiving and in the standby condition. The output voltage was set to about 13V.

After many months of satisfactory operation, what I suppose was the inevitable happened, and one of the 2N3055 shorted from C to E. The resultant application of about 30 volts was a wee bit rough on the gear but fortunately the fuse to the high voltage section went open/ckt when the transmitter was keyed on. I had rather a mess to clean up after an electrolytic blew its innards out and I reckoned it would be better if I could incorporate some protective device. I lay no claims to the result as being optimum but to date it is operating quite OK.

I broke the output lead and inserted therein a large W/W resistor to limit the voltage to the receiver section in the event of another failure, and have bridged across that a set of Heavy Duty relay contacts which are closed when the relay is not energised.

On the supply side of the resistor I have connected a 24 V Zener diode (with suitable limiting R in series). In the event of another transistor shorting through, the Zener will conduct and energise the relay which is also in series with the Zener. When the relay functions the contacts open and the load is upplies via the large resistor mentioned. This arrangement as I said, is not very elegant but does serve the purpose of protection.

I propose to knock up a tone oscillator to be powered by the voltage developed across the resistor (the one in series with the Zener) and have the output fed to the PMG pair and thence back to the remote control units as an indication that a failure has occured and attention is required.

— Cliff Jenkins, Roma, Qld.

((I can't say that I think much of that commercial design. Next issue we shall be presenting a simple power supply which simply inserts a WW resistor in series with the regulating transistor on the collector side. At low load the voltage drop across the resistor is negligible and E_c is high, but I_c is low so P_c is low. At heavy loads the resistor drops all but about 3V across the Tr, not only thereby automatically limiting the maximum I_c which can be drawn but also reducing regulating transistor collector dissipation substantially. With this simple trick you could remove 2 or 3 of the extra 2N3055's !—Ed.)) ((Ed. P.S. I like that idea of the warning osc. Same thing could be used across this protective R too.))

LETTER: EEB Pounds A Long!

"EEB Staggers on..." Horribly negative. Surprised at you. "EEB pounds along!" Positive. Inspiring. Encouraging. Let's take out a subscription!... In yesterday's mail, a copy of ((various scraps of EEB))... What magnificent service. One sure way of hooking me for life! Slightly related to bribery and corruption. And there is some darn good stuff in those issues, as in the 1970 volume.

... Enclosed with this missile are four of our latest Alpine Plant issues of NZ mint commemoratives. Hold 'em 6 months and they will have doubled their value — 12 months tripled or quadrupled — 5 years — 50 years..

— Bill Potter, ZL1BHP, Bay of Plenty, N.Z.

((Many thanks, Bill, the stamps have been relayed to the children, with your instructions... — RLG))

LETTER: ((How many other magazines receive such items??))

Will you please cancel my subscription for EEB, as I will not be requiring it any further. I would like to thank you for all the copies during the last few years, the excellent presentation, and the cracks at the PMG.

Thanking you, with best wishes,

— (Correspondent), Tasmania

QUOTES:

"We're gonna make this country safe from fear; we're gonna do it if you let us..." — Richard M. Nixon

"Cities have their contract, houses their lease and civilisation its licence to suicide on orgasm when the prospect of man's madness becomes too strong to deny; when the oldest pleasures are rank and decayed, when power to control and destroy becomes the only human power left..."

— Tales from Antartica (Melbourne Uni, 7/73).

"... This whole process of developing kitsets for the amateur fraternity by branches of the National Amateur Radio Body is unique to the best of my knowledge. I am an avid reader of both local and overseas magazines. It is very seldom indeed that one encounters descriptions of kitsets to an equally high standard, designed under the same conditions, and supplied to the same type of people elsewhere in the world. In fact the unique New Zealand attitude of ((electronic)) homebrew is demonstrated to its fullest extent by this cooperative enterprise. Long may it reign!"

— Freak-In, 11/72, p. 402.

((May it indeed!! — RLG))

LETTERS: THE CONTENT OF THE AUSTRALIAN ELECTRONICS EXPERIMENTERS BULLETIN

((WE SENT OUT A NOTE OF ENQUIRY TO PAST-SUBSCRIBERS RECENTLY TO ASK WHY THEY DROPPED US. SEVERAL IN FACT RESUBSCRIBED, THANKING US FOR REMINDING THEM. SOME DID, WITH RESERVATIONS. AND SOME DID NOT, BUT WERE KIND ENOUGH TO TELL US WHY -- and THAT IS VERY MUCH APPRECIATED. HERE ARE SOME OF THE RESULTS, AND WE PRESENT THEM BECAUSE WE FEEL THEY WILLbOF GENERAL INTEREST. It should be noted that these letters were received before our recent notorious 6-months holiday from EEB! So....

EEB Too Simple

I find the material slightly too simple in EEB, but alright, though. I would appreciate more articles on new developments, e.g. Phase-locked loops, Varactor tuning, etc. Your articles on the Reciprocating Detector, and Crystal Set Technology are very good, and help me make up my mind to renew.

My main interest is probably dissimilar to yours for EEB, as it is mainly Audio (Hi-Fi experimenting, Tape recording) with little equipment for radio receiving -- although I am working on a Broadcast Band Receiver for HIFI (PLL detector with possibly a 5 or 10MHz IF strip; don't laugh! 455 kHz gave me too much trouble with a 15kHz bandpass.)

I would like to see some construction articles, with some mention of Audio.

-- Tim Gibbs, Hurstville, NSW

((So would we -- RLG))

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EEB too time-consuming

I regret to say that I no longer have time to read EEB, although it has given me many hours of enjoyable reading, and I would like to thank you for publishing such a worthwhile magazine.

-- (Correspondent), Narwell, NSW

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A Balanced View?

What do I look for in an electronics magazine? I lean towards constructional probjects which have a practical value (to me), but also enjoy reading articles of general interest, new developments, discussions and book reviews.

As I am not in close contact with the communications or amateur radio fields I am not greatly interested in that direction, however I know the world would be full of zombies if we all shared the same thoughts and a magazine such as yours (or any magazine) has to cater for all interests.

I particularly enjoyed the informal and humourous style of your magazine (those recipies!) but at times I thought there was too much RLG.

I wasn't particularly wrapped in the new size of your magazine, particularly with regard to the circuit diagrams which I thought were too cramped; I've been apoilt by other magazines.

I read with interest your letter describing proposed projects such as an exhaust gas analyser and others. I am therefore renewing my subscription...

--- G. Mc Cabe, Warners Bay, NSW

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More circuits Needed?

I find EEB has far too much unapplied theory. By unapplied I mean an author will say something like "a PLL can be used for perfect AFC", but do we ever see a circuit, or a complete receiver? Never! If lots of reference books are available you can look up the references given, but most people don't have access to the references.

Don't get me wrong, I'm not completely against theory. I'd like to see a nice theoretical (and not just scientifically blinding) article, with a few typical circuits given as a basis for experimentation.

Another objection was that EEB doesn't have enough on communications, but lately it has improved in that respect. I think that the dandelion wine, sotries of whisky bottles, articles knocking the PMG etc have no real place in a highbrow (sic) magazine that EEB tries to be, when its not being an experimenters magazine.

-- Steven Fraser, VK7ZSF, Sandy Bay, Tas.

P.S. I wonder how many "experimenters" really know what they are really doing? Most just hook together parts, I think, and couldn't design a one-transistor common-emitter amplifier, much less anything complicated. How about a few decent design articles by EEB?

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More simple circuit design needed

Although Steven in the above letter rather tends to miss the Point of EEB, it reminds me of a horrifying day I had recently with a group of HAMS. I am impelled to this: If you revitalise EEB a timely (?) thing would be a burst on RF measurements (using Amps, Volts, and Ohms rather than Counters, Impedance Bridges, etc.) à la Scroggie. Ignorance appears widespread. Oh yes, and include something telling how to calculate inductance, ref: Radiotron Designers Handbook et al (or just refer readers to that still excellent work). Would you believe that those so-called amateurs didn't know you could calculate inductance other than to a rough approximation? -- and they couldn't even do the latter!

-- Chris Pitcher, Assoc. Editor.

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SSTV and Underground EEB

I am still working up the Amateur TV gear, and have accumulated enough odds and ends to construct the SSTV Minitor in AR earlier this year, and a receiver to use it with!

How about more articles on TV?

Have you considered supporting schemes for pushing electronics experimenting as an "underground" or "counter-culture" thing? It is, after all, a creative thing for people to work on with their hands and minds, something most people (even in Australia) are being deprived of...

Perhaps you could run a series of articles on Clubs throughout Australia, with potted histories and details of current activities and meeting times.

-- David Thomas, VK1ZVT/T, Waramanga, ACT

((YOU'll also find ATV Informatin in most issues of the Radio Bulletin of the E/MDARC (EEB Apr 72, p.40), and in various issues of AR, 6UP, or Tuned Lines, and probably Victorian VHFer, not to mention all the overseas publications.

-- You know, it seems to me that a number of our correspondents are labouring under a misconception of the operation of Information Supply services in a Society System. The progress of technology (interalia!) has become so extensive and so rapid that it is quite absurd to ask that any one publication even hope to cover all relevant aspects of every major development or approach. The attempt so to do has turned several American technical magazines into big thick potpurris of indigestible technocratese.

-- The only way to keep on top of the Information Explosion is to learn to become cunning with sources of information. This does NOT mean reading every magazine or book published!, nor trying to find THE ideal magazine or book. It means, rather,

to learn how to find
a) Good summaries of the principal advances,
b) Good discussions of what those advances mean and whether they were worth doing, and
c) Specific information on specific subjects about which you want to be informed -- either theory and/or practice.

In other words, you cannot possibly hope to read all the libraries, so why not learn how to use the library cataloguing file -- as it were?

You will find Items (a) sometimes in EEB, often in "Technical Topics" monthly in Radio Communication (and therein also numerous items of general, not mrerely communications interest) and in "Amateur Radio Techniques" (which is an anthology of TT), and in various other summarising services which have been springing up in various magazines, e.g. Ham Radio, Radio-Electronics, etc. There is, as yet, no formal Abstracting Service of the kind we have been suggesting for years.

You will find Items (b) in EEB, Electronics Australia, 6UP (Aust.), and of course often in the abovementioned "Technical Topics" -- the latter delivered with insight and some dry British humour. And elsewhere; let us know!

Items (c) are the most difficult only because there is such an enormous coverage possible, but one first starts with good reference Handbooks of the usual sorts -- Radiotron Designers Handbook, Terman etc, and Handbooks by Orr, ARRL, RSGB, etc. And there is a truly vast number of specific books published on various topics, from Ryder, Tab, and the rest. One can find out about these from:

(1) Reading book reviews in periodicals,
(2) Talking to people who know good ones,
(3) Browsing through the bookshelves of people with tastes similar to yours,
(4) Browsing through the stock of the big technical book dealers such as abound in Swanston Street Melbourne (etc), and
(5) Consulting LIBRARIES OF
    (1) The State Library, or nearest branch, remembering that through interlibrary loan you can obtain any book from any library in Australia (or a photocopy of any magazine article!)
    (2) Radio Clubs, WIA or other.

The order of importance is not necessarily as listed here, merely as it occurs to me. Ultimately, of course, all of these suggestions come down to buying or borrowing the necessary information, but that is unavoidable; if anyone thinks of an alternative to that do let me know.

-- But note that this programme does not require you to try to read every magazine published every month (Editors excepted, alas). It does require that you know, from a general exposure, the sources of information where you can find what you want. THAT is the reason we publish reference lists, book reviews, and references in our texts, sometimes. With that lever you can move much.

-- I was started off on all of this, from the Letters, and from contemplating Electronics Australia's fine Fundamentals of Solid State (and the Basic Radio Course) lying on my desk. -- RLG))

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Bibliographies and Components

I think that the EEB gets better each issue and I shall most certainly be renewing my sub...

I heartily concur with your comments regarding bibliographies. There are so many article in so many magazines these days that it is becoming an effort to keep abreast of developments (Have you heard about the Texas computer systems engineer who took a two-week vacation and came back only to find he was obsolete?).

What is strongly required is some publication along the lines of "Physics Abstracts" which goes through all the popular electronic and amateur literature and makes abstracts of the articles therein, The nearest thing to this at the present moment is the EEB bibliographies.

Re: the "Components Availability Crisis" -- I can't really see the point in this one. I would have thought that there is a virtual parts bonanza on at the present moment compared with what there was when I started in electronics a half dozen years ago. If you compare a copy of a recent Electronics Australia with one from that time I think that you'll find that there are a lot more firms like Dick Smith, etc, who cater exclusively for the hobbyist at extremely favourable prices. Transistors have, for example, become a lot cheaper; when I started out I can not remember seeing 4c resistors advertised. Or consider the MPF121 gate protected MOSFETS for $1; with these available why buy the junction FETs such as the 2N5459 for $1.45?

((AND in the recent post I have received a catalogue from Warburton Franki Co. (who also stock a variety of some of the more esoteric components experimenters look for) in which is advertised the new range of TO92 bipolar transistors from Fairchild Australia P/L. These have a "PN" prefix rather than "2N", and cover a number of the very nice and verypopular items we have mentioned in these pages, for example the PN4250 identical with the 2N4250 which has such marvelous lineearity and high gain. And the cost? 35c each! -- RLG))

The only area where I feel there is a parts availability crisis is in the more exotic and complex components area such as mechanical filters, etc.

Indeed, I have been getting Ham Radio for about 6 months now, and was surprised to see that Australian component prices seem to be not all that much higher than American ones. On the other hand, prices for most American books available through Australian book sellers are exorbitant.

While on the subject of books, have you seen Hemingway's "Circuit Consultant's Casebook" and the new (8th) edition of Scroggie's Radio and Electronic Laboratory Handbook" ? I have copies of both of these and they seem to me to be very good, although expensive.

-- Eric Gauja, Merrylands, NSW

((Hemingway's and Scroggie's excellent books (I forgot to mention them elsewhere on this page) as well as most other books in print can be obtained at a substantially lower price by sending to Hoods Books and Equipment Co., P.O. Box 32064, Oklahoma City, Oklahoma 73132, USA)) --RLG

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((There are more of these very interesting letters but we'll have to present them another time --Ed))

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QUOTE WITHOUT COMMENT (from AR, 12/72, p.2)
An item in "League Lines" of "QST" advises that the ARRL's "Mobile Manual for Radio Amateurs" first appeared in 1955. "Over the years shifting interests... markedly lessened its usefulness to the Amateur and so it is being discontinued... to be effectively replaced by the special repeater manual now in production."

THOUGHT FOR THE MONTH: "I would conjecture that, given all the attention now being paid to the year 2000, the Japanese will specifically pick that year as their target date for surpassing the most advanced western countries" -- Herman Kahn
(from: "The Emerging Japanese Superstate")

PUZZLE -- by John Campbell (W2)

1) What was the first commercially successful thermoplastic material?

2) What was the first commercially successful thermosetting material?

3) What was the first successful foam plastic composition material?

Each of those first-successfuls is in very wide and common use today. The termoplastic is not only about the cheapest, but has excellent chemical, mechanical and heat-resistant properties that make it as important today as ever. Like most thermoplastics it's a first-rate insulator, highly transparent and easily coloured.

The thermosetting material also has extremely good thermal properties= it will stand more heat than any other known thermosetting material, and has outstanding chemical resistance. Excellent mechanical properties and low cost.

The foam is probably used in greater tonnage than all the other foam plastics today, and although chemical properties aren't any too stable and it reacts badly to humidity. Nevertheless it's widely used as a packaging material.

Think about it yourself a bit before reading the answers here:

The answers are perfectly obvious-- once you remember what the terms, thermoplastic, thermosetting, and foam plastic actually define.

To begin with, "plastic" means that it's mouldable -- that you can push it into a desired shape which it will later hold. It derives from the Greek word, plaston, meaning bread-dough. So, obviously, bread is the original foam plastic -- poor chemical stability, of course, which makes it quite nutritious. And as a packaging material it's very popular. Ever try eating a tunafish salad sandwich without the bread?

A thermoplastic is defined as one that can be moulded hot, and remoulded if reheated. Try glass as the original.

Thermosetting of course means a composition that can be moulded to a desired shape, then undergoes a physico-chemical change when cured at high temperature to take a rigid form. The original was, of course, clay. Certainly ceramics can't be beat for high-temperature applications.

Surprising how few people ever really define the real meanings of the terms they use;

Ed. Note: Several other very useful and ingenious ideas by John Campbell can also be found in EEB for Feb 1971, p. 21, including comparison of wood vs plastics, and the use of Talc Rock ("Soapstone") which can be carved like wood but which can then be baken in an oven to form "Steatite" which is rock hard and is an excellent insulator. "Soapstone" can be obtained from "Marcus Art Centre" in Carlton, Victoria.

LETTER: More on Linear Tuning.

I would like to point out a gross omission in the December 1972 EEB (no. 5a, p. 103). You made mention of LINEAR TUNING etc with standard tuning gangs or something ((sic)). THE DEFINITIVE ARTICLE on tuned circuits, superhet front end tuning and linear tuning et al appeared in Electronics Australia, August 1967. Titled "Design Procedure for Aegis Pre-Wound Short Wave Coils" by L. R. Mitchell it was a very comprehensive article on the subject despite the obvious company PR headline. Mr. Mitchell and yours-truly designed those coils and I did much research for the article, which was acknowledged.

I'm not blowing my trumpet, believe me, but there is no comparable article on the subject in the literature or the text books. Despite the fact that it might appear from the article that only Aegis coils can be used this is not so. An enormous nomograph is included in the article, which is universal as the basic parameters of L, C and f are listed as well as the specific data for the Aegis coils. A separate nomograph is provided to ascertain constants for LINEAR TUNING, including for superhet front ends, three-point tracking and all that.

All the info is accurate, and it all works, is easy to follow and I have had cause recently to use it and found it apot on. One would think that intervening production changes, subtle though they may be, would affect the results; not so. I believe that reprints of the article are still available. Spread the good word among the troops will you. There are limitations to the linear tuning bit but these are mentioned in the article and provided the guidelines are followed no problems will occur...

-- Roger Harrison (VK2ZTB), 47 Ballast Point Road, Birchgrove, NSW 2041

((Roger is Editor of 6-UP (Aust) magazine, and in response to our suggestion about sweetness and light on p. 103 of the December EEB he pledges to be sweet and light. We have not heard from the other parties. Roger's magazine is of interest to experimenters interested in VHF and much else. A sample copy can be obtained from him at the above address. -- Ed.))

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Quote

"... It's not only the allocation of a finite length of time that's important but also what you do with it after you've got it. The old-time research men may not have been so hot at organizing meetings, filling in forms and churning out reports, but it's my considered opinion that they could run rings around us when it comes to getting a job out."

(-- "Real and Imaginary" by "Vector", Wireless World, Dec 1971, in a fascinating review of "History of Radio Telegraphy and Telephony" by G. G. Blake -- Chapman and Hall publishers, 1928!)

TELEVISION INTERFERENCE MANUAL by B. Priestly, G3JGO

-- A REVIEW by R.A.J. Reynolds, VK7ZAR (active at last on 52.525 FM --)

The Radio Society of Great Britain describes this work as follows:

Television interference is one of the most challenging problems facing the radio amateur today. While many cases of interference are due solely to deficiencies in modern electronic entertainment equipment, there are certain basic requirements with which the radio amateur must be familiar. This Manual examines the problems and suggests remedies. It also provides a wealth of technical information on many aspects of electromagnetic compatability. The author is an acknowledged specialist in this field and has contributed numerous articles to Radio Communication.

The Television Interference Manual comprises 100 pages of A5 format (148 x 210 mm) and has a spiral binding enabling the book to be laid flat on the workbench. The manual may be obtained from RSGB Publications, 35 Doughty Street, London, WC1N 2AE, price 80p. The postpaid price is 90p.

((EEB Ed. Note: The book is also available locally in various technical bookshops for a rather higher price, and from the WIA or NZART))

It is a very lucky Amateur operator who has not had experience of TVI to some extent. Eliminating TVI requires probably more understanding of electronic principles than any other single problem that the amateur encounters... Hence any new material that comes to hand is welcome. In the case of this new manual, it appears that the writer has made himself very aware of the material already available, and has sorted out the details that are associated particularly with the Amateur. He has done so in a readable but concise text which is sure to become a standard reference on TVI.

After making an appraisal of this new RSGB publication I read through a couple of papers on TVI as well as a "typical" parallel volume printed in America. There was little, if any, material in the rest of the publications that was not covered in this new volume, provided that only amateur problems were considered.

As far as we in this country are concerned, however, we have a problem in the interpretation of some of the tables and text which refers to specific channels and systems. In Australia we have our own very efficient 13-channel system of TV with standards that are not the same as in the British or American systems. The Australian Amateur must have just a little more insight but all the same, the problems and solutions of others should not be ignored, as many TVI problems have similarities, and clues as to problems and their solutions might well be obtained from problems in other systems.

The first four chapters are introduction and very basic theory of the arrangements of the TV spectrum. Chapter 5 deals with the sources of TVI in a correctly operating transmitter, while Chapter 6 enumerates variations and miscellanous matters. The meat really starts in Chapter 7. Breakthrough into audio circuits is discussed, be they TV, HIFI or any similar circuit involving an amplifier, and solutions presented.

Chapter 8 is labelled the "Data and Reference" section, but really it is the most important chapter in the book. The use of devices like ferrite beads, the design of low-pass filters, as well as stubs are detailed along with a couple of testing methods, which although in my opinion marginal in value, are well worth printing -- particularly as I have not seen them elsewhere. But the British system rears its head, and commonsense must be used when, say "Channel 5" is mentioned. This is similar to our Channel 2. The Australian Channels 3 to 5A of course, are not covered in this book.

Several Appendices follow, including design information on components, high and low-pass filters, stub filters, notch filters and a little test equipment. A statement as to the legal position in Britain is included

Mentioned in the book and well worth restating, is the need for diplomacy in dealing with neighbours. The author recommends assisting the complaintant where feasible. But experience shows that well-meaning amateurs can upset the performance of equipment whilst trying to correct interference -- and this is not restricted to TVs. Therefore unless you really know what you are doing (and your neighbour has a similar opinion) don't touch his equipment!!

(Thanks to RSGB for our copy)

(FURTHER INFORMATION: p. 22, 24)

"The Little Red Hen Ham and the Free Enterprise System"

ONCE UPON A TIME there was a Little Red Hen who scratched behind the barn and uncovered some old radio parts.

She called the other animals in the barnyard and said:

"If we all scratch together, we can find enough parts to make some ham gear, and talk to other animals all over the world."

"Not I," said the Cow.

"Not I," said the Duck.

"Union don't allow me to scratch," said the Pig.

"Then I will dig them up," said the Little Red Hen.

And she did.

When she had dug up enough parts, the Little Red Hen said, "Who will help me put together this gear?"

"Not I," said the Cow. "I was a dropout and don't know how."

"Not I," said the Duck. "I might lose my welfare benefits if I did such work."

"Not I," said the Pig. "If I'm the only one helping, it would be discrimination."

"Then I will," said the Little Red Hen, and built a fine ham station.

"I want to talk" said the Cow.

"Let's yack with some girls," said the Duck.

"I demand equal air time," said the Pig.

"No," said the Little Red Hen. "I did it all myself, and I'm going to relax and work DX."

"Capitalist," bawled the Cow.

"Equal time, equal time," squawked the Duck.

"Pig!" squealed the Pig.

They painted big signs and picketed the Little Red Hen's radio shack, and marched around singing "We Shall Overcome."

And they did.

For when the Farmer came to investigate the racket, he said: "You must not be greedy, Little Red Hen. Look at the oppressed Cow. Look at the underprivileged Pig. Look at the less fortunate Duck. You are making second-class citizens of them."

But I built it all myself," said the Little Red Hen.

"Fine," said the Farmer. "That is the wonderful free enterprise system. Anyone can provide himself with anything he wants. In many barnyards, the Farmer would take it all away from you. Here you only must share the fruits of your labor with your less privileged neighbors."

So the Little Red Hen sorrowfully dismantled her radio station, and painted a protest sign, and learned to sing "We shall Overcome."

And she lived happily ever after with her barnyard friends and grew fat on the handouts of corn from the kind Farmer. But sometimes her neighbors wondered why she built no more ham stations.

((From QRM, Bulletin of the Ozone Amateur Radio Club Inc, Rt. 1, Box 185, Bay St. Louis, Miss. 39520, U.S.A. Edited by Jim Pfeiffer, WA5CKJ; all Club Editors who want to see how to layout a Club Bulletin for good presentation and interest should contact Jim for a sample....

-- I'm not sure I understand all of the moral of the story, but I did enjoy it! --RLG))

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Quote

"No country has the right to impose its will on another by force."

-- Richard Nixon

PERPETUAL CALENDAR -- R.V. Anderson, KØNL

((From Amateur Radio News Serivce Bulletin, January 1972, p. 20))

Hammermill is passing out a little advertising piece which is a perpetual calendar for the years remaining in the 1900's. In showing it to various individuals almost invariably someone will ask on which day he was born. Since the calendar is for the years following the present, not preceeding, this one sent me to the books. While the perpetual calendar shown is for the 1900's only, the ones shown in the books will permit figuring for any century, even B.C. and in either the Julian or Gregorian calendar. These have been simplified to the following chart. You are guaranteed to be the most popular person at a party if you are able to tell on which day of the week anyone was born, because it seems to be a most popular question, and normally virtually no one knows.

PERPETUAL CALENDAR
1900-1999

Month:

Jan*	2		Apr	0		Jul	0		Oct	1	
Feb*	5		May	2		Aug	3		Nov	4	
Mar	4		Jun	5		Sep	6		Dec	6	

Last two digits of the year:

00	06		17	23	28	34		45	=	0
01	07	12	18		29	35	40	46	=	1
02		13	19	24	30		41	47	=	2
03	08	14		25	31	36	42		=	3
	09	15	20	26		37	43	48	=	4
04	10		21	27	32	38		49	=	5
05	11	16	22		33	39	44	50	=	6
51	56	62		73	79	84	90		=	0
	57	63	68	74		85	91	96	=	1
52	58		69	75	80	86		97	=	2
53	59	64	70		81	87	92	98	=	3
54		65	71	76	82		93	99	=	4
55	60	66		77	83	88	94		=	5
	61	67	72	78		89	95		=	6

Note carefully the asterisks after January and February. This means to reduce the year by one. For example, in figuring a date in January of 1972, you would look in the chart for 1971, not 1972.

To use the chart: Write the day of the month. Then write down the number which follows the month in the chart. Write the number following the date in the "Last two digits of the year" column. Add these three figures; divide by 7. Ignore all but the remainder, which indicates the day of the week. Saturday is 0, Sunday is 1, etc.

Example: January 19, 1972. The number after January is 2. The number for the year 71 (because this is * so reduced the year by one) is 4. Add 19 plus 2 plus 4 equals 25, divided by 7 gives 4 remainder. 4 indicates Wednesday.

Have fun.

Did you resist the temptation to figure your own?

Sat = 0	Tue = 3	Fri = 6	
Sun 1	Wed 4	Sat 0	
Mon 2	Thu 5	Sun 1	etc.

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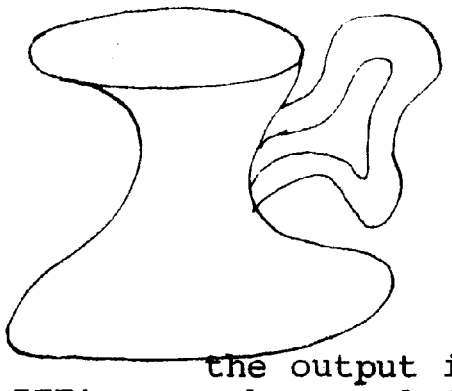


pitchers corner -- by chris pitcher (vk3)

How to use transistors with the i.f. transformers as-is.

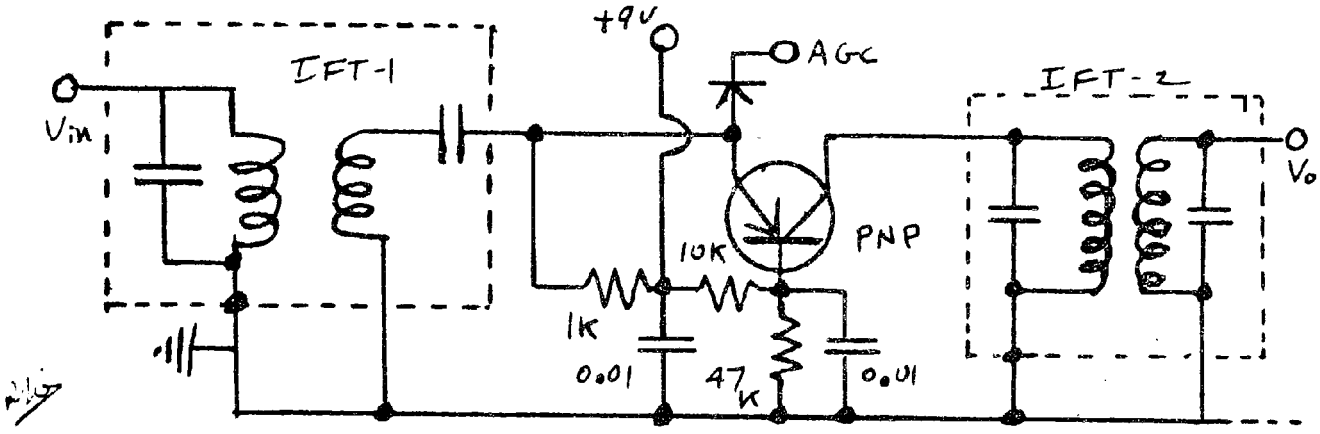
This is the idea I threatened to mention last month. IFT No. 1 is modified by opening the secondary connection between the capacitor and the coil at one end, and inserting the tr's emitter in series; obviously a common-base arrangement, so the output impedance is quite high enough to feed IFT2 directly. Both IFT's are the usual double-tuned high-impedance valve types (from junkbox, viz.).

With the usual type if IFT, an emitter current of about 2mA will give a loaded Q of about 60. Higher emitter currents give higher Q, but the gain (V_o/i_{in}) is approx constant due to decrease in the output impedance. Circuit is shown below.

Also, the gain, $V_o/i_{in} \triangleq Q_L{}^2 Z_L$ where Z_L = IFT impedance (or load Z)

The AGC diode shown represents the ideal method for this use, where an impedance to ground bleeds current from the transistor. This keeps signal-handling ability constant with AGC action.... NB: I haven't yet got around to neutralising this yet. I think it probably does need it.

((Ed. comment. Can't see why it does. But if it does need neutralising you might as well use another transistor between IFT-1 and the transistor you have; I reckon you'll get a better Z-match at the input (e.g. ca 1000Ω) to an NPN emitter follower stuck in in place of the 1K resistor; computer transistors are cheap))



Handbook Performance

Elsewhere in this EEB (or the next) should be a review I made comparing the Orr vs ARRL amateur radio handbooks. This makes more sense than just telling about one or the other by itself. I did start this some time ago but ended up with the rather shallow effort RLG specifically didn't want. So I decided actually to use both of the books as references for a while and let them infiltrate my system. Neither of them really makes what I would call a good reference, but I feel that I can at least now make a constructive comparison, not only with respect to each othr but also against that mythical fount of knowledge, the Ideal Reference Book about which Dick and Rod had so much to say in Oct 71 and Feb 72 EEBs. Alas poor Langford-Smith...

Receiver Performance

Saw a rather good article in early 1973 Ham Radio by someone who has woken up to the fact that the definition of receiver performance is by signal-handling ability rather than sensitivity. He went rather off the rails at the end, however, when he started discussing devices. People are really still thinking in terms of valves. Perhaps that is why IC's are so popular; it goes back to the old system, where the valve/IC manufacturer does all the hard work, and we just use his devices in his recommended circuits. Maybe sophistication came too quickly for most.

Computerisation and Modularisation

Here is a somewhat related philosophical problem. As you have doubtless heard, the new image for the computer is somewhat similar to that of a faithful dog, always obedient, taking all the hard work out of engineering. Maybe. For some things there is no other way, but for some there is, and do we know it? ((CONT. NEXT MONTH))

IS AMATEUR RADIO NECESSARY??* -- A Squaretable

A: Have another beer.

B: Don't mind if I do.

A: What are your thoughts on Repeaters?

B: All in favour of them. You fellows are squeezing into less and less space.

A: Well that's good isn't it? We're using the bands more efficiently.

B: Yes it certainly is good. There are a lot of other chaps who want that space, and it looks as though they ought to have it.

A: Oh?

B: You realise, say, that 80 metres is ideal for people doing work in the outback?

A: But why 80 m. Why not 81 m?

B: All right but they want 80 m, and the equipment is already commercially available

A: But we have already got plenty of amateurs on 80; just listen to the QRM any week end.

B: But how dead is it during the week? And what is to prevent you from doing all your operating with VHF repeaters? You could get nearly as much DX from a chain of repeaters as you get from 80 metres.

A: But that's not fair! A lot of blokes prefer to build HF equipment which is less critical of components and adjustment than is VHF gear.

B: Oh yes, and how many people do build their own any more?

A: Plenty; the amateur magazines are full of constructional articles.

B: Do you build?

A: Well no, but that's a special case; I've just got too much to do for the wife and my job.

B: It's not so special; when more people were constructing they were just as busy. But let's return to the original point. You chaps have already lost a large slice of 80 to commercials who do in fact use it constuctively. You can hardly assert that most of amateur operation is constructive nowadays. Furthermore repeaters show that you can operate on much less space than you have been given. Why, for instance, should you have 4MHz on 2 metres when in fact you produce the most activity there from FM contacts using only some 800kHz? That leaves some 3MHz largely unoccupied.

A: But the low end is certainly occupied very heavily by AM, etc.

B: Sure, some 200-300kHz worth; that's heavy?

A: We have to plan for the future; more amateurs will need more frequencies.

B: The present channel spacing could be reduced, and more amateurs could be put into each channel.

A: This would turn amateur operation into one great net.

B: Isn't that the direction its going now?

A: How about individualists who don't want to be crowded in with the others?

B: Let's keep our prioities in mind. The important thing is not what amateurs want but what societies need.

A: I suppose that society "needs" space in 40 and 80 m while there is ample space available to them outside of our bands?

B: There is such space, but you must admit that the propaganda stations find a hand-picked audience already at hand in the amateur bands.

A: Amateurs are not interested in propaganda!

B: Then why don't more of them jam the broadcasts of the Intruders? Only a tiny signal sitting on one of their frequencies can cause havoc.

A: Amateurs have more important things to do. The fact remains that the Intruders have no business being there; are you supporting their propaganda activity?

B: Certainly not. Arguments have in fact been advanced in favour of your having more space in 40 m, but this was opposed by the government of Infrabovia -- with whom we are presumably on friendly terms. What more can be done?

A: At least we shouldn't lose the frequencies to which we are entitled.

B: Are you entitled to them?

A: Yes, we were given these frequencies by international agreement.

B: Modern tendencies toward band-sharing show that this agreement is no longer as valid.

A: But that's not fair!

B: So? What have amateurs done in recent times to justify their use of the bands?

A: Training new technical talent?

B: Thats taken care of nicely by commercial and military training programmes.

A: Civil defence?

B: This is already handled very competently by governmental agencies.

A: Message handling?

B: Not significantly outside of North America, and look at the mess it has become over there. They are even phone patching commercial transactions now!

A: At least amateur radio provides a healthy hobby for a large number of people.

B: Have you listened to the bands recently?

* This conversation took place in Melbourne a few months ago; RLG was not present!

A: Of course.

B: Do you call "healthy" the kind of obscenity, discourtesy, bad operating, and incompetent operating heard there?

A: Thats only a noisy minority.

B: You can't convince the public of that.

A: (smugly) Most of our operation is on SSB and the public can't receive that, so they don't matter.

B: The commercials can, and they do matter. And they want your frequencies. You have shown that with the aid of repeaters you can do with far smaller bands. You have shown by scanty use that you need far fewer bands. And you have shown by incompetence and poor operating that you are jolly lucky to have any frequencies at all.

A: If you destroy radio you'll be destroying a large commercial enterprise.

B: Who's destroying radio? Only amateur radio; there is much commercial and service opportunity in other directions. Already component manufacturers are recognising this by largely ignoring amateur complaints about component scarcity. The big production goes where the big money is: In the entertainment and commercial communications markets.

A: (Gasp) I need another beer.

B: Me too. May I make a suggestion I hope you'll pass on to your mates. You'll have a better chance of keeping the bands if the intelligent majority accepts some responsibility for pulling the Clods back into line. This requires individual responsibility, and that means you and your friends. If you do nothing, you'll get nothing.

ΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩ

Editor's Note: Any correspondence on the above subject should be concise, and should not repeat subjects already covered fully above.

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The ardent swain, picking a bouquet of wildflowers for his loved one, was disconcerted to find himself suddenly in the same field with a large bull of unfriendly appearance, which gazed at him steadily and pawed the ground in a threatening manner. The young man, spying a farmer on the other side of a fairly distant fence, shouted "Hey mister, is that bull safe?" The farmer surveyed the situation with a critical eye, spat to one side and called back, "He's safe as anything". He spat again, and added, "Can't say the same about you, though."

-- Isaac Asimov

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THE HUMAN SIDE OF TVI: A SEQUEL

-- Refer EEB, Augtober 1972, p. 77

(Reprinted from "Cross-Talk" by G. Slaughter G3PAO*, Radio Communication, June 72, p388)

Friends and neighbours

How many of us can really enjoy neighbourly friendship as it should be, when so often our hobby becomes a serious bone of contention, sometimes even involving whole families? Three cases out of 12 recently under investigation by the Interference Committee† suffered from this sad and unfortunate state of affairs, and not from technical inadequacy.

There is of course no easy remedy once the damage is done, and to refrain from operating is of no value either. One's primary objective should be to work one band at least and to be seen to be operating without causing interference (even if it is with only 1W across town). It will take patience and time, but eventually the breach, with near neighbours at least, may be sealed; enough perhaps to show what can be done on the amateur's own tv receiver with a filter and a bit more rf in the pipeline. It may then be possible to persuade a filter into the house next door and then perhaps further afield. One satisfied customer can lead to others.

One member's solution

A letter from a member mentions the importance of the public relations angle; the writer asks neighbours if he is causing interference (breakthrough), and keeps a "tvi suppression kit", comprising HPFs, braid filters, ferrite rings for use on mains leads, etc at the ready. He enlists the aid of another operator to work his station when investigating a trouble spot and estimates that in most cases about 30 minutes is needed to clear the problem. It should be clearly understood that only aids external to the tv set are offered and that the amateur in no way attempts to modify the receiver itself. (*This does not imply that the writer's approach is endorsed by the RSGB*).

At the transmitter end he continuously monitors his transmission with an old TRF tv set and uses a KW lpf plus an o/c ¼-wave coaxial stub tuned close to the Band 1 sound channel. He tells us not to forget the possibility of trouble from the swr bridge diodes and at the receiving end to check all coaxial plugs for correct make-off, and also to ensure that the tv set chassis is mains neutral.

The newcomer's approach

For the newly-licensed amateur, it must be confessed that after the hard slog of the RAE plus the testing determination of the cw hurdle to gain a full ticket, the temptation to chase big game with lots of beautiful new gear at every hour of the day and night for the first few weeks is generally irresistible and most succumb to it.

Let us be honest with ourselves. If the chap next door takes up golf, practices in **his** garden, and keeps breaking **our** greenhouse lights, and then declares it an act of God, it is most improbable that we will feel inclined to agree with him, even if his set of clubs has cost him something like £70. Suppose it is suggested to him that he reverts to putting, rather than muscle-powering 300yd drives. If he does not agree and says "It's my golf and my garden", then we are probably not on speaking terms any more. Is there a parallel here?

Until he is able to pronounce his own equipment and television receiver clear, a cautious approach both in frequency and talk power is well worth a trial by the newly-licensed amateur. Initially he could use sufficient audio drive so that only his most immediate neighbour is likely to be affected in a mild way and then start by putting this right.

Help and advice

Finally, remember that the RSGB Interference Committee is willing to help, ready to help and able to help, but . . . **do not cut the wicket to pieces before going in to bat!**

TVI problems should be sent to the Interference Committee, RSGB, 35 Doughty Street, London WC1N 2AE.

---

* 6 *Leggatts Wood Avenue, Watford, Herts.*

† *At its meeting on 10 April, the RSGB Council adopted a recommendation of the TVI Committee that it change its name to Interference Committee.*

A question only serious hams should answer...

((EEB Ed. Note: Outside the U.S.A., "serious hams" are known as "amateurs"))

by Jack Quinn, W6MJG

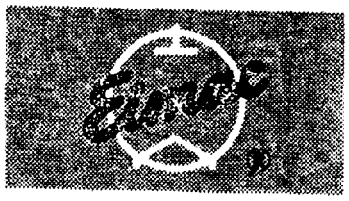
How come you are still asking for our obsolete book? The one called "The Care and Feeding of Power Tetrodes." Look, we've already mailed out over 100,000 copies of the thing. It's just got to be in the hands of every amateur who ever went on the air. Don't get me wrong, I'm happy you find it useful. But now you should be asking for our *NEW* book, "The Care and Feeding of Power Grid Tubes."

It so happens that right now on my desk is a pile of these new books. They're really pretty interesting. You see, one of the fellows on our staff—Bob Sutherland, W6UOV—took it upon himself to incorporate the answers to over 400 questions asked of us in a year's time. In fact, he has spent just about every spare moment away from his shack, preparing this new pocket-size book. I couldn't believe that it has almost 200 pages. Bob said he just got carried away. He has expanded the original book, which we published back in '46, so that in its new form it covers all types of power grid tubes in RF and AF service. Even has graphs and things like that.

Now you're probably wondering, where can I get it? Thought you'd never ask. Right this minute there is another pile of these books at your nearest Eimac/Varian distributor, or your favorite technical bookstore. Figuring all the time we've spent in getting them ready for you, they're really a bargain at $3.95 each. If it's inconvenient to get to the distributor or the bookstore, write me, and I'll send your request along to the book retailer.

OR ORDER FROM EEB (at Sandy Bay) for $A3.00 ea.

Jack Quinn
Division Marketing Manager



Division of Varian
San Carlos, California 94070

HANNA HINTS -- Ralph Hanna, W8QUR
((Amateur Radio News Service Bulletin, Dec. 1970))

Consider some of the beverages that are native to, and popular in, some of the foreign countries.

One of the first that comes to mind is Mexico and Tequila. Tequila actually is a century plant of the cactus family, and the drink is made from fermented and distilled juice. The plant is also used as a stimulant and antispasmodic.

Of course you all know that Vodka comes from Russia. Vodka is made from almost anything, as it is almost pure alcohol and is diluted with water. Russian Vodka is made from the grain rye, or from potatoes.

Rum is made in all of the islands of the West Indies where sugar cane is grown. It is made by distilling the fermented juices of sugar cane or molasses, or both. There are two types of rum: Jamaica which is full flavored, and the lighter Cuban or Puerto Rican rums.

Rum is often bottled under variously colored labels, generally indicating strength and use. White label is most delicately flavoured, and is used in cocktails or as a liqueur. Gold label is a medium dark rum. Purple label is a strong rum used in cookery.

Since we are getting so much stuff from Japan, we should take a look at what they drink. Most everything is about the same as the States; fermenting grain and the like. About the only thing they have unusual is the wine that is made from rice. Suki never gained any popularity in this country because it is a drink that should be served warm. People here do not like a warm drink ((VK too!)), and Suki is no good cold. It is a drink that is more valued for its aroma, rather than the taste. To bring out the aroma the wine must be warmed above room temperature

Since country is the object, it may interest you to know that, contrary to what we have been led to believe, the Germans are not great beer drinkers. The Belgians drink the most beer, and the English come second. As for hard liquors, the area that drinks the most in the world is our own District of Columbia ((Washington, D.C.)). There must be a reason.

XXXXXXXXXXXXXXXXXXXXX

To cure warts:
Collect small stones to the same number as the warts, stand in the middle of four cross roads and fling the stones into the air, scattering them to the four winds. Relief will be immediate.

((CONTINUED FROM p. 19)):
Ed. Note on RAJR's Review of the TVI MANUAL:

See also "The Human Side of TVI: A sequel" elsewhere in this EEB. For Reference the following articles may also prove of interest:

"Tackling TVI", Radio Communication, October 1971, reprinted in Amateur Radio, April 1972.

"Practical Braid-breakers using Stock Materials", by Ian Jackson, G3OHX, Rad. Comm. Nov. 1972.

"RFI -- Don't Go it Alone", by G. Slaughter, G3PAO Rad. Comm., May 1973, p. 346.

"Audio Frequency Interference", by P. W. Waters, G3OJV, Rad. Comm., April 1973, p. 246ff.

"Radio Frequency Interference", by W. R. Moody, WA3NFW, Ham Radio, March 1973, p. 30ff.

"Newcomer's Notebook" by R. Champness, VK3UG, Amateur Radio (Aust.), Jan 1973, pp 12-13 (Poor set design contributes to the problem)

AND so on; as you can see this subject comes up quite frequently in the amateur literature. Thanks to Dick Ferris for the literature searching. -- RLG

XXXXXXXXXXXXXXXXXXXX

WHAT NOT TO DO ?

And then there was this chap who had an inductive load and he wanted to see what the output current was, so he connected an ammeter straight across the solenoid terminals. He reckoned the current was nearly an amp. Having obeyed the instructions to disconnect the solenoid he thought everything would be all-right, but he wondered why it didn't work the second time!

= =

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AN INFORMAL ELECTRONICS EXPERIMENTERS BULLETIN

APRIL 1973 Vol. 9, No. 2 P. 25

CONTENT:

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"JUNE" ISSUE:

Metrication, ICs, Linear, VFO, Noise etcetera

SEMICONDUCTOR TESTING -- Part I

A SIMPLE TRANSISTOR TESTER (AND VOLTMETER) -- R. S. Maddever (VK3)

In 1966-1967 EEBs we examined a number of simple "Grandma's" methods for testing semiconductors, and a detailed discussion of the theory involved. In view of the nonavailability of past EEBs it could be worth resurrecting here a few of the more practical methods currently in use at our location. We shall examine a quite simple transistor tester, and then a more comprehensive one, and finally EEB will include an elaborate diode-testing unit (also useful for transistor voltage tests).

Leakage

If the circuit of fig. 1 is constructed then the meter will be measuring I_{ceo} at a collector voltage of about 6V. This is called the "Collector to Emitter Current with Base Open" (thus the "CEO" subscript). A good transistor usually has a very small leakage current (measured in this way), less than some 50μA for germanium (though this can depend very much on temperature), and probably less than 1μA for silicon. An NPN transistor is shown in fig. 1, but of course for a PNP one the battery and meter are reversed in polarity.

Gain

In fig. 2 we show that a small current, I_b, is introduced into the base circuit. The transistor will amplify this, giving quite a lot larger collector current to flow through the meter. For a current gain of 50, the collector current is some 50 times the base current. The symbol for gain measured in this way is h_{FE}, and so $h_{FE} = I_c/I_b$. The symbol, β, is also used but strictly speaking this applies to the change of collector current which happens when base current is changed, and this will only equal h_{FE} if the transistor amplifies perfectly linearly...

The small base current can be obtained most simply by a resistor taken from the same collector supply battery, and this is shown in fig. 3. For a silicon resistor the base-emitter voltage drop will be some 0.4V, so most of the battery voltage will appear across the resistor.

Then, $I_b = (E_{cc} - 0.4)/R$ If R = 600K and E_{cc} = 6V, then I_b = 10μA. If h_{FE}=50 then I_c = (50)(10μA) = 500μA. If we calibrate the meter by dividing microampere readings by 10, we obtain the d.c. current gain directly. (If E_{cc} = 6v)

The final circuit

This is shown in fig. 4. A switch has been added to select the NPN or PNP socket, and a somewhat more elaborate switching arrangement could do the same by the use of only one transistor socket. The 390Ω is to prevent too large a current passing if a transistor is short circuited, and the diodes protect the meter from excessive currents too; somewhat better meter protection is obtained if a resistor is inserted at point "X", of a value somewhat less than that which decreases meter FSD reading at rated FSD current. As you can see, some voltage-multiplying resistors have been added to allow the use of the meter as a simple voltmeter. In these enlightened days 1 mA is not sensitive, but it is useful for testing batteries and other non-critical circuits; for considerably better sensitivity it can be incorporated in the transistorised meter amplifier circuit described in EEB, Feb. 1972.

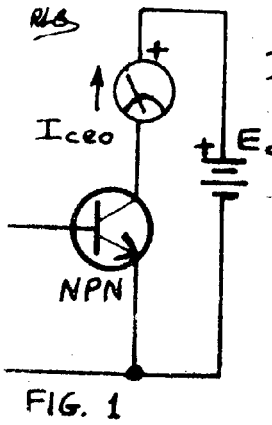


FIG. 1

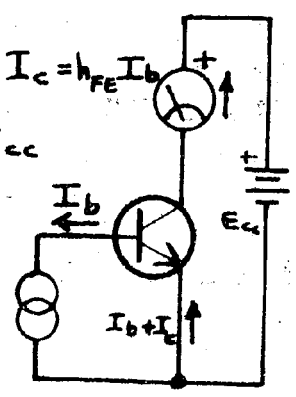


FIG. 2

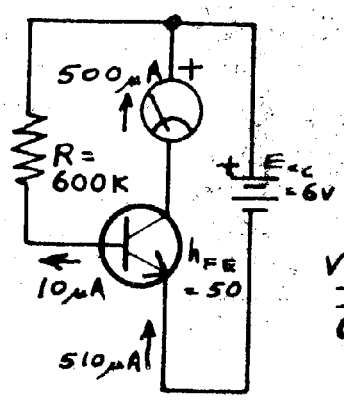


FIG. 3

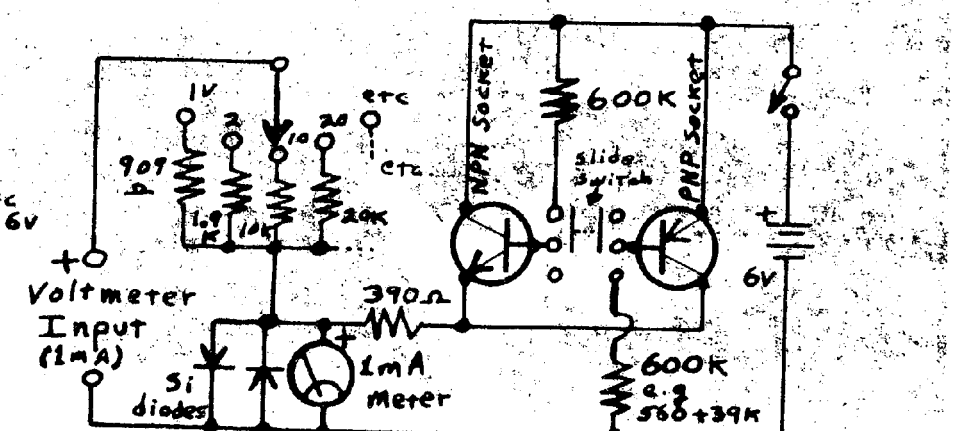
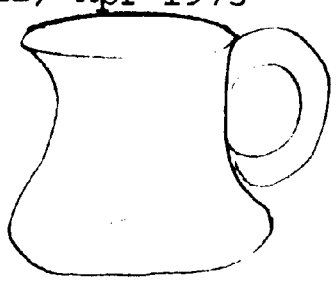


FIG. 4: Voltmeter & Transistor Tester



pitchers corner -- by chris pitcher (vk3)

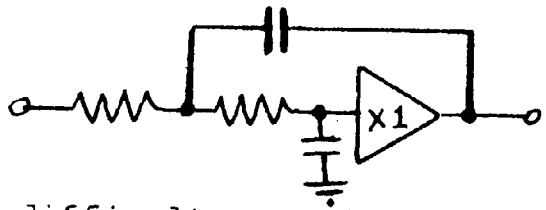
Computerisation and Modularisation (continued)

Is the Computer a Faithful Dog, a devoted servant? For some things there is no other way. Suppose you want to calculate the field pattern of an aerial for a range of frequencies, and it is a very complex array. It ends up with the "1000 men working for 100 years" if you do it by hand.

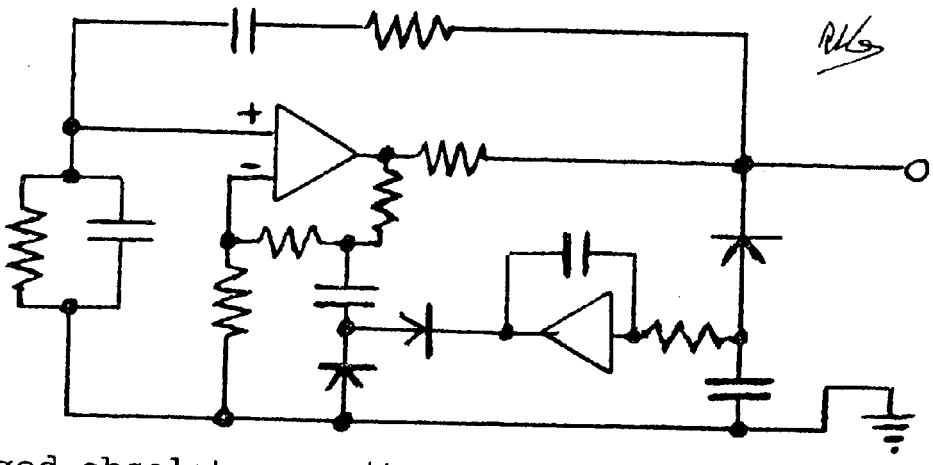
Conversely, the frequency response of an R/C network (if it is small) is fairly simple, and gives a good deal of insight into electronics if calculated the hard way. Well, where is the dividing line? I am not being facetious. I can see the day fast approaching when nobody will be able to calculate anything. Look at filter design. Articles on the subject usually commence with "my programme is as follows..." The result, of course, is that we can design filters now with a minimum of effort which would have been impractical, say, ten years ago.

The trouble is, of course, that people will lose touch with the "nuts and bolts" side of things. This is the real reason for my fear of ICs. You may laugh, but I can name at least three engineers who think nothing of designing around op-amps, shift-registers and the like, but who baulk at putting a transistor in combination with a few resistors. Here are two examples:

The Sallen-and-Keys filter is generally shown as at the right here, where the box is an amplifier with unity gain. Now, an emitter follower gives unity gain, with an error of only a few percent under most conditions. But I had a great deal of difficulty convincing an engineer that he could replace two µA741's with two transistors, with no measurable loss of performance. The final design used ICs; the argument is that ICs are almost as cheap as transistors. Here is another example:



Officially a "1000 Hz sine-wave source" is depicted here. All that was really required was a noise in the headphones to tell a pilot that his wheels were up. Now maybe the first one was justified*. But this last one was judged "too expensive" by (The Establishment) and so it wasn't built. Nobody thought to make it cheaper! Surely there must be a middle course?



Or are we just to become slaves to the System? The trouble is, to question the value of ICs is to be judged obsolete, as it were. In fact, I swear that a year of being considered antiquated causes ICs to be used many times when they need not be -- from the standpoint of simplicity and/or cost.

Handbook Performance (continued)

Further to my review of the Orr vs ARRL Handbooks -- some of the things about the Orr which caught my eye, if you want to mention them, are:

(i) Good explanation of SSB, including PEP.
(ii) Good explanation of neutralisation.
(iii) Concept of intermittent service for Power Supplies.

There are some things which I don't like, but these are covered in the Review. I wish I could find some nice things to say about the ARRL effort.

You know.... this idea of an Amateur version of the renowned Langford-Smith Handbook is not as silly as it might sound. I have been teaching a few friends my approach to active devices, because I got sick of them always bleating about "what circuit to use", etc. Knowledge of a few basic design ideas can free us from the slavish dependence on circuits books. More about this, a bit, next month...

---

* It certainly is. Gains < 1 seriously degrade the Q of a filter circuit. Adequate gain cannot be attained by an emitter follower, since it only gives a voltage gain of the order of some 0.97 at best. -- RAJR.

A NEW SYNTHESIZER PRINCIPLE

((Probably)) by Jack Sullivan, VK6ZFO

((From: W.A. VHF Group News Bulletin, June 72))

M. J. Underhill of Mullard Research Laborotories has pointed out that PAL colour TV delay lines can form the heart of a ((frequency)) synthiser. Both Wireless World (U.K.) and Electronics (U.S.) report this development.

The PAL colour TV delay line stores colour information for a period of one (horizontal) TV line (at 15,625 Hz this is 64µsec) to be compared with the incoming colour information. This comparison allows some benefits over NTSC, the earlier colour TV system.

In order that the line be useful for PAL TV it has to have:-

High Accuracy	±0.005µs
High Stability	±0.005µs over 50°C
Broad Bandwidth	3 to 6 MHz
Low Cost	About $12

Only the volume production for TV can give such performance at so low a cost.

If a signal swept from 3 to 6MHz is fed through the line, it will be found that the input and output will be in phase (with each other) every 15.625kHz (1/64MHz); and at the intermediate frequencies proportional phase shifts will occur. If the phase detector's output (suitably amplified) is fed to the (voltage controlled) oscillator's control input, locking will occur at 15.625kHz intervals. These intervals may be further apart than desired; two methods are available to give closer-spaced frequencies. Fig. 1 shows the first:

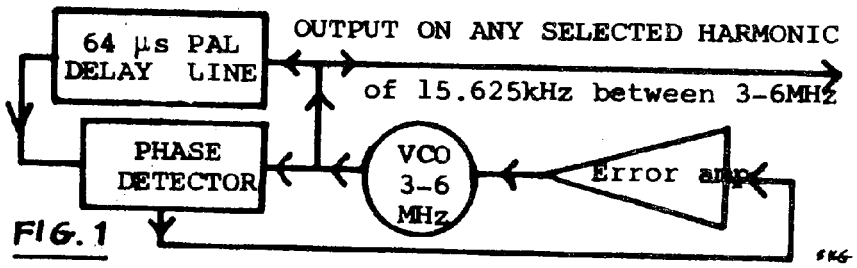


FIG. 1

Here, instead of locking with Zero phase detector output, a d.c. signal may be fed into the error amplifier so that an output from the phase detector is required for lock. The frequency will then shift so as to give the corresponding phase shift; this makes frequency modulation very simple. However, since phase detectors give somewhat less than 360° coverage, an inverter (180° phase) has to be switched in or out to halve this range. See Fig. 2:

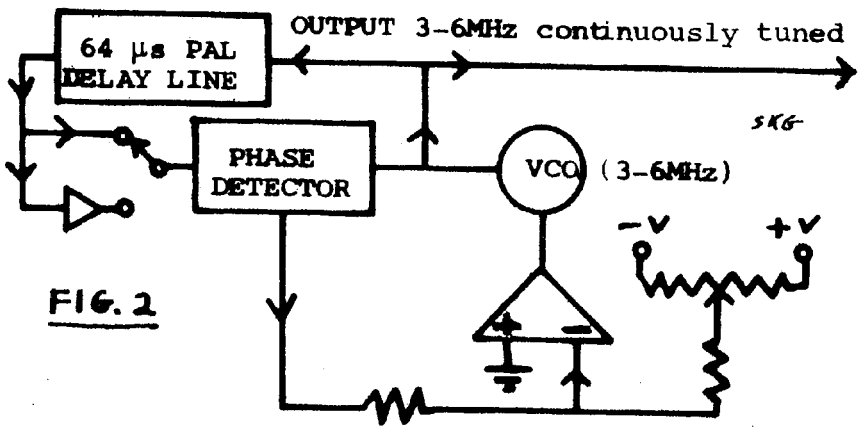


FIG. 2

Alternatively a digital phase shifter system may be used, as shown in fig. 3. This can most simply consist of dividers between VCO and delay line, with a phase shift in the drive to the phase detector. Binary dividers give 2^{-n} MHz steps, e.g. 1/512MHz or 1953.125 Hz steps with 3 binaries. Unless binary (or Octal) channel division and numbering come into vogue, divide-by-5 circuits give more attractive intervals.

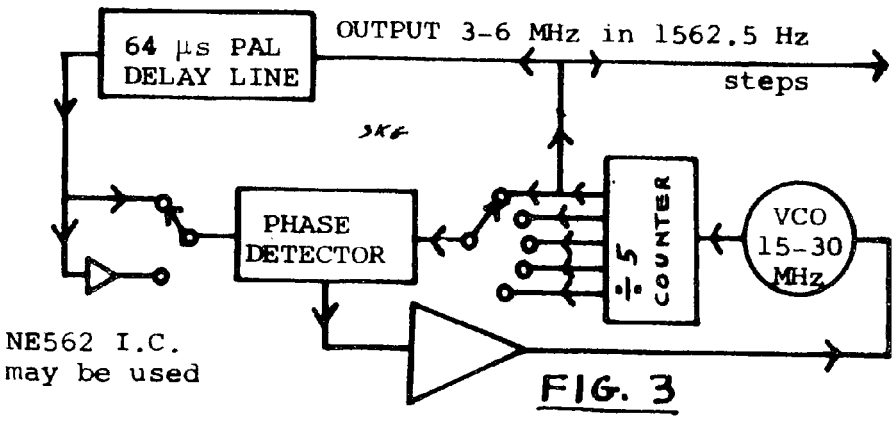


FIG. 3

RAJR Note: This is a reasonable idea, giving accuracy better than with simple L/C systems. It is not quite as good as crystal control, but it is cheaper, operates over a wide range and its accuracy and stability do approach that of a crystal system.

XXXXXXXXXXXXXXXXXXXXXXXX

Quote

We can no longer afford to let such secondary social and cultural effects just "happen". We must attempt to anticipate them in advance, estimating to the degree possible, their nature, strength and timing. Where these effects are likely to be seriously damaging we must be prepared to block the new technology. It is as simple as that. Technology cannot be permitted to rampage through the society...

Does a proposed innovation help us control the rate and direction of subsequent advance? Or does it tend to accelerate a host of processes over which we have no control? How does it affect the level of transcience, the novelty ratio, and the diversity of choice? Until we systematically prcbe these questions, our attempts to harness technology to social ends -- and to gain control of the accelerative thrust in general -- will prove feeble and futile.

Here then is a pressing intellectual agenda for the social and physical sciences. We have taught ourselves to create and combine the most powerful of technologies. We have not taken pains to learn about their consequences. Today these consequences threaten to destroy us. We must learn, and learn fast.

-- 'Taming Technology' in "Future Shock", by Alvin Toffler (Bodley Head, London, 1970).

XXXXXXXXXXXXXXXXXXXXXXXX

"To err is human, to forgive takes restraint;
To forget you forgave is the mark of a saint!"

AN IMPROVED BEER RECIPE -- Staff

By popular demand we herewith update the fine recipe Jim Coote was so kind to provide us in the 1970 April EEB before Lionel Murphy (long may he reign!) made it legal in Australia (c.f., December 1972 issue).

The ingredients are now available widely in this country at a variety of shops (chemists, delicatessens, etc) which also may sell prepackaged "kits". We have, however found better results using the basic ingredients even though this requires rather more work. The more esoteric chemicals can be obtained from any Chemists Shop. Tap water can be used only if it is free of noxious substances -- beware!

The following recipe produces a beaut beer with a good body and a bitter taste. Alcohol content is slightly higher than the commercial brews. For a lighter body, more (or less) alcohol, etc, see "Alterations".

The units are now metric, and you're going to have to get used to them. But for the faint-hearted, 28g = 1 oz, 450g = 1 lb, 5 litres = 1 gal or so, 1000 ml = 1 litre, and 1000g = 1 kg.

Ringwood Special Hops: 100g
Pride of Ringwood Hops: 50g
Dark Malt Extract: 3.5 kg (prewarm first!)
Cracked (in a coffee grinder on "coarse")
Crystal Malt: 500 g. Use the medium roast for best results.
White sugar: 1.5 kg; dissolve in about 1 litre of water, boil for 15 min or so.
Salt: 5 ml
Lemon: Juice of one.
Calcium sulphate: 5 ml
Di-ammonium hydrogen ortho phosphate: 5ml.
Yeast: Vierka Lager or Cenovis: 0.5-1.0ml
(Vierka from Home-brewing firms or from suitable Chemists; Cenovis from Health food shops, but be sure to get the "Fermenting" type. The other is dead)

Preincubate the yeast: Add the yeast to some 500-1000 ml water to which has been added about 10 ml of malt extract, and keep covered and warm (but not above blood heat) for a half-day or so before needed. DO NOT use Bakers Yeast!

Obtain a white plastic 50 litre bottle, cut off the top evenly and replace it by a polythene sheet secured circumferentially by masking tape (put the tape only on the plastic and not partly on the bottle). Sterilise this bin by swirling with some potassium meta bisulphite solution (50 g to litre of water), which can be recovered for reuse. Keep Vat tightly covered at all times except when adding ingredients, etc.

Boil 10 litres mountain water in a 20 litre ("30 pints") covered pan, and add to vat. Boil another 15 litres ditto, add hops (weighed carefully) and crystal malt grain, simmer very gently for 30 min; do not use a smaller quantity of water; the more the better. Remove the bulk of the hops from the pan with a collander and transfer hops to another container. Then drain the liquid through the collander into the vat.

Add another 15 litres or so of water to the drained hops, bring to boil (in the 20 litre pan) and simmer very gently for another 30 min, add a small handful of fresh hops, simmer another 5 min. Remove most of the hops, and pour the liquid through the collander into another pan, but do not yet add to vat. Discard the hops mess ((But the hops go very well in the garden -- Alice.))

Bring this liquid back just to boil, turn off heat, add the prewarmed (to make it pourable) malt extract, the boiled sugar solution, lemon juice and chemicals. Stir very well and add it all to the vat.

Boil up some more water, add to vat but leave about 5 litres space on top (for the froth). Next morning stir the liquid in the vat fairly thoroughly with some long clean implement, and with a clean pan scoop out some of the liquid and allow it to splash back into the vat to introduce some air; repeat several times. Then add the preincubated yeast and recover vat. Note that when the yeast is added the vat should NOT be much above blood heat.

When froth develops after a period from a few hours to a day or two (depends on the yeast), skim once with a clean utensil, then recover and leave it all alone.

Eventually (1-2 weeks, depending on the temperature) the frothing will stop and the yeast will begin to settle -- as shown by a visible darkening at the surface. At this time top up the vat, and wait another 2 to 4 days for complete settling. The brew is then ready to bottle.

NB: If a fermentation bubbler gadget is used (although it is not really necessary if the vat is keps in a room with a moderately even temperature), the time to bottle will be determined by a suitable reduction in the rate of bubbling; you'll have to determine this for yourself.

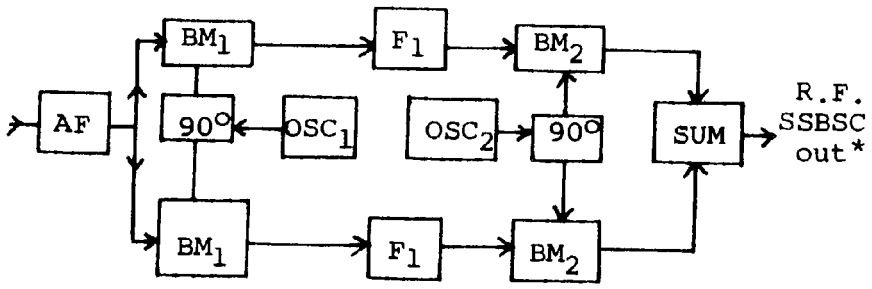
Prime 60 ordinary beer bottles with 5 ml (NOT MORE) of white sugar and syphon from the top level of the liquid into the bottles. Use a flexible rubber tube and pinch off between bottles. It helps to have a short glass rod at the vat end of the tubing, poked into a large waxed cork stopper which floats on the liquid in the vat; that way it takes only the top liquid whilst syphoning. Do NOT use a tap arrangement on the vat; it is a source of grief.

Crown caps may be put onto the bottles with the aid of the convenient capper available from the branch of the Australian Home Brewers Co. in your city (or from relevant Chemists).

Age for 10 days or more. Pour the contents of a bottle into a pitcher continuously and slowly without glugging. And stop when sediment appears at the neck of the bottle.

LETTER: Active filters and Bandwidth...

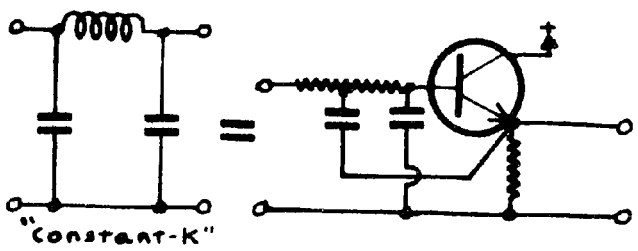
I heartily concur with your findings as presented in the Audio Selectivity portion of State of the Art, VI, June 1972. Some time ago I built a "Third Method" SSBSC Generator, this sort of thing:



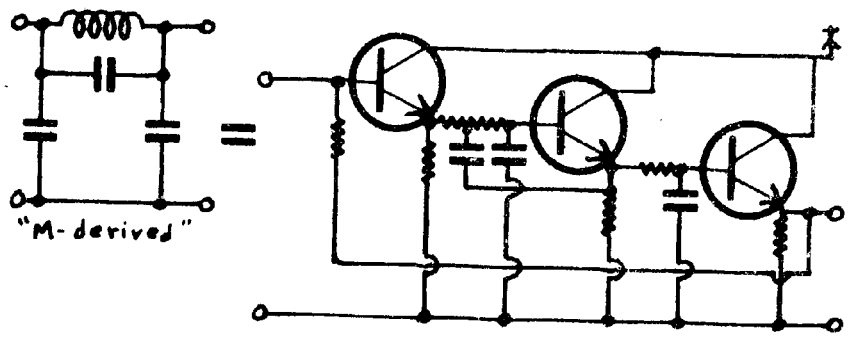
*Carrier Freq ($OSC_2 \pm OSC_1$). ((Editor's apologies; Chris's diagram looked much better than the above)). Here OSC_1 is in the middle of the A.F. range (1200-1600c/s), and OSC_2 is in the RF range. 90° means 90° phase-shift network; BM means balanced modulator; F_1 means low-pass filter.

Now, these filters are audio low-pass, cutting off at the frequency of OSC_1. They have to be pretty good; about -40db or more at f_c + 300cps or less. It can be done without much trouble; it is just a "big" filter; i.e., lots of bits.

I found that a passive filter (about 7 sections of Classical Design) did the job OK, but cost a lot for inductors. An active filter was more complex for the same job, but cost less (no inductors). But the performance was the same.



See Handbooks, "A.R. Techniques", etc. for details



You see, an active filter just synthesizes the response of some (simple but expensive) passive filter. One section of active filter won't be much good (-12db/octave), but neither will one section of passive filter.

Now that filter I built was one way (and a fairly simple one for active filters) of achieving an "M-derived" type of response (ie. one pole or point of zero response) which can be shifted quite close to the cut-off frequency. But to make a good filter of it, yuo have to combine it with more of them, as for passive filters.

Of course, if you shart talking about Chebyshev, Thompson; or anything else, the fabrication of the relevant active circuit becomes a rather more interesting exercise.

The take-home lesson: People have a tendency these days ((these days ? -- RLG)) to go overboard for the first thing they read; a tendency to be discouraged. The details matter not; for the same end result you will work just as hard, no matter how you go about it.

As for the bandwidth question, well, an Editorial in Wireless World asked "How do we compare 8Mc/s of Coronation St, with that many ambulance radio channels?" I may have said that before, but I like it. ((No doubt; what does it mean? -- RLG))

As for the Webb audio phase synchronous detector idea (this month's State of Art), I don't ever like audio phase shift networks. It is usually easier, if possible, to leave it at r.f., and do all the phase shifting there, then at the last convert it down.

-- C. Pitcher, Northcote, Vic.

((But with a.f. networks you can adjust them exactly more easily with a CRO. -- RLG))

((Yes, but r.f. p.s.n. don't need adjustment; with modestly accurate components any error in angle will tend to be quite small. --RAJR))

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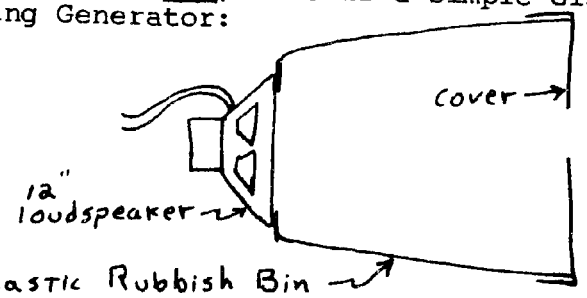
LETTER: Giant Smoke Ring Generator...

As postscript to my Improved Illuminators in Augtober EEB, here is a simple Giant Smoke Ring Generator:



The bottom must be cut out of the bin before the speaker is screwed on! The cover is just a circular disc with a hole cut in it, to the required size of the smoke ring ((Drawing: 2 concentric circles; draw your own! -- RLG)).

Method: Fill up the bin with smoke; this is the only hard bit! Apply a pulse to the speaker such that a strong pressure wave travels down the bin, e.g. as from the application of a suitably strong d.c. (but stop when the voice coil smokes!). When it hits the cover it forms a torus (= doughnut) which is continually turning itself inside out. This carries the smoke out with it, and is in truth the smoke ring itself.

-- D. Brown, Gosford, N.S.W.

P.S. I pinched the idea, modified from an American hobby magazine (Popular Science?), but I never got mine working. It was all built and then someone dropped something in the bin and through the speaker cone. It was, after all, a rubbish bin.....

ANTENNA FICTION, Revisited -- RHF (VK7ZDF)

-- An Article for anyone who receives (or transmits) signals on the short waves.

In the December 1970 issue of Auto-Call there appeared the following statement:

"Our antenna man is holding his nose at the use of a log-periodic beam vs. the standard beams. He says a log-periodic is designed for extremely wide frequency coverage, such as from one band to another, and that hardware which contributes to frequencies between bands is wasted -- you should concentrate on the bands, not the frequencies between them."

This kind of comment is so typical of a certain widespread ignorance of fundamental facts, that we may devote a little space here to its correction.

The Log-Periodic and Bandwidth

The log-periodic antenna is an array which can give excellent results over the range of frequencies for which it is designed -- and this range can be broad indeed.

In contrast, a highly directional beam array of the usual construction performs properly only at one "spot" frequency, and deteriorates rapidly on either side of it. This interests us when the bandwidth of acceptable performance of this kind of structure is less than the (e.g. amateur) band in which it operates.

The Typical Yagi and Bandwidth

For example, consider* that "a typical 2M Yagi is peaked on 144.1Mc for the AM nets. At 146Mc for the FM nets this typical aerial no longer has high gain; it is an attenuator, with a lousy radiation pattern too**. On 148Mc it need no longer exist***. Some people complain of 'no activity' in that part of the spectrum. Small wonder."

The L-P Bandwidth is Useable!

A log periodic can cover such a frequency range with ease, so obviously there is good reason to use one whose frequency response straddles the band. This in spite of the fact that the resulting fractional bandwidth ($\Delta f/f$) is relatively small in terms of usual L-P usage. A small fractional bandwidth doesn't mean you are getting only a fraction of the total performance. It means that you are using only a fraction of the total capability of the system. There is quite a lot of difference between these two concepts!

A Simpler L-P Design

For those people who want constant high performance over a given band, and all-band coverage by a single antenna structure, it is not necessary to design for a continuous spectrum coverage.

It has been found experimentally that those segments of the array corresponding to undesired frequencies may simply be left out, and the structure can be contracted accordingly without detracting from the performance of the remainder!

Good Designs

Satisfactory designs of some sensible antennas have been described in the 1971 ARRL Handbook, ARRL Antenna Book, Orr's Radio Handbook (E/E, 18th Ed.), and in the periodical literature. For example, in Ham Radio for July 1969, Crowell and Orr present a "Log-Periodic Yagi" Beam Antenna". It is a hybrid design featuring a flat high gain characteristic over a 2 Mc range at 50Mc, with extremely high attenuation for signals outside of its pass band.+

Since nominal broadbanding of an ordinary Yagi lowers gain, this shows that with a Log-Periodic you can have your cake and eat it as well. It is a far cry from the opinion by the "antenna man" quoted at the beginning of this article.

Another article on the Log Periodic appeared in 73, Oct 1967, examining design criteria.

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* From: "Antenna Gain, Fact or Fiction", R. H. Ferris, EEB, Aug. 1969, p. 87.

**Dick is being kind to the Yagi. The existence of a peak response close to the working frequency can cause intermodulation and exacerbate noise. -- RAJR.

*** Unbelievers refer to Orr and Williams VHF Handbook (Radio Data Publications). And anyone who reckons we're simplifying or overlooking something,is referred to the 1969 EEB article.

+ But note that the design in HR was incorrectly labelled. The 51-1/4" and 49-1/2" elements should be swapped. -RHF

Better Design? (Comment by RAJR)

In Radio Communication of Feb 1972, G3VA in "Technical Topics" reports a "new" design for a log-periodic which is claimed to provide substantially more gain than the normal dipole type, whilst retaining broadband characteristics. This item was developed at the Central Electronics Engineering Research Institute in India, and involves axial displacement of the elements, plus use of a plane reflector ("back-fire" operation).

This is reported as a new development but I seem to remember a design using just this system some years ago in an American paper on UHF Communication.

The fact remains that you can always get "better" performance from an antenna in one direction by sacrificing results in another. The famous "tradeoff": the most obvious parameters are gain vs bandwidth, but there are many others. It is this ubiquity which has given antennas their reputation for seemingly endless "improvement". In this matter, however, as in all others you never get something for nothing. Even the better design of the Log Periodic system provides only a 9db (or so) gain over a broad frequency range. To obtain more gain, the bandwidth must be reduced, or the size must be increased (as in the Indian development), etc.

It is hardly surprising that the recent development in Log Periodic Antennas came from an Engineering Institute, since the contributions by amateurs to basic engineering achievements in the past 20 years has not been generally outstanding.

The Log Periodic was developed some 20 years ago by telecommunications engineers overseas, and there have been numerous developments since then. E.g., the A.P.O. developed a 2-10 MHz version designed for wide band HF communication in the late 50's.

Ten years later the Log Periodic was hailed as a "new" amateur development. It has yet to appear in the RSGB Handbook, it has only recently appeared in the Orr and ARRL Handbooks, and quite surprisingly it isn't mentioned in the otherwise contemporary British work, Amateur Radio Techniques (1970 Edition).

And that is only one application. There are numerous others (e.g. Vackar and Seiler Oscillators, slot antennas, phase locking, etc etc). Can amateurs still produce something new??

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SOLID STATE ALL THE WAY -- Frank Merritt (VE7AFJ)

((CARTG: RTTY News 12/72))

It is easy to look at the transistor IC technology as being virtually an absolute. This should surely be the Era of No Failures. Now, as we are moving farther into this Era we again realise that this hope is merely a dream. Actually, we have been over this road before. Back in the Thirties when the metal tube was brought out there was serious talk about not providing metal tubes as replaceable items. Today we recognise that, to say the least, no metal tube is a permanent unit. During the later stages of WW II the locktal tube was thought to be the final answer. Again this proved to be an illusion.

It is true that with proper design solid-state failures can be reduces to a practical minimum. Transistor/IC units, however, still fail. Recently I had difficulty in getting 60mA through the constant-current section of my printer magnet circuit. After checking the transistor and finding that it was fine I found that the zener diode had failed. This was a gradual thing. Again the eternal quest for the ideal had proved to be an illusion.

As the solid-state state-of-the-art is maturing we find that service is no longer as easy as it was in the relatively simple days of the vacuum tube. The complexity of modern circuitry and the relatively complex active devices impose a definite penalty in terms of service.

Many modern units of communications equipment are built using Printed Wiring Boards (PWB's) stuck in out-of-the-way places. In some units access to the individual PWB's makes one wonder about maintainability at all.

More fun to come. Stay loose!!

RLG NOTE:

Current practice seems to be to reduce the demands of complexity by replacing whole circuits at a time. In a notable example of this about which I know, a very cheap calculator is regarded as virtually unrepairable. If it starts adding wrongly you throw it away and get a new one!

You must admit that it is easier to pop several circuit boards in a Tester and throw away the bad one, than to spend laborious hours trying to find the crook transistor...? And in some modern engineering designs that bad transistor won't be so accessible either.

Industry could, of course, build stuff to last forever -- and their care in designing equipment for telephone and cable service illustrates this amply -- but it would cost the earth. Will you pay that much?

THE FATE OF AMATEUR RADIO?

((Reprinted, in part, from an Editorial titled "The Decline and Fall of the Radio Magazine", by C. C. Drumeller, W5JJ, Collector/Emitter, December 1971.))

At every gathering of radio amateurs you hear loud moans about the lessened feed-in of new blood into the game. And, pray tell, just how do you expect to get that new blood? No magazine tells the prospective radio amateur how to get his hands wet in the building game. It has been a coon's age and a possum's lifetime since I've heard of a newcomer building a receiver... and dern' near' that long for a transmitter!

John Q. Public is totally isolated from amateur radio. Newspapers, when they mentionamateur radio at all, in those rare instances when they don't confuse it with the CB criminals, invariably denigrate it by calling it ham radio and implying that radio amateurs are a collection of irresponsible kooks ((drongos)). Conventional radio receivers, even the "all-band receivers" sold to the general public, are not capable of receiving the SSB transmissions of radio amateurs. There is no interface between the general public and amateur radio; a wall of non-communication separates the two. And "radio" magazines don't help break down that wall! Its a bloody shame that there can't be a well-marked trail leading the "electronic hobbyist" to the ranks of radio amateurs. But now, "never the twain shall meet"

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Quote: Cheap Telephone Calls.

"Rather than bemoaning the passing of the simple homebrew a-m transmitter, look toward the possibilities of intercontinental communication when you want it, rather than at the whim of the ionosphere. The amateur's traditional communication expertise, inquisitiveness, patience, resourcefulness and determination must again come to the fore in this present and indescribably exciting field of amateur satellite communication."

-- J. Fisk, (Ham) Radio, June 1972.

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LETTER: Amateurs have a RIGHT to exist! ?

I've been reading some back issues of EEB (mainly due to lack of current issues) and I rediscovered the comments by John Andersen in the Oct 1971 issue regarding the place of the amateur in the scheme of things.

As all such discussions do, it stirred me up a bit, because I believe that one of the most essential points is being continually missed.

Its all very well to talk about the amateur service being basically an experimental one, but the fact is that only a minority of amateurs are actually involved in any experimental work, and that almost exclusively on VHF and UHF.

Most amateurs are basically operators, some using home-brew gear, but a large proportion using appliances. VK7ZFO pointed out the justification for commercial gear, with which I agree, and disposed of the "supply of operators" argument. Which leaves us with -- what?

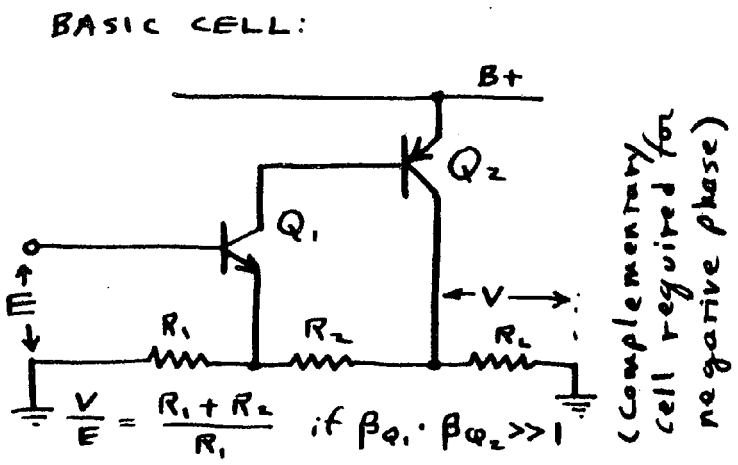
I believe it leaves us with a group of people, spread over the world, who have the technical knowledge and the inclination to communicate with each other. The airspace they occupy is miniscule compared to the relatively sparsely populated commercial allocations.

Any completely non-technical person in the States can get a licence to gossip on the airwaves, so, aside from the other reasons for the existence of the amateur service, should not we be allowed to indulge our hobby to the fullest extent -- particularly as it undoubtedly promotes international friendship, something we could do with a lot more of these days.

Just as private pilots are permitted to use airports, so I believe amateurs are entitled, and I repeat entitled to a proportion of the available airspace which was all opened up by amateurs at one time or another, and not just HF and VHF.

So, to all those amateurs who've bothered to think about "why... we are all here", stop trying to justify operating! We're entitled to it.

I saw a very interesting article in the May 1970 "Australian Electronics Engineering" (p. 25) concerning low B+ power amplifiers. It looks as though it may be the answer to something I've been puzzling over for a while: how to deliver 30W into a 4Ω load from a transformerless transistor amp with a B+ of 12V. This amp is claimed to drive the load to almost the full a.c. supply voltage, which should just about do it. The basic circuit is as below:



-- Clyde Stubbs, VK4CS, Cairns, Qld.

((I wonder how we might convince the various Intruders on the Bands, that we DESERVE the airwaves -- which they believe more important for the inane trivia they disseminate in Megawatt volume. They think they deserve the space too, and they have bigger transmitters, and louder mouths in political councils... --Ed.))

"THE LITTLE DAZZLER" -- the Best Torch in Town, with the Least Battery Worry...
-- by Peter Ward (VK3)

1) Purchase one Eveready "Big Jim" Lantern. Order it with optional high-power sealed beam (Part No. 4547); NOTE: Few dealers know of or stock other than the standard sealed beam, part No. 4546; insist on the one you want.

2) For a battery pack order a set of 5 min. NIFE CELLS from "Direct Disposals" -- cost, approximately exactly the same as for a dry cell pack, and the only difficulty is that you have to build up a box to hold the cells with a similar mounting arrangement.

This extra trouble is worth it. These five cells will fit into a pack almost exactly the same size as the commercial one, but of course weigh a little more. As these cells have to be fitted with plugs for charging you will have to design your box accordingly. (Write to me, c/- EEB if you are really stuck) The cells have to be insulated from eachother, of course.

Note that the lamp I specify here is a 1.25A job so don't purchase the normal dry cell rack for your BIG JIM unless you are one of the filthy rich.

"Direct Disposals" (Brisbane) provide info for putting these cells into service, but these few notes may help:-

Electrolyte: 20% potassium hydroxide sol'n.

Charging Rate: They suggest 1 Amp. As these cells are sold as 4A.H. this suggestion is not in accord with the generally accepted 7-hour charge rate for these cells. To avoid cell damage I suggest you stick to approx 500mA.

((Ed. Note: It might also be a good idea to refer to the EEBarticles, "Danger -- Explosive Batteries!" in April 1972, p. 40 and December 1972, p. 126...))

Charging: Whilst charging,these cells will "spit" electrolyte mist out the vent plug, and will make a generally horrible mess over your torch. To prevent this place a small strip of sponge across the vent holes when charging -- and rinse well after you have finished.

((Ummm, I just realised that the explosive batteries thing won't apply to these vented items but the caution is probably worth mentioning anyhow in eventof someone using the sealed type instead. Incidentally, it might be worth considering removing these cells from the torch whilst charging, to avoid the mess...? -- Ed.))

Charge Retention: Expect these cells to lose 25-30% charge per month.

Cell Life: Hard to tell what to expect from cells which have been in storage for an unknown period of time. I have 3 sets in use and found no "duds", but some cells hold the charge better than others. In this regard, those cells made in 1945 (slotted plugs) are markedly better than those made in 1942 (square plugs); consider this when ordering them.

Putting Cells into Service: As received, these were all dry, sealed, and in varying states of charge; so:
1) Fill with water, and allow to stand for 2 hours with the terminals shorted.
2) Drain, refill with fresh electrolyte.
3) Charge. Fully charged no load = 1.5V.
Fully charged, 250mA load = 1.2-1.3V.
Discharged voltage < 1V.
4) You may have to replace perished seal rings on the vent plugs.

Changing Electrolyte:
1) Short for several hours.
2) Drain, refill with fresh electrolyte.
3) Charge.

Extra Dazzle: Order 6 cells, and make pack accordingly. Shortens beam life, of course, but oh what glorious light!

Life: Life between charges with the 4547 beam is not as long as you would expect for 4A.H. cells. Several low-rate discharge tests leave me with a suspicion that these cells may only be 2A.H. Good life and a fair light are obtained with the standard 4546 beam which draws, I think, only 0.5A.

Cost of Cells: With fresh electrolyte this will come to about $4.50, which compares with a dry cell pack price of about $3.55, but of course the rechargeable items can be used many times over.

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How to break an egg

It would appear that farm chickens are intolerably healthy, for their eggs can be robust. Normal methods for breaking them can have little effect, and an attempt to force the issue can result in spectacular disintegration of the hapless vehicle.

There is one method to avoid this distressing result, short of reverting to the supermarket eggs: hit the middle of the egg smartly with a heavy sharp knife. The shell will then divide with a loud report.

Danger: A good aim is essential.

And: Do not apply this method with supermarket eggs unless they are held in a chain mail glove.

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Quote

"Guests at the Milton Hotel, Port Klany, where a case of typhoid was reported on Saturday, have been assured that in view of the possible danger all vegetables are to be boiled in water specially passed by the Manager"

-- Straits Times (Kuala Lumpur)

This & That

Don't get shirty, chaps, that's what it actuallysaid. Which reminds me, I'm again embarrassed by the fact that the recent advertisement in Electronics Australia managed to appear before these issues of EEB; the latter were planned to appear a long time ago, but it does seem to take a lot of time for them to percolate through the various stages of processing necessary. Well, never mind, I say, just keep repeating to yourself, 'EEB is worth waiting for'

Back to computers, I've got a nice full file on the subject, in which Les Yelland and others argue pro & con on whether computers are human. As Prof. L E Smthye said in a recent Symposium on Pollution Control, "It's not much use getting a wrong result quicker from a computer than you would have in doing it longhand." That's not fair to computers, I reckon; most mistakes they make come from mistakes in programming -- and as far as I know we don't allow computers to programme themselves -- yet. Another item in that file is the description of how we are technically able to make a really good computer about the size of, say, a human head. But the unsolved problem is, of course, interfacing. Not to mention the fact that semiconductors are substantially less efficient than neurones, and a head-sized computer might have to run red hot! The only reasonable choice is to manufacture one of Asimov's Positronic Brains complete with synthetic neurones and several hundred million bit-containing pathways. And assuming that the new random-learning computer principles are applied, we shall have succeeded to producing a Thing which can think as well as we can. Well, wot then?

How long do you think that Mr. Robot would last when it (he?)(or if we're being Equal, she?) made trenchant comments on the rationality of the policies of the Director of the Laboratory, or when it antagonised the leader of the local plumbers union? Then we'd devise a way to reprogramme the Brain a bit to make it conform socially. At that we should have no difficulty, since a wide variety of tested methods are already at hand...

Which reminds me, the students of our local College have published their first Newspaper (?), and its so full probably of libellous comments that I must muse that different rules must apply to student newspapers than apply to some underground electronics magazines.

I see that the Arabs are forcing the Yanks to reduce heating and speed to a reasonable level. There's always some good in everything...

WHERE WAS ALL THE DX AT?? — Greg Johnston, VK7KJ

This scribe has found very little to enthuse about for a few months past on the higher frequency DX bands, with 20 15/10 M being very largely untenanted during the hours when 'on air' time is available. W/VE stations can be heard in the 0200 to 0300 and thereabouts region on 20, with openings gradually extending out to the 0700Z region, and this trend should show further improvement over the next months and bring with them a greater measure of the 'rare' DX not noted since the early part of the year.

If you are keen enough to brave all the JA SSB QRM on the low end of 40M the pickings on CW are much better, with good representation from the European area including some of the rarer U-type prefixes which are currently coming through anywhere up to S9 from about 1000Z, on. With fortitude and persistence the odd African prefix may be heard around 1400Z and later through the JA and commercial QRM, though it makes contacts very hard to maintain. Of late there have been some extremely powerful W-signals thundering in at all hours from about 1000Z, on.

Although the QRN level is generally on the increase as our summer approaches, good contacts on SSB can be had below 3.7Mc from 0700Z all around the South Pacific area, along with an occasional South American or Carribean station. Should split-frequency operation be possible then the possibilities are much better, with much of the DX operating around 3.8Mc and listening near 3.690Mc. To achieve much on this band a good (!) antenna is a must most of the time at least with the G5RV exponents not doing too much good for themselves.

Having already broached the subject of SSB operation on VHF in past issues I may be able to enveigle yon Editor to use some of the material from Mike, ZL4GF to provide an example of the general type of simple equipment which I consider would form the nucleus of a very nice HF and VHF station having simplicity and the extreme in portability as the major keynotes.

I have had the pleasure of hearing two or three of these little rigs on the air from ZL on 80M lately and even with a mere 5 wattsthe results can only be described as startling. Being interested in the setup of the gear I made a plea to Mike to let me have the details which he duly did via our redoubtable Editor. It llooks good, RLG, how about a bit of space for it? ((The Otago 9MHz SSB Exciter was published in Break-In, May, Jun, Jul 1970 We'll indeed publish his 5W linear plus Direct Conversion Rx one of these days — RLG))

ADVERTISING

This Page: Personal = FREE Commercial = (ENQUIRE) We guarantee nothing..............

THE AMATEUR RADIO MOBILE SOCIETY facilitates amateur operations, and publishes the nice ARMS News. For example, the January and February 1973 issues contained: A Mobile Linear Amplifier for the FT-75 Transceiver (Full details), Antenna Polarization on Two Metres, The hazards of shorting the LT with your watch or ring!, Oscar-6 News, "Why I am interested in mobile operation?" (with an interesting discussion of what kind of antenna a mobile whip really is), Awards News, Multiband mobile antenna idea, ARMS Information Service; Inverted "L" Antennas (Full details), Comments on Electronic Ignition performance etc, Two Metre Antenna Idea, and a note about r.f. getting into the Electronic Computer of the newer Volkswagens and XKE Jaguars! Don't buy one of those care if you intend to run mobile! For further details in joining the ARMS and receiving their News, write: Mr. NAS Fitch, 40 Eskdale Gdns, Purley, Surrey CR2 1EZ, Engl.

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THE CANADIAN AMATEUR RADIO TELETYPE GROUP publishes "RTTY News" monthly at a cost of only $C2 p.a. It contains contest news, enticing advertising for RTTY equipment (and now the $A buys about $C1.50, as our $ keeps going up & up!), and competent technical articles. For instance, in July 1973, "Building a Model 32 Selector Magnet Driver"; in the June 1973 issue, "A Canadian Ultimate Transmatch", and "The Low Cost of Homebrew" by our own Frank Merritt, VE7AFJ — and it applies to all kinds of construction, not only teletype. If we have room we must reprint it sometime in EEB. And so on. Send subscriptions ($C2.00) to CARTG, 85 Fifeshire Road, Willowdale, Ontario, Canada M2L 2G9. Or send $A1.90 to EEB (difference in exchange covers bank charges and air mail postage), at Sandy Bay.

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THE RADIO BULLETIN OF THE Eastern/Mountain District Radio Club is a nice magazine; if you like EEB you'll like it. E.g. in the Sept 1973 issue:

Club News (of interest to nearby members)
A Series Modulator for Solid-State Transmitters
A Quantitative Comparison of AM, FM, and SSB
(with a note on the superiority of CW!)
Introduction ot SSTV, IV: Using Fast Scan Camera, Live.
(And: "Interested? Conused?... Wanto learn more?
Why just read these brief summaries each month? Hear
it ALL explained FULLY -- and have your questions answerd
--- each month at the TV Group Meeting!")
Circuit Ideas (CRT ((CRO)) Monitors), full details.
Pages from the Past: A complete 1908 Transmitter.
Disposals News: ATV, New IC Regulator, IGL Reg P/S, etcetcet
(including 2M FM Carphone Kits, LM380 kits, etc)
Classified advertising; bargains for Members

Plus many advantages for Members who are able to attend meeting, social and technical events, etc. Details last EEB or send for info. Australia's No. 1 Radio Club and electronics publication! Cost: $3.50 first year, $3.00 each subsequent year. The price is rock bottom for the benefits received. Send for a Membership Application Form to:
The Secretary, Eastern and Mountain District Radio Club, P.O. Box 87, Mitcham, Victoria 3132, Australia.

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OTHERADVERTS AS PER Feb EEB: Good stuff there, particularly the availability of inexpensive overseas books & equipment

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EDITORIAL: This & That (continued)

Last issue I noted that the PMG was going to double our postage over the next few years. This statement was in error, and I apologise: The postage went up 240% with this issue, no warning, just this massive slug. Our postal bill will be upwards of $40, and helps to explain why we

(continued):
keep the rate where it is, and forget some ideas I had for developing N.A. sub numbers (particularly Canadian). N.A. subscribers can still send their subs to Frank Merritt (as per p. 48 here), but don't tell your friends about EEB -- Hi!

We are pleased to announce that the few U.K. subscri-

still will be upwards of $50, and helps to explain why we are sending two issues at a time during 1973, even if we weren't trying to Catch Up. All this seems to prove is that both the Liberal and Labour parties are impartial when it comes to expressing contempt for a free press. Evidently the DLP lost (cf p. 13).

Your ordinary post has gone up from 40% to 70% too; perhaps you haven't noticed, because postage comes in such small bits and besides its not much of your budget. But it is just One More Thing, and it is an atrocious example of profit-taking during the changeover.

As before, postage to NZ has certain advantages over the local variety, e.g. 15c/50g to NZ, 20c/50g to New Guinea; perhaps it will cost less when the latter State achieves its independence? (Quoted: AIR mail rates)

Seen on a shop window: POLYURETHANE FOAM, PEAT MOSS. Could it be that in these enlightened days the latter is now a byproduct of the former???

Its a pity but the fine duplicated magazine "Spectrum" in New Zealand is now coming out only as a thin Newsletter. Reading between the lines, it looks as though interest in constructional activity by real experimenters is waning, even in New Zealand, and financial support for "Spectrum" has collapsed. A pity, but as they point out there is still Break-In, and indeed in Australia we have both Amateur Radio and Electronics Australia. So why do we have so much extra publishing activity by mags like EEB, the Radio Bulletin, 6-UP, Tuned Lines, and the S.A. WIA Journal? Ego gratification? One answer might to to contribute whatever it is we are contributing, less frequently. I am reminded of this by a note from Roger Harrison, editor of 6-UP:

"I'm seriously thinking of changing from monthly publication to either bimonthly or quarterly next year. At the moment I work 6 weeks/month on 6UP. The family complains. Getting help in the drudge work is almost impossible. Reminds of the story of the little red hen. Ah, amateurs, what a heartbreak old bunch you are!"

I'm sure Roger won't mind my revealing this touching bit of confidence; it only makes sense, and I reckon that with the incredible new postal bills there is going to be a massive swing toward bimonthly and quarterly publication. Just as well, perhaps, in view of the other thoughts above.

Incidentally, the American (and Canadian) dollar keeps sinking so fast that it just isn't possible to keep up with it. Aside from what this implies for the financial stability (?) of the rest of us, it means that it is becoming absurd to try to charge a reasonable subscription for North America. So, I'm just going to

We are pleased to announce that the few U.K. subscribers we have can now send their £ to our new Representative there:

Jim Coote, G3UGD
56, Dinsdale Ave., King's Estate, Wallsend,
Northumberland NE28 9JD

and finally, remember that renewal subs are now sent (in Australia) to Bob Walton's new address, as per the Renewal Sheet, not p. 48 here.

This issue

Brenda begs me not to put such a horrid creature on our front cover again! By the time she has to collate upwards of 1000 of the things she has the Shudders. I'll have to use a nice natural subject next month, like a wildflower, or a cow or the like.

I might note that in spite of our slightly unkind words on p. 31 of this issue, we have the greatest respect for R.V. Anderson (Andy) and his publications. A large part of our "Quotes" and fascinating titbits (e.g. SWOOP) comes from them, most notably the Bulletin of the Amateur Radio News Service. Andy is an oldtimer, and knows a lot about publishing; if you publish any kind of duplicated or other effort you should contact him: KØNL, QTHR.

Finally I note that Jack Quinn came out better in this issue (p. 42) than last month's. Our printer was a bit concerned about February's item, lest North American readers think he were negro!

Oh yes, one extra word: We must hasten to admit that the Power Supply on p. 47 is hardly original, and a similar item appeared in Electronics Australia, Nov 1968. But is worth mentioning again, if only to say how to adjust the extra series resistor for best results. And as we saw from p. 14 last issue of EEB, the lesson hasn't necessarily yet sunk in for the design of commercially-built P/S's.

UNDERGROUND LIFESTYLES (Ref. Toffler, p. 28 & 41)(here)

"Future Shock" By A. Toffler is one of the significant books I have read this year, the others being "The Human Use of Human Beings"by N. Wiener, and "Man the Unknown" by A. Carrel. Toffler gives us a possible glimpse of the awful future which awaits us, and I rather prefer Carrel's constructive attitude to Toffler's which exorts us to cope with the insanity of future society. I'd rather be a sane drop-out. Toffler is in some respects an updating of Carrel, with an industrial flavour, but still quite significant in many parts.

Toffler's section on Novelty (Ch. 14) asserts "However, we pay for the benefits we receive (for belonging to a social group). For once we psychologically affiliate with a subcult, it begins to exert pressures on us. We find that it pays to 'go along' with the group. It rewards us

with warmth, friendship and approval when we conform to its life style model. But it punishes us ruthlessly with ridicule, ostracism or other tactics when we deviate from it"

Pondering on this I consider that as one of the great plethora of new magazines spewed out by our information-oriented society, EEB belongs to one of those subcults! Toffler refers specifically to the publication quandry in his chapter, "The Origins of Overchoice". What is to be done about it? I made suggestions on p. 15-16 of last month's EEB, and obverse I imply strongly that all of us ought to publish less frequently.

In the present instance I affiliate with the device of my own creation and so am rewarded simultaneously by friendship and approval when I turn out a good issue or am not too late. And ridicule and disapproval when the issue contains too much B to appeal to A (and too much A to appeal to B!) — or when my publication schedule is 6 months late. Believe me the latter is a frantic stimulus to virtue, but in this real world where I happen to have other obligations too, this imposes a practical limit which night- and weekend-work cannot satisfy.

In any event, that, dear friends, I now realise, is why I instinctively set my own standards and publish what interests me at a given time — or in any event what happens to be at the top of the Files. If I tried to please everyone (indeed, anyone), I'd oscillate from one extreme to the other, as the phase lag between desired & achieved goals induced a hopelss instability (See "Human Use of Human Beings" — Cybernetics for People).

Doubtless this explains why we acquire such devoted enthusiasts, and why we regularly lose large handfulls of subscribers, and why some advertisers tend to be faithful and why some wouldn't be seen in our company. And why we have had such substantial difficultytrying to exceed the 1000 subs mark; almost, but never quite there!

Do we not, therefore, earn the title, "UNDERGROUND ELECTRONICS" in the best tradition of this fragmented 20th Century and its esoteric lifestyles??

DICK SMITH & CO.

Old Dick spends a fortune each month in advertising; if you'll patronise him and tell him that you heard about him through EEB we might be able to get a corner of that investment from time to time. I note by the way, that EEB got a nice mention under the "Amateur " section of his big Catalogue published in the October issue of Elec. Aust. Thanks, Dick -- and Roger.

It seems to me that as long as we have firms like Smith and Kitsets and Radio Parts and Micronics and the Rest, we shall not have to worry too much about the Parts Availability Crisis, which has been discussed for the past year or so in these pages. Reading the overseas literature reveals that we appear to be in a substantially better position than the North Americans, and possibly even than the British.

=-=

INSPIRATIONAL MESSAGE ((QSP Florida Skip, via ARNS))

LORD, thou knowest better than I know myself that I am growing older and will some day be old.

KEEP ME from getting talkative, and particularly from the fatal habit of thinking I must say something on every subject on every occasion.

RELEASE ME from craving to try to straighten out everybody's affairs.

MAKE ME thoughtful, but not moody; helpful but not bossy. With my vast store of wisdom, it seems a pity not to use it all... but, Thou knowest, Lord, that I want some friends at the end.

KEEP my mind free from the recital of endless details; give me wings to get to the point.

SEAL my lips to my many aches and pains... they are increasing and my love of rehearsing them is becoming sweeter as the years go by. I ask for grace enough to listen to the tales of others' aches and pains. Help me to endure them with patience.

TEACH me the glorious lesson that occasionally it is possible that I may be mistaken. Keep me reasonably sweet; I do not want to be a saint... some of them are so hard to live with, but a sour old person is one of the crowning works of the Devil.

HELP ME to extract all possible fun out of life. There are so many funny things around us and I don't want to miss any of them!

AMEN!

= = = = = = = = = = = = = = = ((I think Editors must be sweet masochists; the above item is spread widely by them— RLG))

PLEASE be patient (& renew if nec.): June & Oct are coming!

HANNA HINTS -- Ralph Hanna, W8QUR

-- RELIABLE VFO CONSTRUCTION --

(From A. R. News Service Bulletin, 2/72)

Quite some time ago I wrote an article about adding a VFO to a Heath 18-3, the 160 metre sideband transceiver that came out as a crystal controlled set. The oscillator oscillated very well and drove the unit in fine style. It also drove me and a couple of other people out of their minds because the drift in frequency was just unbelievable. Adding NPO (no change in capacitance with temperature) capacitors and N750 (negative temperature coefficient) capacitors helped some, but still I was never sure what the frequency was going to be the next minute.

Ham Radio magazine had an article on VFO's and the author offered to sell a little circuit board to make within a Vackar or a Seiler VFO. The author did not say much about eliminating drift except that good mechanical construction should be used. This prompted me to read everything I could find on the subject of VFO's. Following are some of my findings:-

A lot of guys lucked out ((dipped out)) by having no drift when building a VFO. I'm not sure I believe them!

Mechanical construction is of the utmost importance which sort-of goes along with heat dissipation. Use heavy metal and lots of it. Mount all components very rigidly.

Toroidal inductors are about the best that can be had. The "L" air core is next but the problem is mounting, and it must be rigid. Ceramic coil forms are almost as good and can be mounted rigidly. Slug-tuned coils while in many ways (useful) are not suitable at all. The iron in these is very temperature sensitive, and mounting can be a problem; also the βQβ is much lower and it can be a problem to get the circuit oscillating. The βQβ of a toroid can easily be as high as 250, while the slug-tuned coil may be only 50. Paint the toroid with a good quality varnish to keep the wire from moving.

Just about the most important components are the capacitors. Silver mica should be used everywhere they possibly can affect the frequency. For some reason the old moulded or postage-stamp silver mica tended to cause less drift than new dipped silver micas. I may just be unfair in that statement because both types are available with different characteristics. The old ones indicated this by coloured dots. The new ones show it by a letter in the model number. The letter quite often is only on the package, so we may never know the characteristic unless we order them specially.

-- Continued next month.

SWOOP --Elise White (YF, KØCNV)

(From A.R. News Service Bulletin)

It continually amazes me at the excuses reasons, and causes amateurs come up with to justify or avoid doing this or that. I've heard a number in the past ten years, but the squirrelist I've ever heardis the justification for two metres.

I've lived through earthquakes, floods, natural or un natural disasters with assorted characters wandering in and out of the house at all times of the day or night, but I can't find one single recommendation for two metres at breakfast.

The only time the phone isn't ringing or someone knocking on the door is breakfast, but no -- yak! yak! Somebody quit talking while I'm interrupting.

It's the first thing loaded in the car and even taken to Thanksgiving Dinner. We have it with snacks and on trips. The only good thing about this new rig is that it's turned off for 8 hours getting its battery charged.

"I never get lonesome or isolated as we are since the repeater went in. The rig sets right in the kitchen."

"I can go anyplace now, I never get lost."

"It's fun travelling now. Someone can always talk me in."

"It's such a homey band, like having close neighbours."

"We're moving to the mountains, but we made sure we could hit the repeater before we bought."

"I've talked my way across the States coast to coast. That's really something."

Give a ham a mike and most of them develop verbal diarrhoea and with a 45 second cutoff they really speed up.

I'm not moving to the mountains. I'm neither isolated nor lonesome, and I've seen many interesting things getting lost. I have no intentions of going coast to coast talking or otherwise and I don't want a radio in my kitchen -- AM, FM or shortwave, especially for breakfast. So, until somebody can come up with a good concrete reason to justify the noise I'm screaming loud and long!...

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ATTENTION PROSPECTIVE SCIENTISTS! (ARNS, 8/71)

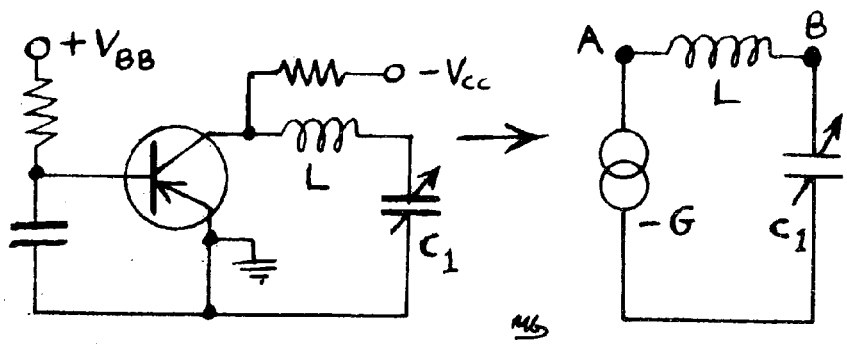
"Do you know a pre-college budding scientist who has not decided which is his prime field? If so, he can get "Search" and "Test Yourself in Science" at one dollar (US) each from Scientific Manpower Commission, 2101 Constitution Ave., NW, Washington DC 20418, USA"

LETTERSLETTERSLETTERSLETTERSLETTERSLETTERSLETTERSLETT

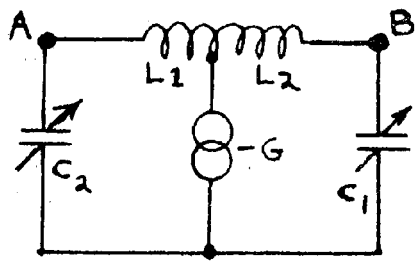
Uses of Transistors in Avalanche Mode

I'm spending all my spare time on the Avalanche Effect (EEBs, late 1971 etc). The trouble is in coupling to a cavity resonator. I.e., in my spare time I'm reading up on Microwaves.

One odd effect I have discovered deserves a brief metnion. Consider an avalanche oscillator (by now established here as a mostly-reliable VHF oscillator/amplifier):



If now, the collector of the transistor is shifted from point A to a tap on the coil, in the direction of B, and point A is returned to ground through a capacitor, thus:



Now the beast will oscillate at the frequency where the impedance is a minimum, which is approximately (if the tap is close to A) the series resonant frequency of C_2L_1. If a signal is coupled into the tuned circuit L_2C_1, the beast functions as a self-oscillating parametric amplifier -- I think.

Anyway, it amplifies. Just how much is parametric and how much is negative resistance I don't know. Noise? I don't know, but I'll find out.

Incidentally, its not really necessary to use a tapped coil; two separate coils should work, although I haven't tried it yet.

-- Chris Pitcher, Northcote, Vic.

= =

Receivers etc.

I particularly enjoyed the article on receiver design in EEB last year, and particularly the one on Reciprocating Detectors. I think that a magazine of this type should concentrate on in-depth technical articles. If it also manages to be entertaining as well, all the better!

73 Magazine manages to do this with its strong (political?) editorials and the wry sense of humour of "W2NSD". Someone will have to explain American politics to me sometime -- damn if I can differentiate between Democrat and Republican, except that they make different policy speeches before the elections.. Come to think about it they do the same thing in Australia too!...

I feel that the main reason people aren't building and experimenting in the electronics field is through lack of time. When one considers the trouble involved locating a circuit, then parts (or substitutes), correspondence about availability of same, postage, possibly the problems of importing from overseas... Well! Sometimes it has taken me one year to get a project going from the time of reading the original article. Once its built, unless one is directly involved in electronics there's the bother of lining the circuits up correctly without the proper test equipment.

I need a new receiver, but when I compare building one (say from an overseas magazine) or buying say, an old RCA AR88 (2nd WW Vintage, like myself) for $80, well! Yes, they're around at this price, in Sydney at least.

Can I enter into the Handbook controversy? A Handbook is particularly useful when starting out into radio. You can always refer to it when first stydying, and when the lecturer is not about. I feel that when one knows something about radio its use diminishes because the monthly mags carry all the latest gen. The only time I refer to a Handbook (usually AR Techniques) is to cross-check some theory behind an article in some rag. A Handbook can never keep really up to date...

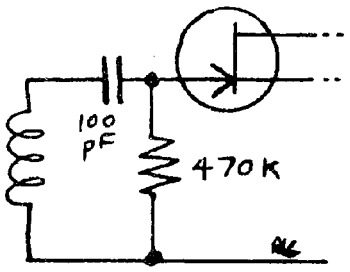
-- Keith R. French, Haymarket, NSW

= =

JFET Circuit Loading

I was interested in the article on p. 122 of the Dec 1971 EEB regarding JFET circuit loading.

I recently rebuilt the converter shown on p. 70 of the Sept issue, into a more elegant case, and having made a Dip Oscillator in the meantime, I found precisely the same thing -- tuned-circuit loading by the FET even though the FET is supposed to be a high impedance device. An ohmmeter test on all the 2N3819's I have showed the gate-source junction to be a diode of the same resistance as a silicon base-emitter junction (are they all damaged?) and I put it down to this.



Connected as shown at the left, most of the Q was retained, and the inbuilt capacitance reduced, giving increased coverage at the high end.

The same happened with the oscillator (30pf cap) but perhaps due to the increasd Q it now blacks out the TV tube from two rooms away and gives a lot of spurious responses. Probably have to remove most of the turns on the coil primary. The coupling capacitor to the mixer had to be removed completely. The extra components seem to have introduced a bit of noise, perhaps due to unsuitable resistors, and possibly some due to increased sensitivity.

-- R. H. Beinke, Port Lincoln, SA

((On one hand, an FET is NOT necessarily an extremely high impedance device at radio frequencies; in this respect they behave exactly like that other "high impedance" device:valves. See the Radiotron Designers Handbook for a very good treatment of this subject. On the other hand, a JUNCTION FET has a junction; so who is surprised? See any text describing how a JFET works; the junction shows a reasonably high impedance when back biased. Remember that a bipolar transistor's base is forward biased. All of you, please read fundamental theory of the devices you use, before using them. You'll be able to make them work much easier and better... In that vein, look up oscillators; distortion, etc. -- RLG))

CONVERSION OF ELECTRONIC PHOTOFLASH TO A STROBOSCOPE

-- R. Wilson (VK2ZVX)

A motorised switch can be used to trigger a strobe, but an electronic circuit is more reliable and stable.

This trigger circuit uses a PUT (Programmable Unijunction Transistor) in a simple relaxation oscillator, but a UJT-type circuit also works well. I run my trigger from a small 9 volt battery, but it is quite possible to drop the 300 volt supply through a resistor and zener diode.

To allow the photoflash to be operated safely as a strobe, the dump capacitor must be reduced in capacitance -- generally to a few microfarads.

Most straight-type xenon photoflash-tubes dissipate about 40 joules;

MAX. ENERGY INPUT = $CV^2/2$ per flash.

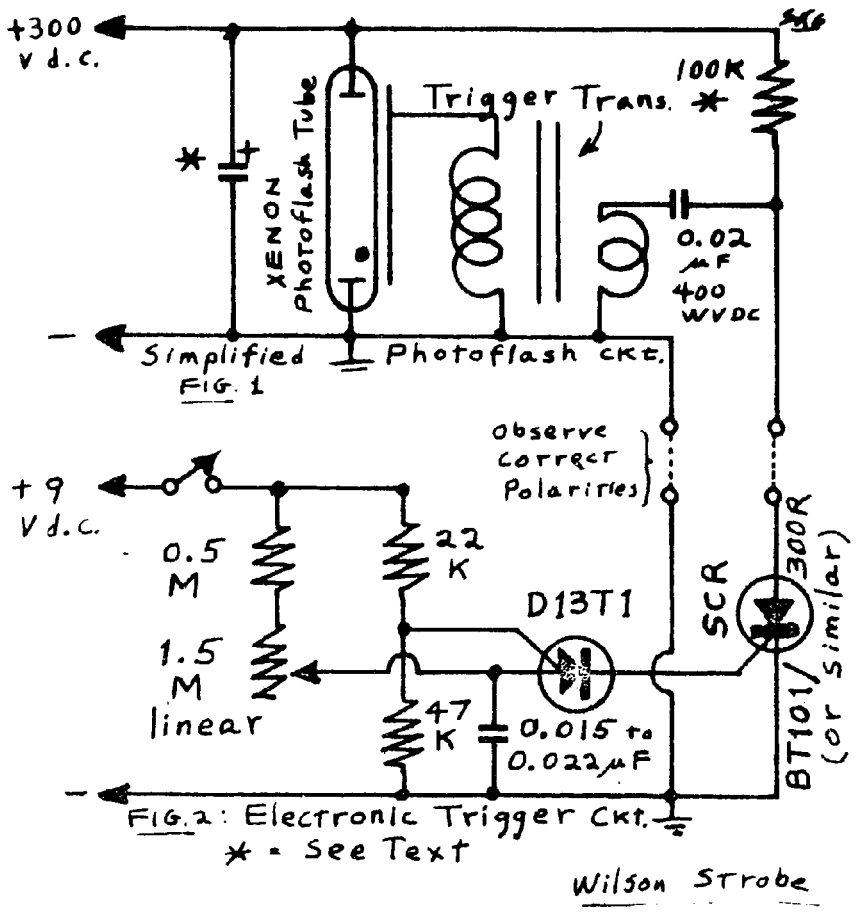
This means that for more flashes per second, the input capacitance (and thus input energy) must be reduced. I find, however, that at about 300 volts, 20 to 30µF gives adequate results when used at a moderate flash-rate for dances, etc. This higher dissipation does not appear seriously to reduce tube-life, if the tube is allowed to cool periodically. The dump capacitors used are standard "Ducon" electrolytic types, and I have not experienced any failures caused by surge currents, etc.

Generally, reducing the size of the dump capacitor is all that has to be done to the flash. Sometimes, however, the trigger-capacitor charging resistor has to be reduced to enable adequate trigger voltage to be developed, especially if erratic flashes are observed.

The electronic trigger is substituted in place of the original camera connections. When connecting, be sure to have correct polarities on the SCR.

Flashtubes and trigger transformers may be obtained from:

Circuit Components (A/Asia) P/L,
P.O. Box 70, Bexley, NSW 2207.



Quote

"Such innovations imply enormous changes in instructional techniques as well. Today lectures still dominate the classroom. This method symbolises the old top-down, hierarchial structure of industry. While still useful for limited purposes, lectures must inevitably give way to a whole battery of teaching techniques, ranging from playing and gaming to computer mediated seminars and the immersion of students in what we might call "contrived experiences." Experiential programming methods, drawn from recreation, entertainment and industry, developed by the psych-corps of tomorrow, will supplant the familiar, frequently brain-draining lecture. Learning may be maximised through the use of controlled nutrition or drugs to raise IQ, to accelerate reading, or to enhance awareness. Such changes and the technologies underlying them will facilitate basic change in the organizational pattern..."

"Tomorrow's illiterate will not be the man who can't read; he will be the man who has not learned how to learn."

"Even during early industrialism, Herbert Spencer maintained that "Education has for its object the formation of character," which freely translated means the seduction or terrorization of the young into the value systems of the old".

-- from "Future Shock", by A. Toffler, Chapter 18.

One reason why your amplifier may be unstable...

(Reprinted from
73, March 1968)

by Jack Quinn, W6MJG

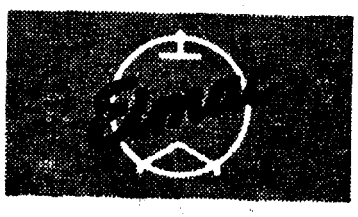
Some hams dropped in the other day and we got to talking about dynatron oscillation and what effect it has when you are trying to stabilize an amplifier. We agreed that it is a common form of self-oscillation; most of us have experienced its effect as noise interference, or distortion on a carrier—even unwanted side bands. We agreed that it produces thermal strain on elements. But some hams didn't know that the voltages can get quite high and can reduce the tube life. In a runaway condition, the tube can be destroyed.

We said that dynatron oscillation is caused when any electrode in a vacuum tube has negative resistance. But how this is caused wasn't clear to everyone. And perhaps, more important, what can be done to eliminate it. If you were to look inside a tetrode, you would see some electrons flowing from the cathode to the plate hitting the screen grid. This collision would knock loose low energy electrons which are called secondary electrons. Most of them return to the screen grid because of the relatively low screen-to-plate potential. If they try to get very far from the screen, the plate will attract them. The result is an uncontrolled electron flow from the screen to plate. This is secondary emission. And during part of the operating cycle of the tube it is possible that more electrons will leave the screen grid than will arrive. Thus causing dynatron oscillation and possibly a runaway condition.

Now that we had a better understanding of how this oscillation occurs, we began to come up with suggestions of how to eliminate it. One ham suggested that we change the operating line so it doesn't pass through the tube's negative resistance region. In this way, the oscillation would never have a chance to get started. I suggested that we reduce the alternating current impedance in the screen grid circuit so that the voltage could not be developed across it. A very large capacitor across the screen grid power supply (say up to 1000 microfarads) should work well.

Why don't you let me know if you have had this problem—and solved it in another way? I'm always glad to get into discussions like this. I think we all learn a little more.

Jack Quinn
Division Marketing Manager



Division of Varian
San Carlos, California 94070

DIGITAL INSTRUMENTS -- Part I

-- by N. D. LORIMER, B.Sc., C. Eng., M.I.E.R.E., M.I.R.E.E. (Aust.)
Head, Department of Electronic Engineering,
Tasmanian College of Advanced Education

((Editor's Note: We are grateful to Mr. Lorimer and to the Tasmanian College of Advanced Education to allow us to print the Notes prepared for the course "Digital Instrumentation". These Notes are appearing here because they are a relatively concise treatment of a large and important field, and we know that they will be of interest to EEB readers. Owing to space limitations however, it will be necessary to present the material in the format here shown. We apologise for the smallness of the print but hope that the material will still be read with the close attention it deserves.)) ((P.S. Subsequent pages are better!))

Digital techniques are now employed in so wide a range of industrial and research instrumentation that a comprehensive coverage is virtually impossible, but an understanding of the basic principles (whichapply to virtually all cases) should be of great assistance in situations not mentioned herein.

These notes are not encyclopaedic, and many possible variations of the techniques mentioned are in use. Fortunately, many manufacturers provide a section on "operating principles" in their equipment handbooks which provides a brief outline of the techniques employed in a particular case. Extracts from handbooks from Solartron, Hewlett-Packard, Fluke, Weston, and Schneider Electronique have been included in these notes. A brief book-list is appended to this introduction for the benefit of those who wish to "read around" the subject.

Most current (1973) instruments employ integrated circuits almost exclusively, which makes for compactness, low power consumption, and reliability. Design of special-purpose subsystems is comparatively easy using i.c.s as a "building-brick" approach can be employed, and manufacturers are usually willing to supply copious information. Because of this, the treatment of circuits has not included any design concepts.

Although care has been taken in the preparation of these notes, some errors may have crept in, and advice upon these would be appreciated. ((They can be sent c/- EEB. -- Ed.))
I would like to express my appreciation of the efforts of Miss Wendy Brown and Miss Anne Mackey who between them transformed these notes from my illegible scrawl into their present form.

Further Reading

Dean, K.J., Digital Instruments (Mc Graw-Hill, 1965). Elderly (pre IC) but of value in spite of outdated hardware terms.

Malmstadt, HV and Enke, CG., Digital Electronics for Scientists (W.A. Benjamin, 1969). Up-to-date, comprehensive. Fairly simple approach. Some 40% of the book acts as an instruction manual for a commercial "logic tutor" system.

Cooper, W.D., Electronic Instrumentation and Measuring Techniques (Prentice-Hall, 1970). Little on digital instruments per se, but good coverage of transducers, etc.

Bartee, T.C., Digital Computer Fundamentals, (Mc Graw-Hill, 1966) As per title, deals with computers, not instruments, but early chapters on logic and switching systems are good.

1. Introduction

1.1 What is a Digital Instrument?

Measuring devices may have readout in one of two forms, Analogue or Digital. In an analogue instrument, the readout is obtained via some proportional variation of (generally) position of some part of the instrument, e.g. angular deflection of a pointer proportional to current flow in a d'Arsonval movement, height of mercury column proportional to temperature in a thermometer. In a digital instrument, readout is (again generaly) in the form of a displayed decimal number.

The speedometer/odometer system of a motor vehicle is an example of a combined analogue/digital display, speed being displayed in analogue form by a moving pointer, distance in digital form on a totalisator.

1.2 Analogue versus Digital

In the electrical firld, analogue meters may be electromechanical, relying on electromagnetic or electrostatic forces to cause a pointer to deflect against spring pressure, electrochemical, using a current-induced chemical reaction to produce a time-related colour change, etc. Digital meters (ignoring outdated techniques) are entirely electronic in operation, employing appropriate analogue-to-digital converters. Because of their greater complexity, digital instruments are often much more expensive than analogue devices of similar performance range, but other factors other than prime cost must be considered:

1.2.1 Reliability

The usual d'Arsonval movement is inherently fragile, the digital instrument has no moving parts. Precision moving-coil meters in particular must be used in a specified orientation and vibration can affect readout. A digital display is vibration-proof and totally insensitive to orientation (excepting d'Arsonval-based projection displays, not now popular).

Moving-coil movement life, in good conditions, is a function of prime cost (construction quality), virtually indefinite. Digital display life is thousands of hours, solid-state component life is again virtually indefinite.

Overloading a moving-coil instrument can cause movement damage requiring a very high degree of craftsmanship in repair. Overloading a digital instrument may cause component damage, generally within the capability of a "normal" technician. Note the "may" -- most digital instruments can accept massive overloads with impunity.

1.2.2 Readability

A clear analogue meter scale is reasonably easy to read, but a multifunction instrument often presents a "cluttered" appearance, making misreading common. A digital display is eminently readable.

1.2.3 Versatility

Digital meters can perform any function available in analogue instruments plus others, particularly in the counter/timer field. Autoranging is found on many digital instruments, but is

virtually impossible in analogue instruments.

1.2.4 Precision

Reading precision of a d'Arsonval instrument depends on scale length and subdivisions, pointer width, and operator ability. Interpolation is possible but may be erroneous and parallax may be a further source of reading error. A digital instrument has precision determined only by "scale length", i.e. the number of digits provided.

1.2.5 Accuracy

Accuracy is always a function of prime cost, but in general, digital instruments are more accurate than analogue instruments.

1.2.6 Printout

Chart recorders are analogue instruments which provide hard-copy printout. Digital instruments can be interfaced to line printers, teletypes, etc, but a more useful facility is the possibility of direct on-line interfacing to computers for instantaneous data processing or/and assessment.

1.2.7 Remote reading

Where readings have to be monitored at a distance, the binary-coded output of a digital instrument provides an ideal data signal for transmission. With an analogue instrument, a television link is one (expensive) solution.

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2. BINARY LOGIC

2.1 Why Binary?

If an instrument is to have a digital readout system it must emply a number system, and the system chosen should be compatible with electronic operation. If a decimal number system is adopted, it is necessary to be able to represent ten distinguishable levels of signal corresponding to digits 0 to 9. The only successful electronic ten-level system is the neon stepping tube, typified by the Ericsson Dekatron, which is seriously limited in speed of operation (i.e., under 10 kHz).

Considerable simplification of the necessary electronic circuitry is obtained if a two-level system is adopted, the signal levels being "presence of signal" and "absence of signal". These are the levels obtainable by use of a switch in a circuit, and the electronics of digital instruments hehce comes under the generic term, "switching circuits".

2.2. Binary Numbers

In the decimal system there are ten digits 0,1,2,3,4,5,6,7,8,9; in the binary system there are only <u>two</u> digits, 0 and 1. The binary addition table is thus very simple:

$0 + 0 = 0$
$1 + 0 = 1$
$1 + 1 = 0$ carry 1, i.e., $1 + 1 = 10$

(Compare $9 + 1 = 10 = 0$ carry 1)

A decimal number, e.g. 378 is a shorthand form of $3 \times 10^2 + 7 \times 10^1 + 8 \times 10^0$, i.e., $300 + 70 + 8$.

Similarly a binary number, e.g., 101 represents $1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$, i.e., (in decimal): $4 + 0 + 1 = 5$.

The binary "multiplication table" is of little interest in the context of digital instrumentation, but the multiplication process is simple, e.g.:-

$101 \times 0 = 0$
$101 \times 1 = 101$
$101 \times 10 = 1010$
$101 \times 11 = 1010 + 101 = 1111$

The binary number sequence is of form:

Decimal	Binary	
0	0	
1	1	($2^0 = 1$)
2	10	($2^1 = 2$)
3	11	
4	100	($2^2 = 4$)
5	101	
6	110	
7	111	
8	1000	($2^3 = 8$)
9	1001	
10	1010	
11	1011	
12	1100	
13	1101	
14	1110	
15	1111	
16	10000	($2^4 = 16$)
etc.		

Binary numbers are generally much "longer" than their decimal equivalent, for example $2^{10} = 1,024$ so, as an approximation, ten "binary places" are required to represent a three-decimal-place number.

2.3 Logic (Refer to fig. 2.3)

Logic is the science of reasoning, and being a science, follows strict laws (first propounded by Aristotle). The first and most important of these is that if a statement is not true it must be false (Aristotelian logic does not recognise the "half-truth", but is not "black or shite", but rather "black or not-black".)

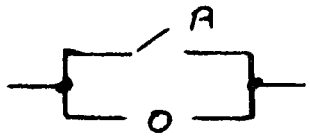
Being a true science, logic conforms to mathematical rules, e.g. just as the solution of $y = 3x + 2$ cannot yield two values of y simultaneously for a single real value of x, thus a logical statement cannot simultaneously be both true and false. The nineteenth-century work of Boole, de Morgan, and others provided us with what is teermed Boolean Algebra, a symbolic method of expressing logical statements in mathematical form.

Boolean algebra has uses in the analysis, synthesis, or simplification of sequential switching systems, which (if properly designed!) operate logically in that a given sequence of events always results in a given system response, determined by the system interconnections. The basic rules of Boolean Algebra are set out and illustrated in terms of switches in fig. 2.3 .

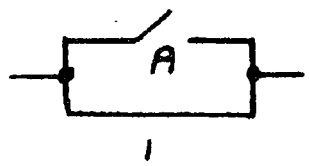
(CONTINUED NEXT ISSUE)

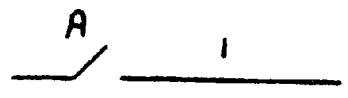
Fig. 2.3 Illustration of Logic Laws

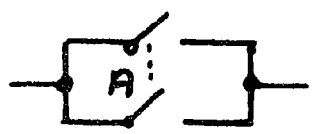
Switch open = 0 switch closed = 1

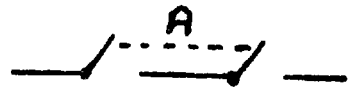
$A + 0 = A$ 

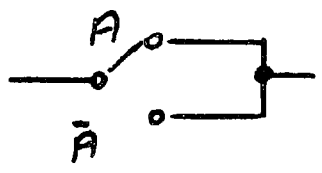
$A . 0 = 0$ 

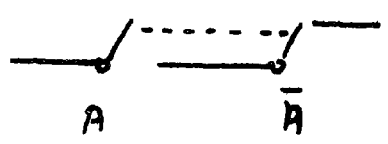
$A + 1 = 1$ 

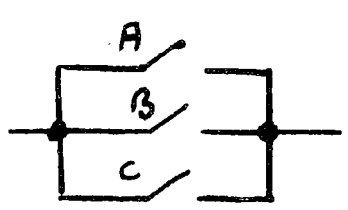
$A . 1 = A$ 

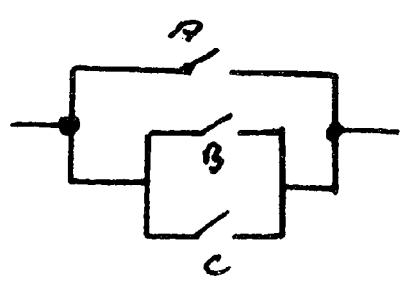
$A + A = A$ 

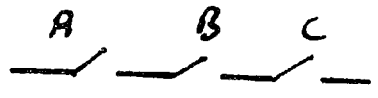
$A . A = A$ 

$A + \bar{A} = 1$ 

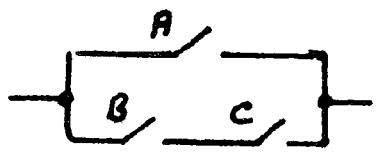
$A . \bar{A} = 0$ 

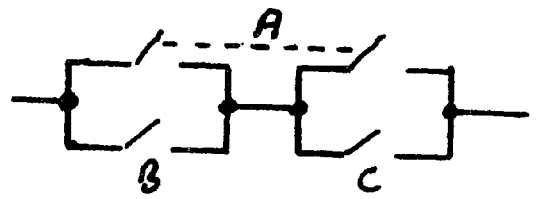
$A + B + C$ 

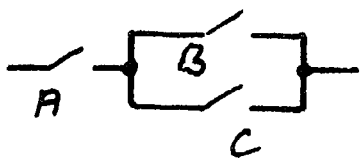
$= A + (B + C)$ 

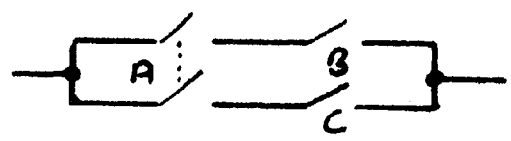
$A . B . C$ 

$= A . (B . C)$ 

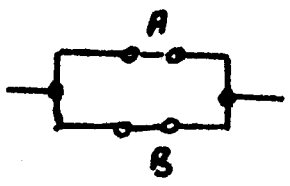
$A + (B . C)$ 

$= (A+B).(A+C)$ 

$A . (B + C)$ 

$= A . B + A . C$ 

de Morgan's Theorem:

$\overline{A + B}$ 

$= \bar{A} . \bar{B}$ 

An open circuit condition is being considered.

A or B closed gives same result as A and B closed.

INTEGRATED CIRCUITS AND THE EXPERIMENTER -- James M. Bryant, G8FNT

I wish here to discuss the effect of the wide use of integrated circuits on circuit design in general and on amateur radio in particular. In future I suspect that more and more circuit design will be done in the integrated circuit companies themselves but, since there will always be applications where no suitable integrated circuit exists, circuit design will continue to be necessary outside as well. This will also apply where it is not practical to make an IC for reasons of uneconomic quantities or of performance requirements incompatible with integration. So the "non-integrated" circuit designer will not die out, though he will become rarer.

The idea that the average amateur or other experimenter is a circuit designer, however, is a misconception -- though a very old one. The majority of these people who design and construct their own equipment are, and always have been, integrated circuit users. Until now they have been obliged to construct their own "integrated" circuits with valves, transistors, resistors, capacitors, etc, but now they can buy them ready-made from Plessy and others. Evidence for this is plentiful, among it the comments in EEB on the average amateur textbook which contains a few "baby" circuits and then rings the changes on the same half-dozen circuits that all the rest of the textbooks extol.

Amateurs in general do not design circuits -- they design systems and then look around for circuits to perform the functions their system requires. Many circuits used in this way by amateurs are more or less unsuitable for the job they are called upon to do but their use is so traditional that no one questions it.

In the two years I have been applying the Plessy SL600 integrated circuits in communications systems I have questioned most of the commonly used amateur circuits and systems, and have often been appalled by just how unsuitable so many are for the tasks required of them. For example, transistor r.f. amplifiers are intrinsically liable to cross modulation and intermodulation, but are still widely used at HF and VHF and are almost universal at UHF. Likewise bipolar transistor VFOs are noisy (usually only 90 db between oscillator output and local noise), while FETs are some 50 db quieter, yet FETs are used much more rarely.

Similarly in system design the double superhet with a tuneable IF is very commonly used at 144 MHz and above, but is almost unusable in the presence of an unwanted strong signal. Again, almost all h.f. receivers have r.f. amplifiers when in fact combined atmospheric/galactic/manmade noise at h.f. is so strong that a loss of 8 db in the front end filter/mixer/narrow crystal filter still allows the use of quite noisy i.f. amplifiers (and of course mixers) without degrading the system noise, at any rate if a reasonable antenna is used. All the r.f. amplifier adds is the possibility of saturation or intermodulation when strong unwanted signals exist.

To summarise, I think that, far from damaging the constructional side of amateur and other experimental activities the introduction of good commercial integrated circuits will lead to the replacement of the bad home-made circuits previously used -- particularly when adequate applications literature is available. Such good ICs will also increase enormously the performance and complexity possible in home-designed and constructed amateur systems while simultaneously reducing both the cost and the risk of failure.

Ed Note:
The author has in fact published linear IC applications widely in the amateur literature, and if you ask him nicely I reckon he may send you suitable literature on application of Plessy semiconductors. Write to him c/- The Plessy Company Ltd, Cheney Manor, Swindon, Wiltshire SN2 2QW, England, U.K. And of course mention EEB.

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"If you help a man in trouble, that man will never forget you -- especially the next time he's in trouble!"

Making Tea (tepidly)
Scientists tell us that the best tea is made if the teapot is not prewarmed.

A SIMPLE REGULATED POWER SUPPLY -- by G. R. West and R. L. Gunther (VK7s)

In 1970 EEB featured a series of articles on the design and operation of Regulated Power Supplies, and some practical circuits were presented. One such was a regulator by Smith in the July 1970 issue, featuring the use of computer-board transistors in a diode-stabilised standard series-regulator system. The circuit of fig. 1 here is similar but with some improvements, and in these days of integrated circuits is presented without much apology for reasons well discussed by Chris Pitcher in "Pitcher's Corner" in these pages. It is important for experimenters to be ABLE to construct stuff using discrete components and above all to understand thereby how the circuits work.

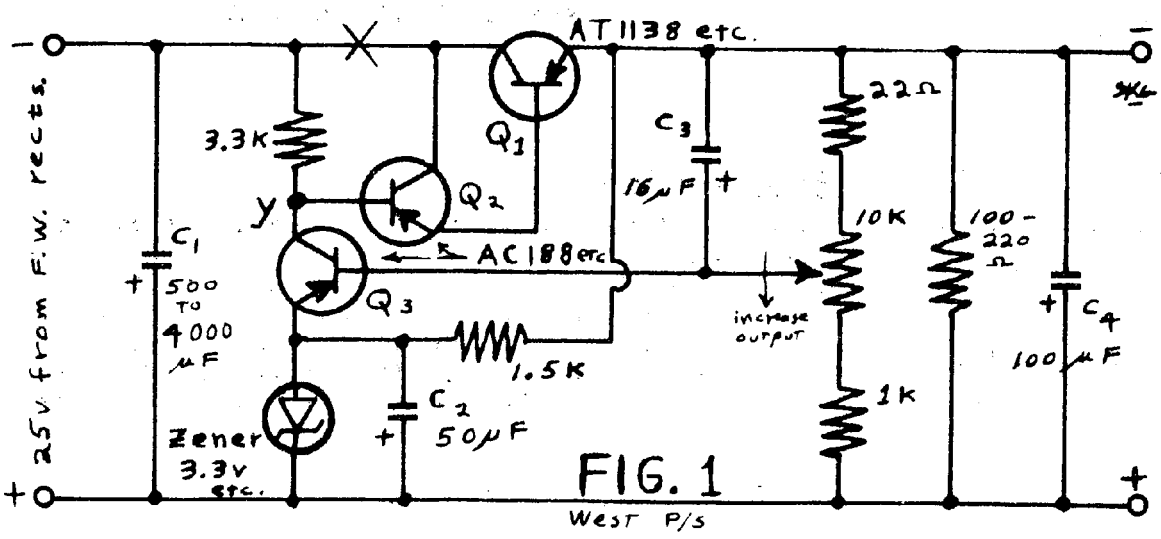
This circuit handles considerably more current (eg 3A) than Smith's, because of the larger series-pass transistor (any 5A PNP would do), and has considerably better regulation (e.g. -0.1V for 3A load) than obtained by RLG for his fig. 21a of the abovementioned articles. This improvement is doubtless due to the higher amplification (the Darlington pair) together with the use of a proper zener rather than a diode reference. C3 and C4 are included in spite of RLG's warnings in the May 1970 EEB because they improve the a.c. regulation and ripple, and untoward effects have not been evident. In other words, the circuit works fine, in the best "Grandma's" tradition is spite of the warnings by theorists.

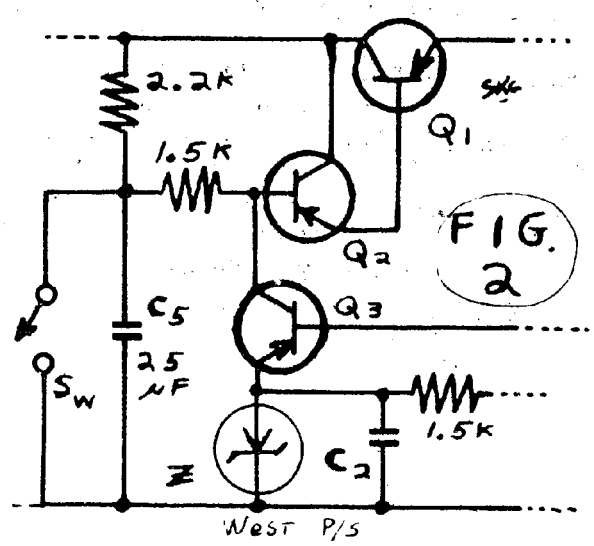
The minimum output voltage is limited by the zener (e.g. about 4V here), and the maximum is determined by the voltage dropped by Q1 and Q2, a volt or two. You can get nearly the same voltage out as in, but regulation goes to pieces when the drop across Q_1 is less than about 2V. C_1 can in fact be anything above 500µF, but higher values allow higher maximum output. Contrary to popular impression, a power supply regulator will not accomplish miracles, and if you feed it raw d.c., a lot of its regulating ability will get used up smoothing out the ripple, so not being available for useful output maxima.

C2 reduces dynamic impedance of the zener, so reducing ripple; it can be such a low value as shown because its 1.5K series resistor is taken from the low-ripple output rather than the input. C3 improves the a.c. regulation (and ripple-reduction) of the circuit considerably by feeding a.c. easily to the base of Q3, while d.c. regulation is still excellent via the bleeder and amplifier. C4 reduces ripple still further and reduces peak-current demands on the regulator -- apparently something for nothing.

But in this life, nothing is free (this is RLG talking now) and the cautions displayed in the May 1970 article are well illustrated by the article "Perils of Power Supply Design" in the October 1970 issue. It amounts to the fact that this regulator here described will do a fine job generally, but avoid using it on heavy inductive (e.g. motor) loads and on loads where regulation must be dependable at highish frequencies (e.g. > 10kc). Warnings by theorists may, therefore be taken with a grainof salt as long as the dish is not too salty already!

The AT1138 (or equivalent) can handle several amperes, though load current must be reduced as output voltage is cut down. As output voltage reduces, the Q1 Q2 pair





must drop the rest of the input voltage, and this will produce heat, principally in Q1, to the amount of P = IE, where I is load current and E = $E_{in} - E_o$. For Q2, I is load current divided by current gain of Q2. Best idea is to find the maximum amount of power to be dissipated by Q1, and post a list of allowable output voltages and currents consistent with this, on the front panel. Quite aside from what the Book says, this will vary from one installation to the other, and will depend on the size of heatsink and the goodness of thermal contact of same with transistor. The usual rule of thumb is to determine the amount of power (e.g. load, at E) which makes a germanium transistor hottish to the touch, or a silicon one painfully hot; caution: use different fingers to test each time!

A series protective resistor can be inserted at "X" for better results. Its value will depend on the input ripple, output voltage desired, and Murphy. For a 3A max load the resistor would be some 0.5 to 0.7Ω, wirewound of course. It reduces collector dissipation to a low value, so protecting against overloads and also reducing strain on the transistor. It is still worthwhile to retain a robust unit for Q_1 to handle high loads even at low output voltages (as set by the pot). An optimum value for the series protective resistor can be obtained by applying the maximum load current (to a load), and increasing the resistor until ripple becomes evident in the output; thenuse a somewhat smaller value of resistor.

The whole unit was built in a small cast chassis which got only warm with 3A out at 20V. Q2 and Q3 and circuits were put on a PCB inside the chasses.

An interesting variation has been found useful. The 3.3K resistor is broken up as shown in fig. 2, and C5 added. Not only does this give improved ripple filtering (for reasons discusssed in the 1970 articles, for fig. 20), but "Sw" makes an excellent standby switch or secondary power switch. When it is closed, output falls rapidly to zero, and safely. When it is opened, output rises slowly as C5 charges. Not only does this prevent the annoying "thump" in an amplifier, but when used to turn on test circuits it allows close estimationof overload conditions.

If, for example, there is any tendency to a current overload, a sharp eye on a meter and a quick finger on "Sw" will forstal trouble -- because output falls so quickly when the switch is closed.

This kind of protection can, of course, be done automatically by any of the current-limiting or overload-latching circuits, e.g. as described in EEB of 7/70: an overload is detected via a series resistor, and that voltage is used to trigger an SCR which functions in place of "Sw". These kinds of circuits are described in the various transistor and SCR Handbooks (e.g. by G.E., Motorola, Westinghouse, RCA).

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Alas poor Descartes...

"They tell us the tests are clean. If it is true, why don't they let off the explosions in France, or Corsica? We have asked the French to allow international control by six scientists -- three French and one each from Australia, Japan and New Zealand. They refuse. How can we believe that the French scientists tell us the truth?

-- Francis Sanford, Representative to the French National Assembly from French Polynesia.

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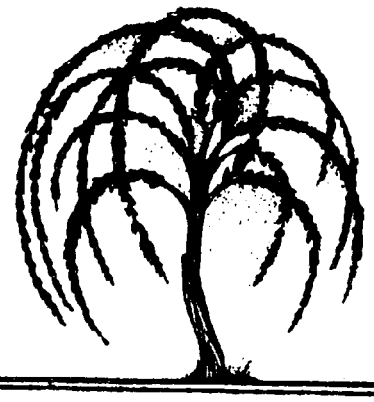

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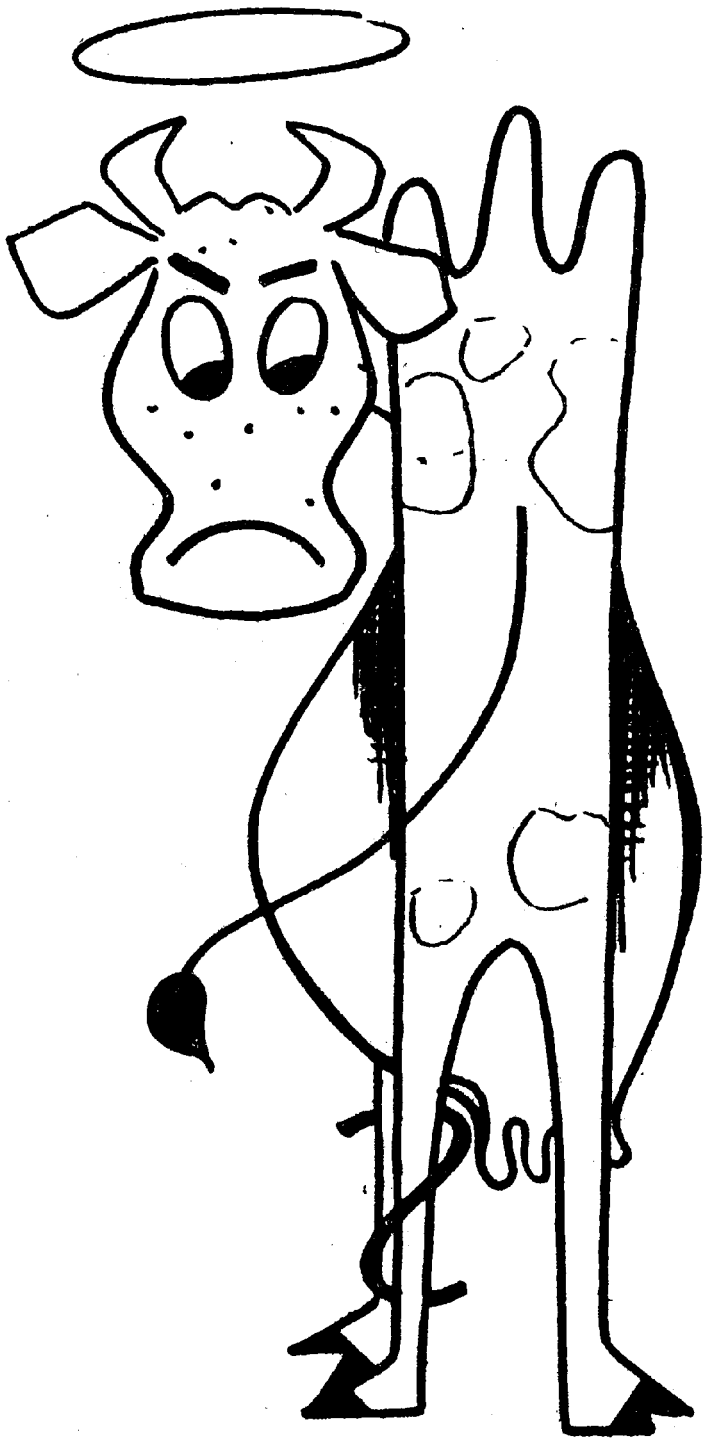

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AUGUST: More Cows, Beer Recipe, II, Frequency Meter, OTL Amps, Bachelor Light, Parts Availability, Coaxial Compatability, Digital Instruments, Sensible S-metering, Amateur Radio Etc. A lovely potpurrrrri.

FREQUENCIES (and some other Sacred Cows in Science) -- RLG

This is the Theory that Jack Built ● ● ●

"...This is the Constant K
That saved the Summary
Based on the Mummery
Hiding the Flaw
That lay in the Theory Jack built.

This is the Erudite Verbal Haze
Cloaking Constant K,
That saved the Summary..... "

((From Item 30, in the book by Winson and Parry, in Reference List here.))

VHLF

I noticed a notice by an Australian Airline, announcing "New High Frequency Jet Services...". Intrigued, I calculated the average time separation; it came to roughly 0.4 trips per hour. Assuming a full cycle to take twice as long (?), could that mean a mean frequency of about 0.00005 cycles per second, or as is now Sacred, an equivalent number of Hertzes?

Its one way to introduce an observation that in several instances I have noticed that CQ magazine has gone back to good old kc and Mc where relevant. Which will doubtless annoy many Engineers who would like to see the world unified and made uniform, and all people to fit the mould. Yes yes, I know, in Science we need uniformity. We see similar tendencies in buildings designed for human use where all human occupants are assumed to work most efficiently in a wide-open area devoid of indows and kept at an even temperature of 75°F or whatever; why not at 98.6°F if we're trying to duplicate the psychologically most secure conditions? But I digress...

Systeme Internationale non expurgée

(("International Agreements require International Agreement."))

In the interests of Scientific Uniformity we are now being asked to fit into a tighter mould of nomenclature. It is the International System of Units, "SI", which has gone one step further than nominal scientific passion for metricity.

While the Anglo Saxon World is trying to become used to the idea that weight might be measured in units other than in those of Lumps of Rock, we Scientists are now going to be deprived of our classical gramme, dyne, atmosphere, micron, and even the lowly degree. Instead these are to be replaced by the kilogramme, newton, newton per square metre, micrometre (?), and kelvin, respectively.

There are other num erous changes too, e.g. heat capacity will now be joules per kelvin, rather than calories per degree (no more calories, no more degrees!). The new System will be introduced progressively from 1972 onwards, at least in Great Britain, and presumably as well in the rest of the world.

I suppose that this move will have its value in rationalisating (?? try: rationalising) metrication, but one might observe that it may prove awkward in some instances. Thus, our gravimetric balances will presumably have to be calibrated in units of 0.001 kg or 0.000001 kg, rather than in grams or milligrammes. μkg??

Awkward Units

That such units may prove awkward seems likely. We have had an example of this for some time in electronics, the unit of electrical capacitance, the farad (but the farad is, fortunately, an SI unit!). How many farads do you keep in your workshop? Obviously we use microfarads and micromicrofarads, the latter being shortened to picofarads or lengthened to nanofarads as appropriate (?).

Well, a farad is a coulomb per volt, and a coulomb is quite a lot of electrons; for similar reasons how many amperes (viz., coulombs per second) do you feed to the anode of your 807 valve?

The take-home lesson? Humans will always find mthods to resist being stuck with awkward units.

Exit the Degree

It is true that "kelvin" seems to be an improvement over "degrees kelvin" or "°K" or even "degrees fahrenheit". But we may have some difficulty separating "273K" from a reference to Boltzman, or the Constant "K" which appears so ubiquitously in Science, as mentioned at the beginning of this article.

Ah, but you'll be able to tell which is which by "context", whether we're talking about temperature or a constant of integration. Context? That's Science?

Enter the Pascal?

Or consider that beauty for the unit of pressure, the "newton per square metre" for which there has also been suggested the somewhat shorter name of the "pascal". We have been finding it convenient to use millimetres of mercury to measure pressure in the past times, particularly when related to the pressure of the atmosphere at sea level.

This method has the disadvantage that it is very simple, since you need only measure the millimetres that a column of clean mercury is moved by a given pressure.

Now we may exercise our Science by measuring said millimetres, and then converting them to kilograms per metre-square second. This enables us to convert one atmosphere = 760 mm to the figure 101,325 newtons per square metre. Now, isn't that convenient? And what it does to the equation for Standard Free Energy has to be seen to be believed.

This does have the advantage, I must admit, of rationalising units, obscure as it may be, but when the pressure is very low, as in a partial vacuum we have been measuring it in microns, μ, a millionth of a metre (of mercury, of course!). Now we are privileges to convert all such readings into units of 0.121212 $kg.m^{-1}s^{-2}$.

Human beings being as they are, this will in due course be shortened to pressure measured in "kilograms", thus microns of pressure will become kilograms of pressure. I suppose that's not so bad, but at reasonable pressures we are obviously going to have to do something about those hundreds of thousands of newtons, so we'll likely be using kilonewtons; an atmosphere of pressure will be about 0.1kN -- although as I understand it, such truncations will be forbidden, theoretically.

Chemists in my audience may also be amused to know that in the new System, according to the first Reference below, "The definition of the mole presents some difficulties and it seems a pity..." I have quoted the author slightly out of context, but the omission of the rest of his sentence does indeed seem a reasonable value judgment....

On being Wieldy

I suppose that most of that carping is really unnecessary. We'll get used to the new units, just as we got used to the old ones, though I must say that it is going to make teaching more interesting. Not to mention the beautiful confusion it is going to cause with textbooks.

On the other hand, I must admit that "ohm" is rather easier to say than the "volt per ampere", which is also less awkward than "one hundred million absolute electromagnetic unit seconds per coulomb" (and what indeed is an e.m.u.?), not to mention that "coulomb" refers to a certain number of electrons; the lowly "ohm" might be described as the passage of 9,650 million emu per faraday. Oops, what's a "faraday"? Well, I don't know of any famous scientist named "gram equivalent", so let it be.

The Problems of Translation

To explain to students the meaning of the ability of a liquid to carry electricity, one has to talk about conductance. What is that? G = I/E, which is also 1/R, but ohms ohms don't mean any more to them than mhos, so we use the latter to best advantage. Might we then progress to G = (1/E)q/t ? But electrons per electromotive force second doesn't seem more sensible than does "conductance" in the first instance, so "oh, you know, the ability of a thing to conduct electricity". Ah, that one can understand immediately.

One day, therefore, we must inevitably explain that a Hertz (yes, that's an SI unit too) is "really a cycle per second". There are people who object to this, and they point out that there are no such things as "cycles": the unit of frequency is really sec^{-1} (or now: s^{-1}), not c/sec. It's true!

Frankly, I'd rather call frequency "Inverse Seconds", or if you prefer, "Insecs", since we do love to shorten phrases; it makes more sense than calling them Hertzes, and it is briefer.

But alas, I must also admit that Hertz was a great scientist, whereas an Insec sounds rather like somebody with six legs. So I suppose we're stuck with Hertz.

.... unless, of course, those people flying inertialess discs and wielding force beams up there in the sky, have six legs.....

References

"SI Units for Chemists", by N. H. Davies, Education in Chemistry (1970), p.344.

"The Use of SI Units", Publication PD5686 British Standards Institution (London), 1969.

Physiochemical Quantities and Units, by M. I. Mc Glashan, Royal Institute of Chemistry (London), 1968.

"Notes on SI Units for Teachers", by N. H. Davies, School Science Review, 51, 942 (1970).

((NB: Please do not request copies of these materials from us; they are British publications; consult your local Library if interested....))

Postscript: MUST reading for all Scientists and non-scientists:

1) SCIENCE IS A SACRED COW, by Anthony Standen (Dutton, paperback, 1958).

"A brilliantly amusing, highly informative debunking of Science -- by a Scientist". Here is a typical

excerpt:

"If it isn't a 90% yield of potatoes, it's something else. It all comes down to "correlations" (one of the scientists' favourite words). They measure two things, and find that when one of them changes the other also changes: this is called a beautiful correlation, and it is pursued with a solemn, dead-pan intensity, as if a correlation were a thing in itself. Very often they argue that the one thing caused the other, when it might well have been the other way round. Executives have been found to have a large vocabulary; therefore, learn ten new words every day, and you will become an executive.

"Or else, there will be an argument that, in principle, runs like this: a man gets drunk on Monday on whiskey and soda water; he gets drunk on Tuesday on brandy and soda water, and on Wednesday on gin and soda water. What caused his drunkenness? Obviously, the common factor, the soda water."

((Comment by J.E. Andersen:

Hold it right there! The Real Scientist (e.g. you or I) would then test the hypothesis by feeding our subject soda water until he was awash. Then, if his eyes brightened, his cirrosis receded and his children no longer recognised him at breakfast, the hypothesis would have to be modified a bit.)) *

((True, Standen sometimes stretches his point, but there remains much entertaining truth in his little volume... -- RLG))

* But see p. 47, next month's EEB.

2) THE SPACE CHILD'S MOTHER GOOSE, by F. Winson and M. Parry (Simon and Schuster, N.Y., 1966)

One of their items is quoted at the beginning of this article. Or consider the following one:

"Resistor, transistor, condensers
in pairs,
Battery, platter, record me some airs;
Squeaker and squawker and woofer times π
And Baby shall have his own
private Hi-Fi."

A Delightful Book, for young and old.

ΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩ

... "I take my wife out every night but she keeps finding her way home... On the questionaire, the man answered the question, 'Length of residence in present location' by writing down, 'forty two feet'." -- (KØNL)

WHAT FREQUENCY?

((From Auto-Call, September 1970))

Occasionally we hear on the air, statements in regard to frequencies which involve cycles, not kilocycles. Having specified a frequency, somone will say, "You're 25 cycles high", or some such statement which involves measurements in cycles. But there is plenty of room to suggest that his equipment is not as precise as he thinks it is.

Nearly everyone (which includes this fellow) uses 100 kHz check points, checking with WWV. But:

1) Unless our hero is a piano tuner, or otherwise understands the value of beats, the chances are that he will not zero WWV. as precisely as he thinks. He can be off 25 kc or more and still think he's zero beat. ((I think he means 25 cycles -- RLG))

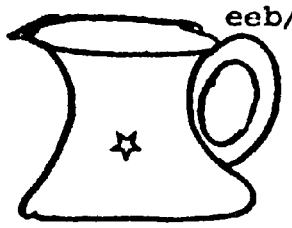
2) Can he be sure his dial is linear? Just because the dial reads properly at the "00" points, can be be sure that the tuning mechanism controlled by that dial electrically follows his engine-divided scale on the dial? He cannot! There are places on individual receivers where the dial is off as much as 500 cycles.

3) Can he depend on the stability of his receiver? Once set, can he be sure that it stays there? Precise frequency measuring equipment will show that almost any receiver will drift, so he can't be sure his original calibration is correct forever.

4) Where does he set the dial for a SSB signal? Does he set the dial where the voice sounds most pleasant to him, or does he zero beat the sideband when the fellow talks? There's quite a bit of difference between the two settings. Indeed there is a difference beteen the setting of the dial for voice depending on the individual. So it becomes questionable, in view of the above, that a precise statement can be made where the measurement involves a few cycles.

The next time you hear someone quoting frequency to a few cycles using his regular receiver and not using equipment especially designed for the purpose, you might ask him how many ARRL frequency measuring tests he has participated in lately, and what were the results.

((EEB Note: Lovers of Progress should note that it is not strictly correct to speak of "cycles"; there isn't any such thing -- there are only Hertz-seconds. Heh.))

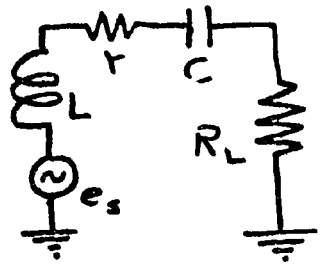


pitchers corner
-- by chris pitcher (vk3)
-- translated by led gunther

DISCLAIMER: The opinions expressed herein are not necessarily those of pitcher or gunther, but arise spontaneously from this office by spontanous transmogrification of Inspired Scribble.-- RLG

How to use transistors with the i.f. transformers as-is AND undistorted by the Editor!

Hold still, leo, whilst I nail you to the wallpaper! Your gratuitous alteration of my February diagram missed the point entirely. Consider the following equivalent circuit:



This is the secondary of the IFT in question; e_s is the induced voltage (from the primary). Now for maximum power transfer to R_L,

$$R_L = r$$

where r is the equivalent series loss resistance of the tuned dircuit -- usually low. ((And mostly, the reflected impedance of the driving stage -- Dick Ferris))

At that point,

$$Q_L = Q_o/2 \quad \text{(i.e., Q reduced to half).}$$

As R_L is increased, Q_L decreases, since R_L is in a series-tuned circuit. To give it some values, say L ≐ 1mH, Q_o = 100, so r ≐ 30Ω, which matches nicely into a transistor's emitter ($26/I_{DC}$ Ω). However the base will look like some 250 to 2000Ω, whence

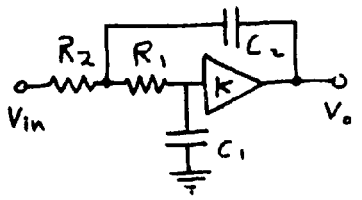
$$Q_L \doteq 10 \text{ for } R_L = 250\ \Omega$$
$$1.5 \text{ for } 2000\ \Omega$$

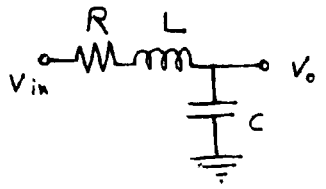
Ergo, don't connect it to a base circuit. QED.

active filters revisited

All right, now it's Rod's turn.

In my column in the April issue he made the comment that an emitter follower cannot give adequate gain to provide adequate Q for an active filter. I wish to point out that Gain < 1 does not degrade the Sallen-and-Keys active filter realisation (In these enlightened days, it is becoming known as a "Voltage-controlled-voltage-source-realisation", or VCVS for short. Progress!). Consider the following obvious considerations:-





THE TRANSFER FUNCTIONS ARE SHOWN, RELATIVE TO DIAGRAM AT RIGHT, AS

$$\frac{V_o}{V_{in}} = \frac{1}{1 + pCR + p^2LC}$$

WHERE $T = \sqrt{T_1T_2}$

$$= \sqrt{R_1R_2C_1C_2}$$

$$= \frac{K}{1 + pT/q + p^2T^2}$$

$$\frac{1}{q} = (T_1/T_2)^{1/2} + \left[(1-K)/b\right](T_2/T_1)^{1/2}$$

$$b = R_1/(R_1+R_2)$$

NOW, IF T/q = CR, T^2 = LC, THEN THESE TWO FILTERS ARE IDENTICAL. IN THE ACTIVE CASE WE CAN JUGGLE THREE THINGS: THE GAIN K, THE RATIO OF THE TWO TIME CONSTANTS, AND THE RESISTIVE FACTOR b (USUALLY = 1/2). IF THE GAIN IS FIXED, WE JUST LOSE ONE FACTOR. QED.

((EDITOR'S NOTE: FURTHER CORRESPONDENCE ON THIS SUBJECT IS WELCOMED, AND WILL BE PRINTED IN TYPE SOMEWHAT SMALLER THAN THIS.))

Hot Air Avalanches

In that same April issue I think I may be talking hot air about Avalanche Transistors (p. 40), but I wish someone would show me where ((At least he's impartial! -- RLG)). Haven't done any more about them lately.

Hot Air Noise

OM Bryant (April p. 46) is also talking hot air. Bipolars can have the same noise performance as FETs working as oscillators*. They are easier to quieten, because they are better switches. ASSUMING that harmonic output is not called noise, in which case FETs can be 6 db better**. The reasons are well explained by Edison (1930!) and others (mullard, England have also done a great deal on this.).

Mr. Bryant does have some points, even though they do make me hot under the collar. But if you want an article or ((illegible)) *** on oscillator noise performance, let me know!

SOME CAUSTIC COMMENTS ON THE KØNL DIGITAL FREQUENCY METER APPEARING on P. 5, FEB!

I hope that fig. 4 of that article is not the final circuit. There are some things not done with TTL, and they are nearly all there! I am enclosing an article on TTL a la Arandna ((no, that must read Grandma)), which will amplify this; however, I hope no one builts it.

In order, then:

(i) The reset pulse generator is capacitatively coupled. This is undesirable for 3 reasons:

(a) The gate driven will (not might) oscillate as it recovers through the linear region

(b) Capacitors tend to build up charge, due to different impedances for charge and discharge.

(c) As a corollary to b, it is possible to apply a negative pulse to the driven gate Input, destroying it utterly!

(ii) The crystal oscillator can run out of crystal control (it is really only a locked multivibrator). Stability can be indifferent.

(iii) The input gate will oscillate, since it is biased close to the active region. The same remarks as in (i) above apply doubly here with the 0.1μ Input capacitance.

I will explain the above at greater length if you like but it is fairly well-established practice with TTL (See any application literature: TI, Fairchild, Signetics, Philips etc).

Therefore, I would suggest the following modifications:

* BULL.--Dick Ferris
** Depends, on how you drive them. A Class C FET isn't much different to a Class C bipolar.
*** Not until you straighten out with JMB/DF!

I) Replace the "RESET" gate with a monostable (e.g. 74122), set for a pulsewidth about one period of the Input waveform or less ((Ed. Note: I am assuming that Chris's "I/P" mean "Input"; if it is some obscure ICism read it accordingly). Note: There are minimum requirements for the reset pulse width to a 7490 (50µsec). It is also not recommended that count pulses be preset while resetting. ((That doesn't make sense? Proper translation of the Scribble is doubtless "be present while resetting". -- Ed.)).

II) Replace the 1 MHz oscillator with a discrete component version (at 35c per transistor, why not?).

III) Introduce some hysteresis into the input gate, or (better) use a Schmitt trigger (e.g. 7413), or (best) use a discrete component input amplifier/interface.

With all that said, I must confess I miss the point of the whole exercise. The main cost of a counter is the indicating decades ($5 - 15 per decade) and timebase (often omitted -- use the mains). With gates at 50-60c per package (15c per gate) it costs very little to build a decent input and control section. Pinching pennies there is likely to invalidate the whole effort.

I do not usually get heated about things you publish; however, I do know a bit about TTL, and it can be disasterous if approached in a cavalier fashion. Best not to be known by our (admittedly few) failures.

((Note by Dick Ferris: Complete agreement!

((Note by the Editor: I reckon all this is highly worthwhile, since it is likely to get Rod hopping to complete Part II, with suitable comments -- a pressure made particularly difficult by his having moved to Melbourne, and by the high cost of phone calls to there... It must, however, be mentioned that the device in question works just fine!! I have seen it working, so we'll look forward to Part II won't we, Rod? -- Expect it in early 1974, because of publishing schedules...))
((P.S. Those of you who don't know a TTL from a TVI will be able to follow Norman Lorimer's clear presentation on the subject in these pages, and sometime also Chris's own TTL thing)

((Chris again:)) Incidentally, Hemingway says the same things in "Circuit Consultant's Casebook", p. 32, a most excellent book published in the U.K.

Satisfied Customer

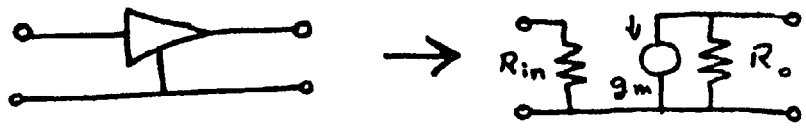
I have.. opened communications with WHK Electronics, the firm who advertised so effectively in the August/October 1972 EEB. Their gear is good (someof it unobtainable elsewhere), and the proprietor is spot on. One satisfied customer speaking! Maybe they'll put in some more adverts?

How to cope

The obvious solution to your backlog of articles is to put out a separate book or booklet once a year or so. Call it something like "The EEB Experimenters Annual" or something. ((A fine idea -- after we get around to our long-delayed anthology! --Ed.))

'An Amateurs' Langford-Smith?!

Continuing the point I made in the Apr EEB and in the Orr Review (elsewhere in this issue or Another), about the need for a really good experimenters Handbook: Knowledge of a few basic design ideas can free us from the slavish dependence on circuits books. E.g.. you take a box, then



This applies to valves, FETs, transistors, depending on the values you put on the components. I think I have nearly got the point across. I feel that a book (or books, each covering a topic) up to say, Technician level would sell like hot cakes.

There is nothing of that kind available at present, between the SAMS style of ...., and say, Millman and Tank or Cherry and Hooper. Yes, I am trying to talk RLG into it. Perhaps as a series of articles? Sort of where the Electronics Australia Basic Radio booklet leaves off? If I get time I'll even send you a few articles to convince you!

((AND THE REST! It would be a tremendous job, obviously calling for big guns. Say, Bill Orr, with Rod Reynolds, Chris Pitcher, RSM, Dick Ferris, and several other tame engineers of commonsense calibre. With suitable royalties to be provided, of course... -- RLG))

The Problems of Overchoice

I picked up the July 1973 issue of 73 mag this morning. It just happens to contain an article giving a design procedure for a broadband phase shift network, and a realisation of a phase-lock loop using one 7401 quad NAND gate.

It's all so easy these days. Funny as it may seem, one of the problems with the new job is the matter of choice. Hard to explain, but there are so many ways of realising the beast these days that I have trouble choosing. And when I am writing the specifications it becomes near impossible. But I'm learning.

ΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩ

USES FOR TASMANIAN APPLES ((OFGS Newsletter))

... Weight-watchers please note: If you were to eat some ripe apples at night in place of dinner, you would reduce with impunity. For an upset stomach, try raw grated apple, slightly browned; or try apples baked in their skin, with cores replaced by raising and currants -- a delicious treat!

(Crushed) apples can be used as a poultice on a boil or skin sore, to draw the poison out. For beauty-conscious women -- use apple as a skin-scrub. Slice in half and apply directly to face in a scrubbing fashion. Works wonders.

Remember the old saying, "An apple a day keeps the doctor away"...

((When do ordinary folk get RIPE apples in Tasmania?? -- RLG))

VOLTAGE REGULATION USING AN INTEGRATED CIRCUIT

-- by Les J. Yelland (VK3)

Owing to miniaturising of the components, with consequent very low current-sinking propensities and low power handling capacity, one does not ordinarily turn to ICs when it comes to voltage regulation. However, by using a power transistor of appropriate size to do the power handling, an excellent regulator can be made using an IC operational amplifier and a low power zener, as in the circuit diagram. It is capable of better performance than the discrete-component one described by West recently in these pages.

This circuit uses a µL 741 operational amp by Fairchild, to feed the base of the controlling transistor. Feedback is taken from a voltage divider across the output, and the error detected is multiplied by the high gain of the amplifier. This provides a degree of accuracy of voltage regulation which almost "anticipates variations of output voltage and corrects them before they occur."*

Greatest regulation accuracy occurs when the output voltage is about one third of the input. In this case, at 10V from an input of 30. The drop, with a load of 250mA is then about 0.1%. It increases slightly up to about 23V and then falls off more rapidly. Regulation at 22V falls off to about 0.5 %. Some ripple is present in the output under load. This can be reduced by increasing the size of the 500 µF input filter capacitor. Ripple can also be reduced by supplying the load through a series resistor (on the load side) into another capacitor, but of course this ruins the regulation for some conditions of load.

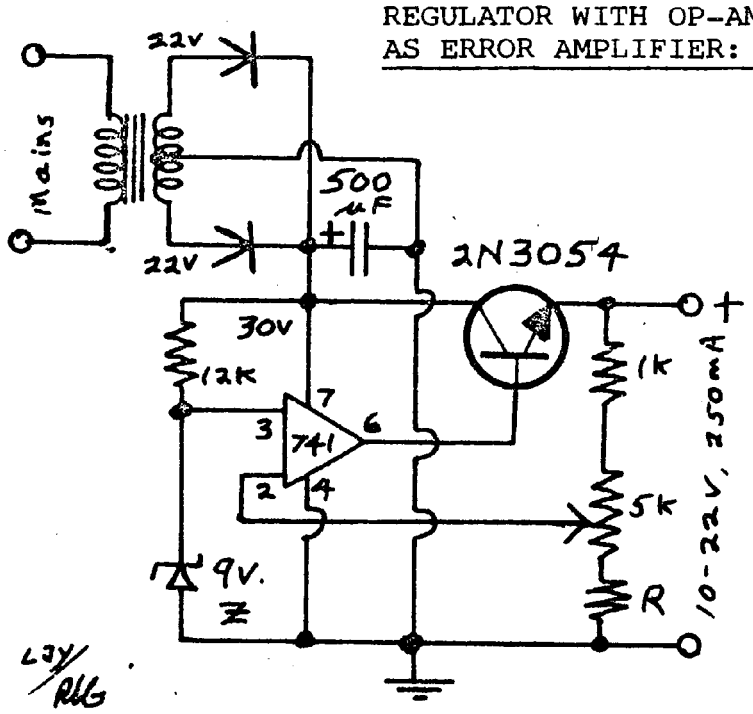
It should be remembered that although a regulator can imitate a filter capacitor in reducing ripple is <u>is</u> not a filter capacitor and if you require it to reduce ripple it is less available for regulating load. The better d.c. with which you supply the regulator, therefore the less ripple will be enclountered at the output under load, particularly at the higher output voltages.

With R = 2.2K the maximum output voltage is 28V. When R is increased to 3.9K the max is 25V; R may need some juggling to get it exact. It is very convenient to calibrate the potentiometer directly in terms of voltage output by setting it to a position that produces a given voltage (read on a good meter placed at the output under moderate load), and making a mark at the end of the pointer knob, marking either on the panel or (preferably) on a piece of card glued to the panel. For a professional-looking job, make a circle with a compass at the right diameter before affixing to the panel. Put the lines and numbers in pencil until you are sure, and finally mark them in Indian Ink --carefully.

Once you have a reliable calibration it is very handy to be able to set the voltage to any desired value within the range, without having to bother about a meter at the output; it also frees a meter for other purposes.

The diagram here shows a variable voltage power pack which is useful for the test bench, but if a constant voltage supply of the best sort is required, make the transformer voltage twice that of the output d.c., the zener one volt (or so) less than the output, and adjust the voltage divider for the required voltage. Reasonable values for the divider would be about 1K and 6.8K, with the tap at 1K from the positive end. The 12K resistor would, of course, want to be altered as suitable to place a reasonable current through the zener (e.g. 1mA under full load).

REGULATOR WITH OP-AMP AS ERROR AMPLIFIER:



* He jests of course, but in fact in our 1970 series of articles on regulated P/S design we pointed out that it is in fact possible to build a regulator using <u>positive</u> feedback which appears to anticipage changes before they happen. This does work for d.c. loads, but if there is an a.c. load component that Perfect Regulator can be very unstable! --Ed.

The little girl watched her mother in fascination as the mother put on heavy cold cream over her wrinkles. "Why do you do that?" the little girl asked. "To make me beautiful," was the reply. Then she proceeded to remove the cold cream with a facial tissue. "What's the matter ?" asked the child, "Giving up?"

I wonder is the same thing happening to the little girl that happened to me the day Virginia told me she wouldn't come home from work because she was going to the beauty shop. When she came home I met her at the door and asked, "What's the matter, was the beauty shop closed?" When I picked myself up, we had cold shoulder and hot tongue for supper.

-- Ralph Hanna, W8QUR (<u>ARNS Bull</u>., 8/70)

TWO RADIO HANDBOOKS -- a COMPARISON

-- by Chris Pitcher (VK3)

The (latest) Radio Amateurs Handbook, by ARRL vs
The Radio Handbook, 18th Ed. by W. I. Orr, W6SAI (Publ. "Editors and Engineers")

What do we want?

What exactly do we require in a Reference Book? It is far better to ask this question (which has indeed been asked before in EEB, e.g. Nov 71; Feb, Jun, Dec 1972) than to insert yet another Review saying the same old things about Content. I propose here to restate the principal points made by Dick Ferris and Rod Reynolds previously, and to apply them to a comparison of these two Handbooks.

What do we require in a Reference Book? The ideal would probably be a collection of volumes of encyclopaedic proportions, with a superb indexing system, into which we could delve when an "It" was not performing properly. The Book would present lucidly exactly what we did wrong and what is required to correct it. The production of such a work approaches the requirement of the Infinite number of Monkeys and Typewriters, so in practice we must accept something rather less.

On the other hand, a good reference work should still fulfill the same purpose even if imperfectly. How?

Doing without Monkeys

Now, assuming you are not engaged in the grey area of original research, the device you are in the process of constructing will have been constructed before; even if it hasn't, something like it will have been. And if it is to obey the laws of Physics it must have some foundation in basic facts.

Both these things (i.e., previous efforts and the facts they depend on) should be contained in a reference work. To give a practical example, you have an oscillator which won't. It will either be of a type already described, in which case the said reference should tell you enough about it to show why yours is not working, or it will be of your own contriving, in which case you will be looking for a description of the process of oscillation sufficiently general (but still lucid) to apply to the particular beast in front of you. From this you may discover which particular principle does not apply to it, and is therefore stopping it from working.

Basic Approaches

I have been applying this acid test to the abovementioned two reputable reference works. It is instructive to read the Preface to these works, as they are both a fair summary of the approach applied. To quote:

> The wireless experimenters of 1900 would be confounded by the vacuum-tube equipment of the sixties and dazzled by the solid-state techniques of the seventies. But they would understand the underlying fundamentals of today's sophisticated equipment since it still obeys the natural laws of electricity as set forth by Ohm, Ampere, Faraday, Maxwell, Hertz, and others so long ago..
>
> -- W. I. Orr

> ... its objective has always been to present radio theory and practice in terms of applications... how to do it... rather than abstract principles... our concern is not with what is merely new or novel or intriguing, but with what is practical, meaningful, proved, and above all, useful ((their italics)).
>
> -- John Huntoon, ARRL.

A Value Judgment

Now at this point, someone has to make a subjective value judgment. In my exalted position as arbiter, I come down on the side of the sentiments expressed by Orr -- This is not to say that he achieves his objective; merely that I feel he is leading the best way.

I have discussed this with many people, and I find that I am outnumbered. The argument that if it isn't (or hasn't been published in QST and made its way into the Handbook, you can't build it -- seems to be the popular one, and that if something might appear Elsewhere they probably wouldn't want to build it! I'm not altogether in agreement with this, but who listens?

I mean this: I am rather keen to see things explained in terms of fundamentals. I would, in fact, like to see radio theory beginning with Physics (not merely semiconductors), basic things like energy, power, charge, magnetic field, possibly even Maxwell and field theory. But of course these subjects are covered Elsewhere, and neither of these Handbooks goes this far.

Scraping along vs Understanding

The ARRL approach seems to me just sufficient to pass the theory exam for an amateur licence, without attempting to impart much understanding. This may be intentional, but I don't like it.

Orr, on the other hand, gives the impression of trying to explain. He doesn't completely suceed; inductance is a difficult concept to grasp without reference to Physics; so is resonance (though Resonance is possibly the only section of the theor, part in which ARRL attempt to explain the concept). The introduction, however, of vector (or phasor) notation represents a real attempt by Orr to explain rather than just present for learning. It seems evident that Orr has not completed the rewrite of these sections. Well, if he continues in the same vein we can expect even better results.

Valve Thinking

When it comes to actual radio (viz., communications) both works are still dominated by what I call "valve thinking". The biggest waves the solid-state revolution

→37

This & That

Aye, that it is, and how much longer is a month and even several of them. Well, here are three EEBs in one go; although I didn't succeed getting them out before Xmas as promised they are appearing before Easter.... Never mind, enjoy life as it comes. Me -- I'm spending my summer holiday doing EEB. Poor Alice. She's very understanding.

How's this: Charles V is reported to have said, "I speak Spanish to God, Italian to women, French to men, and German to my horse"! Actually they are being kind to the Germans these days (and the Japanese) and even the Chinese -- but woe unto the French. In that vein, here is one that came from a High School Student in an actual discussion at tea time:

"My French teacher is so good at that language that if she went to France you wouldn't be able to tell her from a Frenchman." Do tell.

Finally I may note that the other day I almost remarked to a couple of students that I had nearly mistaken them for girls. But it was fortunate for my professional dignity that I held my tongue; they were girls.

Actually, I grew long hair last year, but the result was neither male nor female so I exchanged it for a beard, which is doubtless impressive but still anuisance. There must be a better answer. I'll have to publish a photo one of these months.

Why all this irrelevance (though some readers seem to like it)? Because I'm feeling putupon by the magazine, & I don't see how we can possibly publish it this week, but we have in the past, and... It is going to help that Chris, our Printer has a fancy new gadget which sorts the whole magazine, staples it correctly and folds it neatly — all in an hour or two for a thousand issues. Brenda took the news with a mixed expression, but we'll probably return to her most competent collating (the machine won't spot blank pages so let us know if yours is) when we catch up on our publishing schedule a bit.

The PMG Corner ((Stop me if you've heard this before))

The PMG must also be a devotee of Wilson't First Law, as quoted above (For the benefit of overseas readers, the PMG is the Director of Posts, Telegraphs, Radio, Television, Communications by Torch or Any Other Method, and a proud leader in the fight to milk the public of worthless dollars))

Some of you are of the opinion that I berate the PMG abt the ears excessively. Quite aside from the atrocious example the P.O. have provided us in the decimal changeover and now in metrication, and aside from the utter fraud involved in one government department charging interest to another, and aside from the anti-intellectual and anti-democratic policy which rates books and magazines at about the same postal value as scrap iron — aside from all that you'll often squirm nicely when you try to squeeze 10 grams into an overseas air mail letter.

Among other things, that's when the reduction from 1/2 oz (14.2g) to 10g will hurt, even though the postage has been reduced slightly. It is remarkable how often an air mail letter lies between 10 and 14g. If you overstep the limit you'll be paying not 18% more, but 118% more.

One can send packets by Air Freight within Australia for better, quicker (and even cheaper!) service than by the P.O., but what about the escalating costs of correspondence abroad? Air Letter forms? Ho ho. Those nasty blue Air Letter things weigh 3.21g each. At 12c postage that's equivalent to 53c for ½oz; at 14c postage it comes to 44c for 10g. That's a 76% profit for the P.O. Neat, eh ?

Do you see the "Australian P.O. News"? It's a publication in which the P.O. actually brags about its curious policies! In the meantime our postal bill goes up and up and up....

Commonse Amplifier Design

OK, back to work. Here's an interesting piece by J. Vogt in (Ham) RADIO magazine of March 1972 (you can see how far behind I am in my reading), entitled "Improved 2-M Preamplifier" (using cascoded J-FETS):

"Of course if you want AGC then gual-gate MOSFETS are the thing. But who needs AGC? Ever looked through designs for the new ham transceivers and the commercial transceivers for the business band? They don't use AGC; not as a rule."

... He also brings out some obvious and good ideas:

"When designing a circuit, use more parts if that's what it takes to make it easier to build... Secondly... mismatch a little. Throw away that last ounce of gain. Use more stages or devices instead... If you have so much gain that it takes off, load it down with resistors until it stops. Then if you need more gain, add another stage. (PTO)

ADVERTISING

This Page: Personal = FREE Commercial = 50c per vertical centimetre. We guarantee nothing..............

THE AMATEUR RADIO MOBILE SOCIETY serves radio amateurs and others everywhere, who are interested in the theory and operation of mobile radio. In our part of the world their biggest service is the publication of ARMS News.

Look atthis: In 1972 they published articles on

- TECH. INFORMATION SERVICE
- MOBILE MICROPHONES
- IGNITION INTERFERENCE!
- OVERVOLTAGE PROTECTION
- RESISTIVE IGN LEADS etc.
- PYE RANGER CONVERSION TO 2M
- COMPUTERISED IGN PROBLEMS !
- SYSTEMATIC SUPPRESSION SYSTEMS
- FT101 MODIFICATIONS
- CONSTRUCTORS AWARDS
- PORTABLE VERTICAL ANTENNAS explored
- REMOTE CONTROL OF THE YAESU FT101 TRANSCEIVER
- THE PROBLEMS OF MOBILE RALLY TALK-IN STATIONS
- PREVENTING EQUIPMENT ROBBERY FROM AUTOMOBILES
- And much more

Even if you only read last month's advertisement here you saved yourself much trouble if you wanted to go mobile in an XKE Jag or VW1600 -- and subsequently I believe they have solved the Computer rfi problem. And of course if you ever intend to travel to Europe and operate Mobile, ARMS Membership is a MUST. For information and sample copy write:

Mr. N.A.S. Fitch, 40 Eskdale Gdns, Purley, Surrey CR21EZ, England, U.K.

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THE CANADIAN AMATEUR RADIO TELETYPE GROUP publishes "RTTY News" monthly for only $C2.00 p.a. (or send $A2 to EEB). This interesting publication contains news of interest to Radioteletype enthusiasts and those contemplating such; it also contains articles of general and experimental interest (e.g. see EEB Oct 1973, p. 66). For sample copy or subscription write to: CARTG, 85 Fifeshire Road, Willowdale, Ontario, Canada M2L 2G9.

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THE RADIO BULLETIN of the Eastern & Mountain District Radio Club speaks for itself. Consider contents for Oct. 1973:

- A 576 MHz CONVERTER
- RADIO TELETYPE RECEPTION — a good, general presentation
- A CONSTANT OUTPUT SPEECH AMP.
- 2M FM NET ALLOCATIONS LIST
- PAGES FROM THE PAST: The well-equipped Amateur station of 1908!
- CIRCUIT IDEAS -- Several methods for checking transistors and their circuits. And a Power Supply Regulator, and a Simple Crystal checker.
- DISPOSALS NEWS: These are real goodies, transistors, LEDs, ICs, tubes, valves, kits, etc. These are available (to members) at bargain prices.
- THREAD CHART (Whit, UNC, UNF, BSF, etc.)
- CLASSIFIED ADVERTS, all kinds, free insertions for members. Just think; with a free advert in EEB and in the RB you could reach about 1200 readers.

If you can attend the monthly meetings and special functions, you can get even more out of membership. This is obviously one of Australia'stop radio club and informal electronics publications (EEB is prettier, but doesn't contain as much meat, nor as often). The cost of membership is rock-bottom, considering the benefits: $3.50 first year, $3 p.a. afterwards. Send for a MEMBERSHIP APPLICATION FORM (and sample copy?) to:

The Secretary, Eastern and Mountain District Radio Club, P.O. Box 87, Mitcham, Victoria 3132, Australia.

= =

HAVE YOU SEEN 6-UP? This is an audacious Magazine published in NSW, with news, technical articles, propagation, comments and even Real Advertisements ((how do you do it, Roger??)). This is the EEB of VHF (and beyond). Send for a sample copy to: The Editor, 6UP, 47 Ballast Point Road, Birchgrove, NSW 2041, and enclose a stamp or two. The subscription costs $3.00 ($NZ3.50) for a year's supply. Printed on Offset, and a nice production it is.

= =

EEB COMPONENTS: The response to our December E.A. and subsequent EEB adverts for 88mH toroids was quite incredible. We had 200 in stock (a reasonable number for such an unknown quantity) and that went in three days. Since then we have received orders for another 500 or so, and we have been sending frantic messages to the [illegible] asking for more. They will

received orders for another 500 or so, and we have been sending frantic messages to the USA asking for more. They will arrive in Due Course, so please be very patient. They have been somewhat delayed because this item is beginning to dry up on the Disposals market... The transistor sockets stood up rather better, but out of 500 we have only a few dozen left (at 10 for $1.50, postpaid), and more are on the way. More types of components will be stocked too. Wait.

BOOKS OF ALL KINDS, AMATEUR RADIO TRANSCEIVERS, etc. are available directly from the U.S.A. at a healthy discount compared to prices in Australia or New Zealand. Cut out the expensive middleman and import stuff yourself! There are no customs duties on books, and customs arrangements for equipment can be handled by private individuals merely by asking your Customs Office about particulars (or you can use a Customs Agent and still save quite a lot). Any American book in print. Gear is mostly Drake, but other types are available.... The books discount is most impressive too.

Write: EEB Accessories, P.O. Box 32064, Oklahoma City, Oklahoma 73132, U.S.A.

Editor's Extra Note: From surface appearances you'd never imagine the heartache that can be involved in publishing something. When this page was put on our "Automatic" Duplicating machine, said gadget took it and promptly tore the stencil to little shreds!!! Since there wasn't even one good copy produced the fractured stencil had to be peeled off of the rollers, spread out, carefully blotted and reassembled on the Light Table. This is the Second Bash. I hope...

EDITORIAL: Continued!

If you need more selectivity, use a multi-pole filter or a different type of filter."

This is sound advice, except for the small detail that what this Yank means by "designing a circuit" is to take a piece of a circuit from here and there out of context. He brags about it, saying, "I am a great circuit snatcher"

This is the kind of attitude which we prefer to oppose. As long as electronics builders and experimenters are laden with the burden of trying to make sense out of something in someone else's designs via cut-and-paste, just so long will their efforts be largely sterile, and so long will magazines (and Handbooks..) continue to publish endless variations on basic themes -- so wasting our time, forests and patience (who can "read" several of the mammoth American magazines thoroughly in a busy month?). Chris Pitcher expands admirably on this theme in his various "Pitchers Corner" pieces in EEB.

Incidentally, when I say "our" attitude I do not impose an official EEB orthodoxy. I merely mean that for the most part this is an opinion of most or all of the people involved with producing EEB. If you have a divergent view, send it to us and we'll print it in due course.

ERRATA & a Few Comments

Y'know, the only time I take a really close look at an issue is after it is printed. When I'm editing or typing it I'm too involved with the mechanical problems. I usually catch errors just after I have typed them, but not always. So... Authors & Readers please be understanding and make all obvious corrections on the text. Tnx.

But, here are a few belated comments on the April issue:

1) That Dreadful Photo. Sorry, Brenda. Some readers have made favourable comments -- but they didn't have to stare at 1000 copies of the Monster while collating.

2) Maddever's Transistor Tester. Actually, Richard had it correct in his M/S but I typed it wrongly. Tsk tsk.

If $I_b = (E_{cc} - 0.4)/R = (6.0 - 0.4)/560K = 10$ uA, then obviously R is indeed 560k, and not 600 K; please make that correction on p.26 NOW. But note that if you want it to measure gains really accurately, install a pot so that E_{cc} can be adjusted to constant value throughout the life of the battery. For example if this were 5.1V, R = 470K for I_b = 10 uA. Since this will require an extra switch, you might as well allow for switching R to 2.35Megs to obtain an h_{FE} =500 range (or a meter shunt could be removed from a 200 uA movement). Another switch gang or two would solve the selection of NPN vs PNP. You want a diagram? No. Aside from the bother of draughting, working out switching is fun and informative. If you don't want to, buy the nice kit from Kitsets Aust; write Garry Connelly and mention EEB, hi.

3) P. 27, line 18 from the page bottom. Chris's fear is that people use ICs even when not necessary. Perhpas so, but sometimes I use the car just to go a half-mile (oops, km) to the shops when I could perfectly well hop on the horse in the next-door field (fair dinkum!), or even on the pushbike. It doesn't much worry me that the car performs this simple task through the exercise of fearsomely complicated Machinery (not to mention energy waste, pollution, &c.). Progress imposes on us the burden of ease and comfort, and who amongst us would wield a rod of iron when he could milk a calf of gold? -- I jest, of course. ICs (and cars) have their place if used with Commonse.

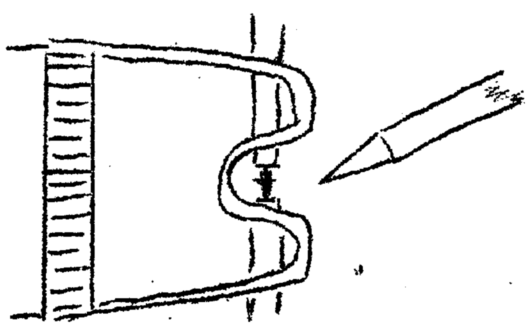
4) The Pitcher Review of the Orr vs ARRL Handbooks; it's finally in this issue. It was delayed some months while our local Staff delayed and pottered about a bit, but never mind. The whole point to the Exercise really, is not to compare the two books, except to point out what everyone already knows, but

a) To show that both books are likely worth buying by all;
b) To show that the Radio Handbook has all the makings for a prototype Langford-Smith. Admitted this would take a few more years to write, but well worth it. Sales? Langford-Smiths "Radiotron Designers Handbook" has sold nearly as well as the Bible, and I reckon it gets used a lot more often. It (L-S!) is what I still recommend to enquirers who want a good, not-too-complicated design book. It's all valves, of course, but after all with only a few alterations you can substitute MOSFETs for them, and silicon diodes for the valve equivalents. The same formulae apply nicely....

Incidentally, we won't have Greg Johnston's "Where the DX is at" again until we catch up on our rather alarming publishing schedule, for obvious reasons. Hope springs eternal, however....

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

LETTER: TV Servicing, soldering hint.



For handy hints here's something. A novel 3rd hand for use in soldering ends of wires and small components is a 10c mouse trap, screwed to a corner of the bench. Bend the spring-loaded wire loop to provide room for a soldering tip. And tack a piece of asbestos board to the top of the wooden base.

I am only a very small-time experimenter in electronics but am frequently asked to help friends and relatives with problems in current model Radios and TV sets. Can you advise me who publishes Service Sheets with circuit-diagrams nominal voltages, valve and transistor line-up, adjustment prodedures, etc?

— W. H. Langford, Deepdene, Vic.

((Sorry to disappoint you, OM, but in March and April 1970 we published quite a lot of information on why you should NOT attempt a service job. We could probably scrape up a 1970 volume at current prices if you want, and would recommend those articles to you or to anyone who is in a similar position. Of course there are Service Sheets for all such things, and if you're still determined after reading our stuff you can doubtless find out all about them from your friendly local Serviceman — but you're much better off, not. — Ed.))

!!!

A GREAT FONDUE (and simple too!) — C. D. Walker (VK7)

((As translated and embellished by Bronda Ford, our All Purpose Secretary — Ed.))

2/3 bottle Cider
2/3 bottle white wine
1/2 lb Romano Cheese (Grated), to taste.

Warm liquid slowly, add cheese slowly and keep stirring until it becomes thick. Keep on heat while stirring. Dunk (or dip, if you prefer) pieces of bread (French or Wot), vegetables, cooked meat or fruit into the Fondue mixture. Use a fork or else you'll burn your fingers — and eat. Delicious. You should try a Fondue Party.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Then there was the time little Willie asked his Dad, "DAD where do I come from?" Since it was about that period of the boy's life, Dad proceeded to sit the son down, and went into a lengthy explanation of the whole process. After which little Willie said, "Well, that's pretty complicated, but I wanted to know. That new kid in school says he comes from New York." ((KØNL; Andy, I had to substitute N.Y. there, because here most people would imagine that a Buffalo was a rather large and somewhat extinct animal...))

... Sign on lift: "Eighth floor Button out of order; push Buttons three and five instead..."

Local musician tells me of a new one! In purchasing an amplifier the salesman was comparing tubes vs solid state. The solid state, says he, is way above tubes because it gives an instant response when the string is plucked, whereas there is a delay in tube amplifiers! Do tell... Microseconds?

— KØNL (in Autocall, or ARNS Bulletin)

set up were in what has become known as functional designing. To go back to our laboured example: You say you have a requirement for an oscillator. But do you? An oscillator implies that you have jumped in midstream; your actual requirement was for a source of sine waves at a certain power into a specified impedance, whereas an oscillator implies a device rigged up to produce sine waves. The point is that it doesn't matter a bit what you use; it is the sine waves that are important.

Or are they?

Take the process one step further. Do we really need sine waves? Perhaps square waves, or triangular waves, or some other creature yet unborn would be the best for this particular requirement.

In the days of valves, we only had one device, and the whole engineering process was so inflexible that this was the only way around. Where we came unstuck was that transistors make very poor valves, so all our thinking had to make a lateral jump. These two reference works are not alone in not having made that jump very successfully. But while Orr shows that at least he is looking for a way to go, ARRL show that they have no intention of going anywhere. The previous laboured discussions and reviews of ARRL material in these pages give enough examples of details without more here.

Fiddling with Circuits

In fact, I feel that the way that both Handbooks (but ARRL particularly) treat a subject by showing "representative circuits" is a hindrance rather than a help. Here again, it seems, I am on my own. A friend of mine, in particular, claims that it is ideal. To wit. "I can take a circuit from the Handbook, fiddle with the values and achieve anything I want to". Well, maybe.

The only feature in which ARRL comes out on top is in their treatment of Transmission Lines and Antennas. It is still, in my opinion, not ideal, but they do at least try to explain the concept of surge impedance, whereas Orr assumes all that.

Promisc and Perfection

I realise that there are a great many good features in both books which I have not touched on. Many people will obtain a great deal of valuable information from each of them, and as they both likely fill a useful purpose they ought to be general reference works on the shelves of every experimenter. But I still feel that there is room for an Amateur's Langford-Smith, and that is what I have tried to compare these two works to.

In fact I feel I have been unfair to Bill Orr. There has obviously been a great deal of time and effort expended on rewriting the Radio Handbook. But it might not take very much more ((sic)) effort to turn it into a real first-class reference book.

A COMMENT by RLG (Ed.):

Chris's point is well taken in reference to requirements for learning design, and in our Hobart branch of the Youth Radio Clubs group we try to put this into practice. The point will be to attempt to equip the boys with the skill to design their own amplifier or oscillator, and indeed to try to make the basic decision Chris mentioned as to what kind of oscillator (if any) ould be best. This is considerably more than the boys would need to obtain their amateur licences, and indeed this states by implication what has happened to the value of the modern amateur licence. Armed with such information these chaps will not have to search the Handbooks for the Right Circuit into which "somehow" they fiddle the right values; my word I remember the endless hours I wasted of my youth trying to do that. And forsooth, have you ever got a book-circuit to work straight away even if you used the identical values??

On the other hand it should be mentioned in all justice that ARRL have in the past 3 years or so made an obvious attempt to update their Handbook, albeit with the superficial aims that Chris describes. But at a million copies sold per year it cannot be denied that their approach is somewhat popular. Whether it is desirable is another matter, but the ARRL work does have the advantage of presenting current trends rapidly.

After all, e.g., Orr barely mentioned direct conversion, and his present "Mathematics" chapter is a profound waste of space -- being either too elementary or uninformative.

Further, although Orr's 18th Ed. shows considerable improvement over the previous work it is evident that it was put together with excessive haste. It is beyond question that the Orr Handbook ought to be published only as frequently as consistent with a thorough and competent revision for the State of the Art -- as tends (albeit imperfectly) to be done by the Radio Society of Great Britain in their fine "Radio Communication Handbook". For this it is also evident that a group effort would be appropriate, and there is evidence for just such a trend in the list of Mr. Orr's acknowledgments -- into which, for somereason, some of us seem to have crept!

Clearly the basic philosophy behind the "Radio Handbook" qualifies it to be the precursor to a new Langford Smith. It could well lose some popularity to omit the high power Finals and other evidences of competition with ARRL, but it should also be remembered that the "Radiotron Designers Handbook" has sold a Very large number of copies indeed, and is still an important reference work on fundamentals even though its applications are thoroughly obsolete. Langford-Smith will be remembered as a man who lead rather than followed popular taste. His successor could become similarly immortal.

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● DIGITAL INSTRUMENTS -- Part II
-- by N. D. Lorimer (VK7)

((Editor's Note: Please note correction to Part I, p. 44, 7th sentence in section 2.3: "black or white". It could have been worse.

Also please note the beginning of a useful series of articles beginning with the Nov. 1973 issue of Break-In (N.Z.): "An Introduction to Binary Logic" by D. K. Hampton, ZL3II. Similar treatments have also appeared in every major electronics magazine in the world, including Electronics Australia from whom it is also available in booklet form.

It's all worthwhile, the more the better, and each treatment from a different point of view, as herewith.))

1. Introduction
1.1 What is a Digital Instrument?
1.2 Analogue versus Digital
2. Binary Logic
2.1 Why Binary?
2.2 Binary Numbers
2.3 Logic

BOOLEAN ALGEBRA -- Laws of Logic

((Refer to fig. 2.3, p. 45 last EEB))

Aristotelianism:

A logic variable can adopt one of only two states, "1" or "0", true or false, volts or no volts, open or closed. (In electronic terms, in positive logic systems, "1" represents the more positive of the two possible voltage levels)

Notation

$A + B$ means A or B

($A + B = 1$ implies $A = 1$ or $B = 1$ or (A and B) = 1)

$=$ means "has the logic value".

$A.B$ means A and B

($A.B = 1$ implies $A = 1$ simultaneously with $B = 1$)

$\overline{A}$ means the logical inverse of A

(if $A = 1$, $\overline{A} = 0$)

Laws

$A + 0 = A$	$A.0 = 0$
$A + 1 = 1$	$A.1 = A$
$A + A = A$	$A.A = A$
$A + \overline{A} = 1$	$A.\overline{A} = 0$
$A + B = B + A$	$A.B = B.A$
$A + B + C = (A+B)+C = A + (B + C)$	
$A.B.C = (A.B).C = A.(B.C)$	
$A + (B.C.D. \ldots.) =$	$(A+B).(A+C).(A+D)\ldots.$
$A.(B + C + D + \ldots) =$	$A.B + A.C + A.D + \ldots.$

de Morgan's Theorem: $\overline{A + B + C} = \overline{A}.\overline{B}.\overline{C}$

$\overline{A.B.C} = \overline{A} + \overline{B} + \overline{C}$

2.4 Logical switching systems

A series of interconnected switches can form a logic system, but the usual building block of electronic logic is referred to as a "gate", a sophisticated form of high-speed switch. Various types of gate are available, each with its own particular application. Standard symbols are shown in fig. 2.4.1.

A gate may require the presence (or absence, or a combination of presence and absence) of two or more inputs to "open" it. In most modern electronic positive-logic systems, the positive supply rail voltage represents logical "1", zero voltage represents logical "0", and (conveniently) the same voltage levels represent binary "1" and "0". The "truth table" represents the input-output relationship of the gate, e.g., the AND gate has output "1" only when all its inputs are "1", or output = (input 1).(input 2).(input 3). etc. Gate behaviour may be equated to systems of switches as shown in fig. 2.4.2.

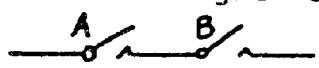
De Morgan's theorem shows that the NAND gate (. AND with Negated or inverted output) is identical in behaviour to an OR gate with inverter inputs, and the NOR is identical to an AND with negated inputs as demonstrated by the truth tables of fig. 2.4.3. Function equivalences of this type are often of use in designating systems with integrated circuits when standardisation of elements is desired.

Gates (and other elements) can be interconnected, subject to device limitations, to perform decision, mathematical, and control functions, some typical simple systems being shown in fig. 2.4.4. Note from the figure that more than one system is possible for any given function, the choice of gate type being dependent upon factors to be considered later.

FIGURES ((Distributed as space available)):

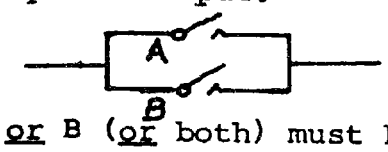
Fig. 2.4.2: Basic Logic Gate Concepts:

AND



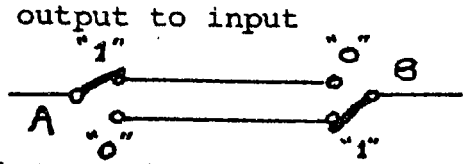
A and B must be closed to connect output to input.

OR



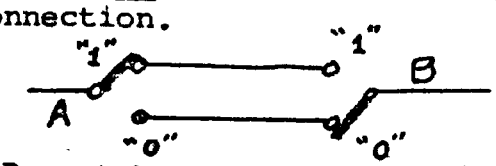
A or B (or both) must be closed to connect output to input

Exclusive-OR



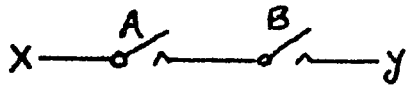
A or B but not both must be in "1" state for connection.

Equivalence



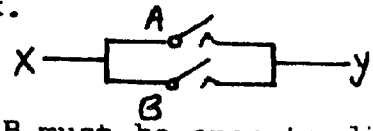
A and B must be in same state ("1" or "0") for connection.

NOR



A or B must be opened to disconnect y from x.

NAND



A and B must be open to disconnect y from x.

NOTE: The NOR and AND, and the NAND and OR, are inverse-function pairs. c.f. De Morgan's Theorem.

Fig 2.4.1 Logic Gates

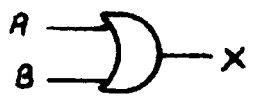
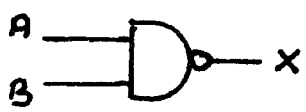
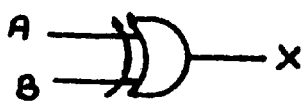
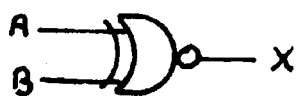
Function	Symbol	Truth Table	Boolean Equation
AND		A B X 0 0 0 1 0 0 0 1 0 1 1 1	$X = A.B$
OR		A B X 0 0 0 1 0 1 0 1 1 1 1 1	$X = A + B$
NOT		A X 0 1 1 0	$X = \bar{A}$
NAND		A B X 0 0 1 1 0 1 0 1 1 1 1 0	$X = \overline{A \cdot B}$
NOR		A B X 0 0 1 1 0 0 0 1 0 1 1 0	$X = \overline{A + B}$
EXCLUSIVE-OR		A B X 0 0 0 1 0 1 0 1 1 1 1 0	$X = A.\bar{B} + \bar{A}B$
EQUIVALENCE		A B X 0 0 1 1 0 0 0 1 0 1 1 1	$X = A.B + \bar{A}.\bar{B}$

Fig 2.4.3 de Morgans Theorem

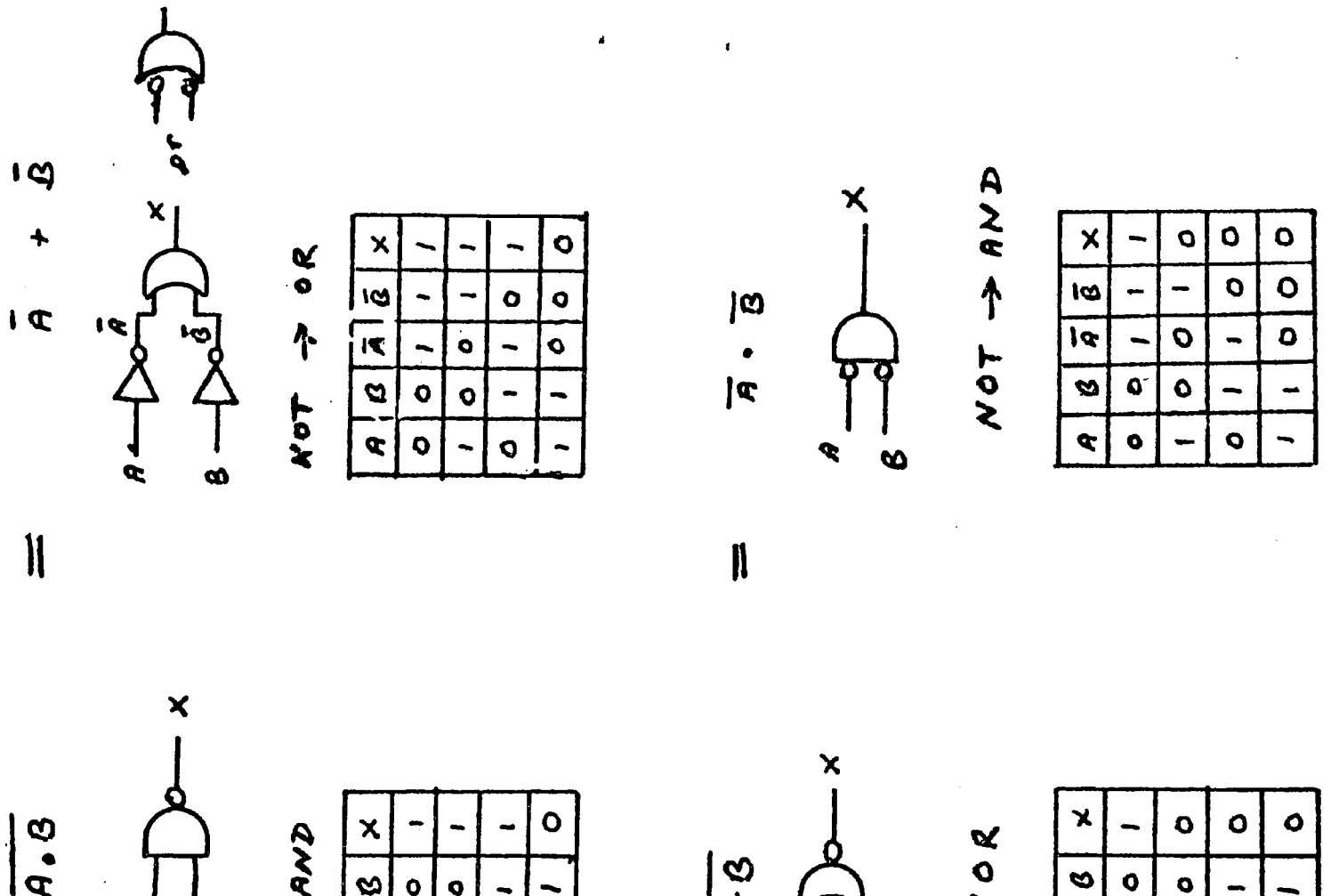
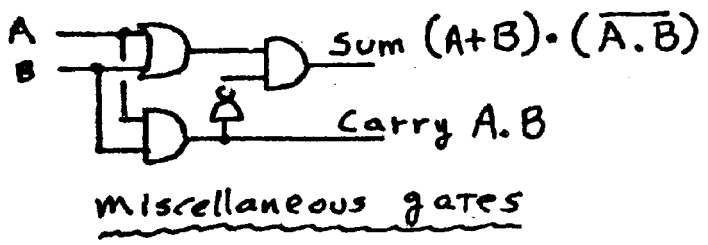


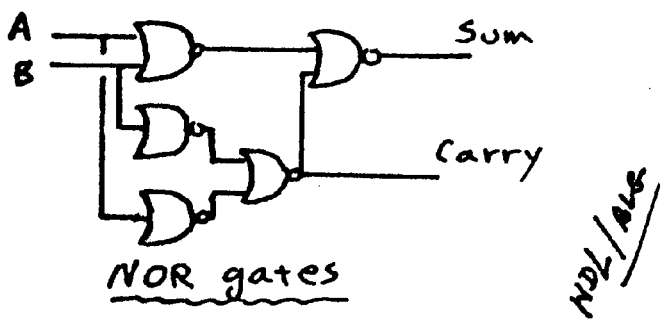
Figure 2.4.4: The Half-adder

The "half-adder" is a subsystem used to perform binary arithmetic, adding binary digits of equal order in accordance with:

0 + 0 = 0 0 + 1 = 1
1 + 0 = 1 1 + 1 = 0 carry 1.

Two circuits are shown below, one incorporating only NOR gates:

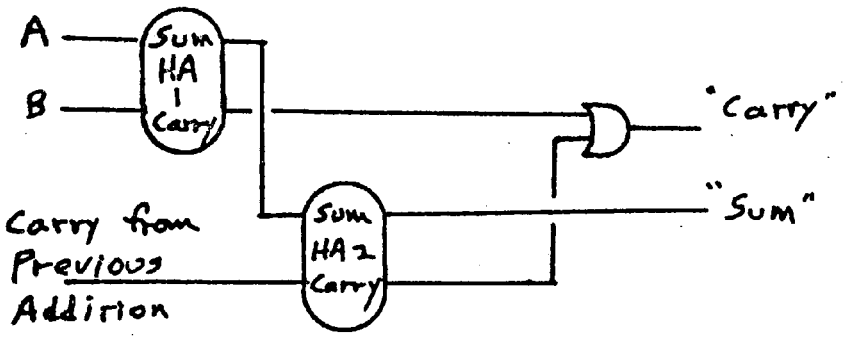




NDL/AUG

(Fig. 2.4.4., continued):

To allow for "carry" from a previous-order addition, a "full-adder" is needed. This may be formed from two half-adders, thus:



In Part III, we shall consider the application of Boolean Algebra to Gate Systems, and the operation of a Transistor as a Switch.

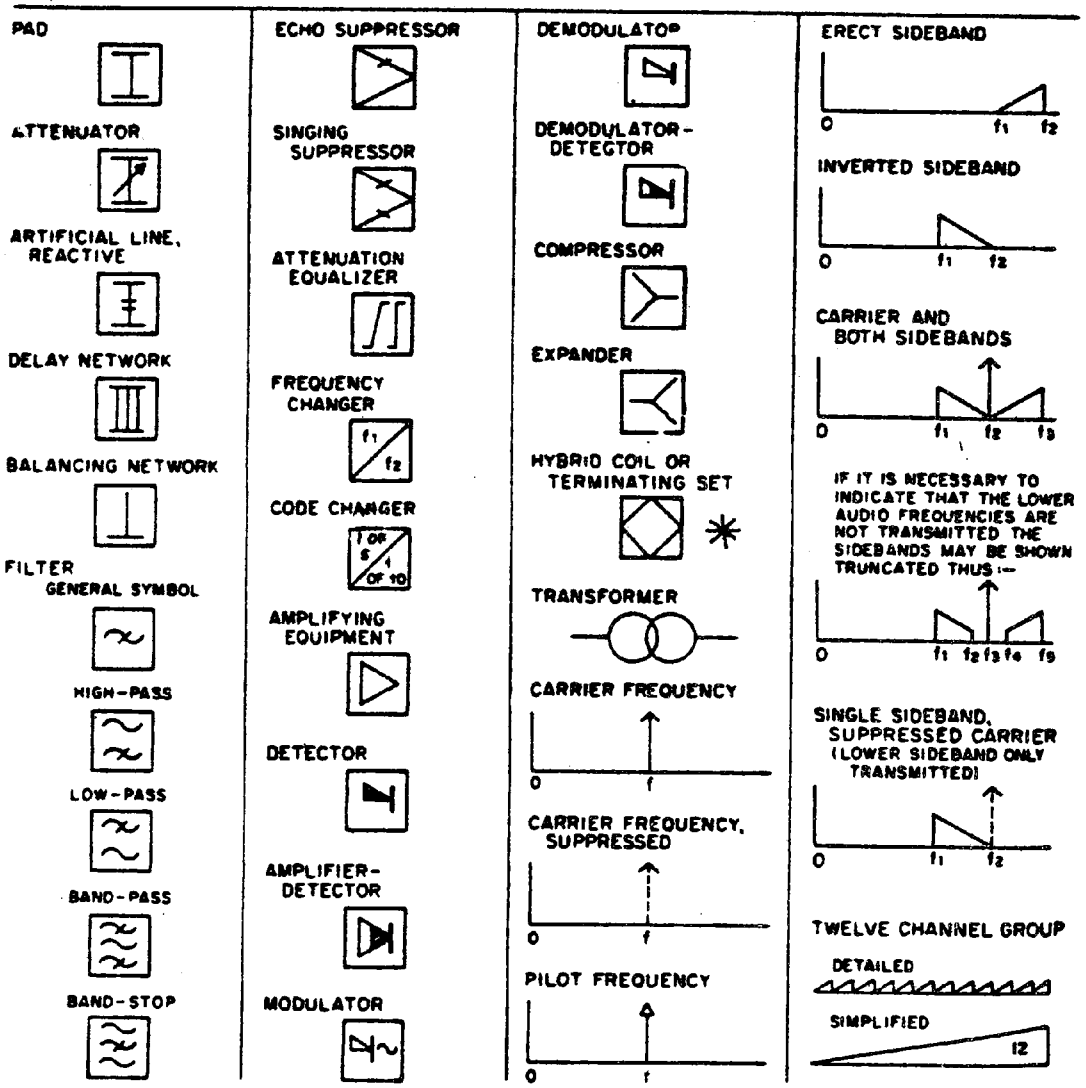


Fig. 9—Selected British block-diagram graphic symbols.

PATENT COVERAGE OF INVENTIONS

A patent in the United States confers the right to the inventor for a period of 17 years to exclude

following material applies generally to patents for inventions and not to design patents nor to patents for horticultural plants.

xxxxxxxxxxxxxxxxxxxxxx

DISCLAIMER

The opinions and facts presented here in no way represent the views of The Australian EEB inasmuch as The EEB is an aggregate of printed pages, and as such is entitled to no opinions whatsoever

xxxxxxxxxxxxxxxxxxxxxxxxx

*Amateurs seem to use this symbol for MIXER

REFERENCE DATA FOR RADIO ENGINEERS (5th Ed)

Published by Howard Sams and Co, subsidiary of ITT. $A15 when ordered from Yankee sources (see adverts EEB); considerably higher locally.

When I first picked up this book it struck me as a rather odd collection of stuff, presented sometimes in an odd sort of way. After working through it a couple of times and then using it in the course of daily work for a period, these ideas changed to one of ready acceptance. Perhaps the title or the traditional concept of a "radio engineer" needs changing. No longer is he one who designs systems and hardware with a sliderule and tinkers with servos. The great swags of Fourier transforms and mathematical tables indicate increasing sophistication in his electronics, but this is the lesser part.

The real emphasis is on communication theinteraction between the nature of speech, information theory and resulting pulse-code modulationsystems, and traffic concepts of complex networks. The language is the statistics of Gibbs rather than the determinism of Newton and Maxwell. A serious book for serious users, it standswell on the shelf beside Terman, Langford-Smith, Landee and Henney.

((WOT? NOT Orr?))

The nearly 1200 pages of text is backed up by a 41-page index. Provided only that you are careless as to who controls your economy or fixes your elections, by all means buy it.

-- Rich. H. Ferris

((Now there's real talent, to be able to inject politics into a technical book review! The book is really an amazing compendium of information, but most of it is truly for engineers; I just didn't have the background to appreciate much of it, but as a general reference work it even has value, as the tables at the left will show. You should at least have access to this book, and if it isn't around tell your local Institute branch, or University to Library to get it))

RL-G

A FIVE-WATT LINEAR AMPLIFIER

-- M. J. Groth (ZL4GF)

This amplifier has a gain of about 7db, and will give 5W out for 800mW input on 80M. More gain is possible by removing the 10Ω base resistor, but stability could suffer. The power transistor is a Fairchild AY8114, but better ones would be available now. Any r.f. power transistor of f_T > 30MHz should do, although VHF types may be unstable.

The construction is not critical. I built mine in a trough of aluminium with a 1" T-section as a heat sink, which is more than adequate. It is only just possible to feel the temperature rise after an hour or so on full CW output (not possible with modern commercial units). The Q of the two T-networks is about 5, and no tuning is necessary over the range 3.5 to 3.9 MHz. Just peak up the trimmers at 3.7 (or 3.6 in VK) MHz, and you only lose about one-half db at the edges. The coils are as follows:

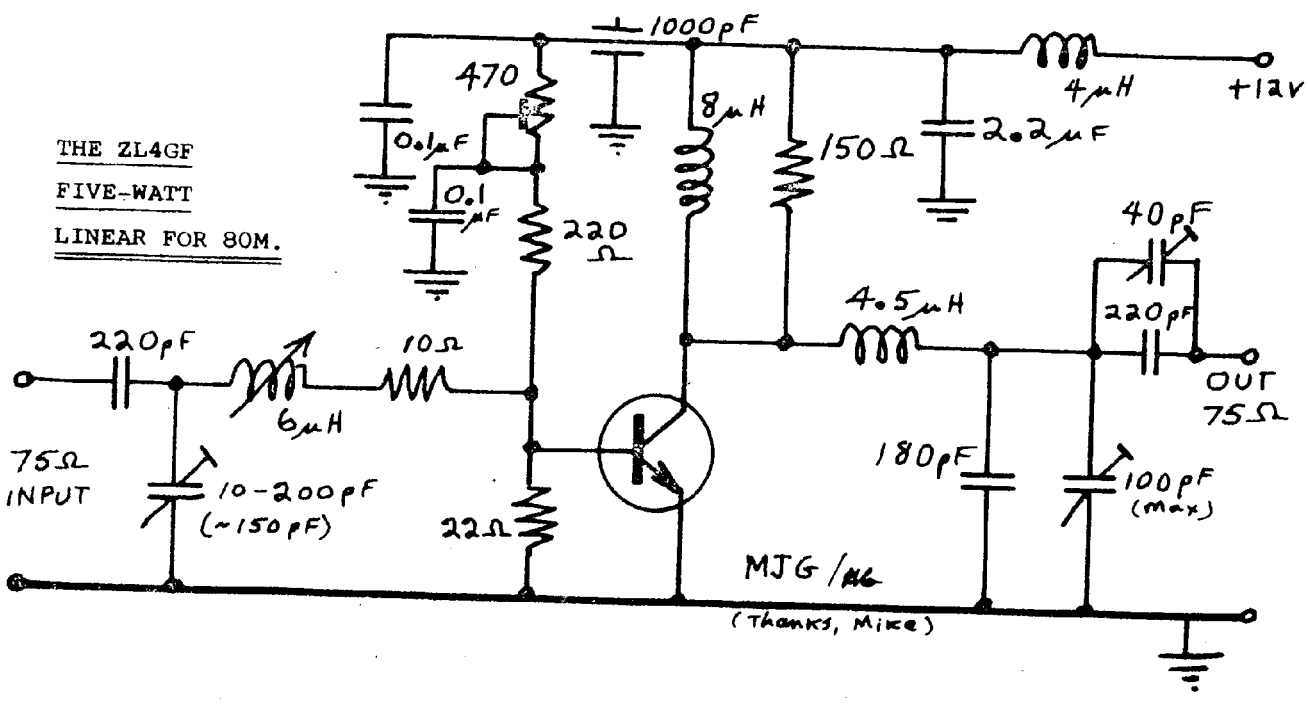
BASE NETWORK COIL: L ≐ 6 μH, 25 turns on 3/16" slug-tuned former.
OUTPUT INDUCTOR: L ≐ 4.5 μH, 18 turns 22 swg enam spaced over 1-1/2" on a 1/2" PVC water pipe (OD about 3/4").
RF CHOKES: 4 μH, about 3 W Philips resistor with one layer of 25 swg.
8 μH, as above using 29 swg
Mica trimmers are satisfactory for the input and output.

Adjust bias until the transistor starts to draw quiescent current, abt 30mA. On a battery supply this needs adjusting as the battery runs down. The 470 Ω resistor was a carbon trimpot, but a WW would probably do in a pinch. Good earthing is necessary due to the low impedances.

The design is for 75 Ω loads and inputs. For 50 Ω reduce L to abt 2/3 and increase C to abt 1.5 times values shown. The rig is very stable, and is the first Linear I've built. It is driven by an Otago Branch exciter which supplies about a watt of drive. These exciters are all solid state, and have only two transistors, one FET and 3 ICs and have a reputation for being the HIFI exciters without the gritty sound of filter units*. The Linear here described appears to preserve the fidelity of the exciter, by the on-the-air-reports. ((Re filters, cf. Pitchin, EEB Aug 1973))

((Ed. Note: In a Letter, Mike Groth writes: "With reference to your squaretable discussion on p. 78 of the Augtober 1972 EEB, the Otago Branch Exciter is up with the state-of-the-art, and in my opinion easier to get going than a Tucker-Tin. It would be what VK7WH is looking for. When finished the project will transceive on all bands from 3.5 to 144 MHz. I have added a Direct Conversion Receiver..." We'll be printing it (the receiver) in EEB!))

* For the Otago Branch exciter, see Break-In, 1970



HANNA HINTS -- Ralph Hanna, W8QUR

-- RELIABLE VFO CONSTRUCTION (cont)--
(Part I, EEB Apr 1973)
(From A. R. News Service Bulletin, 4/72)

I failed to mention last month that I had started to make the Seiler VFO. I wish now I had never started. It may not have been so bad if I did not have a digital frequency counter. This thing will show the slightest drift, down to 1 Hertz. All the things I tried didn't make any improvement. Sometimes it would drift higher and sometimes lower in frequency.

Last month capacitors were being discussed. Mica capacitors, for the most part, have temperature coefficients of plus or minus 100 ppm or better. Ceramic capacitors are available with zero temperature coefficients of various values from 150 to 1500 ppm negative. The drift will usually be lower in frequency. If the drift is this way, then it can usually be corrected with a capacitor which has a negative temperature coefficient. There is a formula in the Handbook for this. Heat is the cause of most drift and there will be more on this later.

The tuning capacitor must be of the best quality and be of the double bearing type.

Most of the articles available do not say much about drift, but all manufacturers say something about how much it will be after so much warmup. Swan and Eico had a lot of trouble with drift on some of their equipment. With SSB very little drift can be tolerated. Drift in a transceiver can really be murder. If two guys are both drifting and therefore follow each other's drift, they could move right out of the band!

There are many considerations when making a VFO.. Loading is very important, and a buffer stage is a must. If a transceiver is used, then usuall y an amplifier is required to get the output high enough to do any good. In some cases harmonics must be suppressed, and also parasitics. When using an FET, a diode will clip the usual peak which is very rich in harmonics. Of course a tuned circuit in the output will also help. Parasitics can often be suppressed by use of ferrite beads.

In the one I am trying to make, I find that the leads must be anchored very securely with no possible movement. My biggest problem, and I don't have the answer yet, is the heating of the transistor. The temperature measured with a thermocouple and found to increase 10° above room temperature in less than 15 minutes after turn on. The frequency decreased at an alarming rate. Some transistors never really did settle down.....

XXXXXXXXXXXXXXXXXXXXXX

SOLID STATE HOMEBREWING -- Jerry, WAØPFS

(From Amateur Radio N.S. Bulletin, 5/73;
QSP Heart of America Radio Club, K.C.Mo)

As more and more amateurs switch to factory made gear, and as industry uses more ICs and disposable modules, the life of the homebrewer gets tougher and tougher. If you have recently tried any of the construction articles found in the periodicals, you are already well acquainted with the hassle involved getting a few needed components.

The transistors and ICs in radios and TV sets are apt to be designed specifically for that purpose and have operating characteristics that are of little use elsewhere. There are exceptions, but they are few and far between.

There is only one way to combat this lunacy. Arm yourself with a good semiconductor cross reference guide and a wide assortment of electronic parts catalogues.

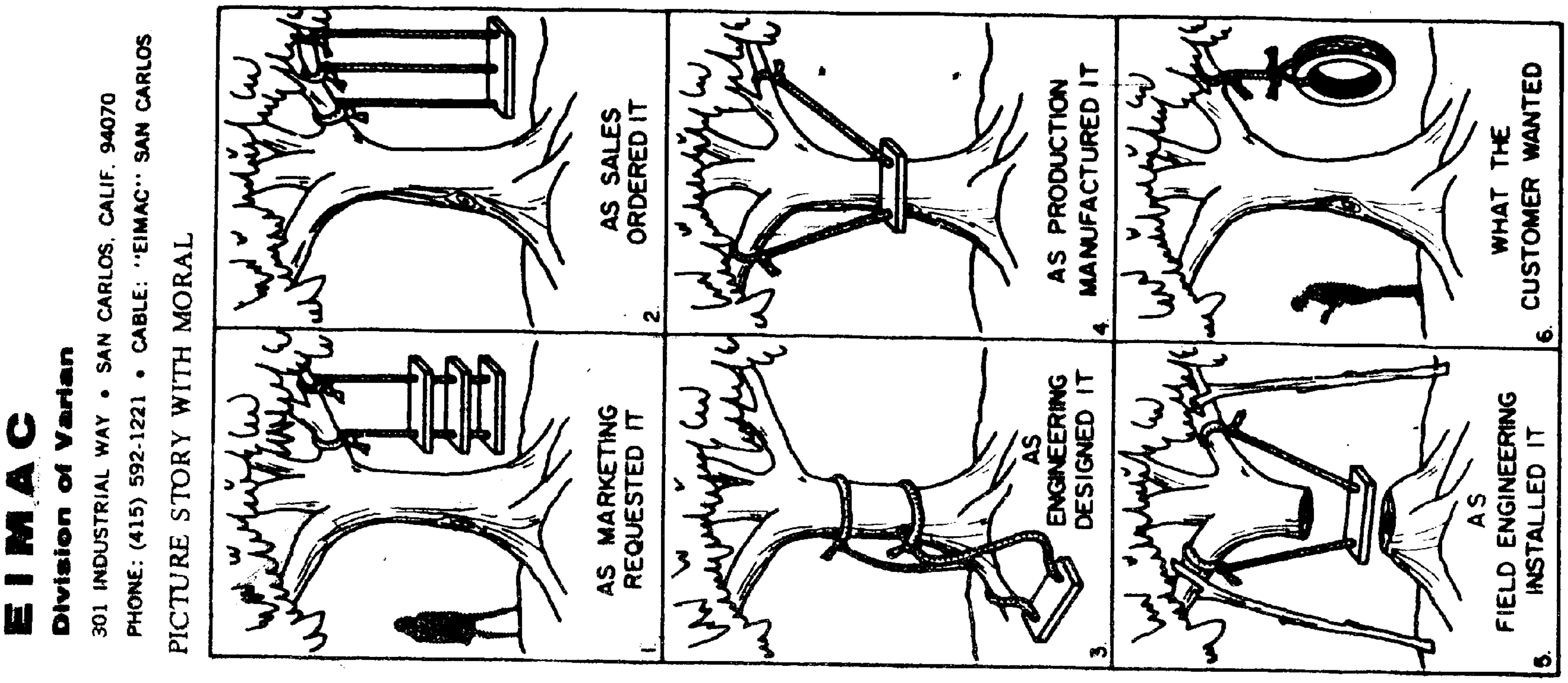
Tops of the replacement guide is Howard Sam's Transistor Substitution Handbook. This handy little paperback, which is updated every year, covers practically every transistor made from 2N34 to 2N6000 with receommended substitutes. It also covers devices from Japan and Europe, as well as replacement types manufactured by Delco, G.E., Motorola, and others. Most manufacturers also publish replacment guides which are available at distributors.

If you can't find what you need locally, you must use the mail order service. Allied and Radio Shack are the best bets in any case. You can get a catalogue from any of the local Radio Shack stores. Be sure you get the Industrial Catalogue. The more common entertainment catalogue is devoted to Hi-Fi, CB and simple experimenters stuff.

Getting the parts is often a struggle, but the satisfaction of having something work which YOU built makes it all very worthwhile.

EEB Ed. Note:

The situation for most common parts is not quite so bad in Australia and N.Z., but these points are still generally interesting. We have numerous still-reliable mail order houses and local distributors. See also EEB articles, 4/72 to 2/73 et seq.



Reprinted from the March 16 issue of Electronic Design.

SWOOP -- by Elise White (YF/KØCNV)*
((from Amat. Radio News Serv. Bull. 6/73))

I'm no moralist. I could care less how others live, dress, behave or addressed until these screwballs infringe on my personal rts.

I've been receiving mail addressed to

"Ms. Joe White" or
"XYL of Joe White".

I'm not Ms. anything, nor am I an X of anybody. Joe White put out 2 bucks, suffered through a formal wedding and has supported me for 25 years. I'm proud to bear his name and no bunch of sexless females or obsolete key pounders are going to deprive me of my rightful title.

The terms, XYL, OM, and "Hi, Hi" are as archaeic as a stone ax and a dinosaur, and in today's operation constitute poor operating practices. Everybody buys the most exotic equipment they can afford and brags extensively about the technical advances they made, and then falls back into spark-gap lingo.

You hear learned discussion on triggering the amateur satellite, diodes, transistors, solid-state equipment, fancy antennas, repeaters and in the next breath, "There goes the buzzer, the XYL is calling me to dinner."

Ninety percent of these dingalings couldn't spell cat with a key if they had to, but as long as they have VOX they're in business.

The very next time I get a letter from some advertising buy, politician of women's libber marked "Ms." or am handed a name tag with XYL on it, somebody's going to be eating an appetizing titbit.

No male, female or morphrodite dot-and-dasher, or would-be, could-be or are-politician is going to deprive me of my correct title. I've had it clear to here.

* This is OK, isn't it, OG? Saves space! -L.

Quote

"No one -- not even the most brilliant scientist alive today -- really knows where science is taking us. We are aboard a train which is gathering speed, racing down a track on which there are an unknown number of switches leading to unknown destinations. No single scientist is in the engine cab, and there may be demons at the switch. Most of society is in the caboose looking backward."

-- Ralph Lapp (quoted by A. Toffler, in "Future Shock")

this ELECTRONICS EXPERIMENTERS BULLETIN IS PRINTED WITH LOVE, AS TIME ALLOWS. PROSPECTIVE AUTHORS SHOULD SEND FOR OUR "MANUSCRIPT POLICY" SHEET. ARTICLES EARN FREE SUBSCRIPTION CREDIT (only). IF YOU HAVE A TECHNICAL FACT OR OPINION OR RECIPE, HERE IS YOUR OPPORTUNITY TO SHARE IT WITH OTHERS.

EDITOR: R. Leo Gunther (VK7RG). ASST. ED.: Chris. Pitcher (VK3). ASSOCIATE EDITORS: Dick Ferris (VK7ZDF), Rod Reynolds (VK3ZAR), Les Yelland (VK3), and Rich. Maddever (VK3). SUBS MANAGER: Bob Walton. DRAUGHTSMEN: RLG and Ron Parker. SECRETARIES: Brenda Ford and Alice Gunther. A most impressive list, but Leo and Brenda still have to do most of the work!

AUSTRALIA: $1.55/yr, $4.20/3-yrs to R. A. Walton, 396 Rokeby Road, Howrah, Tas. 7018; P.O.'s preferred. NEW ZEALAND: $1.70/yr, $4.60/3-urs to N.Z.A.R.T., P.O. Box 1459, Christchurch (N.Z. funds). CANADA, USA: $3.50/yr, $9.25/3-yrs to Frank Merritt (VE7AFJ), P.O. Box 309, Parksville, B.C., Canada. ELSEWHERE: £1.50/yr to Jim Coote (G3UGD), 56 Dinsdale Ave., Kings Estate, Wallsend, Northumberland NE28 9JD, England, U.K.

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COMMERCIAL ADVERTS.: $A10/pg, $A6/half. Circ. ca 1000. PRINTING: Advance Publicity Co., Hobart 341-817. Yes.

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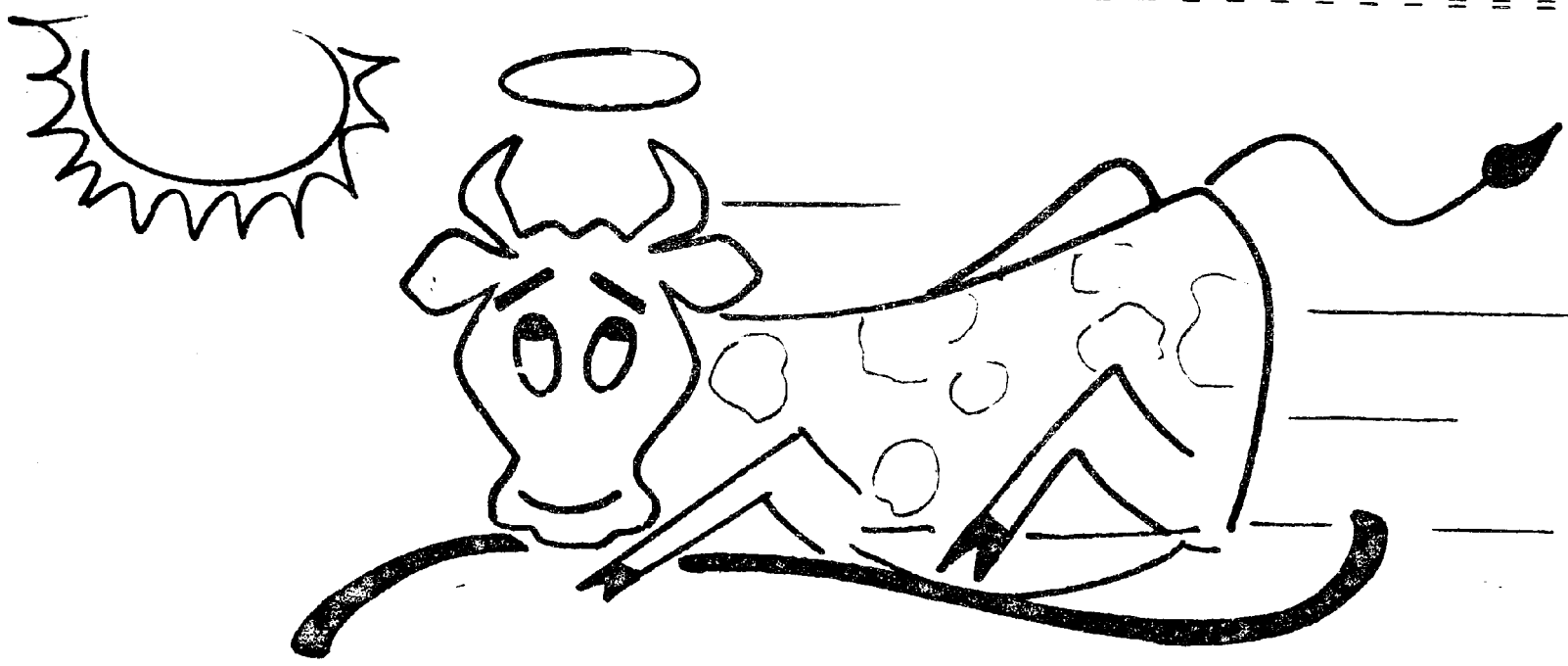
THE Australian EEB

→ 30c per copy

P. O. Box 177
Sandy Bay,
Tasmania 7005
Australia

→ Underground Electronics

August 1973 Vol. 9, No. 4 P. 45



CONTENT: (* = Constructional)

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Humour: 56.
Philosophies: 52, 56, 64.
Recipies etc: 47, 48, 50

==========

OCTOBER: Semicon Testing, II, Bistable Multivibrators, Converters, Digital Instrumentation, Exalted Carrier, etc.

MILK COWS AND REAL COMMONSENSE -- A Defence of Science*

by J. E. Andersen (VK7ZFO) (now VK2)

S.I. Saw, Marjory Daw,
Gunther shall have a new master.
He shall sway
In a Hertzian way
Or face pedagogic disaster!

I couldn't agree more with the paper on Sacred Cows -- except, I thought the argument was on whether we should all speak the same language, not on points of grammar or spelling.

The Whole Point

The whole point is whether we have a set of units which everyone uses and understands, or whether we retain systems based on the conveniences of antiquity.

For example,

1 mile = 1000 paces of one standard Roman Legionaire.
1 foot = The length of William The Conqueror's pedal extremity.
1 pound= The weight of a lump of iron the Astronomer Royal happened to have about him.

Far better than this is a system based unequivocally on things which do not change: electrons, wavelength of a particular emission of caesium or krypton etc. Granted a few conversion factors change, and the working units appear to change if only in name. But what of it? The apparent complexity is simple compared with that of the whole heap of existing units and their conversions. If you think horrible things happen to Free Energy equations in S.I. Units, you should try setting one up in c.g.s. and find your data comes in MKS or FPS units. This used to keep me awake at nights until I discovered a computer grows sleek and contented on a diet of equations and JANAF Tables.

A Common Language

Adherence to a standard set of units does not imply uniformity of thought and action. Heaven forbid! What it means is that what we write and say is instantly understood by someone else; it is an aid to communicating ideas which are essentially non-uniform.

A common language improves communications, reducing the scope for misunderstanding and thereby helps stop the trend towards that hideous state of complete conformity of thought and action. Conformity is born of fear, out of a lack of communication (i.e., ignorance). Why else do totalitarian systems rely on secret police and censorship? But I digress.

The Uses of Adaptability

The "new" units do at times look awkward. But somehow I seem to have seen all this before. I remember 20 years ago (my Godfather how time slips by -- are SI secs shorter..?) when doing Physics I Our Lecturer* introduced us to the MKS System which was then replacing c.g.s. units. Units were then changing names, as they are again now. Some things, e.g. electrical units, became simpler, others more complex. Textbooks were confused then, written as they were to cope with both British and metric systems. So whats new? They're still written that way ((viz., confused! And now more of same. -- Ed.))

There is nothing more certain than that humans will alter units to give convenient numbers. This can be done very easily with metric prefixes, whether these are legal or illegal according to S.I. standards, without destroying the lingua franca.

Another point is well illustrated by your example of pressure units.**That is that nature is not conveniently constant or regular. 1 atmosphere pressure steadfastly refuses to be 1000 millibars or 100,000 N/m^2. Meterologists have for generations accepted 1 atmos as being 1013 millibars or so, and will not be amazed to wake up one morning to find it is about 1013×10^2 N/m^2. Humans have one characteristic a physical constant has not -- they can adapt. So they will adapt to a change in nomenclature.

---

* This item came addressed to: "The Editor, EEB, Alias Le Duc du Tour de Babel".

*Editor's Note: One of numerous comments Mr. Andersen made on the margins of my Sacred Cows article, probably not for publication was:

"... which reminds me of how my old Professor used to distinguish between a physicist and an engineer. If faced with an improbable answer the physicist meticulously checks his calculations. An engineer multiplies and divides his answer by 981 thingohs or 32.2 whatsists to see if they look better."

** Or commenting on units of pressure, particularly very low pressures:

Try 1 Torr = 10^{-4} mm of mercury
= why go further?

Or: 1 tor = a Scottish mound
2 tor = one lassie .....

The old c.g.s. metric system was an attempt to develop a universally applicable set of units. It was found to be wanting, and so was modified to MKS, which in turn has given way to S.I. Who is to say this is the last word? History is littered with the corpses of last words.

The Uses of Change

Change is the characteristic of human affairs, and accelerating rate of change is a characteristic of our times. People have the advantage over dodos and dinosaurs that they can adapt to change. Sacred cows arise from attempts to buck this law of nature. Science is not alone in having Sacred Cows for this reason. Certainly there are aberrations where a scientist apes some aesthetic Eastern mystic and sits motionless for hours contemplating his correlation.

The uses of Responsibility

In general, though, the difficulties of science which provide so much merriment in the popular press are due to the inability of laymen to make best use of the results.

Is the atomic physicist really to blame if a few generals want to throw bombs at each other? Is the engineer to blame if some idiot wants to pass another car at 70 ((MPH?? -- Ed)) round a blind corner? Is the chemist to blame for pollution if the Board scrubs out the waste treatment plant from his process?

Common language and Common sense

The problem arises because one group does not understand what the other is talking about. It is no good talking kilometers/hr to an official whose mind plods along at perches per diem, or talking litres/min to a yokel who measures fuel consumption in haybales/month. Without a common language, communication becomes difficult if not impossible.

To summarise, this is the whole point in having a universal set of units. Then the ordinary man in the street and the scientist are at least talking about the same thing in the same terms. Its not much but it is a start, and I will gladly replace 1 atmosphere with 101325 Newtons per square meter if what I write is instantly recognised in Hobart or Helsinki.

There are and will be difficulties in coping with change. In the end, common sense will prevail over the more awkward aspects.

And isn't common sense what your delightful publication is all about?

((I herewith take Les Yelland's advice and forgo the temptation to make reply with comments about humans and responsibility. What do you people think?? -- Ed.))

HOW TO MILK A SACRED COW -- KØNL

((Retitled from "Useless Information", in Auto-Call, June 1970))

Last month we asked our members if they could tell us for what purpose a power transformer having a tapped secondary of 0.435V would be. Smitty, W3 GKP, is the only one who answered, as follows:

"0.435V is just right for electrocuting paramecia. To do this you can build on a slip glass a little pond with walls of shellac, burying in the wall 2 fine bare wires. The specimen, contained in a drop of swamp water, is placed in the pond. The wires are energized. The result is just like stopping your movie projector. Of course the centre tap is so you can make with a rectifier in case Kansas protozoa prefer d.c. Unless your eyesight is real good you will need a microscope".

We tried Smitty's idea. Unfortunately we had to do a little substituting since all these protozoas, paramecias and all that stuff wasn't available. So we went down to the local beanery and got a cockroach. He wanted to travel so we embedded the legs (two of them) in the shellac. Then we turned the juice on. He did a foxtrot. We buried two more legs in the shellac and turned the juice on. He did a waltz. Finally

Finally we buried all the legs in the shellac. When we turned the juice on, nothing happened, which all goes to prove that if you bury all of the cockroach's legs in shellac, he cannot feel electricity.

ΔΔΔΔΔΔΔΔΔΔΔΔΔΔ

RULES_FOR_WRITERS,_and_HOW_TO_SUBMIT_ARTICLES,..

((From NARC News, QSP ARNS Bulletin 11/69))

For a long time we've been looking for a set of concise rules for writers, and finally found them. KL7FLS has sent them to NARC, and we proudly reprint them here.

1. Don't never use no double negatives.
2. Be sure each pronoun agrees with their antecedent.
3. Join clauses good, like a conjunction should.
4. About them sentence fragments.
5. When dangling, watch participles.
6. Verbs always has to agree with their subjects
7. Just between you and I, case is important.
8. Don'T write run-on sentences not using commas as they are hard to read.
9. On the other hand, don't use commas, which aren't necessary.
10. Try to not ever split infinitives.
11. Its important to use apostrophe's correctly
12. Proofread your copy carefully to see if you any words out.
13. Correct speling is esential allways.
14. When using hyphens at the end of sentences always be sure to hyphenate at syllables.

IMPROVED BEER RECIPE -- continued from last month ((see also, p. 75))- RLG

Helpful hints

A day in the fridge will settle the yeast a bit better, but excessive chilling spoils the taste of this product -- in notable contrast to the commercial variety. Any good brewers yeast will settle pretty well by itself, and the fridge treatment merely allows you to get the last drops out; but this brew is so cheap that you could afford some wastage without fear. It is, however, essential not to add ANY chemicals to settle the yeast; they also reduce surface tension and so reduce the amount of gas (viz., head) in the liquid.

In last month's article, the "0.5-1.0ml" of dried yeast ought to read, "about 1/2 tsp" or some 1.5ml, since in fact 1 tsp is about 3 ml.

Be sure to rinse the bottle thoroughly right after emptying, and drain it upsidedown. Keep the drained dried bottles covered, and they will be in good condition for the the next brew. When the bottles are clean they can be prepared for the next brew very simply by a few small rinses of hot water just before bottling (but of course don't forget the teaspoon of sugar in each for priming)(Use a measuring teaspoon! 5ml is too much, produces excessive head. Metric, bah!)

Conditions for Excellence

-- Follow the instructions last month carefully, and the following cautions as relevant, and you'll never have trouble.

1) You ensure that the vat is clean and sterile; if you omit the swirl with the potassium metabisulphite solution you'll grow nasty wogs.

2) The top fits reasonably tightly on the vat; this is less important if the room temperature is quite even.

3) The brewing temperature is even (e.g., should not vary too much from night to day) and cool (ideal is 10° to 15°C; 20°C is getting warm). But if you live in a warm climate (e.g. north of Tasmania or south of Alaska) persevere irregardless; the brew will merely have to age longer.

4) The hops are genuine. The worst hops are the supermarket variety, and we definitely know of brews which have been quite ruined by them. Use only real hops, obtained from a proper homebrew agent or from a cooperative farmer.

5) Unusual contaminants are excluded. Keep the vat and all preparation areas well clear of soap powder and other noxious agents! There are two well documented cases of soap powder falling into the vat just before bottling.

6) Avoid excess sugar in priming the bottles; it produces excess froth, and in extreme cases causes exploding bottles. Never use more than 1 level teaspoon -- I mean 3-4ml-- of sugar per ordinary size bottle (e.g. 735 fluid millilitres)

7) Avoid esoteric modifications (pasteurisation, etc) unless you know exactly what you are about. Pasteurised bottles tend to explode during the heating process, etc.

8) Even if (for some reason) you happen to produce a terrible-tasting lot, don't panic (unless it was due to soap powder etc), let it age another month and it will come right. There is no such thing as a bad brew; only some are better than others.

9) The capper available from Australian Home Brewers (at least in Hobart) is a lever-arm type and is much superior to the old hammer-it-on (and break some) method.

Conditions for Alterations

There is really no such thing as an Ideal Recipe. Tastes vary and it is possible to make a variety of good brews. Your brew will taste good if you start with a good recipe -- and most recipes are OK, though ours is better.

Various variations are possible, e.g.,:

1) For more alcohol use more sugar, and conversely. But the Malt Extract also contains a lot of sugar and so will affect the alcohol content. The ME, however, also affects the body, as discussed below, and this must be taken into account.

2) For heavier body and a different taste use brown rather than white sugar. Some people prefer the brown, many don't.

3) If you want to approach it cautiously, at least try priming the bottles with brown rather than white sugar. This will give you an idea what brown does, and in this case imparts a slightly different taste which will be pleasing to everyone.

4) For more body ("heaviness") increase hops and malt extract in the same proportion, and of course conversely.

5) For more bitterness increase hops (or decrease malt).

6) For more sweetness increase malt (or decrease hops), keeping in mind that this will also increase body. If you want more sweetness without heavier body you can add a few hundred grams of lactose ("milk sugar").

7) You can omit the crystal malt, but the taste is definitely better with it.

8) You can omit the phosphate and calcium, but a friend tried that and reports that the result without the chemicals was not as good.

9) You can use any kind of yeast at all, but a proper brewers yeast (as recommended in last month's article) is best. Bakers yeast is worst because it settles very poorly.

10) A passable Stout can be made from White sugar 1.5kg, Brown sugar 2.0kg, Malt extract 2.0kg, Ringwood Specials hops 100g, Crystal grain (cracked) 200g, Dark grain (cracked) barley 200g (100g if you don't like the taste so smokey), Lactose 300g, chemicals, yeast etc. More dark grain makes a smokier taste, more lactose makes it sweeter, more brown sugar or malt extract makes it heavier, etc.

11) British recipes suggest adding a cupof strongly brewed ordinary tea to the vat before adding the yeast. Our experience is that it does not harm the brew but it is not certain whether it improves it.

12) Some people use a pillowcase to hold the hops thereby reducing bother, but it reduces the efficience of extraction too, and also is is decidedly unpleasant to squeeze a boiling-hot pillow case!

13) Some people use a fermentation bubbler, although not really necessary for beer.....

LETTER: A Handy Frequency Meter

The handy frequency meter shown at the bottom of this page covers a range from about 5 Hz up to 1 MHz. With a 50μA FSD meter as shown, ranges are as shown in table. With a 100μA meter, values given can all be doubled, up to 2 MHz. The first stage only can be used as a Schmitt trigger, with or without divider. The whole thing can be used as a motor tachometer, providing theinput is filtered ((and voltage-limited, e.b. by zener)) to eliminate spikes.

All but the 100K pots are screwdriver adjusted tab types. The 50K is adjusted with a CRO on trigger output to get 1:1 mark-space ratio on a square wave, when about 6V a.c. is applied to the input. The 100K (sensitivity) pot is brought up from minimum till the meter gives reading. It should be left just above that point, as further advancement just loads the input without affecting reading.

Linearity and correctness of scale readings depend upon quality of capacitors, but I obtained good results with low voltage Polyester types.

-- Les Yelland, Prahran, Vic.

((Many thanks, Les. I'll try printing your diagram as-is, because you send such beautiful draughting. Incidentally, a useful companion to this instrument would be "A Secondary Frequancy Standard using ICs", by Roy Milan, ZL1WI, in Break-In, Nov. 1973. Uses two MC7490 decade counters and seven transistors. I mention the latter out of spite, for the sake of those chaps who insist that transistors will soon become obsolete. They won't unless you build an IC to cover every conceivable function, purpose and permutation... -- Ed.))

<<<<<<<<<<<<<<>>>>>>>>>>>>>>

A BRIEF SQUARETABLE (e.g. dialogue) ON THE OTL COMPLEMENTARY AMPLIFIER ON P. 33 OF OUR APRIL ISSUE WHICH CLAIMED TO DELIVER 30W INTO A 4Ω LOAD WITH A 12V POWER SUPPLY:

Ron Skruzny (Vic.):

With reference to this amplifier, the only way this could be done is if Q2 is in continuous saturation, and only d.c. passes through the load. ((Sure, that's why I called it a "power regulator" on p. 25!--Ed))

If the source is a.c. the power delivered to the 4Ω load is, as usual,

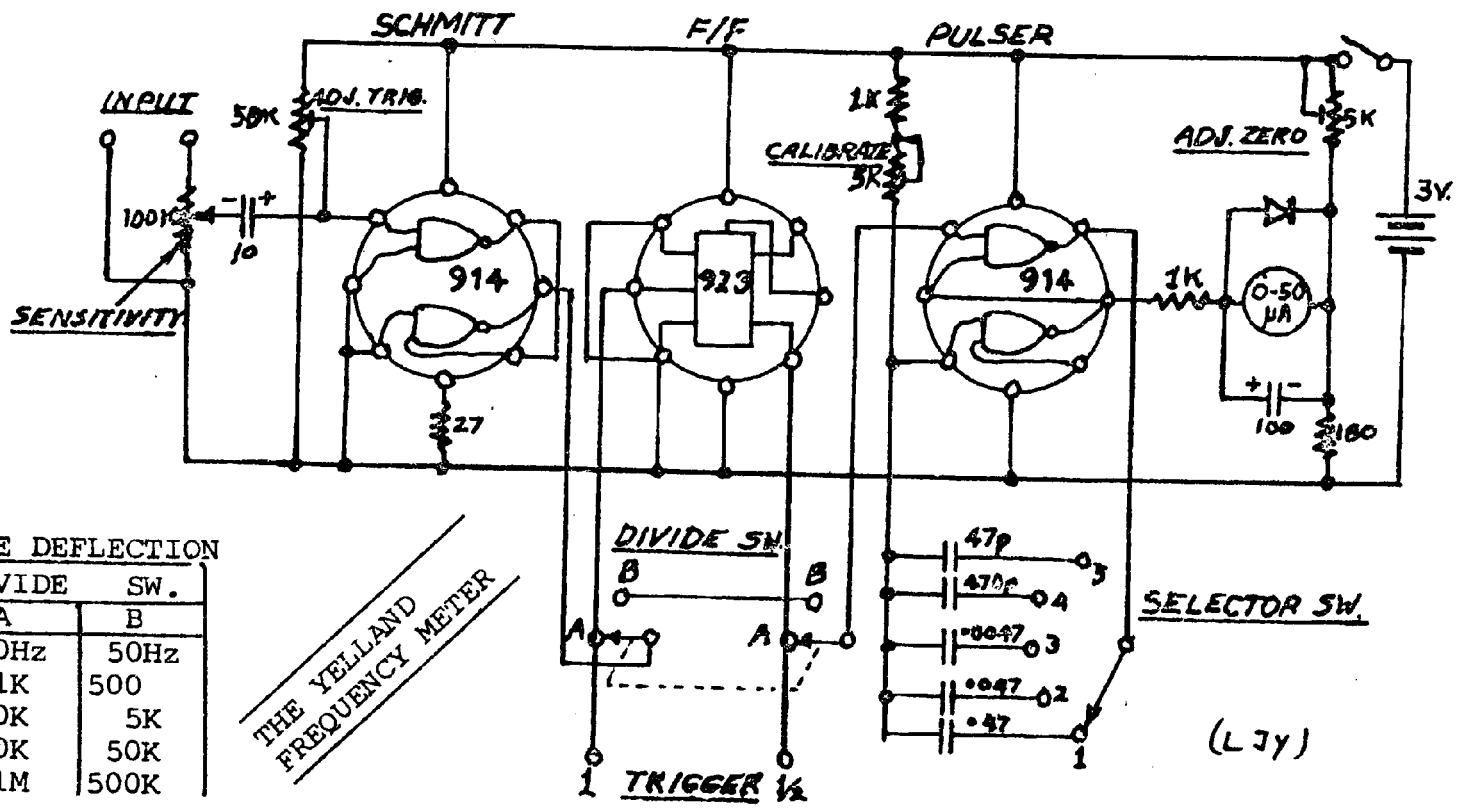
$P = (V_{rms})^2/R_L$, and since $V_{rms} = 12/\sqrt{2}$ here, then P = 4.5 watts, which is quite a lot different from the 30 watts claimed.

Dick Ferris (Tas):

I suspect there is more to this than meets the eye. In the April article, Stubbs refers to the circuit as a "basic cell" presumably the foundation for something further to be done with it.

As the circuit now stands, we can only assume it to be useful for a.c., and wired equivalently as shown here in fig. 1 (P.50). Then the peak a.c. voltage across the load is $V_p = (12-V_{sat})/2$. For a typical silicon power transistor we can put V_{sat} = 1V; then V_p = 5.5 V. For a square wave signal, $P_{max} = V_p^2/R$ =7.5W. For sine wave signal, $P_{max} = V_p^2/2R$ =3.75W.

Alternatively, if we try to make something of the note about a complementary cell the circuit becomes as in fig. 2 here (see P.50). But it now requires two 12V supplies, which can be awkward. The square wave power is now about 30W, and the sine wave pwr is some 15W, depending on V_{sat}. This substantial improvement in power is merely the



FULL SCALE DEFLECTION

SEL. SW.	DIVIDE SW. A	B
1	100Hz	50Hz
2	1K	500
3	10K	5K
4	100K	50K
5	1M	500K

THE YELLAND FREQUENCY METER

consequence of the fact that doubling the voltage will increase power fourfold. From fig. 3 (below) it can be seen that this circuit is simply a half-bridge.

The only way to get similar performance from a single 12V supply is to use a full bridge, shown schematically in fig. 4. In this case, whereas previously one end of the load was held at fixed potential while the other was varied between the + and - rails, here both ends of the load move, but in opposite directions.

The peak voltage now available is $V_p = 12 - 2V_{sat} = 10V$, and $P_{max(SQUARE)}$ is abt 25W, and $P_{max(SINE)}$ is about 12.5 W. Although the max power is less only one P/S is needed. In this case it is irrelevant whether the emitter or collectors of the power transistors are connected to the load ((as long as you are consistent!)) -- might as well use one of the standard emitter-output complementary amps on each side.

Incidentally, it should be noted that the difference between my power levels and those quoted (after some correction) by Ron, above, was simply because I took V_{sat} into account; this matters, if 20% matters (but it is only 0.8 db....).

((POSTSCRIPT TO CHRIS PITCHER: Relax, O.C., we'll print your article on complementary amplifiers one day. -- RLG))

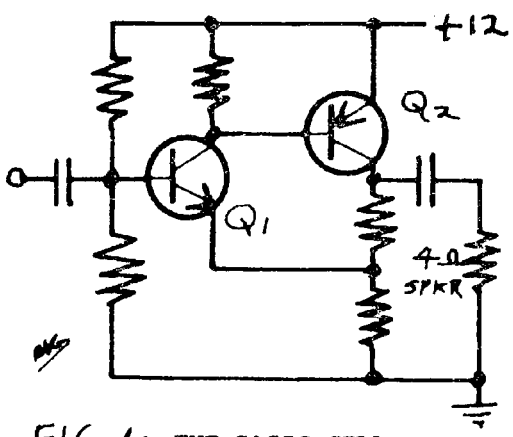
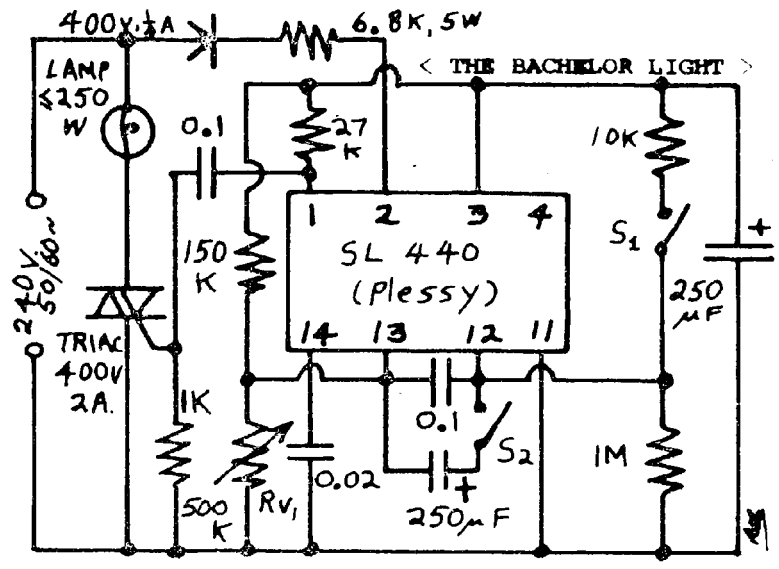


FIG. 1: THE BASIC CELL

A BACHELOR LIGHT -- Jim Bryant (G4CLF)

Here is a gem of a circuit, called a "Bachelor Light" for obvious reasons, using Plessy's new power control circuit, the SL440. When S1 is closed, the lamp is at full brightness; when S2 and S1 are open the brightness is controlled by RV_1 as an ordinary lamp differ, but if both are closed and then S_1 is opened the lamp will, over the next 30 minutes, slowly fade to the level preset on RV_1. Useful, eh?



What to do about Woodborers

People will tell you that wood borers (white ants, termites, etc) won't attack hardwood, or in any event attack only the "sapwood". Its an admirable thought, but unfortunately no one has told it to the termites. If you see find sawdust trails along the runners of drawers or beside timbers in the attic or basement, or if a piece of 'non-attackable' wood breaks when you step on it, you can paint every relevant surface with Kerosene ("paraffin" in U.K.). It smells terrible for a while but a couple of gallons of Kero are substantially cheaper than calling an Exterminator. The treatment will last for a few years, but if you obtain a lovely old piece of furniture be sure to give it the Kero treatment before bringing it into the house! Allow it to air out for a day in sun.

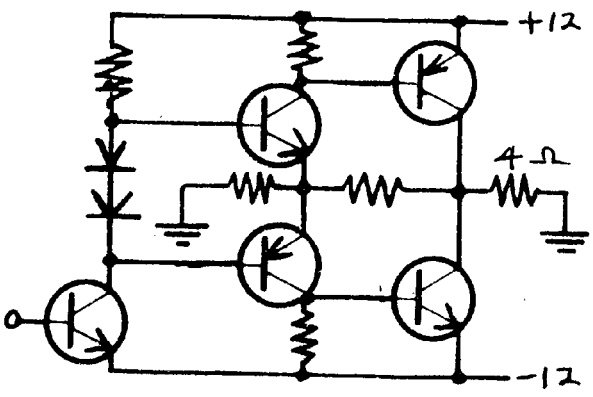


FIG. 2: INCLUDING A COMPLEMENTARY CELL

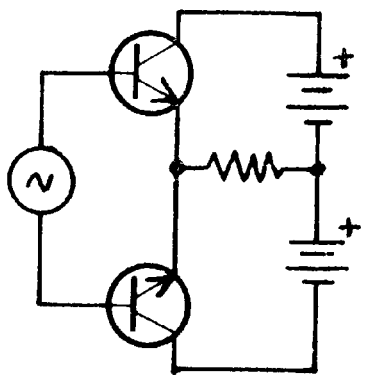


FIG. 3: AS A HALF BRIDGE (schematic only)

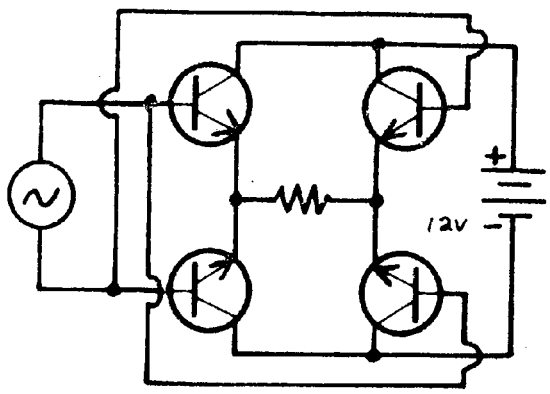
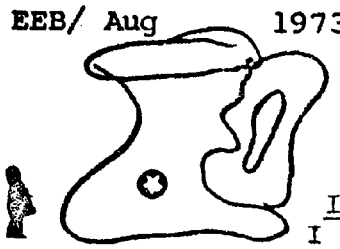


FIG. 4: AS A FULL BRIDGE (schem.)



pitchers corner

-- by chris pitcher (vk3)

In Appreciation

I wish to commend to your attention the "Phasing-type SSB Generator" by Worthie Doyle, W7CMF, Ham Radio, April 1973. I built this little beast (circuit below), and recommend it to those die-hards who use filters in transmitters. They are far more use in a receiver (and of course, a transceiver is like three bulls and a cow).

It should be noted that I used components straight from the drawer (say ± 5%) and achieved -38 db suppression, 300-2700 cps. A little care with an RC Bridge would, I am sure, improve that no end.

There is another aspect. By stuffing SSB in the output socket, one can recover demodulated audio from the a.f. input socket. Yes, it is your "Two-phase Demodulator", all for a total cost of four diodes, a few RC and L's. Compare with the original circuits from which your fig. 11 on p. 64 is drawn in the June 1972 EEB, series of receiver design artic.

The New Zealanders have, of course, made much of the phasing method in their "Tucker-tin" transmitter published some time ago in Break-In, and more recently updated in that mag.

The Real meaning of Receiver Noise

A fascinating book everyone should read who is concerned with receivers is, low Noise Transistor Input Circuits by W. A. Rheinfelder. I am not sure he has all thr right answers, but he certainly has the right questions.

He defines noise as "any unwanted signal" which includes spurious responses, intermodulation, etc. -- something I have been trying to impress for ages on people.

An acquaintance has completed a transceiver for 14 MHz recently. He measured S/N a >10 at 0.5 µV, measured bandwidth as ±12kHz at -60db, ±1.2 kHz at -6db, etc. But he claims it isn't as good as his old receiver. And it is not, but only because he didn't think out signal levels at various stages, or effective AGC -- the kind of thing you pushed at length in your series on Receiver Design in 1971-2. The result was that spurious responses (including intermod and crossmod were spoiling an otherwise good receiver.

But what was the "HAM" verdict? I quote: "Transistors aren't nearly as good as valves" It makes my blood boil -- although Roddam claims that we all need to have our blood boiled occasionally to prevent atrophy.

((Ed. Note: According to that impeccable definition of Noise, what proportion of the amateur and commercial broadcasts could qualify as "signals"? Of course the cross-modulation problem could be solved by some selective system which would eliminate them. Perhaps a Computer keyed to blank out Banality...?))

The Secret of Receivers!

The Secret of Receivers is in the Mixers! A good book is "modulators and Frequency Changers" by Tucker (of Synchrodyne fame) printed circa 1952.

The most important thing is "effective selectivity" as dealt with by Rheinfelder, mentioned above. The idea is to tune in a weak signal, just sufficient to read. Then tune a signal generator around the frequency, and record the level necessary to degrade the Signal/Noise ratio by a specified amount.

This gives a curve which should be the inverse of the i.f. shape. In practice it is about 10-100 times wider than predicted -- due to intermodulation and crossmodulation at the front end. That, of course, is why the abovementioned "ham" got poorer results in practice than he did on the workbench.

I made this measurement with a commercial transceiver at work. In spite of the crystal filter in the i.f., the "effective" bandwidth at -20 db was about 50 kHz! Admittedly the r.f. gain was up a bit, since the "wanted" signal was 0.5 µV.

In another direction, I am going to have a chance to try out my avalanche transistor preamplifier with some sophisticated equipment. The trouble is, the more I play with avalanches, the less I seem to know about them. Sometimes the Noise Figure seems too low to believe, othertimes it's about 50 db (or so it seems). Some decent equipment, like circulators and controllable plumbing would help.

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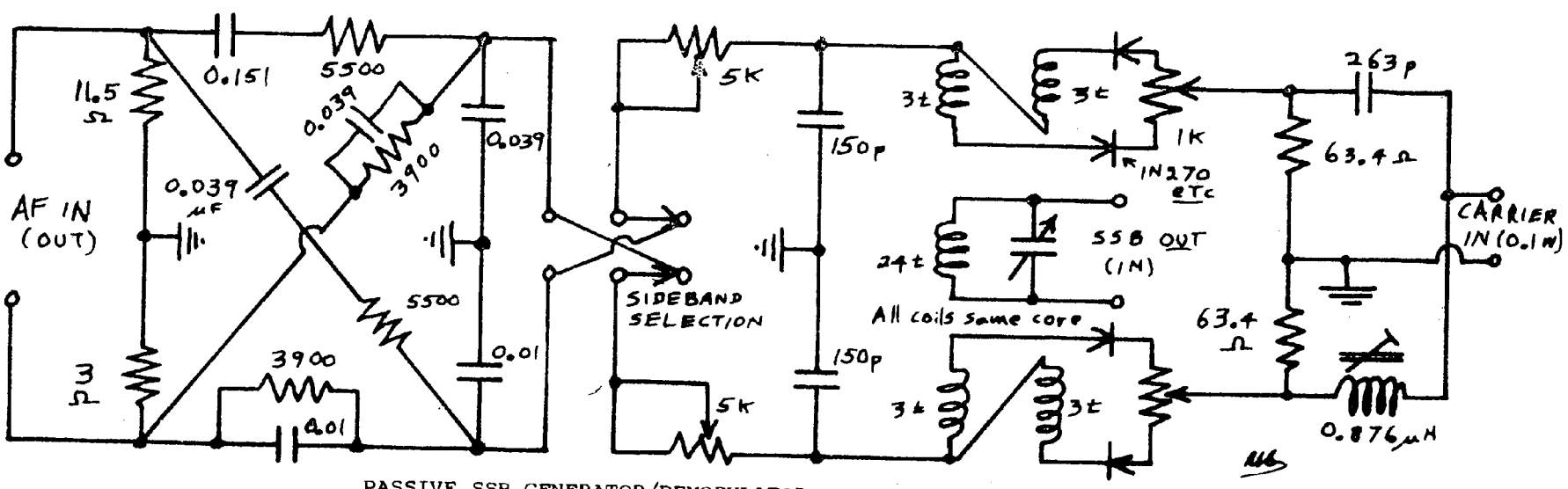
II.4: The necessity of making a major design change increases as the fabrication of the system approaches completion.



PASSIVE SSB GENERATOR/DEMODULATOR, DUE TO W7CMJ

LETTER: Parts Availability Crisis, revisited

As you or wazzit someone else said, component position is bloody awful. I've been using 9914 dual two-input gates in a variety of applications and have had Printed Circuit boards made for them, and filed drawings of the circuit diagrams with the firms using our standard set-ups. I had only three in hand so the firm said they would get the rest. Oh yeah? None of the stockists had any, and when Fairchild were contacted they advised that the Yanks regarded the 9914 as obsolete and were not making any more, nor did they have a replacement.

It's a nice how-d-ya-do that is. Just shows how the whole country could be held to ransom over component parts -- and they talk about the Arabs with their oil!

So-- I had to revamp the design to use discreet transistors ((mebbe so, but I reckon the transistors thought they were being discrete, particularly in the present circumstance!! -- Ed.)). Fortunately I had sufficient of these in stock because the discrete transistors were not available either ((Wot'll you do when they're all obsolete??)). And several of the resistance value and capacitances were not available either! so I've had to go scrounging amongst the junk and old experimental boards to find them.

And the same day comes a whole lot of propaganda from ((a major semiconductor firm)) about their new optical devices (LEDs etc)and other new lines. Beggar 'em and their ICs. What new traps one could be led into by them? ---- won't deal direct any more. One has to buy from --- --- and the bloke there has about as many clues as there are hairs on an egg.

Probably some of the TV boys are cornering supplies for use with colour sets. It ill-becomes this country to become a nation of copyists and manufacture goods under licence from foreign countries. We should be doing our own research and development. But then, --- won't let that happen. Do you know that Australian manufacturers of radio sets are paying royalties to - - - - - - - - - - - - - - - - ((deleted)) - - - - on patents that were either invalid or expired 30 years ago?....

-- ((Correspondent)), Victoria

((I reckon we had to truncate the letter at that point, fascinating as the reasons are for that curious state of affairs. If he's right we'd be twisting the tail of a lion a mite bigger than us; and if he's not we'd get into even bigger trouble. There's some very curious stuff going on behind the scenes I fear... -- Ed.))

XXXXXXXXXXXXXXXXXX

Quote without comment

The test of our generation will not be in the accumulation of knowledge.. In that we have surpassed all the ages of man combined. Our test will be how well we apply that knowledge for the betterment of all mankind.

-- L. B. Johnson, Washington, U.S.A., 1968.

LETTER: Nonrepairability??

In the business I am running into some new perplexing problems. Some of the brand new colour TV's are at times almost unrepairable. I am running into fantastic problems with servicing some of these "advanced" designs using ICs. I had one small jappo TV in the shop that used an IC voltage regulator. The cost of the new IC plus the labour put the repair price up to over 2/3 the original cost.

More and more I am seeing transistor radios that are definitely not worth ANY repair. My customers are having a VERY DIFFICULT time adjusting to the change in the repair situation. The glorious days of "sniffing" the signal through the chassis and repairing as required are definitely over! Some of the jappo amateur equipment are just beyond belief in complexity to service.

To console you, I would point out that this is just the BEGINNING!

As I mentioned before, the inflation here is fantastic. Meat has doubled in price in a year -- in fact, in some instances more.

-- Frank Merritt, VE7AFJ, Parksville, Can.

((The situation has its bright side, though. The boys in our radio class have a built-in source of very cheap components from the "unrepairable" sets available. Indeed, in two cases at least, the boys get stuck into the sets and in relatively short time found that the only trouble was a loose connection! It would seem that this matter of "unrepairability" is a relative thing in some quarters. But even when there is a real problem, the unrepairable sets can provide a fine source of parts, and in these days who could complain about that? -- Ed.))

XXXXXXXXXXXXXXXXXXXXXXXX

LETTER: DESIGN PROCEDURE FOR AEGIS PRE-WOUND SHORT-WAVE COILS.

Reference the letter from Roger Harrison (VK2ZTB), entitled "More on Linear Tuning" in which he discusses coil design procedure, I enclose a reprint of the article to which he referred in the February EEB. I hope that it is of interest.

-- H. Cliff, Aegis Pty Ltd, P.O. Box 49, Thornbury, Vic. 3041, Australia.

((Mr. Cliff has enclosed his article having the title shown here above, reprinted from Electronics Australia (Aug 1967). It comprises four pages of very useful design data and as Roger said it can be applied to a wide variety of coils. Mr. Cliff says that our readers may send for a copy if they include a 4x9" stamped Self-addressed Envelope.--Ed.))

ΩXXXXXXXXXXXXXXXXXXXXXXXXΩ

Quote without comment (Time Mag, 28/12/70)

"The question, of course, is not whether the family will 'survive', for thats like asking whether man or biology or society will survive..."

Gloria in excelsis meo ("Gloria's cat is too large")

Gawdelpus, as Les might say. Talking about disppointing prospects, in a recent E.A. I saw that a new solid-state handheld digital multimeter only selects the right ranges automatically. But you have to set the Function Selectr to DCV, ACV or Kohms. Further, you have to push a switch to turn the readings upside down. How primitive.

In this age of full automation shouldn't such a device automatically select DCV or ACV (with Readout to show) as relevant — and of course to select the Ohms range also automatically when needed. Furthermore, any reasonably versatile device should be able to present the display right-side-up or upside-down as evident from the position of the Operator.

With the use of ELSI circuits such refinements will certainly want to become commonplace, and the servicing of such devices can be reduced to a simple operation in which the entire circuit is simply unplugged and a new one put in its place...

We can look forward to even more useful future developments where the device will incorporate fully automatic connection to the correct portion of the circuit being tested. This would be quite feasible with suitable multi-pole universal interdigitation with computer control...

Prices

I note from that same E.A. that their adverts now cost ¢5/cm instead of ¢10/in. That's a 25% increase. The Post Office has outdone them, however, with 7c for 20g instead of 7c for 1oz, a 41% increase. When EEB goes to a Quarterly schedule in 1974 (issues) at least we won't be making an obvious profit from the metric changeover, and indeed since we'll likely be having about 28 pages instead of our nominal (?) 20, we'll only end up some 7% ahead. But in spite of what Old Peth says in a Letter (next month) I refuse to raise prices at this time. For one thing my conscience won't allow it as long as we publish so tardily. And for another I loathe the Inflation, and am most reluctant to contribute to it. Might this be worthwhile if it serves as a very small example to point the way to those of us who are attempting in these days to grab an ever greater piece of a very finitely-sized pie?... Perhaps the Taxation Bite has not yet caught up with the people who are pushing our Inflation so enthusiastically, but as things get worse and worse it will one day, and then it will be too late to hold the Bridge... Yes yes yes, Arthur, I know I should stick to Electronics, I'm sorry, but there you are.

"COMPUTERS ARE FANTASTIC: IN A FEW MINUTES THEY CAN MAKE A MISTAKE SO GREAT THAT IT WOULD TAKE MANY MEN MANY MONTHS TO EQUAL IT." — M. Meacham (QSP in "The Peter Principle" by Dr. L. J. Peter)

And quoted by Armond Noble in the September 1973 issue of "WORLDRADIO" wherein he apolotises for missing only ONE issue because of the need to computerise their mailing list! But they were lucky. Some companies (he points out) have entrusted their files to computers and were rewarded by bankruptcy as a consequence!

EEB manages to be catastrophically late without any outside assistance, thank you. We also have problems with addressing systems, and so far we have gone through six different kinds. The best was definitely the embossed metal card, but this became impractical because of skyrocketing costs or because of shirty attitudes on the part of proprietors.. Now we'll try another, spirit process on cards...

In any event, that September issue of Worldradio has now grown to a full 48 pages, and that's substantial for a newspaper format. It includes articles on every conceivable aspect of amateur operating activities, from what to do abt international interference, to the VK/ZL-contest, and a reporting of a wide range of newsworthy good deeds, not to mention a serial reprinting of the classic amateur history, "Two Hundred Meters and Down".

You can obtain, on request, a sample copy of WR from 2509 Donner Way, Sacramento, California 95818, USA — or a whole year's worth for ¢US5 to the same address. See your local Bank for the necessary ¢US draft (don't send ¢A!!). It's really very simple. (or send $4 Aust to EEB)

LETTER: Are Amateurs interested in Electronics any more?

In re your December Editorial, "Are Radio Amateurs interested in Electronics?". My interest originates from my livelihood of photography. As in many other fields, electronics is playing an increasing part in photography. (PTO)

Electronic shutter controls connected to the light meter are appearing in many cameras from very cheap (Kodak Inst.333) to professional ones (Pentax 6x7cm S.L.R.).

The biggest impact, however, has been in the industrial and commercial fields. In my business (Central Victoria Colour Laboratory) we use electronics to control temperature of solutions, to time processes, to control colour printers, to cut prints and to price final control strips which read on a densitometer — an accurately calibrated light-measuring device. Without electronics you would still be paying 60c for a colour print as comparedto 35c; some prices have dropped despite inflation.

It's interesting to note that most of this equipment uses valves, partly because no effective substitute for photomultipliers, and most current solid-state devices are basically red-sensitive — although I believe one American company has developed a series of devices which together can be made to approximate the spectral response of the human eye.

For critics of valves, one manufacturer gives a one-million operation warantee -- that's a lot of colour prints. The same manufacturer gives a 3,000,000 operation on a more sophisticated colour printer which uses both solid state and valve electronic control systems.

— Martin Coull, Bendigo, Victoria.

((I suppose the title ought to have been "Electronics in Photography", but never mind. Amongst our readers are surely many interested in matters other than in talking on the air. On the other hand, our promotional mailings to radio amateurs are now going to be discontinued or much reduced, because their yield has fallen from a previous 10% in happier years, to less than 3% now.

There, if you wish, is a cogent illustration of the path being followed by amateur radio enthusiasts even in Australia... We welcome articles on photographic applications of electronics, as on all others, of course -- Ed.))

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LETTER: Inexpensive BNC-Plug Relay

Here is an idea for a cheap BNC Coaxial relay which I haven't seen elsewhere. The diagram shows the setup using crimp connection BNC's, but other connectors OK. I wound the coil with about No. 40 B&S, and it turned on at about 6V, 40 mA or so with the reed relay switch in position as shown below. To wind the coil I used a BNC Female-female adaptor as an arbor to hold the device. I submit a sample for your examination.

— Geoff Cohen, VK1ZVG, Lyneham, ACT

be in the $10 region, which is getting painfully close to the cost of changeover coaxial relay off the shelf.

Even so, the unit has quite some merit where an application for a make-only item exists, and an unterminated line in the "off" condition is of no importance.

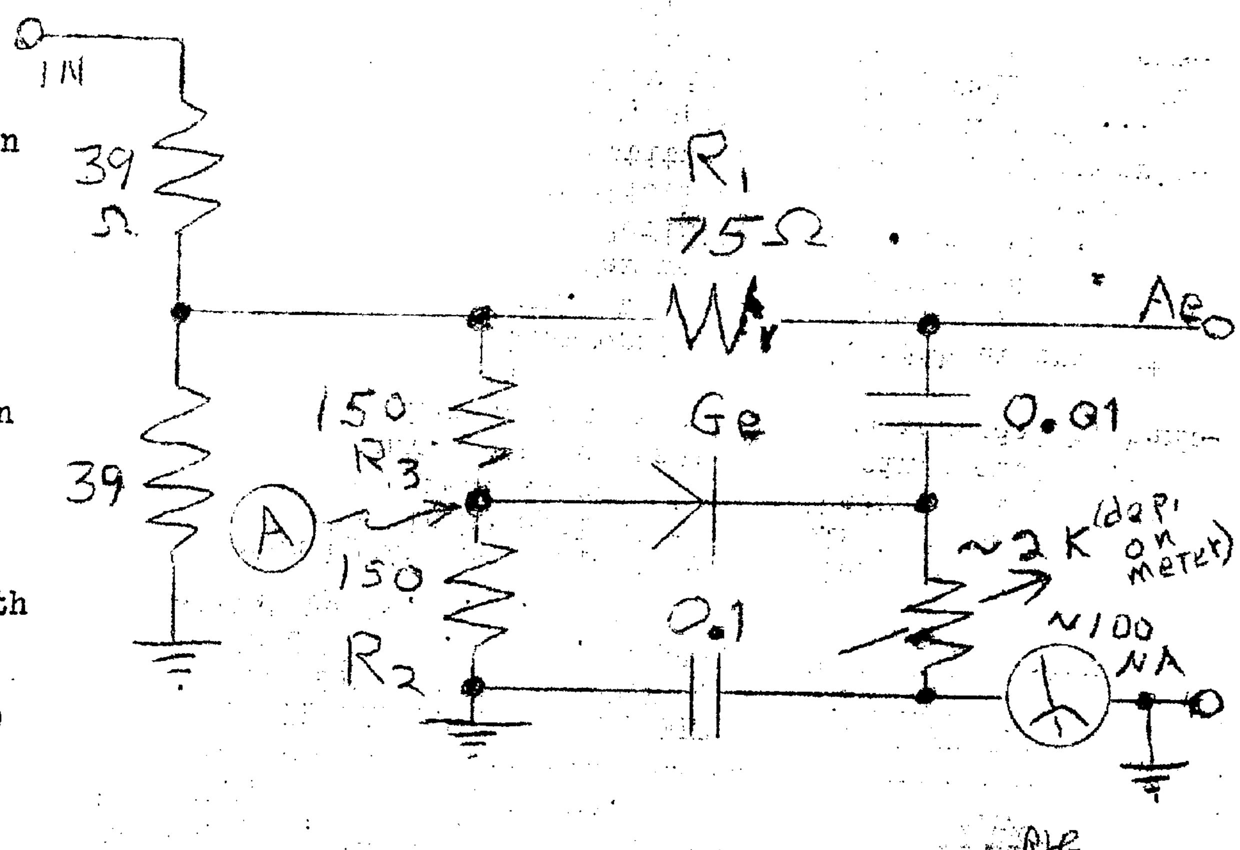
Here is a further thought. What about extending Geoff's idea, and put a reed changeover unit into service? This would certainly mean more metalwork, or it might be possible to get into the innards of a T-piece of some description, saving the cost of 3 of the connectors in the above example.

Comments, anyone?

???

LETTER: Antenna Impudence Bridge

You may be interested in this Bridge:

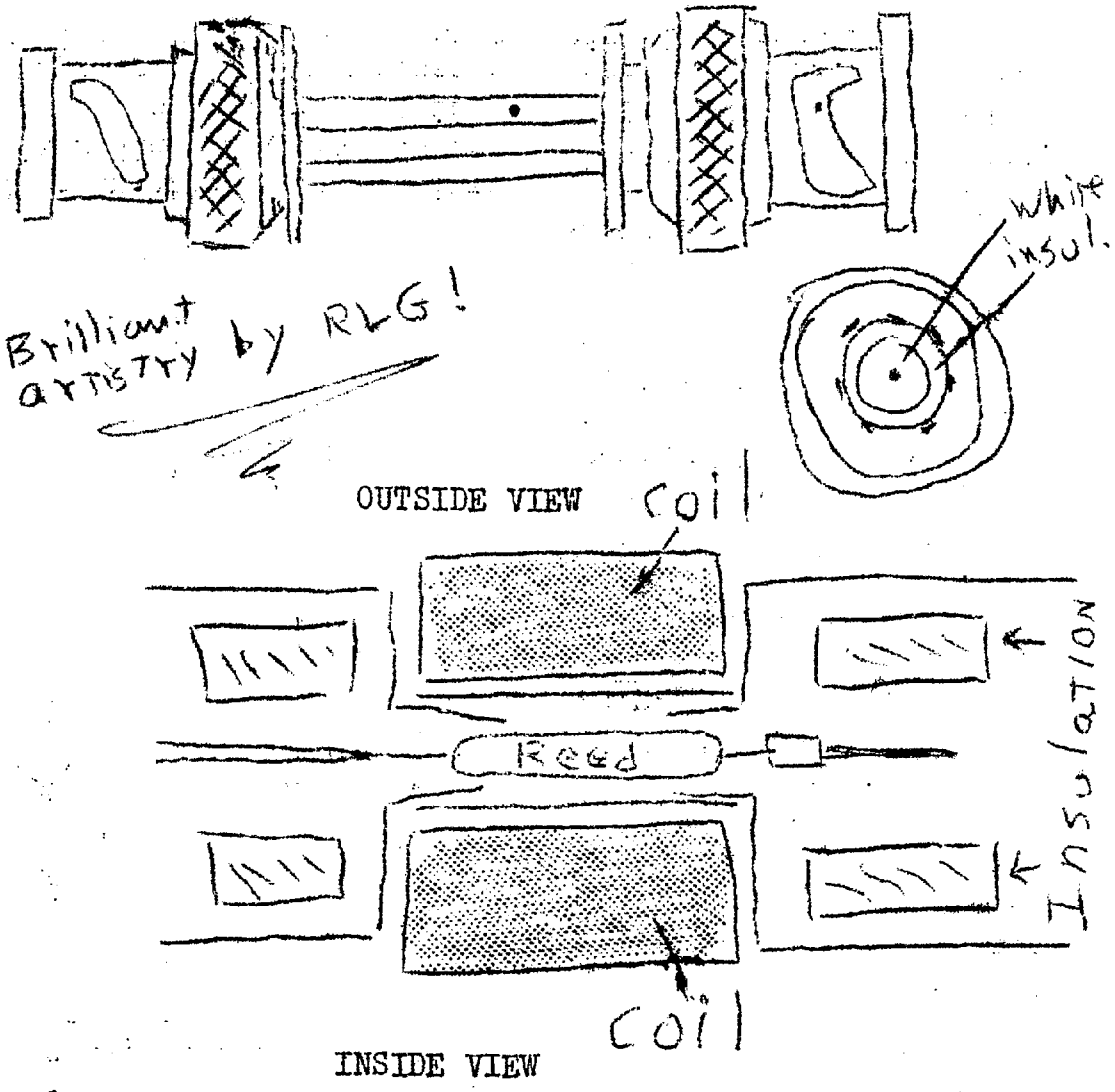


When the Aerial looks like 75 ohms then the potential at AE is the same as at point A, so no current flows in the diode, so no current in the meter. It is better than an SWR Meter, because

1) The Tx sees Z always from 70 to 80 ohms.
2) Only about 10% of the power goes out, so reducing QRM.

For 50 ohms reduce all resistors to 2/3 of the values shown. 0.5W of r.f. input drives a 500uA meter (with a 4.7K resistor) to full scale.

for your examination.
— Geoff Cohen, VK1ZVG, Lyneham, ACT



Comment by Rod Reynolds:

Geoff Cohen has submitted an example of a very simple coaxial relay built around a pair of BNC connectors and a reed contact. Tested at r.f. the unit performs very well indeed, behaving at upwards of 200MHz. But here we may ask the question: what use is a make-only coaxial relay at these frequencies? The usual requirement is for a change-over unit, because:

1) We normally use relays at r.f. when we want to steer signal in one of two directions, and

2) When interruption of one circuit only, is required we usually like to terminate the supply in the "off" condx.

On the other hand two of these units wired as a changeover with the necessary T-piece would serve the purpose quite well. I think, however, that the cost advantage might well be lost (unless you have these units from Disposals Sources). With ordinary connectors at $1.50 (4 required) and a T-piece at $2.50 plus 2 reeds and the necessary winding wire and time we could well

tor) to full scale.
— Mike Groth, ZL4GF, Dunedin, N.Z.

Comment by the Editors:

Strictly speaking this is a resistance bridge because the reference element, R_1, has no provision for comparing reactance in the aerial circuit. This bridge could be OK for the d.c. bands (e.g. below 30Mc), but at a.c. the distributed capacitance could be a problem, e.g. getting two 150 ohm resistors equal..

What happens if the aerial is reactive? The bridge will not null (to zero). If you tune out the reactance you'll get a null whose depth will be determined by the antenna resistance (relative to R_1.)

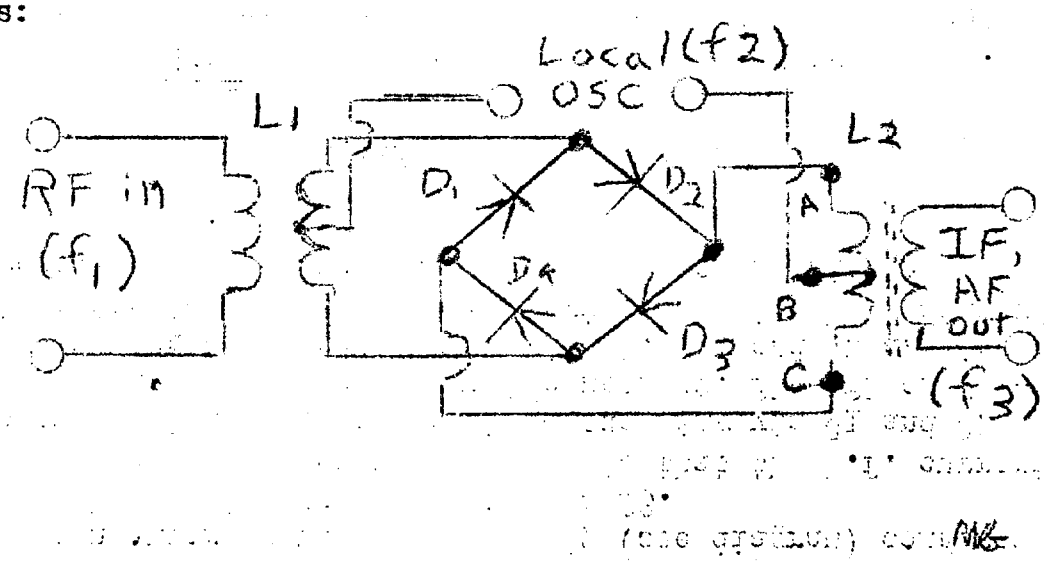
On the other hand it would be an advantage to vary the bridge itself (e.g. R2) and look for the zero null. The value of R2 would indicate the (relative) resistance of the aerial, and the depth of the null is determined by the aerial reactance. When the reactance is tuned out the null would be minimum (e.g., zero).

For practical purposes, if the variable-bridge configuration were used it would be better to use capacitors in place of R2 and R3 and make one of them variable; a pot would be inappropriate because of its notorious capacitance. With capacitative balancing the final of the Tx would, however, no doubt need to be retuned.

@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

LETTER: Practical Balanced Mixer Designs (?)

Have you ever really tried to get a.f. out of the Hot Carrier Diode balanced mixer designs, figs 6 & 7 in the article on Receiver Design in the April 1972 issue of EEB? Thus:



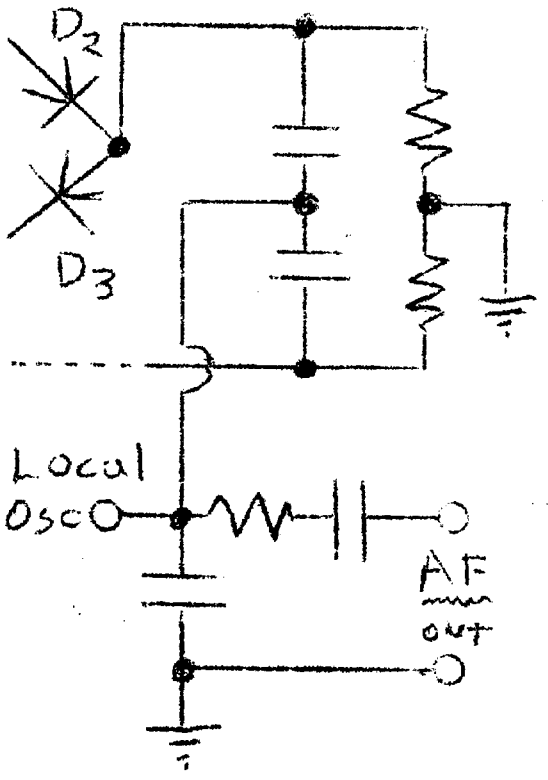
((Ed. Note: We reproduce the circuit here above; it (PTO)

shows the Doubly Balanced Mixer, or "Product Detector" when output is at a.f. For the singly-balanced half-bridge, omit D2 and D4, but results are not as good.))

If you take out an Intermediate Frequency I have no argument with you, but to get a.f. the inductance of the second transformer has to be so high that the Local Oscillator only gets through by capacitative leakage to the ring of diodes. I admit that in most of the designs I have seen, a.f. does come through the a.f. amplifier, by accident.

If, however, a good linear a.f. amplifier is used you wonder where the signal went to. I personally believe that these designs rectify the upper frequency product, and that this is why they work in the form shown. Without a nonlinear audio amplifier you may as well forget it for straight conversion to audio.

To get a.f. out of a h.f. ring detector you need to replace the second transformer with the same setup as in a phase detector or a ratio detector from TV design. Roughly, this is achieved by replacing L2, above, by the following:



The large capacitor used in TV ratio detectors to give limiting action has, however, to be omitted.

— Colin G. Gates,
Merrylands, N.S.W.

Rod Reynolds replies:

Mr. Gates's comments are noted, but we assure him that sheer luck is not all that keeps these units alive. Even if an extremely high L were used for the output coupling, L2, its distributed capacitance could be sufficient to bias the ring adequately. This could be represented by C_1 connected between points "A" and "B" in the Balanced Mixer diagram (previous page), and C2 between "B" & "C". In a practical case this would likely be represented by lumped capacitances added at those locations. The conditions are such that the capacitative reactances of those two condensers would be low at f_2 (see diagram) compared with f3, when f2 is much greater than f3.

The simple way of looking at this is that the h.f. current component of f2 is applied to the diode ring via C_1 and C2, while the low-frequency current component, f1 - f2 or f2 - f1 (as the case may be) passes via L2. C1 and C2 are in fact desirable in this case as part of a "High Pass Filter" to remove f1 and f2 terms. I have yet to experience hearing 28 MHz.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Quote without comment

((Some sections paraphrased for reasons of space — Ed.))

Amongst the governments of the world, military spending is now 250% more than expenditure on health, 150% more than on education, and 30 times more than the total economic aid to developing countries.

The six leading countries spend about 8% of their wealth on arms, while the nine main developing countries spend more than 10% on the military. The amount spent on housing, slum clearance, and urban renewal represents 3.0-3.5% of the world's Gross National Product — approaching half the amount spent on arms.

At least 25% of the world total of scientists engaged in Research and Development are employed in military work, involving 40% of the total R/D expenditure. All medical research in the world takes only 7% of that total.

"The Arms Race has already resulted in the stock-piling of more destructive power than has any conceivable purpose. The threat of ultimate disaster it has generated is by far the most dangerous single peril the world faces today... and it far outweighs whatever short-term advantage armaments may have achieved in providing peoples with a sense of national security. More than this, the arms race makes more acute the very international strains to which it relates."

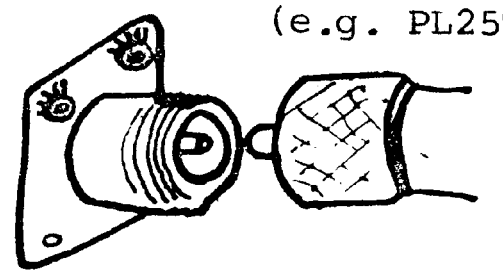
— from a Report on the Armament Situation, submitted to U. Thant, U.N.O., 1971 by unanimous approval of experts from Canada, Czechoslovakia, France, Japan, Ethiopia, India, Mexico, Poland, Netherlands, Rumania, U.K., U.S.A., U.S.S.R., and Yugoslavia.

LETTERS TO THE WELFARE DEPARTMENT (continued):

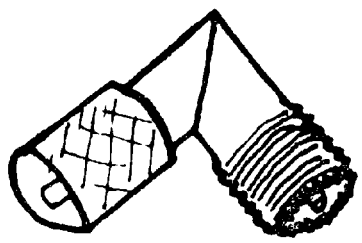
"Please send money at once as I have fallen in error with my landlord."

COAXIAL COMPATIBILITY -- a la EEB*

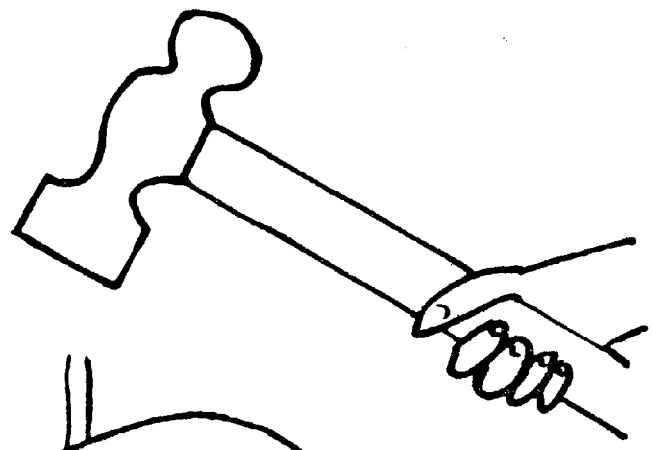
-- by Ellard W. Foster, W5KE

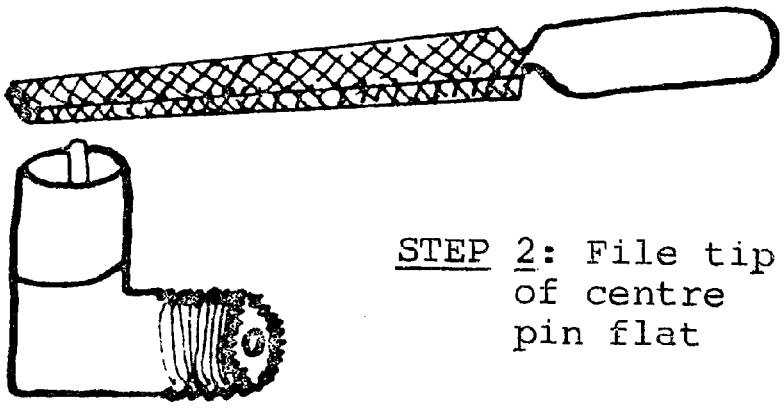


HORRORS!

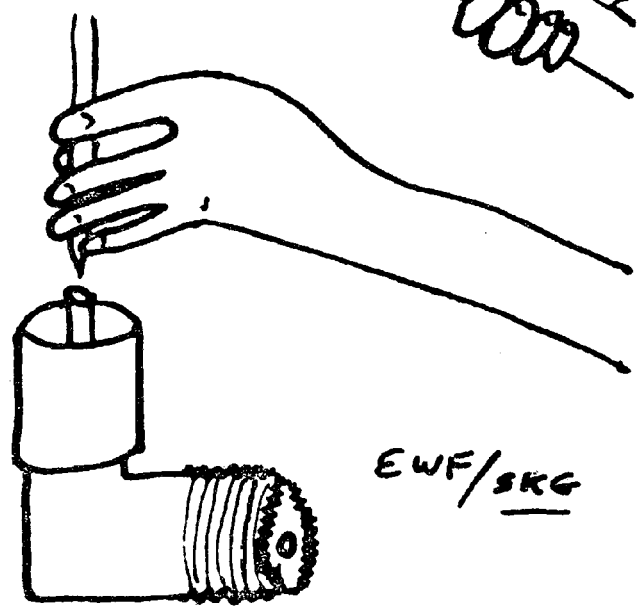


STEP 1: Take one M-359 Elbow

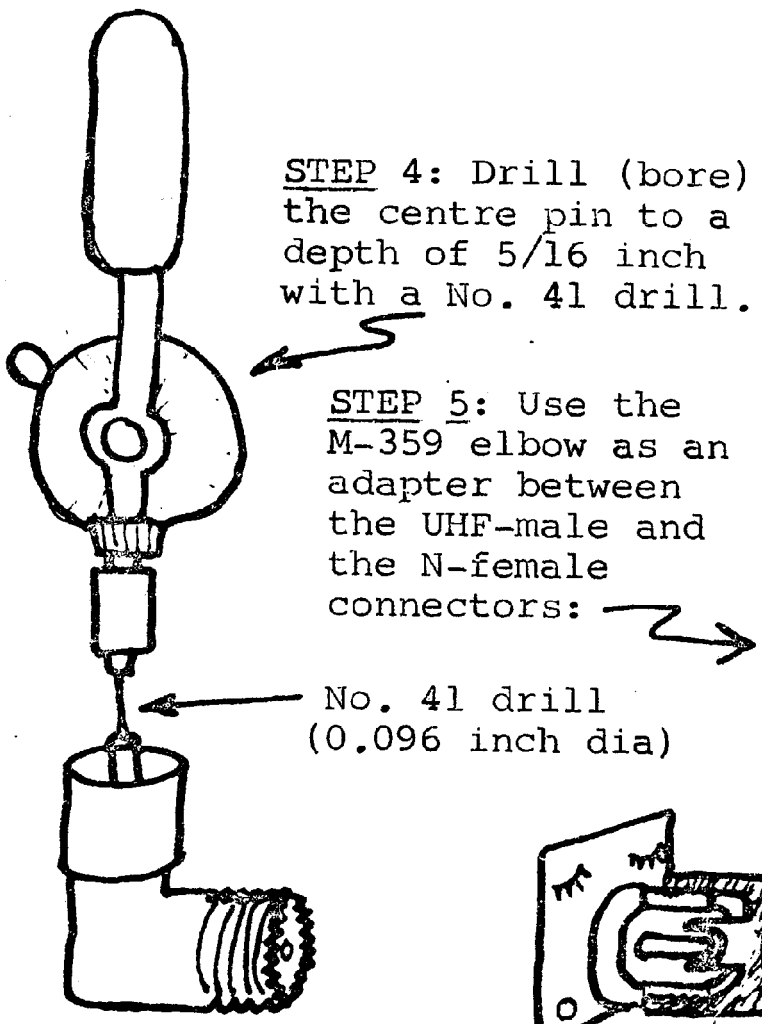




STEP 2: File tip of centre pin flat



STEP 3: Very accurately centre-punch the centre of the centre pin.



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NOTE: Obviously the tools are not drawn to scale. Sketches are crude, will need lots of refinement ((Only for refined-type magazines! -- Ed.)). Additional Note: M-359 elbow should be clamped in vise or other device while working. ((I asked Stephen to draw an elbow clamped in a vise, but he declined! -- Ed.))

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*For a more complete description of this Mating, as well as N male-BNC female or conversely, see Radio Communication, July 1972, p. 439.

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DIGITAL INSTRUMENTS -- Part III

-- by N. D. Lorimer (VK7)

1. Introduction
1.1 What is a Digital Instrument?
1.2 Analogue versus Digital
2. Binary Logic
2.1 Why Binary?
2.2 Binary Numbers
2.3 Logic
2.4 Logical switching systems

2.5 Application of Boolean Algebra to Gate Systems.

Boolean analysis of a system may result in considerable savings, as duplication of paths, etc., are brought to light. In many systems redundancies exist, for example, in a control system, limit switches at both ends of a lift shaft can never operate simultaneously (assuming the floor never falls out of the lift!). The condition under which the circuit would react to both limit switches closing simultaneously is thus redundant (a "don't care" case) which can give further simplification.

Expressing this system in Boolean terms as

$$F = \overline{A}.B.\overline{C} + \overline{A}.\overline{B}.C$$

and knowing that combinations $B.C$ and $\overline{A}.\overline{B}.\overline{C}$ are "don't care" cases, then

$$F = \overline{A}.B.\overline{C} + \overline{A}.\overline{B}.C = \overline{A}.(B.\overline{C} + \overline{B}.C)$$

By inspection, Output will occur:

(i) if there is no input at A
(ii) if the condition $B.\overline{C} + \overline{B}.C$ is met.

As $\overline{A}.\overline{B}.\overline{C}$ is redundant, and $B.C$ is also redundant, the only possible "BC" combinations of interest are $B.\overline{C}$ and $\overline{B}.C$, either of which meet condition (ii). Hence $(B.\overline{C} + \overline{B}.C)$ is redundant, so $F = \overline{A}$ and inputs B and C are not needed.

Being strictly algebraic, the redundant terms may be included in the expression, giving

$$F = \overline{A}.B.\overline{C} + \overline{A}.\overline{B}.C + \overline{A}.\overline{B}.\overline{C} + \overline{A}.B.C$$

(The latter two cases can not occur so do not invalidate the expression; the concept is the same as 10 = 6 + 4 or 10 = 6 + 4 + 0).

Grouping first and fourth, and second and third terms gives

$$F = \overline{A}.B.(\overline{C} + C) + \overline{A}.\overline{B}.(C + \overline{C})$$
$$= \overline{A}.B + \overline{A}.\overline{B} \quad (\text{as } C + \overline{C} = 1)$$
$$= \overline{A}.(B + \overline{B}) \quad \text{and } B + \overline{B} = 1$$

so $F = \overline{A}$

Similar analyses may be applied to any system, and graphical methods are also available.

((EDITOR'S NOTE: There is a Supplement to Section 2, "Simplification of Combinational Switching System" in which a Boolean application allows simplifying a specific twelve-gate system into a four-gate one. Details will be sent to anyone sending a 9x4" stamped SAE to EEB)).

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3. THE TRANSISTOR AS A SWITCH

3.1 Saturated Operation

A full investigation of the switching performance of a transistor requires consideration via "charge parameters", which is beyond the scope of this course.

The junction transistor is a solid-state device which contains two p-n rectifying junctions sharing a common "base" electrode, the device being composed of three layers of semiconductor materials, n-p-n, or (less commonly) p-n-p. The junction between p-type and n-type semiconductor possesses both rectifying and capacitative properties, two-layer p-n devices being used as diodes and also as voltage-controlled capacitors. Fig. 3.1(a) shows symbolic construction, circuit symbols, and two of the many types of practical devices in cross-section.

The Ebers-Moll model of the transistor considers the transistor as two interconnected diodes with associated current sources, and Fig. 3.1(b) shows the four possible "biassing" arrangements. Of these, the "forward" condition is used in linear amplifiers, the "reverse" state is of little practical use; the "saturated" and "cut-off" conditions are used in the majority of switching circuits.

In the "cut-off" condition, neither diode is biassed into conduction, so the current flow through the transistor is negligible; in the "saturated " state, both diodes are biassed into conduction and current flow is limited only by external factors. As these two states represent extremes of the possible biassing conditions they are comparatively easy to achieve with simple circuitry, which is important in view of the large number of identical circuits employed in switching systems.

Cutoff and saturated states thus provide a simulation of switch action, the cut-off state corresponding to "open" and saturation to "closed". The simulation is not perfect as the current is not zero in cutoff state due to minority-carrier flow in the semiconductor, and the voltage across the device when saturated is not zero because of the inherent resistivity of the semiconductor material. In the Ebers-Moll model, the volt-drops across the two diodes will be

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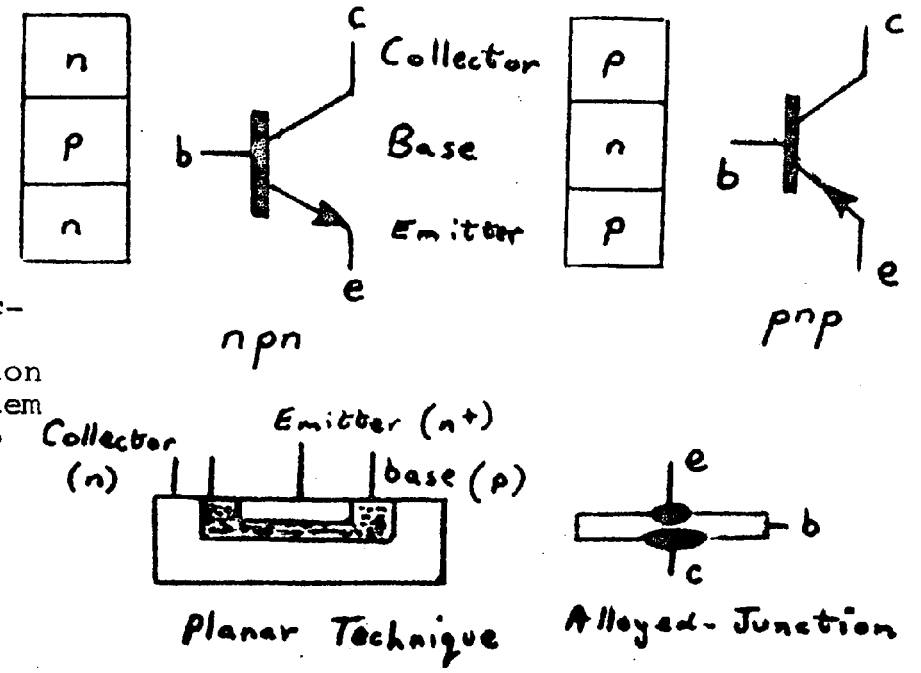
FIG. 3.1 (a):



approximately equal, so the collector-emitter voltage, which is the algebraic sum of these, two opposing volt-drops, is near zero. In the case of an individual transistor, these departures from ideal are not of great importance, as a modern silicon planar switching transistor, carrying say 10 mA when "on", will "leak" less than 1 μA when "off", whilst the voltage across the transistor will be, say 5 V "off" and about 0.1 V "on". The imperfection of the switching action can cause circuit design problems, but this again is beyond present scope.

3.2 Switching Action

The action of a transistor may be considered by reference to either terminal voltages (the Ebers-Moll approach) or current flow. In terms of currents; as collector current is a function of base current, the transistor may be switched between saturation and cutoff by controlling the base current flow. The terminal voltages mentioned in section 3.1 must be satisfied to permit operation in a desired mode, so appropriate current drive into the base terminal will result in the required associated bias state.

Fig. 3.2(a) shows a simple system which, subject to appropriate component values, will give switching operation. With the switch, S to position A, the base is connected via resistor R_b to the supply rail.

By Ohm, $I_b = \frac{V_{cc} - V_{be}}{R_b}$ which can be made any desired value by adjusting R_b. The ratio, I_c/I_b (ignoring leakage currents, which are typically insignificantly small), is a function of collector-emitter voltage, V_{ce} which, as shown by the characteristic curves of fig 3.2(b), suffers an abrupt change of slope at low values of V_{ce}. Since $V_{ce} = V_{cc} - I_c R_c$ due to the presence of the collector resistor, so V_{ce} is a function of I_c which in turn is a function of I_b. As resistance is a linear V/I relationship, a "load line" may be plotted on the characteristic curves between $I_c = 0$, $V_{ce} = V_{cc}$ (assuming no volt-drop across the transistor), and the "working point" is constrained to remain on this line. If I_b is "large", the appropriate $I_c - I_b$ curve will intercept the load line below its "knee", at a very low value of V_{ce}. In such a case, $V_{ce} < V_{be}$ so the collector-base "diode" has forward bias, the Ebers-Moll saturation state.

If switch S is in position B, the base is earthed via R_b so, as there is no source of emf in the loop containing R_b, no base current can flow. Reference to the characteristic curves shows that the $I_b = 0$ curve intercepts the load line at a value of V_{ce} very near to V_{cc}.

The values, $V_{ce} \approx 0$ and $V_{ce} \approx V_{cc}$ are hereinafter referred to as logical "0" and "1" levels.

Intermediate values of base current can of course be selected and give intercepts on the load line in the "active" (forward) region. Such conditions are the norm in linear systerms but represent transient states only, in switching circuits. The static ratio, I_c/I_b in such intermediate conditions is the "d.c. current gain", h_{FE}, which can have values from tens to a few thousand, depending upon the device.

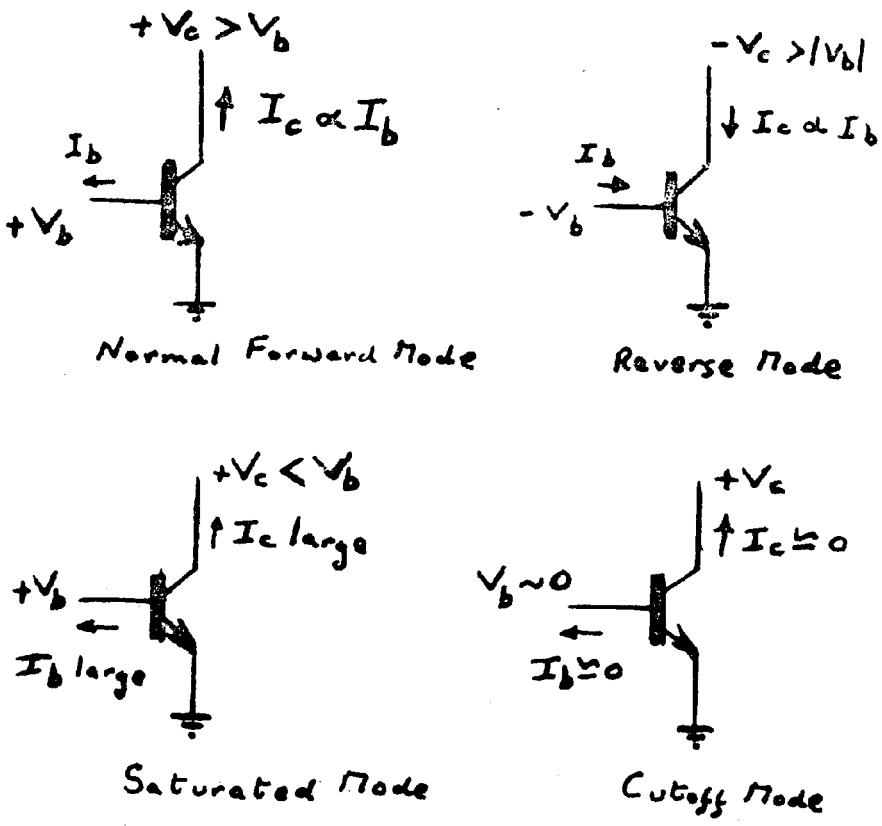
In the saturated conditions, the ratio $I_c/I_b = h_{FE(sat)}$ is small, typically below 20, and often less than 10. The value of $h_{FE(sat)}$ quoted in manufacturers' literature is usually specified relative to a given value of I_c, as $h_{FE(sat)}$ changes rapidly with I_c (viz., note the steepness of the characteristics in the saturation region).

As V_{be} and V_{ce} are both typically small (realtive to V_{cc}), in saturation, $I_c \simeq V_{cc}/R_c$ and $I_b \simeq V_{cc}/R_b$, so $I_c/I_b \simeq R_b/R_c$. And $I_c/I_b = h_{FE(sat)}$ in saturation, so it would appear that a value of $R_b \simeq h_{FE(sat)} R_c$ would be appropriate. Unfortunately, other factors must be taken into account.

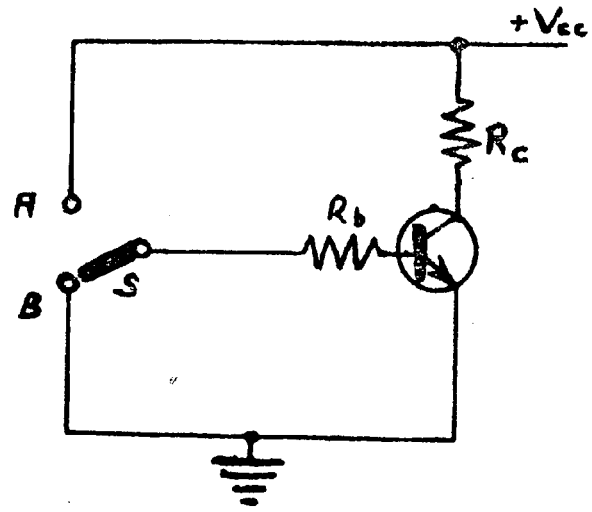
Assuming an idealised input, in the form of an instantaneous change in V_{be}, from 0 to $+V_{cc}$, the collector current waveform will have a typical form as shown in fig. 3.2(c).

The turn-on period, t_{on}, comprises two distinct parts:- t_d, the turn-on delay time, and t_r, the rise time. Consider them separately:

t_d: In the cutoff state, no free charge



(LEFT): Fig. 3.1(b); Various modes of operation.



(RIGHT): Fig. 3.2(a) The transistor as a switch.

carriers are present in the base region (if free charge is present, the device can conduct). Carrier mobility is low in semiconductors, so a short(but measurable) period elapses between the application of a "1" at the input and the onset of collector current flow.

t_r: As mentioned previously, a semiconductor junction possesses capacitance. The device capacitance must, like any capacitor, charge exponentially before a steady-state condition is reached, so collector current rises during the turn-on period in accordance with an exponential law.

The turnoff period, t_{off}, is similarly divisible into two sections:- t_s the storage time, and t_f the fall time. Considering them:

t_s: In saturated working, base current is comparatively large, so the free-charge concentration in the base is very high. Collector current will continue unabated so long as free charge is present in the base region, hence the term, "storage time" -- the current flow is due to "stored" charge as a consequence of the large base current.

t_f: This is a "capacitor discharge " action, being the inverse action of the exponential rise during turn-on.

Note the measurement points for timing shown on fig. 3.2(c). As rises and falls are (basically) exponential (and their shapes may be affected by undershoot, overshoot, ringing, etc), it is difficult to state precisely where full (or zero) amplitude is reached. A standard convention has accordingly been adopted, whereby a rise or fall is measured between the 10% and 90% (of full amplitude) levels; this normally ensures a "clean" intercept of waveform and measuring level. Unless otherwise specified, rise and fall times are "10-90" values.

A useful "magic number" in pulse work is 2.2 -- the risetime of a pure exponential is 2.2 time-constants*.

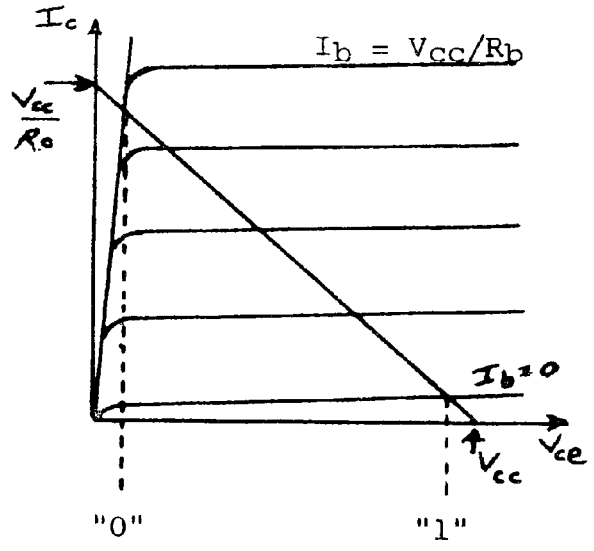


Fig. 3.2(b): Transistor characteristics (note load line).

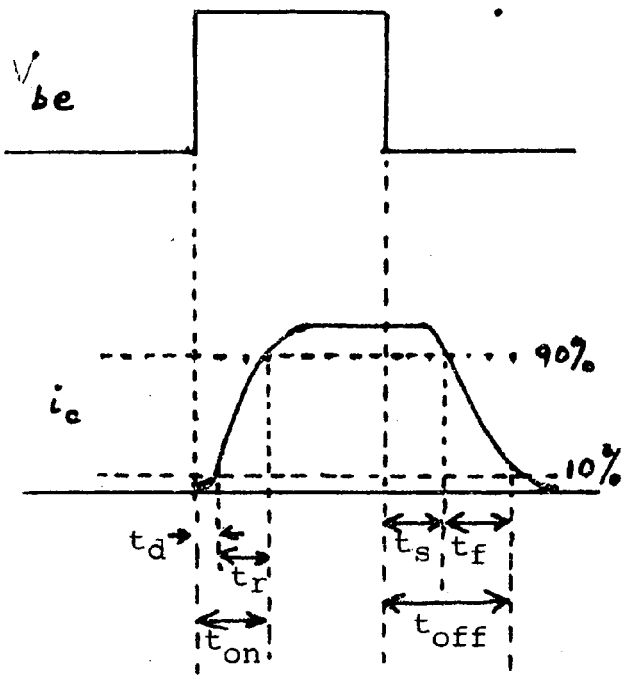


Fig. 3.2(c): Waveforms.

3.3 Switching Speed.

Precise calcuation of the various time elements associated with turn-on and turn-off requires the use of charge parameters. A fairly close approximation to t_r and t_f can be made, however, by an analogous approach based on an empirical expression by Shockley:-

$$h_{fe(f)} = \frac{h_{FE}}{1 + j\, f/f_{h_{fe}}}$$

Here:

$h_{fe(f)}$ is the value of dI_c/dI_b at freq, f.

$f_{h_{fe}}$ is the frequency at which $h_{fe} = 0.707\, h_{FE}$

j is the 90^o operator.

A similar expression to $1 + j\, f/f_{h_{fe}}$ is found in the analysis of CR circuits, where the denominator $1 + j\omega CR$ is found. CR has dimensions of time, so is dimensionally similar to 1/f. ωCR can thus be equated to ω/ω_o where $\omega_o = 1/CR$ and hence to f/f_o where $f_o = 1/2\pi CR$.

$f_{h_{fe}}$ thus corresponds to $1/2\pi CR$ and, of course, CR is the "time constant" of the CR circuit when considering its exponential response.

Thus the "CR" value of the transistor's response to step input is $1/2\pi f_{h_{fe}}$, and the associated 10-90 time is 2.2 time constants (c.f. above), i.e.

$$t_r = t_f = 2.2/(2\pi f_{h_{fe}}) = 0.35/f_{h_{fe}} \;;$$

$f_{h_{fe}}$ may be quoted in the manufacturers's data sheets, or the "gain-bandwidth product",

$$f_T = h_{FE} f_{h_{fe}}$$

may be given, in which case,

$$t_r = t_f = 0.35 h_{FE}/f_T \quad .$$

0.35 is another "magic number", relating bandwidth to risetime; $f_{h_{fe}}$ is the "bandwidth" of the transistor in common-emitter configurat. For a system such as an oscilloscope, the maximum risetime which can be reproduced faithfully may be determined via:

$$\text{bandwidth} \times \text{risetime} = 0.35 \quad ,$$

Hence an oscilloscope with 50 MHz bandwidth can display a risetime of $0.35/50 \times 10^6 = 7$ n sec.

(TO BE CONTINUED)

*Author's derivation in exchange for SSAE.

LETTER: CDI Reliability, and Tachometers.

In regard to failures of the 2N3055 in Capacitor Discharge Ignitions, and therefore my choice of germanium power transistors, I have knowledge of only six or so instances, and in each case the reason was never fully established.

In my case, I chose the OC28, because the late Mullard Outlook always used them in their articles and circuits on converter design, but hesitated in the use of germanium type because of high summer temperatures that prevail on this side of the continent. Their performance across the hot Nullabor convinced me. I used the EHT ferrite "U" core from a TV set, with a voltage doubler. It has been in use for five years without the slightest trouble. I try not to get involved in repair situations simply because it is not my livelihood, and from my experience the service man on the whole is a fairly ethical fellow despite some instances to the contrary (such as quoting $30 for the repair of an alternator, when the tightening of a fan belt achieved the desired result.

In these days of pollutant motoring, the young set appear to place great reliance on dash-mounted tachometers. I have seen some weird attempts to make them work with CDI. The Smiths impulse counter is connected in series with the coil in the G.T. Hunter, and requires a minimum of 0.5 Amp. In one instance it was connected direct with the trigger circuit; it sounded a very rough motor.

The Mullard type seem to present no difficulties. The youthful member of my family got his VDO installed in the Torana GTR, working with 15 turns of hookup wire around the coil output lead.

In previous issues of the EEB mention has been made of the use of the vacuum gauge for timing. The only method that worked satisfactorily for me on Holdens through the years was to run the motor at 1500 revs, advance the needle until it kicks, then turn back 1/2 inch only. Using a timing light, I disconnect all leads except No. 1, and turn the motor over by starter motor. In the last instance the timing coincided with that obtained in the first method.

-- John Mahoney, Floreat Park, W.A.

((For a Tacho especially designed for use with CDI, see Rod Reynolds' design in the EEB, February 1971 -- RLG))

((Germanium transistors have the advantage over silicon that they absorb transients better. I've also heard other examples of silicon breaking down too, and I have used germanium (OC35's) in my CDI while I was using it. But I stopped using it a year ago because of reliability problems in my Roadmonster.

And NOTE: In a recent Electronics Australia they criticised the CDI on various important accounts (some of which paralleled my own experience). So, perhaps its back to the old Transistorised Ignigion again -- BUT with a good ferrite coil and a transistor with a good high frequency response and low V_{sat} and high breakdown voltage -- such as the type used for line output in modern TV receivers -- RAJR))

((Rod says the likely reason the simple transistorised ignition worked so poorly in my VW (particularly when idling) was the lack of just such a decent coil and transistor. So how about you cunning experimenters sending up to EEB a nice design on a vastly improved transistorised ignition -- complete with instructions on building your own coil! It will help to make up for a nice Squaretable on CDI in the files -- which, alas, I waited too long to publish. Progress, bah! -- RLG))

((For further details, refer to discussion on the "Automotive Exhaust Gas Analyser" in EEB of Feb. 1973.))

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SOME OVERSEAS PARTS AVAILABILITY

((Reprinted from Collector/Emitter, March 1972))

One of the most familiar plaints heard among radio amateurs relates to the difficulty of purchasing parts for construction projects. Old favourites... have leaned with the trend and become audio and CB purveyors. Oh, once in a great while you can find a radio part listed. But most mail order catalogues show only the standardized listing of Japanese-manufactured mish-mash, all totally unsuited for use in a transmitter or a good receiver.

The revolution has not come, but there's a faint glimmer of hope breaking through. Two catalogues look promising.

Trigger Electronics, 7361 North Avenue, River Forest, Illinois 60306 (U.S.A.), not only shows a full line of manufactured amateur equipment but also offers a limited selection of high-class components, American-made as well as Japanese-made. Its worthy of your attention.

B-E Flyer, Spring and Summer 1972 (Bigelow Electronics, P.O. Box 71, Bluffton, Ohio 45817, U.S.A.) runs heavily to parts. Some of these are pure surplus "junk", the type that overflows from every amateur's hell-box, but there's a helpful sprinkling of really useful parts. Some are items you'd search long and futilely to locate elsewhere. These are too many to discuss here; so I suggest that you write for a catalogue and spend a bit of time in careful perusal. B-E has an additional service: you can charge the purchase to your Bankamerica Card, thereby avoiding an attempt at estimating postage. At current Parcel Post rates, you'd be well advised not to order any weighty items!

EEB Ed Note: Several other "Basement Electronics" firms also offer attractive components stock, as advertised in QST, Ham Radio, and CQ. In Britain the equivalent can be found in Radio Communication (though less in recent times), Practical Electronics, and Wireless W. These firms are now becoming more willing to sell overseas, and they are probably reliable. I have also had some good results from larger firms such as Meshna and Solid-State Sales. One the whole, however,it is most definitely worthwhile first to check with Australian suppliers!!

SIGNAL STRENGTH AND COMMONSENSE

-- by R. A. J. Reynolds (VK7ZAR)

Everyone has his own ideas about S-meters, and here is just another one with an unusual idea that makes sense.

An S-Meter is supposed to measure the strength of a received signal, and it can be used (and misused) by amateurs in communications, or it can be used by Short Wave Listeners to rate the relative strength of signals received. Either way, there is a question of what units are to be used for the meter scale.

Traditionally S-meters used "S-units", originating from a system which rated S-1 as inaudable, and S-9 as being as strong as it could get. By more or less common consent there was taken to be about 6db of increase in signal for every S-unit, i.e. a factor of four in received power (or two in voltage).

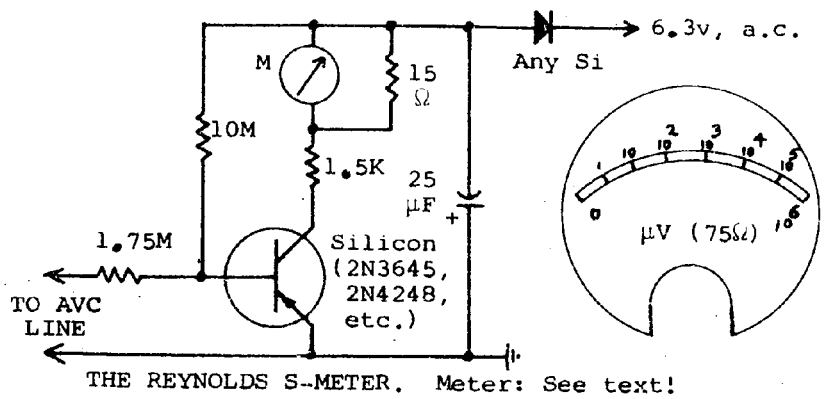
On this basis there might be a factor of a million or so between power received from S-0 to S-9, or a thousandfold in voltage.

This neat arrangement foundered on two rocks:

1) The substantial improvement in receiver sensitivity which made it possible to pull out very weak signals.

2) The tendency of people (that's you and me) to exaggerate. It was not enough to make S-9 the loudest possible signal, we had to add "dbs above S-9", a manifest absurdity.

If to all this you add the tendency not to want to hurt the other chap's feelings by giving him a signal report less than S-9, the result has been largely to make S-unit reports singularly uninformative.



THE REYNOLDS S-METER. Meter: See text!

A better idea

Would it not be more logical to tell someone that he is bringing in a "100µV" signal, than "S-9"? Or "10,000µV" rather than "40db over S9"? And what do you do about evaluating the strength of a nearby station raising a volt on your antenna? 80db above the strongest possible signal? Nonesense.

My receiver is an old B28 (Ref: EEB, June 1968), excellent except for the need for an S-meter. The one shown in the diagram is the one I fitted, and it gives useable readings. It works much better than other circuits tried, e.g. a leaky transistor in a bridge circuit, or a drifting germanium transistor in a Darlington Pair.

The Circuit

The circuit consists of a single stage d.c. amplifier which measures the AVC voltage. The meter used is a rather unusual one, and the success of this particular circuit depends on it. It used to be an r.f. thermoammeter (available from surplus sources (in an antenna changeover box with antenna changeover relay and small coil), and its movement is nonlinear. It is more sensitive at the low end, and this achieves what we want: to make the low AVC voltages more prominent.

If an ordinary current meter were to be used, an amplifier with a logarithmic response would be necessary, and perhaps this could be achieved by modification of standard amplitude-compression techniques (e.g. using diodes in suitable resistance network). If anyone has an idea on that, please let us know. (See Semicon Testing II: 12/73)

In this circuit, at least, the 10 Meg base resistor serves to offset the transistor input by its base-emitter voltage, so that it starts to conduct as soon as AVC voltage appears. The 15Ω shunt on the meter is to stop the needle from over-swinging, because the movement to which I referred is not damped.

The scale shown (not to scale) gives some idea of the results obtained in terms of voltage on a 75Ω line at 25MHz. The remarkably regular characteristic of the meter scale is due to the combination of the nonlinear response of the AVC system combined with

SIGNAL STRENGTH (Continued from p. 62)

the logarithmic response of the meter. The mechanical needle adjustment is adequate for zeroing the meter, and as the transistor is silicon, the zero point does not vary appreciably with temperature. Presumably a simple bridge arrangement could be employed with a germanium transistor to give electrical zero-adjust. This would allow the use of the inexpensive (but still quite good) transistors available from computer boards.

Results

The consequence is that signals can be evaluated in terms of actual strength received. If you do not favour the starkness of a microvolt report, might it not be an idea simply to eliminate the "over S-9" phrase, and assert that the signal is simply "40db" or "80db" or whatever? Either way, lets put some sense back into signal-strength reports.

Incidentally -- photographic light meters tend to have logarithmic movements. Maybe one could be pirated from an old unit? And some cheap light meters have been available fromtime to time on the American disposals market.

Postscript -- RLG

A couple of relevant articles from the Literature are:

"Another look at your receiver and its S-Meter", by J. N. Thurston, W4PPB, QST, Feb 1970. Says that if you keep the r.f. gain control down you'll usually get a cleaner signal, even though the S-meter becomes unusable. Because of the tendency to keep the r.f. gain up so that the S-meter can work, "most amateurs might be better off if their receivers had no S-meters at all"! Of course, with an audio-derived AGC and S-meter to match this would not be relevant, but this brings up the whole question, "why an S-meter"? If you can't make a good judgment by ear, is a meter-derived one better?????

"Plus 10 db", by N. Johnson, W2OLU, 73, May 1970. The difference between 100W and 10kW is 3.3db -- and I might add that the same applies between 1 W and 100W, "Sometimes it makes you wonder if antenna work might not pay off better, doesn't it?"

"Relativity and the S-Meter" by K3STU, CQ, 9/72. The S-meter is a relative signal-strength indicator, and indeed it can be calibrated accurately at only one frequencY! So what is it good for?:

1) An ego-inflator (for the other chap).
2) To help tune antennas.
3) As an r.f. bridge detector.

(Relativity, continued)

His excellent suggestion is to report signal strength by turning up the a.f. gain control, and estimating signal str. by the position of the r.f. gain control adjusted "for good listening volume" together with commonsense. This is also better than keeping the r.f. gain full-on for the reason described above; and it automatically adjusts for best-signal conditions.

"The Truth, The Whole Truth, and Nothing but the Truth" (Which I would subtitle "Another Frank S-Meter"), by L. Cotton, VK5LG, S.A. WIA Journal, August 1972.

He recounts how he is puzzled by a "50db over S-9" report since that means, "You have a signal 100,000 times as strong as a strong signal"! Along with others he claims that the main use for the S-meter so used is to replace a "magic eye" tuning valve. True to this philosophy the author describes a simple valve circuit which is just a balanced cathode follower with one side taken from the AVC and the other from earth. A 200μA meter goes between the cathodes, cathod resistors are 500Ω, 500Ω pot for zero adjust (that seems rather hi to me), and 125V or less on anodes of any dual triode valve at all. And heuses it for a "tuning meter". "S9" is at the far right hand end of the dial so that "I'd say that you have a good strong signal, it's pinning the S-meter..." FETs ought to work just as well from a high R AVC line, with the usual LT to drains, of crse.

ΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩΩ

HOW MUCH IS YOUR HOBBY WORTH?
-- Arthur Godfrey, ZL1HV

((Extracts from Break-In, 11/72, p. 390))

... No longer is it a question of a few frequencies. It is now a question of the whole future of the Amateur Service...

Individually we can do much to impress other countries' administrations. Be tolerant of AM signals; a wandering SSB signal; slow morse, particularly if the signals eminate from a not-so-well-off-as-we-are country. Help to sort out the other fellow's problems. For the benefit of monitoring stations talk more about radio and less about everything but. Glory in anything and everything home-brewed, without apology. Act as the gentlemen of the air we are...

((RLG Note: Relevant is a recent happening on 20 metres. After a chap got through saying that his equipment happened to be home-made, the other bloke came back with a comment to the effect that he didn't bother talking to such people, and goodbye!))

XXXXXXXXXXXXXXXXXXXX

Quote

" 'There's no fun left in amateur radio. It's much too serious. The only fellows having fun and building and experimenting are the way-out groups (sic) like the VHF'ers, the RTTY gang, the slow-scan TV boys and the moonbounce experimenters. The rest of us amateurs are disenfranchised...

'The romance has gone out of (amateur) radio. No more building, no nothing. Just working DX set-ups with store-boughten gear. The wrap-around cabinet and the integrated circuit have just about killed off (amateur) radio.'."

(-- from "Build a 50 watt, 1934-style Transmitter for Fun!" by W. I. Orr, W6SAI, CQ, Nov. 1971 -- except that it will work somewhat better in 1973 or 4 if you supply a coupling "condenser" between the 47 oscillator and the 46 finals!)

Pregnant Postscript (from the same article)

"What about the wrap-around TVI cabinet? Obviously this breadboard rig is completely open... Will it wipe out TV receivers for miles around?

"The answer to this pregnant question is that this transmitter is as clean as most modern equipment. This is partly because the transmitter works on fundamental frequency crystals and no doubler stages are used. In addition the tank circuits are high-C ((250 pF max)) which aid in reducing harmonics -- and the amplifier stage is run closer to Class B than Class C... Extended operation of this little breadboard transmitter has caused no difficulties to date, even in a semi-fringe area of TV reception." !!!!

XXXXXXXXXXXXXXXXXXXXXXXXX

LETTER: Import Duties and high Prices

Regarding Mr. A. Adam's item in the June 1972 issue regarding parts availability: As far as I am concerned, all protectionof Australian manufacturing industry should be severely curtailed. All it does is to force the Australian public to pay exorbitant prices for products which could much more economically be imported. This has the conseuqnce only that we do not have to compete with the more efficient work forces of other countries, while still receiving wages which are out of all proportion to the amount of work we do.

For example -- recently I rodered a V-belt for an accesory drive on a tractor. When I received the account I contacted the supplier, to find out why it was so expensive (over $20 for a 72" A belt). The reason given was the fact that it was imported from the USA and was automatically liable for import duty or about 56%. Locally-made belts are not of high enough quality to last the manufacturer's warranty period, and are therefore not supplied. But since we have companies that make these things, our government says we must protect them to the tune of 56% duty, even though they do not make a suitable product here.

As a primary producer I must sell on world prices; when I buy why should I have to pay double these prices merely to protect our over-producing secondary industry?

-- R. M. Gebhardt, VK5RI, Mt Bryan, S.A.

((A certain educational institution requested tax exemption on a substantialpiece of machinery on the basis that it was not manufactured here. The request was refused on the basis that a certain industry was indeed in that line. Further investigation showed that although that industry could make the machinery if it tooled up for it, they had no intention of so doing. Yet the tax structure was based on their capability for the manufacture! Could it be true that import duties are a simple method for producing government income? --Ed)

XXXXXXXXXXXXXXXXXXXXXXX

II.1: A patent application will be preceeded by one week by a similar application made by an independent worker.

II. 2: The more innocuous a design change appears, the further its influence will extend.

II.3: All warranty and guarantee clauses become void upon payment of invoice.

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EDITOR: R. Leo Gunther (VK7RG). ASST. ED.: Chris. Pitcher (VK3). ASSOCIATE EDITORS: Dick Ferris (VK7ZDF), Rod Reynolds (VK3ZRR), Les Yelland (VK3), and Rich. Maddever (VK3). SUBS MANAGER: Bob Walton. DRAUGHTSMEN: RLG and Ron Parker. SECRETARIES: Brenda Ford and Alice Gunther. A most impressive list, but Leo and Brenda still have to do most of the work!

AUSTRALIA: $1.55/yr, $4.20/3-yrs to R. A. Walton, 396 Rokeby Road, Howrah, Tas. 7018; P.O.'s preferred.
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BOUND VOLUMES: (1971, 1972, 1973 when ready): $A2.75; $NZ3.50; $US5.25; £2.25 from National Representatives, as above, posted from Tasmania. These exorbitant figures include inflated post as well as inflated sum for Registration, needed for reliability to Overseas, alas.
BACK ISSUES: Available only for 1973, 30c ea (50c US).

RENEWALS: PLEASE INCLUDE YOUR ADDRESS LABEL!!!!!!!!!!! and do not renew until you receive a renewal notice.

COMMERCIAL ADVERTS.: $A10/pg, $A6/half. Circ. ca 1000.
PRINTING: Advance Publicity Co., Hobart 341-817. Yes.

THE Australian EEB

→ 30c per copy

→ Underground Electronics

P. O. Box 177
Sandy Bay,
Tasmania 7005
Australia

October 1973 Vol. 9, No. 5 P. 65

(Content, continued from right col)

88: SWOOP; Elise on Antennas.
Essential Info, Subscriptions.

Humour: 75, 82, 79, 80, 88
Philosophies: 69, 73?, 81
Recipes: 82.

Murphy: 87

CONTENT: (* = Constructional)

● I'VE NEVER SEEN A SACRED COW, I NEVER....

--"Metrication, or Bust!" -- Frank Merritt (VE7AFJ)*

The metre as a universal unit of measurement is very neatly being forced sideways down the throats of Canadians. We are told that this conversion has benefits. It is of considerable interest that only one side of the picture is being presented. There is another side to this story.

The inch as a unit of measurement is derived directly from the Pyramid Inch of the large pyramid of Egypt. Virtually all civilisations that have been touched by the ancient Egyptian civilisation have used the inch as the basic unit of measurement.

A bit of research reveals that the Old Digit, Cubit, Orguia, Amma and Stadion of the Greek system of measurement were based on the Pyramid Inch. Again, the Romans in their Digitus, Palmus, Pes, Passus, Stadium and Milliare used the Pyramid Inch as the basis.

In England before 1824 there were 200 Acts of Parliament enacted to define uniformity of measurement with the Pyramid Inch as the basis. Of recent years much has been made of maintaining standards that are not affected by climatic and temperature changes. Still today the standard inch in the Large Pyramid of Gizeh represents the absolute standard.

During the French Revolution all long established standards of measurement were discarded and the basis of measurement was created in the metre. In order to be "ultra-scientific" the authorities based the metre on the size of the earth. Unfortunately, subsequent research has revealed the irrationality of this standard, (and it is now based on the wavelength of light absorbed by Krypton-86. But any standard may be so defined, including the inch! -- RLG))

A major advantage of the metre is supposed to be a universal system of tens from a basic measurement. This is most specifically referring to the common unit, in the English System, of 12 inches in one foot. Using the English System it is quite simple to gain the advantages (?) of the universal system of 10's by using 10 inches to the Ped. The word Ped, it will be remembered, is Latin for foot. Thus in one grand stroke it is possible to gain the advantages of the universal system of 10's and retain the inch as the basic unit of measurement. ((The inch itself can, of course, be broken further into tenths and hundredths. And the inch is a far more convenient and accessible length than the centimetre; if you don't believe this, make some measurements in inches and centimetres, and compare. -- RLG))

There is little doubt but that we will all be saddled with the ungainly metric system in a matter of time. As with most things in life, however, it is interesting to note that there is another side to the picture other than that presented in the mass media. COGITO ERGO SUM.

RLG further Note:

Metrication is even further advanced in Australia than in North America, and is causing some upset. On the other hand, although the inch is a more convenient and logical measure than the centimetre, the latter has the property (as we are sure to be reminded by John Andersen) that it is being adopted by nearly ALL other countries in the world. In this instance, as doubtless with the Hertz and Pascal and the Rest, the interests of "commonality" are better served by everyone using the same unit no matter how silly it is; and you'll get used to filling your car tyres with some 173 kilopascals of pressure, previously 25 psi. Strange world.

Parenthetically, a decimalised inch-ped system would have a disadvantage that the dekaped (10 peds, 100 inches) would be a bit more than 8 feet long, rather ungainly for common use compared to the yard or metre. Of course one could define a new yard as 3 (or 4?) peds... And of course the kiloped (1000 peds) would be about 1.5 miles, and that isn't much advantage over the kilometre being some 2/3 of a mile. Besides, when spedometers read in higher numbers maybe people will be a bit more cautious on the road (for a while at least).

Personally, I shall continue in my own workshop to measure everything in inches and decimal inches because it is more convenient. Cogito ergo dormio.

* From RTTY NEWS of the Canadian Amateur Radio Teletype Group, December 1972

THE TESTING OF DIODES AND JUNCTION TRANSISTORS

SEMICONDUCTOR TESTING -- Part II

-- by Richard S. Maddever
(Geelong Grammar School, Vic.)

This article will describe some simple ways of testing some semiconductors and end with a description of a useful comprehensive tester for gain, leakage and frequency characteristics. Voltage rating tests are not covered, since they have been discussed in the EEB for February and October 1971.

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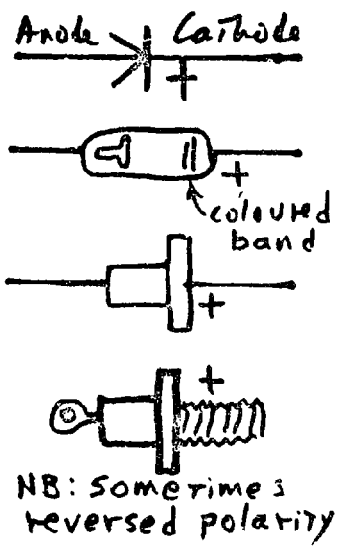
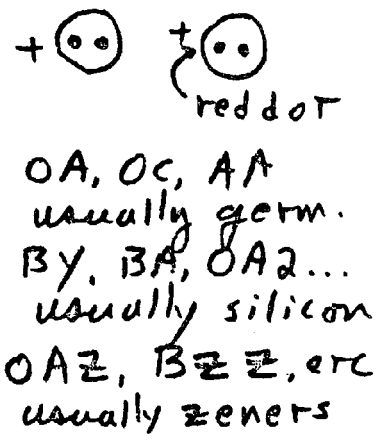
DIODES





➡ DIODE TESTING

With an Ohmmeter

The simplest method of testing diodes requires the use of a battery in series with a current meter, and this is available automatically when a multimeter is switched on to the "Ohms" range; we shall here assume that every experimenter has at least a multimeter, however inexpensive it may be.

When a diode is placed across the leads the resistance should read low in one direction, and virtually infinite in the other. Silicon diodes read somewhat higher than do germanium (e.g., 700Ω vs 200Ω), and this is one way to tell between them, but more accurately if known types are available for some comparison.

In this method, the resistance will read low when the battery positive is connected to the anode (or "negative" end of the diode"). It is important to note that in most meters (and at least one exception is the Simpson multimeter) the battery + is connected via the negative terminal of the multimeter when functioning as an ohmmeter. This means that the diode should read "forward" (i.e., low resistance) when the anode is connected to the negative (usually black) terminal of the unit and the cathode to the positive one (usually red).

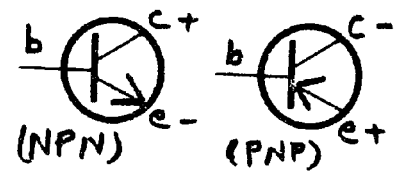
One of the batteries inside a multimeter may be as large as 15 V (e.g. AVO types) and this may be sufficient to destroy some diodes (especially germanium) and transistors. These highish voltages are, however, only found on the higher ohms ranges, and it is generally safe to use one of the smaller ohms ranges for these tests. The X10 range is usually safest, because several hundred milliamperes may flow on the X1 range, and could damage delicate semiconductors.

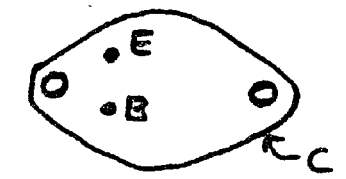
Checking for Silicon vs Germanium

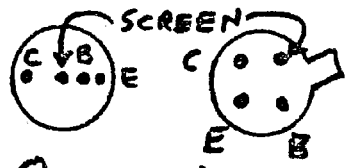
A property of all diodes is that they do not conduct appreciable current even in the forward direction unless the voltage applied across them exceeds a certain small amount. For germanium diodes this will be about 0.3V. For silicon it is about 0.6-0.7V. This sometimes irritating, sometimes very useful property (to be discussed) enables us to make a simple test which is often effective in sorting out good germanium from good silicon transistors -- and considerably more reliably than the comparative resistance test mentioned above.

A pair of resistors is connected in series across a 1.5V battery as shown in fig. 1. They should allow a current of 5 to 10 mA to flow, and be in the ratio of about 2:1, e.g. 220 Ω to 100 Ω. This means that the voltage between points A and B is about 0.5 V. If, thus, a diode is connected in the forward direction, with a 1 mA meter

TRANSISTORS







O... or A... usually germanium.
B.... usually Silicon.
(early OC200, OC202 were exceptions)
For American 2N.... types, consult cats.

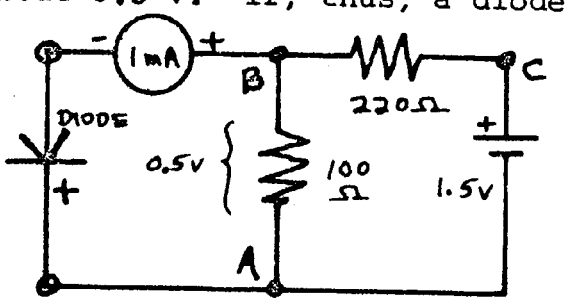
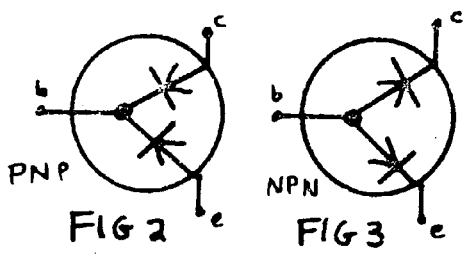


Fig 1: TEST FOR SILICON VS GE.



INTERNAL TRANSISTOR FUNCTIONS

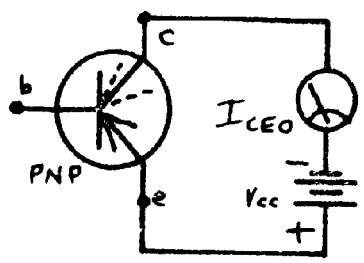


FIG 4: LEAKAGE TEST

(or multimeter set to about this current range) in series with it, then,

-> A small current flows if diode is germanium
-> No current flows if diode is silicon.

Of course if the diode is connected backwards (viz, other way about than shown in fig. 1), no appreciable current should flow for either type. This test is, therefore adequate only if polarity is known or has been determined previously (e.g. by ohmmeter -- but make certain which of the ohmmeter leads is actually positive).

-> ->TRANSISTORS

Transistors consist essentially of two diodes with common connection at the base lead as shown in figs 2 and 3, but of course in the conventional symbol we omit the arrow of the collector diode, to show its different function.

If we know the lead configuration (as on preceeding page, margins), we can test to see what type it is and whether it is functioning reasonably as two diodes.

Transistor Testing

If a transistor is not functioning properly as two diodes connected "back to back" (as in figs 2 and 3) it may still be useful as a single diode, though of course no useseas an Amplifier. Half-good transistors do furnish diodes good for 10-100 mA (depending), and if the base-emitter junction is good it can serve as a zener diode, though of not always high quality (viz, low dynamic impedance); see EEB 6/72, p. 62.

When it is not known which pins are which, it is possible to ascertain this approximately, by finding out which pair act as back-to-back diodes (figs 2,3), and then assume that the base-emitter junction is the one showing the lower resistance in the forward direction.

Assuming a transistor is effective as two diodes we can next test for leakage and in a simple way to use this to see whether it will amplify currents -- its normal function.

Leakage

If a battery is connected between emitter and collector via a meter, as shown in fig. 4 (next page), it will be seen that very little current will flow since the "collector-base diode" is connected in "reverse" across the battery so that although the emitter-base diode would allow current to flow, the only current which will actually flow through the mater will be the "leakage current" through the b-c diode. This is known as I_{ceo} (current between collector and emitter with base open.).

If in a similar test the base is connected to emitter as in fig. 5, the current is usually lower, and is known as I_{ces} (current between collector and emitter with base shorted to emitter). I_{ceo} tends to be larger than I_{ces} because when the base is floating, any collector base leakage tends to bias the base in a forward direction, and this bias is amplified in the usual transistor manner; the base does not "know" whether the bias is applied from an external source or not.

This rather unintelligent behaviour of the base can cause trouble when leakage is critical in a circuit, particularly at higher temperatures since leakage increases with temperature. Circuits are therefore, often designed to minimise leakage effect as possible.

If the test is done as in fig. 6, the current is called I_{cbo} (current from collector to base with emitter open), or often merely "I_{co}"..... These matters have been covered in early EEB's and in Amateur Radio for Aug 69 and Jan 70, and are also discussed in any proper transistor manual or handbook (e.g. by G.E., RCA, Westinghouse, Motorola, Philips, Mullard, etc).

For silicon transistors tested at 6V or so, I_{cbo} will usually not exceed a few nonoamperes, while germanium will have a leakage of perhaps 0.5μA to 25μA (the latter is quite high; should generally not exceed 10μA at room temperature). Values for I_{ceo} will be considerably higher for germanium, and somewhat higher for silicon. For power transistors these values may rise to milliamps. It is convenient to use a multimeter when a wide range of types of transistors is tobe tested, since this allows switching as necessary from μA to mA ranges. You MUST, of course, keep your wits about you in these matters, lest you put the meter on the wrong scale for a given test. This is a good reason for building up a special instrument used only for this specific purpose (as in fig. 14; more on that later).

Current Amplification

Normally if a battery is connected across a PNP transistor as shown in fig. 7 (or NPN in fig. 8) (next page) only the leakage current I_{ceo} will flow in the meter if the base is unconnected. The property of transistors is, however, such that if now a small current is made to flow in the base lead (via the emitter) then a much larger current is produced in the emitter-collector circuit. The ratio of these currents is called h_{FE}, the d.c. current gain in the common-emitter configuration; notice how both currents have to flow through the emitter.

If the base is biassed such that a medium value of collector current is passed (e.g. 1 mA), then a small change in the base current will produce a larger change in the collector current. This ratio is called h_{fe} (or β), the a.c. current gain.

$$h_{FE} = I_c / I_b \qquad h_{fe} = \Delta I_c / \Delta I_b$$

These two gains usually differ somewhat because a transistor is not a perfectly "linear" amplifier: the collector current changes are not always in the same ratio as the base current changes.....

For convenient measurement it is often h_{FE} which is determined in a simple transistor test. The small base current needed is conveniently obtained from the main battery via a resistance, as shown in figs. 7 and 8. If the value of the resistance and the battery voltage are known, the base current may be calculated, as discussed below.

A simple approximate test

A veryquick method which gives qualitative results is to connect the multimeter with (in the usual case of ohmmeter polarity) the + lead to collector and - to emitter (these polarities refer to the marked ones on the case, e.g. + is red lead) for PNP (and opposite if NPN), with the ohmmeter on the X10 position (or X100 if transistor voltage ratings allow; see discussion under Ddiode Testing, above). This gives an idea of I_{ceo} and indeed an exact measurement of it if you realise that the ohmmeter series resistor (inside) is the same as the midscale value of resistance; if you know the battery voltage Ohm's Law does the rest.

Then connect collector to base with thumb and forefinger (or as convenient). The resistance between the fingers is usually a few hundred kilohms, thus allowing the small base current to flow. This should result in increased current in the meter -- i.e. a lower reading of resistance. To get a larger chang the fingers can be moistened a bit, and this can also give a rough idea of the ability of the transistor to amplify.

A Better Way

The abovementioned method is, admittedly crude, but it can be used for want of any more elaborate facilities. Much better is the system shown in fig. 9 if PNP (opposite battery polarity if NPN). As is, it measures I_{ceo}. Short base to emitter for I_{ces}, when meter on μA scale. Finally, with the meter on about a 10mA range the base is connected to the end of the 330K Ω resistor, thus allowing about 6/330KΩ or about 20μA to flow into the base. The collector current is measured (while increasing the meter sensitivity if necessary), and is divided by 20μA to discover the transistor d.c. current gain, h_{FE}, as discussed above.

E.g., if collector current were 1.5 MA,

$$h_{FE} = 1.5 \times 10^{-3}/20 \times 10^{-6} = 75.$$

This means that for every microampere flowing in the base, 75 microamperes should flow in the collector circuit -- ergo we see the phenomenon of amplification.

NOTE-1: Since the gain varies (sometimes very much) with collector current, we should specify the current at which the transistor is tested, and say, e.g., that this one had a gain of 75 at 1.5mA collector current. A transistor whose current gain varies very little with collector current is said to be "linear", and in that case d.c. and a.c. current gains will be nearly the same. Some transistors such as the 2N4250 have quite good linearity, but most do not. This nonlinearity produces rather more problems with transistor circuits than it did with valves..

NOTE-2: The value of current gain found by this calculation is only approximate, for several reasons, e.g., not all of the 6V is across the 330KΩ, because a few tenths of a volt is dropped across base to emitter. Additionally, the meter measures not only I_c but also I_b (i.e., it reads I_e).

The resistors and transistor socket could be mounted permanently on a small board.

The simple tester described in fig. 9, if only used occasionally, might consist of a socket and resistance and terminals on a small chassis (.e.g. the top of a small box of the type in which ignition parts are sold) to which the multimeter and battery are connected when required.

If, however, if many transistors are to be tested (and to avoid difficulties with multimeter scales and possible damage) it may be worth making up a permanent unit including meter and battery, and a special alteration which makes the meter scale nonlinear, to be described later.

Note that this method tests a transistor at a relatively arbitrary (and usually low) collector current. Since, as mentioned, current gain varies with collector current it can be useful also to test gain at definite values of collector current. Such a tester was described in the EEB for October 1971.

(NEXT MONTH WE CONTINUE WITH A TEST FOR THE FREQUENCY-CAPABILITY OF THE TRANSISTOR, A COMPRESSED METER SCALE, AND A COMPREHENSIVE TESTER INCORPORATING ALL OF THESE FEATURES.)

>>>>>>>>>>>>>>>><<<<<<<<<<<<<<<<

"How much of your opinion is based on family tradition, on fear of or desire for personal change, on classprejudice, on fear of personal loss, on fear of seeming to be a crank? If your opinions were entirely based on emotion, on personal like and dislike, your problem would be far easier.

"It is the intricate confusion of fact and emotion, it is the skill with which your personal desire presents to you perfectly adequate reasons for your cherished opinion that make th conflict so acute, and real candour so rare and difficult." -- from "Yoga and Western Philosophy"

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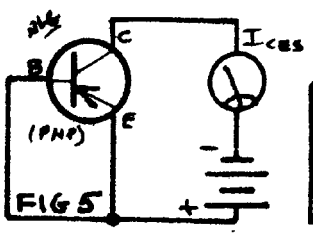

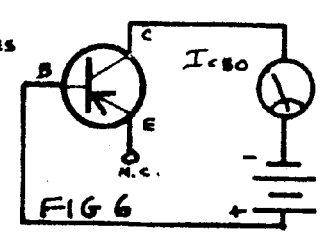

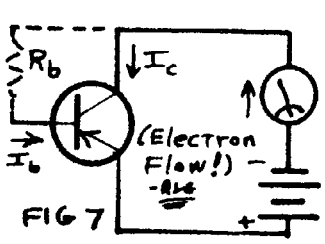

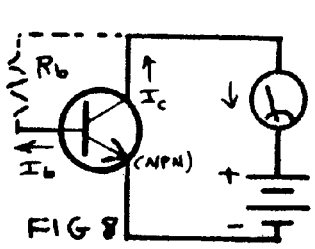

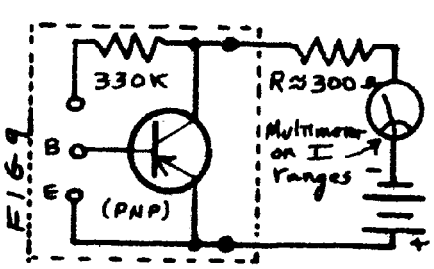

BISTABLE MULTIVIBRATORS

-- by Les J. Yelland (VK3)*

Why?

In the various circuits contained in the ordinary electronics literature, the "Flip-flop" looks a very simple and insignificant thing which will always work if hooked up according to the basic circuit. But, when it comes to the practical application for different purposes, one is liable to run into trouble if all the fundamental principles governing design are not observed, and there are very few journals which treat the subject properly.

I've just finished a FF now, which drives a stepping motor by interchanging the connections on its four stator coils. Each coil-half takes half an amp at 24V and it takes quite a "slog" from an input pulse to trigger a flip-flop which is carrying that much current. I used germanium transistors, as I felt safer with them (re transients etc). Then I have other applications where FFs are running at high speeds and carrying next to no load. I needed a ready reference to the "ins" and "outs" of the game, and from my thinking this article resulted.

The basic circuit

The basic circuit of a bistable multivibrator, or common "flip-flop", is as shown in fig. 1 (next page). This will be quite stable if:

$$R_{C_X} = R_{C_Y} \quad \text{and} \quad R_{B_X} = R_{B_Y}$$

provided that

$$h_{FE_X} = h_{FE_Y}$$ (the d.c. current gains).

In its quiescent state, since both sides are symmetrical, it would appear that the two transistors, X and Y, would take equal currents. On the other hand, any slight variation in the current through one transistor will have a regenerative effect to drive the other in the reverse direction. This will, in turn drive the first transistor further in the direction of the original variation -- thus regeneration, as in an oscillator.

The result is that one transistor is driven to saturation and the other is driven to cut-off. In practice, when power is applied to such a configuration, one transistor immediately saturates while the other becomes cut-off. The saturated one is said to be "on" and the other to be "off". Either one or the other can assume the "on" state in a random manner such that, if power is removed and then re-applied, the chances are that they will interchange their states, but will not necessarily do so. The condition in which one transistor is on and the other off, is quite stable and will remain so until the voltage on the respective bases is changed by external means.

The bias on the base of the "on" transistor is derived from the collector of the other one; since the latter is cut off, almost full applied voltage is available to it. On the other hand the base of the "off" transistor is connected to the collector of a saturated transistor, where voltage is very small.

If, now, the bias of the "on" transistor is reduced by applying an opposing voltage to its base from an external source, it will be taken out of saturation, and its collector current will reduce. This will raise the voltage at its collector which, in turn will apply bias to the base of the "off" transistor so enabling its collector to take current, thereby reducing its voltage. This further reduces the bias of the "on" transistor to accentuate the process until the transistors are changed over, and that which was "on" is turned off (and conversely).

Alternatively, the same effect can be obtained by applying a forward voltage (negative or positive, depending whether Germanium ((PNP)) or Silicon ((NPN))) to the base of the "off" transistor. But turning the "on" transistor off is generally preferred because it involves less power from the signal source. In either case the application of switching voltage is not maintained for any length of time, but just long enough to start regenerative action.

Switching, stability

In practice, switching is by means of short pulses, and if these are applied alternately to the two bases, the pair will interchange with eachpulse.

There are two stages in the changeover. First, the transition stage during which current is decaying in one side and rising in the other. Then the settling stage, after which it remains stable in the new state. Settling time is due to the necessity for voltages to change in various parts of the circuitry. Inherent capacitance of components and stray capacitances across these parts prevent instantaneous changes of voltage, so a little time is involved. Before completion of settling in, there is a short period of instability (during which neither saturation nor complete cut-off has been achieved), and any disturbance during this period can upset the switching process and may cause resumption of the previous state.

An ideal bistable pair should be equally stable in both states. For this to be so, the transistors should be matched and their resistances equal in value. Failing this, adjust the base resistors to obtain the same collector current in each with a given voltage source fed to the bases. To ensure saturation, the base resistor, R_B, must always be $< h_{FE}R_C$.

Using it

A load may be substituted for one of the collector resistances, in which case its re-

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* Electronics Engineer specialising in unusual problems. Address: 59 Porter St., Prahran 3181.

sistance sets the starting point for design of the other constants. Or it may be connected shunting the transistor. This is always the case with a capacitance-coupled load. In that case, the value of collector resistor on that side must be reduced, and the abovementioned provision for R_B applied to the lower R_C. It is important to see that saturation current is not excessive, and equally important to see that saturation does occur; failure to reach saturation not only means instability but also high power dissipation, with probable breakdown. ((Excessive saturation current would be that value which would result in excessive power dissipation by the transistor. The power dissipated in that condition will be $I_C V_{sat}$, and the practical value of power which can in fact be handled will depend on the power rating of the transistor in practice. This will be a fair bit less than the optimistic published value which assumes operation at 25°C, viz., with an infinite heat sink. Since your heat sink will be less than infinite you will have to "derate" the power rating by a value which depends on the final operating temperature of the unit. Such deratings are to be found on the transistor specs sheets. But the final operating temperature will in fact depend on the size and efficiency of your heat sink (and thermal resistance to the transistor case), if any. In such a situation, a Grandma's Method is to increase base current until collector voltage drops to minimum, and then add a bit. Wait a little, and feel the transistor; if silicon it shouldn't be more than quite hot to the touch (preferably less!) and if germanium it wouldn't want to be more than warm. Otherwise you'd best improve the heat sink or increase the value of collector resistor or whatever. -- Ed.))

In the usual applications, a succession of pulses is required to produce a succeesion of changeovers, so pulses must be applied alternately, to each of the bases. They must be of short duration and sufficient amplitude. A common method of triggering the flip-flop will now be described.

Triggering the Flip-flop

With two NPN transistors in the quiescent state, one is "on" and the other "off". The base of the "on" transistor will be positive and that of the "off" one will be at zero potential (ideally). In the case of PNP, the "on" one will be negative and the "off" one will be positive in the case of germanium, or zero for silicon. While silicon remains well cut-off with zero base voltage, germanium requires a back bias of positive polarity to maintain the cut-off condition ((because of the higher leakage current of germanium; see Maddever article, elsewhere this EEB))

In all cases, the polarity of the two bases is opposite so that, if a voltage is applied to them through a diode, current will flow only into the base which does not reverse bias the diode. That means that two diodes may be connected to a single input terminal, and an incoming voltage will be transmitted to only one of the bases, depending on the pulse polarity. By that means the affected base is changed each time and so we get pulses transferred alternately to each base, which is the required condition.

Fig. 2 shows the arrangement with two NPN silicon transistors. The requirement is that an incoming pulse should cut off the "on" transistor. For this we need a "negative-going" pulse with an amplitude greater than the base saturation voltage and a current capability of rising to base current value very rapidly. This is a negative current, so the capability is that of absorbing the current flowing in the base resistor. Consequently, with square wave positive pulses at the input, it is the rapid decay at the trailing edge of the wave which does the triggering.

At the instant of triggering, the current flowing in the base resistor, is diverted through the diode, tending to slow down the decay of current in the pulse. If, then, the trailing edge of the pulse is not steep enough to resist this, changeover will not occur.

With the silicon transistors shown in fig. 2, the amplitude of the pulse needs to be not less than 0.8V and the rate of "fall" at the trailing edge not less than 1.5V per µsec when connected to the flip-flop. Thus, with an amplitude of, day 1V, this should drop to zero in the space of 0.66 µsec.

High Speed Operation

For high speed operation of flip-flops, it may be necessary to shorten the transistion time. This can be done with "speed-up" or commutating capacitors across the base resistors.

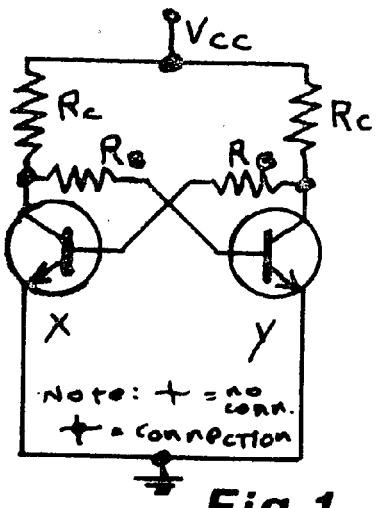

Fig.1

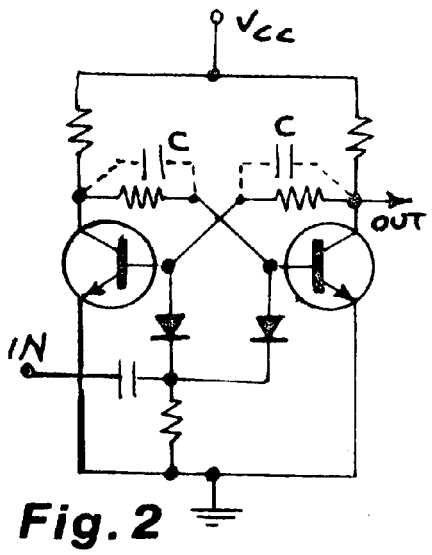

Fig.2

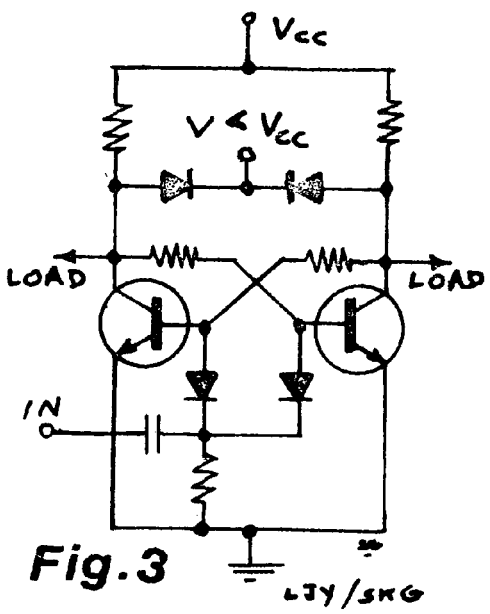

Fig.3

Every transistor has some input capacitance, C_i. For rapid transistion, changes in collector voltage must be transferred rapidly to the other base, but since there is a resistance R_B terminating in a capacitance, C_i, the base voltage can only change with a time constant, R_BC_i -- even if the collector voltage were to change in negligible time (viz., instantaneously). This time can be reduced by "short-circuiting" R_B with a capacitance, C. While this capacitance will shorten the transition time, it also have the effect of lengthening the settling time; during settling the voltages across the base capacitances have to change, and this cannot occur instantaneously. Shortening the transition time is the more important, but for maximum speed of operation a compromise must be made.

The value of C to shunt R_B will usually lie between 10 and 100 picofarads, and can only be determined by trial and error because there is no clear-cut separation between transition and settling times.

In "noisy" situations, where line transients may upset a changeover if they occur during the brief period of instability before completion of settling, it is advisable to speed up the switching by the use of commutating capacitances, even though the speed of operation be comparatively slow. It will then take a very sharp transient to interfere, and such is easily by-passed.

Variable Loads

When the load to be driven is variable, more nearly constant conditions can be maintained by connecting the collectors through clamping diodes to a supply source somewhat lower in voltage than the main supply, as shown in fig. 3. The collector voltages will then be clamped to this lower voltage when they are cut-off, but the higher voltage is still available to supply power for heavier loads.

IC Decade Counters

The method of triggering employed by Fairchild for their Integrated Circuit decade counters is rather interesting. This is shown in fig. 4. Switching is achieved by injecting current into the base of the "Off" transistor, in contrast to cutting-off the "on" one as described above. Two steering transistors are used, with the bases of each connected through diodes to their respective flip-flop collectors, such that current will flow into the base so connected to the "off" transistor.

In the quiescent state, the collectors of the steering transistors, Q4, Q5, are "low" and the output is "high". Thus the base-collector junction of Q5 will be forward biassed. Current flow into the base creates a charge therein. If a positive count pulse is now applied to raise the collector voltage rapidly, the charge (which the diode prevents escaping from the base) will be discharged through the emitter onto the base of Q3. About one volt on the collector of Q5 is sufficient to cause a burst of current to Q3 base and force it into conduction. Thus Q3 is turned on and the output becomes low. That is regarded as the "on" state of the pair, and the next pulse will revert it to the "off" state by similar action through steering transistor Q4.

At any stage, the pair may be returned to the "off" state by the application of about one volt to the reset terminal. This causes transistor Q1 to conduct and lower the base voltage of Q3 (if that happens to be "high") and ensures that the flip-flop will assume its "off" state. This configuration, as shown in diagram, is only suitable for use with low applied voltage, ie, V_{cc} not more than 4.5V.

The collectors of the steering transistors may be connected together as shown, or may be operated upon separately, as in the case in some of the stages of the Fairchild decade counter; this converts the natural module of 16 of four flip-flops, back to a module of 10 for decade counting.

Since voltage is low the resistance values are low, and stray capacitance effects are almost negligible. This enables high speed operation without the use of commutating capacitors, but if the voltage of the count pulse is too high and/or its rise-time too long, one count pulse may trigger more than one changeover.

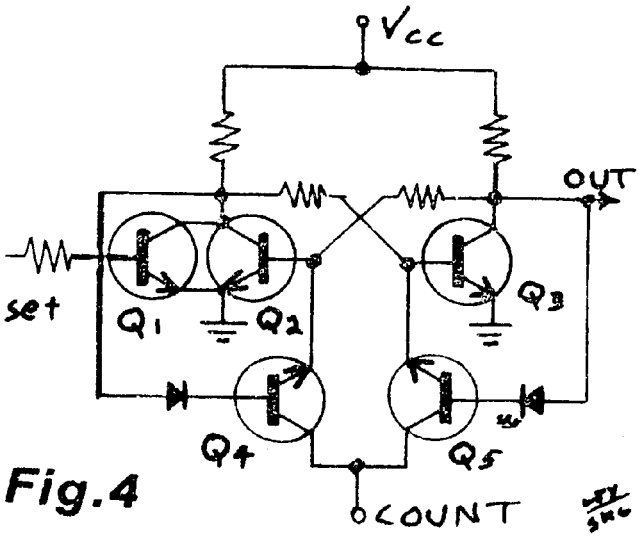

Fig.4

(Thanks for the drawing, Leo.)

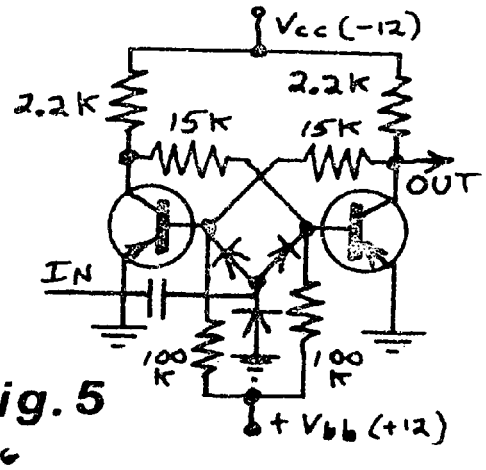

Fig. 5

LSY/RLG

Silicon vs Germanium

In all of the above cases, shown in figs. 1-4, silicon NPN transistors were used, in which the collector saturation voltage is less than the base cut-off voltage. This means that a base which is tied to a saturated collector will be erfectively cut-off. In cases where the saturation collector voltage is above base cut-off voltage (as with germanium PNP) a reverse bias is necessary to ensure cut-off. Even with

silicon, where heavy loads are carried with a possibility of high temperatures, reverse bias may be necessary to ensure stability. ((And as per abovementioned reasoning, the simplest way to ensure stability boundary conditions is to try it with the transistors as hot as they are likely to get in the worst-possible operating condition in your actual chassis and location. -- Ed.)).

Fig. 5 (previous page) shows a typical arrangement with two germanium PNP transistors. The input diodes are, of course, reversed since we now require positive pulses to trigger the switching. Bias resistors of 100KΩ are connected from each base to positive supply.

Switching with PNP transistors is effected by the leading edge of the incoming pulses; while it was essential to secure a fast fall of pulse voltage with the NPN transistors, it is just as important to ensure a fast rise of pulse voltage in this case. An extra diode is inserted as shown, to bypass the negative voltage from the input capacitor.

To avoid the use of a separate power source for the bias, self-bias may be employed by connecting the emitters through a common resistance of about 500 Ω and earthing the base resistors. For equal stability in each state it is then necessary to ensure that the load of both transistors is equal. But the separate source is to be preferred, and as the voltage of V_{bb} may be the same as that of V_{cc} (as shown in fig. 5), it is easily provided with a small diode and capacitor connected to the a.c., inasmuch as the current drain is exceedingly small.

Cascading Flip-flops

Any number of sets of slip-flops may be connected in cascade. It is merely necessary to connect the output of one through a coupling capacitor, to the input of the next (see fig. 6). Every second pulse of the first pair will then trigger the second pair, every fourth pulse will trigger the third and every eighth pulse, the fourth -- and so on, increasing by a power of two with each stage.

Consequently it would take 16 pulses to operate a fifth stage, but for decade counting we need to operate a fifth stage with the tenth pulse. This is achieved by separating the two inputs of the second and fourth stages and feeding the output from fourth back into the second through an AND Gate (see Lorimer's Digital Electronics, Part II, EEB Jun 1973). By this means, the second stage is inhibited from responding to the pulse from the first, during the ninth and tenth counts. One side of the fourth stage is connected to the output from the first, so that when the tenth count arrives, all stages revert to the zero or "off" state, and an output pulse is available for feeding to a following decade.

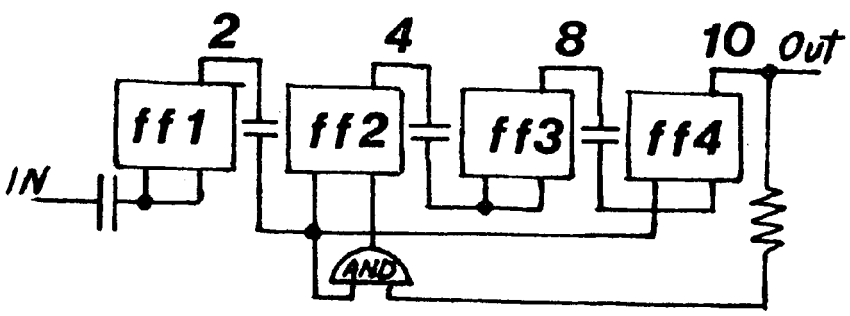

Fig.6 Decade Counter

LJY

ELECTRICAL IMPULSES AND EYESIGHT

((From The Oscillator, W1NPL, Ed., QSP ARNS))

Faculty members at the University of the Pacific Graduate School of Medical Science in San Francisco have a new insight into research on blindless. They are not working with the eyes. They are working with the back, and television cameras and electrical impulses. Already they are getting results.

The method is simple in concept: Instead of the eyes transmitting the nerve impulses, a small television-like camera receives the visual impressions. These are transmitted to 400 small electrodes attached to a person's back. Because the skin has nerve receptors arranged in a pattern similar to the retina of the eye, the impulses may be transmitted to the brain. After extensive training, the blind person can form a visual conception in his brain from the stimulator vibrations on his back.

Dr. Cecil C. Collins, associate Professor in the Department of Visual Science, says the blind person actually sees the objects out in space, instead of feeling them on his skin. A bulky first-run model of the system has allowed blind persons to identify various objects within a close visual field. The television camera features a zoom lens. With the camera, the person can discover such visual concepts as perspective, shadows, shape distortion and changes in size.

The working-model would consist of a one-pound garment worn under the shirt and an eight-ounce vidicon camera worn on the head like a miner's lamp.

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Quote

"Pretty soon most of our scholarly publications will be done on micro-card. IBM and XEROX are going big on microcard. Brittanica is scheculed to come out in its entirety with all volumes crammed onto a small pile of 3 x 5's which will fit into a shoebox or much less. Won't be very long, I suspect. Then newspapers will be out in ten years I'm sure ((He means they will be obsolete)). Closed circuit TV will provide instant selection of choice of materials at a terminal centre so that the individual will have his choice of what he wants to see or read at the dialing of a terminal.." - Ade Weiss

((Marvelous idea; it will make browsing more difficult and censorship more easy! -- RLG))

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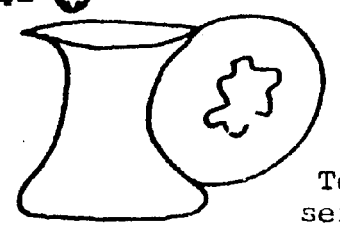


pitchers corner

-- by chris pitcher

Toward the end of your series of articles on receiver design you mentioned a rumour of the use of the Third Method of SSB and phasing in the detector. I built one of these beasts some time ago, and I'll say that one doesn't really gain. Put simply the story is as shown in the two diagrams below. At the left is the Phasing Method, and this becomes Third Method when the stuff in the dotted line is replaced by the figure at the right.

The effect is to replace the a.f. phase-shift network with a fixed frequency PSN (at the frequency of the "f_{LO}" oscillator, ca 1500-1800 Hz) and two low-pass filters. This gives the equivalent of two audio signals 90° apart as for the phasing method. The output carrier (suppressed) is at a frequency, $f_{HI} \pm f_{LO}$, depending whether USB or LSB. The point is, instead of having to make a PSN which maintains ±45° from 300 to 2700 Hz, you now have to

(i) Adjust two modulators (a.f. has to be suppressed, since it is not balanced out).
(ii) Adjust two low-pass filters for equal peak response (not easy!).

What is really required is a phase meter, with a scale from (say 80° to 100°. But if one had that, there would be no problem in building a PSN. As I say, I built one; I offered to send it to you, and you asked if it was simple ((I did??)). Of course, I had unlimited enthusiasm and boundless optimism when I built it, and would have answered yes. Now I'm not so sure!

((How about a design for a nice frequency-independent phase meter, 45° or 90° centre))

A Transistor Hartley Oscillator

This is as shown below; it is quite easy to adjust amplitude, gives a fairly good (ie undistorted) output, and works down to about 0.5 volt (if taps adjusted to suit).

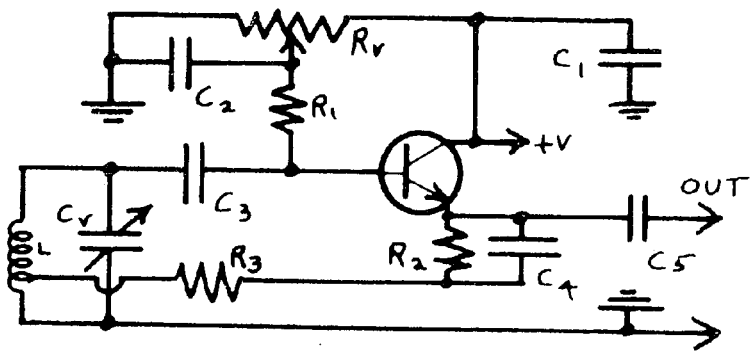
L, C_v = frequency determining.
R_1, C_3 = "grid leak" (or whatever).
C_1, C_2, C_4 = bypasses, 0.01 µF ceramic etc
R_2 = sets d.c. current range.
R_3 = adjusts feedback to give easier control of amplitude by R_v.

((I can just hear some readers screaming, "but what values should I use?" Well, that is what Chris was talking about in this matter of self-motivated design... R_v might bleed 1mA, R_1, R_2, R_3 can be treated as for ordinary bias conditions for an amplifier (look up in GE Transistor Manual for that, or anywhere) as a first approximation, C_3 can have an X of say 100Ω, C_4 an X about same as R_2, and C_5 with X comparable to load -- Ed))

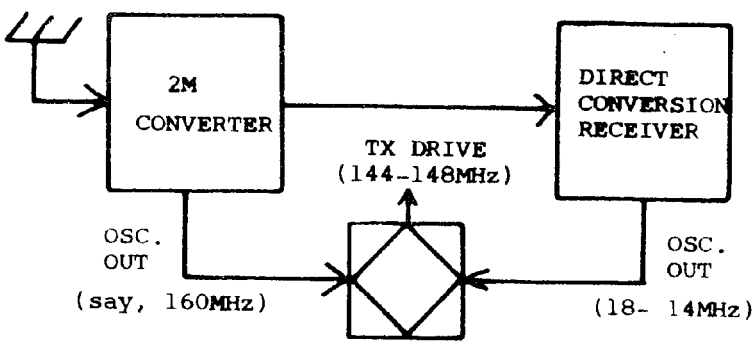
The point is, put a coupling link on L, and it makes a pretty good regenerative detector; easy to set regen (almost as good as screen grid voltage adj), and regen causes vy little detuning. Also makes a first-rate Q-multiplier. If so inclined you can replace the tr with an FET, but of course change the bias arrangements (see e.g., my article in Dec. 1972 issue of EEB.)

Direct Conversion to fill the VHF Bands

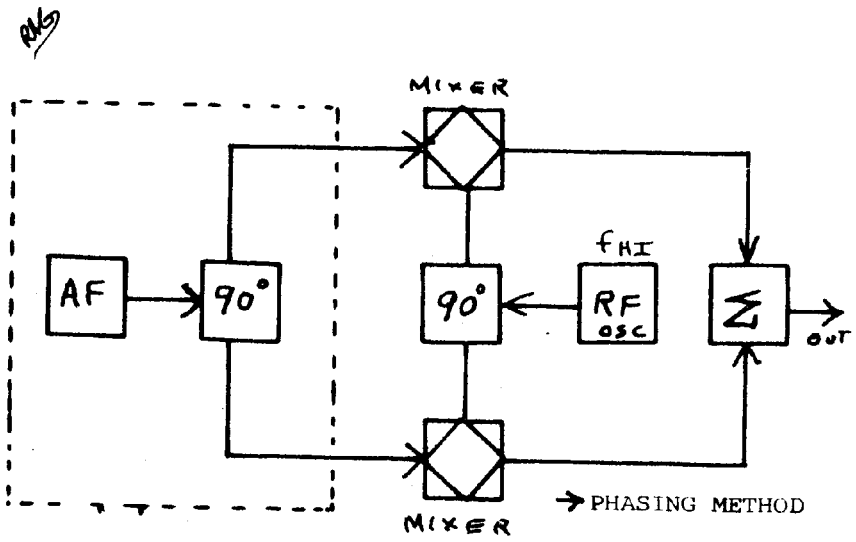
This is the other diag. Everyone clings to net frequencies, a few daring ones using the other odd crystal now and then. Remember the days when VFO meant new acquaintances?

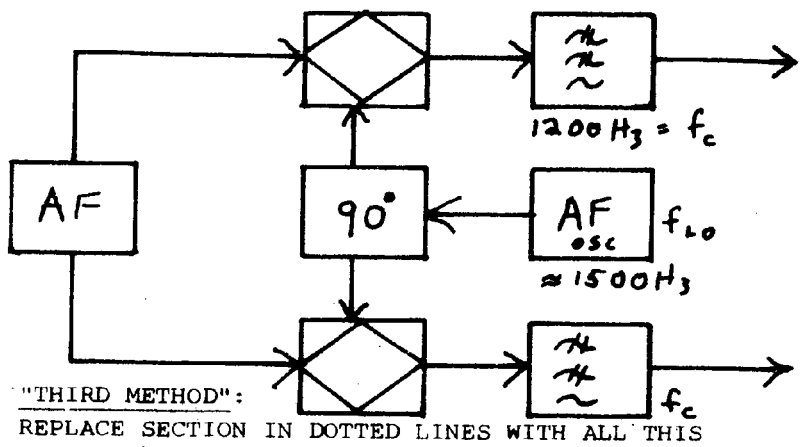


GOOD HARTLEY OSCILLATOR



DIRECT CONVERSION AT VHF





"THIRD METHOD":
REPLACE SECTION IN DOTTED LINES WITH ALL THIS

Further Notes on Sacred Cows (cf EEB, June - October) +

"Suddenly, but not surprisingly, the Australian dairy cow has ceased to be a sacred beast. There may be some surprise at how quickly the Federal Government plans to phase out the $27 million a year dairy industry..."

— News Release

— Actually, we'll be having more stuff in the next issue on the subject of metrication. The whole "Sacred Cows" file has, in fact, been sitting in our files for about a year, but these past months have seemed an opportunt time to bring it out; means more . now that we are actually enduring the event, I reckon.

Indeed, a reader threatens that if "EEB goes metric" he won't renew. Well, John Andersen and others forced us to go to Hertzes, and I've been using Centigrade (now Celsius) temperature at work for years, as well as centimetres, and they are a convenient measure. But at home in the workshop (and for all EEB layout) I use decimal inches, because they are more convenient in many cases. I tried to be smart with our April beer recipe by using metric measure, but got properly impaled on that matter of assuming that 5ml of sugar was the same as one level measuring teaspoon. It's not (no matter what the Authorities say), and seems to be more like 3ml. Use a 5ml measure and you'll get far too much head on your beer.

So...? I think that if our reader resigns because of metric he'll have to stop driving his car, and he'llhave to do a lot of conversions for the units appearing everywhere these days — one of the silliest of which is the specification of wood (timber) dimensions in millimetres, running into hundreds, sometimes thousands.

Yup, it's all quite silly, and this drive to find an ideal standard of measure (and the Rest) for non-ideal human beings reminds me a bit of a quotation from C.S. Lewis entertaining book, The Screwtape Letters (G. Bles, London). It is a Letter from a Senior Devil to a Junior one, and might perhaps be entitled, "Profane Cows"...?:

"... And therein lies the great task. We know that He cannot really love: nobody can; it doesn't make sense. If we could only find out what He is really up to!

"Hypothesis after hypothesis has been tried, and still we can't find out. Yet we must never lose hope: More and more complicated theories, fuller and fuller collections of data, richer rewards for researchers who make progress, more and more terrible punishments for those who fail -- all this, pursued and accelerated to the very end of time, cannot, surely, fail to succeed."

This is also doubtless relevant to the Quote without Comment in the last EEB, p. 56...

Extra Notes on Beer Brewing (ref. April recipe, p. 29 and Improvements and Alterations thereto, Aug., p. 48):

I've learned something important the hard way. A friend gave me some improved yeast which settles much better than the ordinary stuff, but it was wet and had to be kept in the fridge. I used it with excellent results for one batch, but the second one -- for the first time in years — turned out thoroughly bad. The reason: while the yeast suspension was sitting in the fridge some unfriendly wogs decided to keep it company. It seems that they have a taste for homebrew, but they don't return the favour: they taste terrible!!

Moral: use only dried (brewers) yeast. And even then it is a good idea to keep it fresh by storing it in a sealed jar which also contains a separate packet of some dehydrated silica gel. The gel can be dehydrated by gentle warming in the oven until it turns blue. The whole jar is kept in the fridge, and in this condition will keep for ages.

The worst of all this is that I gave away portions of the wet yeast to several friends. At present I'm brewing up a large batch strictly to distribute as a token of penance...

As a strange corollary, one contributing factor to this mess is the fact that for the past year or so I've discovered Yoga. Don't laugh! It has done wonders for my life (except for getting EEB out on time) and peace of mind &tc, but I've found that my beer drinking has decreased substantially — thus the longer time between brews, and so on, as above. This has surprised me, because I was under the impression that I drank only for gentlemanly simpleminded satisfaction and taste. Not entirely so, it seems...

Inflation vs Prices (cf p. 53)

Recently I saw a comprehensive Bibliography on Inflation, prepared by the August institution to which I give of myself. Were it not for the awful things that happen to one's living, the efforts of the economists could doubtless be considered as a Comedy. Some of the titles of the articles tell the story:

"Inflation makes the poor much poorer, the rich a little richer."

(PTO)

ADVERTISING

This Page: Personal = FREE Commercial = (ENQUIRE) We guarantee nothing.....

THE FOLLOWING MAGAZINES ARE OF MUCH INTEREST, AND ARE RECOMMENDED TO EEB READERS. CURRENT SUBJECT CONTENTS ARE LISTED TO PROVOKE YOUR INTEREST. Fees etc are shown; the overseas publications can be ordered through EEB if you are too lazy to visit a Bank for a Draft, by submitting funds in $Aust equal to the numerical value of $US or $C, or at the rate of $A1 = £stg 1.00 . This gives EEB some profit to keep the wheels turning, though at the rate the £stg is sinking that may not be true for long.

WORLDRADIO: An Amateur Radio News Magazine (See p. 53, last month).

THE RADIO BULLETIN: An Experimenters magazine. The Nov/ Dec. issue contained:

News on Awards & Classes & Kits
VHF Beacon Listings
Easy LCf calculations
A Two-Metre Foxhunt Shiffer
A 160-Metre VFO
The TUS-7 RTTY Terminal Unit (in much detail!)
The VK8KK Master Sync Pulse Generator for SSTV
Pages from the Past: A Home-made Phone Receiver that really works ((Lovely! From Radio, March 1937))
Circuit Ideas: Using LM380 to drive Pwr Output Stage
Problems with Dual Polarity Pwr Supply
PIN-diode TR Switch
A Capacitor-Discharge Ignition Ckt.
Crystal frequencies for the new 2-metre nets.
Disposals News: New Range of Semiconductors; LEDs, Pwr transistors, Audio ICs, many kits (from Preamps to Light Dimmers), 2M FM Carphones, SSTV etc etc. +selsyns This is surely one of the most active and useful cheap parts supplier in Australia — for Members only...
Classy Classifieds: All kinds, and free " " !

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And if you are in Victoria there are even more benefits of Membership. Interested?? Send to The Secretary, Eastern and Mountain District Radio Club, P.O. Box 87, Mitcham, Victoria 3132. Membership is $3.50 first year, $3.00 p.a. subsequently and includes the Radio Bulletin. First send for the Membership Form, please.

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6-UP MAGAZINE, edited by the Irrepressible Roger Harisson. (or maybe that's Harrison).: "6UP is not a porographic magazine; but the contents will certainly excite you!"
The December 1973 issue, [illegible]

RTTY NEWS: See p. 34, June issue. More later.

THE AMATEUR RADIO MOBILE SOCIETY: News and technical articles of much interest to mobileers everywhere. Frinstance from March through October 1973 the following appeared in the Mobile News, their official publication:

Choosing a Location for Portable Operation:
I. In Mountains or Hilly Districts
II. Water
Noise suppression in the Datsun, Cortina , etc etc etc.
Computerised Ignition Systems, more and more.
Mobile Rally and other Mobile Events (U.K., Europe)
Awards News, all kinds.... Mobile in the Early 1920's.
Burglar Alarm Interference... VFO for the FT-75
Road safety for mobile operators
Reciprocal Licensing News, various.
Battery voltage, and the FT-101; ckt to keep from overvolt.
Suppression: The use of an r.f. sniffer & Hit and Miss.
Repeaters and the future of the VHF bands
((but see also Feb 1973 EEB, p. 21 ff.))
High Impedance Microphone preamp. for the FT-101
Solution to the Interference in Fuel-Injection systems!!
Automatic 80 Metre Mobile Antenna Tuning Unit(detailed)
French Transponders
An 80M SSB Transceiver for Direct 12V Operation(mostly ICs!
Plugs, sockets and adaptors, a serial.
GW Expedition, 1973; Midland National AR & EE Exhibition
Twelve Volt Power from a Six Volt Car (switch batteries).

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Plus Information Service, and the rest. Send for Membership Form, to The Secretary ARMS,
40 Eskdale Gardens, Purley CR2 1EZ, England, U.K.

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THE WHAT WHERE WHO HASSLES & HOW MUCH

The December 1973 issue contained:
52MHz Bandplan (VK6); 6UP Reader Survey; 6UP Review
200MHz Digital Frequency Meter Kit
Band Analysis Tables; Band Post Mortems; Beacon Bits
Hamads ((surely Roger means Amateuradverts??))
Multiband multimode exciter; New Crystal Frequencies
Oscar Report; Phase Locked RTTY Decoder; CQ-DX.
The VK2ZRH Beacon Saga; Tropospheric Inversion DX
VHF Beacons Listing; VHF/UHF/SHF World Records.

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All this, every other month or so, plus regular items of all kinds. Subscriptions, $3.00 per year, to The Editor, 6ULP, 47 Ballast Point Road, Birchgrove 2041. ((No, that wasn't a misprint; that was so that Roger will know you saw it in EEB!))

BOOK FOR AMATEURS ((AND OTHER EXPERIMENTERS))

(Otherwise known as "The Amateur's Pink Pages")

IS A COMPENDIUM OF COMPANIES, PARTS SUPPLIERS, EQUIPMENT SUPPLIERS ORGANISATIONS ETC THAT CAN/WILL/DO SUPPLY THE COMPLEAT NEEDS OF THE COMPLETE (or incompleat) AMATEUR ((AND ANYONE ELSE)). EVERY SHACK SHOULD HAVE A COPY.

IF YOU BUILD BUY BEG BORROW STEAL OR MERELY READ ABOUT THE SUBJECT — you need one.

THE WWWH&HM BOOK FOR AMATEURS WILL BE PUBLISHED LATE FEBRUARY ((I'm just being realistic, Roger)), so DON'T MISS OUT —— ORDER NOW. Limited First Edition.

Send cheques, checks, postal notes, money orders, or anything nogotiable — to the value of $A1.50 (US2.50) to 6ULP Magazine, as at the left herewith.

THE MILLIWATT: An EEB-type magazine, devoted exclusively to under five-watt amateur radio. Published in the U.S.A. The October 1973 issue contains the first installment of a comprehensive Bibliography on every single article published in the field of low-power transmitting and state-of-art receiving, from 1967-8 to the present — 22 pages of it. This is a most impressive and valuable public service, and relieves me greatly of the need for trying to do that kind of thing myself! This remarkable effort has crowded out the plethora of usual good technical and non-technical copy which typifies the Milliwatt, but there is still room for: A 150 MW 7MHz SOLID STATE PHONE RIG, MODIFICATIONS TO THE TENTEC PM3A TRANSCEIVER, REDUCING HUM IN THE HW-7 (etc), THE WA7OKF WATTMETER REVISITED, A REPORT ON POINT-CONTACT TRANSISTOR PERFORMANCE!, QRP CONTEST AND QSO PARTY INFORMATION, OPERATING NEWS — all in homey informal style. — If you are interested in the finest aspects of Amateur Radio you are interested in the Milliwatt. $3.50/yr to EEB.

EDITORIAL (continued)

"What the government could do about wages and prices (if it wanted to)"
"In an over stretched economy become a brickie"
"Progressive Income Tax — The Inflation Governments Adore" ((This one by RLG! Irressistible))
"Inflation must be stopped"
"The best way to control our dollar is to float it"!
"... it seems Australia's prospects of curbing inflation depend largely on ((Governmental)) fiscal policy." — Gawdelpus.

Gunther's PMG Corner

I notice the 1973 Christmas stamps are printed in gold, as well they might be.

Were you under the illusion that you could collect on your $50 wristwatch if lost in the Registered Mail? No so. $11.15 is now the maximum compensation for ordinary old Registered post (at 75c a pop!)

LETTER: Rough Transistor Checker ((oops, next column))

LETTER: Checking Rough Transistors

This is a method for checking transistors to give a rough idea of current gain, using only an ohmmeter.

1) Connect meter "positive lead to the collector, and meter "negative" lead to the emitter, for NPN transistors — reverse for PNP. The polarities are placed in quotes here, because they should be the actual polarities when the meter is on the OHMS scale; in most meters this is the reverse from what might be expected, e.g., on OHMS the negative lead is actually the red one.

2) Choose an OHMS scale to suit the transistor being tested. With the polarity chosen as above, this range should give almost "infinity" reading on the OHMS scale.

3) Place a finger(slightly damp??) across the transistor collector and base terminals, and note the increase in current (viz, decrease in R) on the meter. This gives a reasonable ((sic)) approximation of gain, particularly if another similar transistor is available for comparison.

— Geoff Cohen, VK1ZUG, Holt, ACT

((And if a transistor tester is near at hand; never mind, it only shows how non-critical gain is. This Principle was also discovered by Rich Maddever, p. 67 here. — Ed.))

SOME INTERESTING BOOKS FOR EXPERIMENTERS -- RLG

A quick visit to the Technical Book Co in Melbourne as I was passing through yielded the following reward of titles; where prices are shown in $A, the overseas prices will, of course, be substantially less (in our value of currency); where prices are shown in foreign currency the local prices will be higher — but remember that it takes a long time to order books from abroad. If you are in a hurry you might be willing to pay the higher price. If you're not, you can order from the U.S. source specified in our June issue (p. 35), or from the U.K. via Blackwells Ltd, Broad St., Oxford, England OX1 3BQ.

BASIC ELECTRONICS, 1st & 2nd Level (Dover, N.Y.) ((Elem.))
BASIC ELECTRONICS, 3rd Ed, by B. Grob (Mc Graw Hill Jap. student edition; $A8.65, dearer in USA! because Jap.) ((Very good, but not for children.))
ELECTRONIC DESIGNERS HANDBOOK, by T. K. Hemingway (Business Books, London)
+ CIRCUIT CONSULTANT'S CASEBOOK, by T. K. Hemingway (Ditto). ((ANYTHING by T. K. Hemingway is worth reading, since he is one of the few electronics writers who believes in a commonsenso approach to electronics. Chris Pitcher says that he will be dnnggg a review of these two books for us one day, don't you, Chris??))
ELECTRONIC INSTRUMENTATION AND MEASUREMENT TECHNIQUES by David Cooper,(Prentice Hall) $A18.
FIELD-EFFECT TRANSISTORS — Philips Application Book $A3.45 ((Of course good, as anything by Philips)) ((For basics there are several other books also available on FETs, including Ed Noll's one, publ. by Sams, and a variety of articles in periodical literature, and numerous applications notes on fundamentals and applications published by Fairchild, Motorola, T.I., and the rest...))
MINIWATT TECHNICAL ((valve)) MANUAL, 7th Ed., 5th print. Philips Industries. ((This item is pretty old, but is invaluable in that it has in one book characteristics of a large number of both American, Australian, & European valves. If you need the characteristics or socket of a really new valve you can always find it in one of the big big Technical Manuals available at any University or Technical Institute, or indeed many TV Service Shops. Wot, you don't use valves? I Have a cogent Editorial coming up on that subject...))
MOS INTEGRATED CIRCUITS AND THEIR EQUIVALENTS, 2nd Ed., 1973. Mullard Ltd, U.K. ((Cf Philips Elcoma here)).
RADIO AND ELECTRONICS CONSTRUCTOR. This is a Magazine published periodically by Data Publications, 57 Maida Vale, London W9 1SN, England, & costs £2.70 or $US7.00 p.a. It seems nice value for money, at just about the right level for EEB tastes. For rather more rigorous treatment try the British Wireless World, also often good. For radio amateur matters, of course, Radio Communication by RSGB.
SOLID STATE SERVICING MANUAL (RCA)
SYLVANIA TECHNICAL ((valves)) MANUAL (Sylvania, USA) $US2.00
TRANSISTOR BASICS — A SHORT COURSE by G. C. Stanley Jnr (of Hewlett-Packard)(Hayden Book Co., N.Y.)
WESTINGHOUSE SCR DESIGNERS HANDBOOK, ed by L. R. Rice, (Westinghouse, USA). $US3.00, $A3.85 ((= $US5.75)).
50 PHOTOELECTRIC CIRCUITS AND SYSTEMS, by P. S. Smith (Iliffe Books, England)((Also available by Iliffe: Solid State (3 vols); IC's, Thyristors. Very good))

And in addition to all that, of course there are the usual basic books belonging in every experimenter's library:
Radio Handbook (Orr, USA)// & Basic Electronics & Fundamen-
Radio Amateur Handbook (ARRL) // tals of Solid State, by
Radio Communication Handbook (RSGB, U.K.)// E, Australia
Radiotron Designers Handbook, Langford-Smith (AWA, Aust.)
Amateur Radio Techniques, J. Pat Hawker (RSGB, UK)
RCA Transistor Manual; RCA Solid-state Power Ckts Manual
RCA and GE Solid-state Hobby Manuals
GE Transistor Manual (now available in new edition!)
Motorola and Westinghouse Power Transistor Manuals/Handbook
RCA Tube Manual ((Like their Transistor Manual this book has an excellent presentation of basic theory, and a good section of typical circuit applications, not to mention an up-to-date listing of detailed characteristics of the electronic devices named.))

WELL, in the Files I have a more comprehensive listing of useful electronics (and mathematics) books, but this will hold you for a while. Incidentally to those of you who detest (for some reason??) seeing lists of books like this, please don't whinge about it; there is a lot of people who do want to know what is going on. One doesn't have to be rich to take advantage of this knowledge. Ensure that your local Library puts in a copy of the lot, if indeed they don't have one already ((have you asked?)). Get your local radio club or local branch of the Wireless Institute or NZART to put in copies of at least the most interesting for their library. Cooperate with friends to buy the others....

A FEW THOUGHTS ON CONVERTERS ((using Valves)) ((from W.A. VHF Grp News Bullein 5/73))

Thinking of building a MOSFET Converter? Unless you are planning some moonbounce work, you may be disappointed with the results. What about your old valve converter? Can it be updated to serve until you get around to the MOSFETs? Let's see.

Perhaps it never worked very well. If you can see the lead on any screen or cathode bypass capacitor, it is too long and the gain and stability of the converter would be improved markedly if you bypassed it properly. And don't bypass the end of the socket pin. Solder right up near the socket. In a critical position (cathode of r.f. stage) two bypass capacitors in parallel may be needed. Two 100pF's can be much better than a single 0.001 µF at 144 MHz.

If something is supposed to be earthed, EARTH IT, solid. The pins of a 9-pin socket will reach the ring around the socket if forced with a screwdriver. Don't use the central spiggot for anything. Earth it, but don't bypass anything to it. Using this as a standoff insulater is just inviting instability.

If your layout is such that you have to use a connecting wire in the signal patt (i.e., near any tuned circuit) use shim brass, cut into 1/4 inch strips. One inch of tinned copper wire is ludicrous at 144 MHz and poor at 52 MHz unless it is intended to be part of a tuned circuit. Speaking of tuned circuits, if you are using more than 14 pF at 52 MHz then you need a bigger coil, if you want efficient operation. Just resonating a tuned circuit does not make it efficient. ((The L/C Ratio must be appropriate too))

Incidentally, do your tuned circuits actually go through resonance, or just approach it at one end of the capacitor's range? That extra few pF should make a difference if your tuned circuit is working OK. If you want to couple two tuned circuits together, couple the coils end to end, not side by side. All that flux comes out the end of the coil but only part of it goes along the side.

Do you have enough injection? To check, measure the mixer anode current. Application of injection should cause a reduction of about 10% in the anode current. All the above comments were just as true 15 years ago as they are now. They are things that make the difference between good converters and unstable, gainless wonders.

Overtone oscillators using VHF crystals will improve most birdie problems. If you have less rubbish you have less birdies obviously. But don't just use a "Robert Dollar" with 90% feedback. These rocks don't need to be thrashed into overtone. They like overtoning. If you thrash them they get hot and drift. So easy does it!

A bugbear of most converters is output coupling. Cathode followers used to be about the best compromise between a simple resistive load on the mixer (yuk!) and a tuned transformer with its narrow bandwidth. Now we have ferrite baluns. Wind 20 turns of the No. 26 SWG enamel wire on one of the figure-8 type TV baluns (winding in one hole and out the other) and then 2 turns of insulated hookup wire on top of the first winding.
Use the 20 turns as an anode load and take the output (50-75) from the secondary. It is broadbanded and presents a reasonable load to the mixer. Just one more thing: a 10 pF capacitor from anode to earth, just to stop the mixer taking off.

Valve types actually don't have much obvious effect as long as they are capable of operating at the frequency in use. Probably more important is the convenience of the pin layout for the circuit we are trying to use. In general, pentodes should not be used at 144 MHz as signal amplifiers although they make good frequency multipliers. If the r.f. stage has worthwhile gain, a pentode can be used as a mixer, if absolutely necessary

If your converter uses a free-running oscillator or octal valves, perhaps a decent burial would be in order.
Otherwise, why not drag out that old converter and see if it can be given a new lease of life?

-- VK6ZCX

A young chap rushed into a bar and asked the bartender: "How do you stop hiccups?" The bartender reached down quickly, and slapped him across the face with a wet rag. The guy was furious. "But you don't have the hiccups any more, do you?" asked the bartender. "I never did. My girl friend out in the car does!"
..... A truck full of cotton wool collided with a truck loaded with chooks and it took two hours for the cotton-picking chicken pluckers and the chicken-picking cotton pluckers to clean up the mess! -- (KØNL)

SOUTHERN SPOKE HAIR

((From ARNS Bulletin, May 1973; although this applies principally to the language spoken in Southern Middle North America, it is of interest here because of the sometimes uncanny similarity to that perfection of the English tongue known as 'Stryne !))

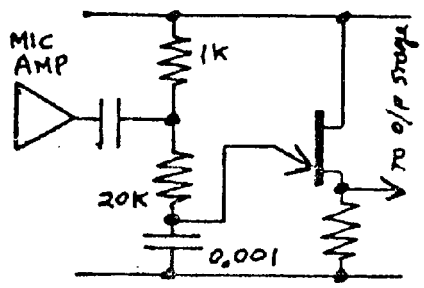
Watt: Primary colour, as in the flag; raid, watt and bloo.
Height: When you don't like someone.
Pry: What you do in a church. (TO B CONTINUED)

LETTER: Light-Beam Communication

I am afraid that you must tell your light beam communicating friends that they are on the wrong path. This is not the prelude to a longpaen of praise for integrated circuits, solid state lamps and the most expensive silicon photocells (although when I build a system I would probably use all 3). The system could be built with valves, neon tubes and vacuum photocells although vacuum photocells (or OCP71s for that matter) do not perform so well under strong ambient light.

The trick is to send a frequency-modulated ultrasonic (20-40 kHz) carrier and to use a tuned amplifier at the receiver so that 100 (or 120 Hz) Hz street lamps and d.c. sunlight, moonlight and car lights are ignored, and only the wanted signal is amplified.

The simplest transmitter consists of a microphone pre-amplifier, FM unijunction oscillator, and a power stage driving either a neon or a solid state lamp, e.g.:



Other possible FM oscillators are ordinary multivibrators with modulation on the timing resistors, or integrated circuits such as the Signetics NE555, or the Plessy SL650; the latter also makes a superb phase-locked receiver in the system.

The receiver shunts the photocell with a tuned circuit at the Tx frequency so that only the wanted frequency can pass any further into the amplifier; alternatively the Rx has the tuned circuit in series with the photocell if it is a current-generating one like a vacuum tube or biassed photodiode. The rest of the receiver consists merely of a suitable NBFM receiver on the correct frequency.

I used a phase-locked loop last time since I happened to be playing with them, but a pulse-counting detector, or a quadrature detector, or even a Foster-Seeley if it comes to that, could be used. Using the optics of a half a pair of 10X50 binoculars at each end of the system, a GaAs power infra-red emitting diode as the Tx and a silicon photociode in the photovoltaic mode in the receiver, I have had satisfactory communication over nearlya mile in daylight without using infra-red filters. At this range, though, the optical alignment is critical. I should be interested to hear if this provokes any new thoughts at your end.

--Jim Bryant, G4CLF, Plessy Semiconductors, Wiltshire, England.

****

Friend: "Did you get that Smith estate settled?" Lawyer: "Yes, but I had a terrific fight. The heirs almost got part of it...." (A/C 11/70)

We're waiting for an Auto-Call want ad offering either a 1959 rig or 1945 XYL. It would read, "One must go," and describe both rig and XYL as being "in mint condition." (A/C 11/70)

LETTER: Experimentation in Canada

I am increasingly concerned by the lack of experimenting in Canada. The present mentality is based on commercial equipment that VERY FEW Canadian amateurs can begin to repair. The amateur equipment that does come to my shop for repair is usually in sad shape. Of course, at that point no repair can be cheap!

To be fair, however, it must be recognised that amateur equipment is getting very much more complex. The "average Ham" (whatever that means?) is just lost with transistors and doubly lost with ICs. I cannot help but wonder increasingly where all this is leading.

Prices up here are just running away. So far we have not been hit with the Arabian oil problem. Fortunately for us we have lots of oil in Canada. Of course, it will be costing more to develop it....

-- Frank Merritt, VE7AFJ, Parksville B.C.

((If you want to see where it is all leading, read my article, "Means vs Ends in Amateur Radio" (and the Rest!) in the December 1973 issue of CQ Magazine. -- RLG)) & maybe Dec EEB

XXXXXXXXXXXXXXXXXXXXX

LETTER: Parts Availability Crisis in N.Z.

... EEB now has the added attraction of being a "pleasant surprise" when it actually does turn up.

Over here life goes rushing on... Am still in transformer winding, which threatens to grind to a halt at any moment, due to shortages of materials such as:- laminations, PVC sleeving, mylar sheeting, presspahn, pop rivets, solder, soldering irons, brass bar for terminals, polyester electrical tape -- you name it. It's sure to be out of stock today tomorrow, or next week!

"Interested Reader" wants to know whether Vol. 8 will be available as a Bound Vol, and if so, how do you propose to include item 5A?

Thank you, Chris Pitcher, for your nice comment on NZ mags. Hopefully you mean "Break-In"and Call Book, of which we are justly proud. I did rough out a comparative review of the WIA efforts, but it turned out so parochial and one-eyed that I abandoned it. Still, "Amateur Radio" has produced one high spot this year in presentation: Page 3 of the April 73 issue with the drawing of the Kangaroo holding an umbrella balancing the photo of the Birdie holding the Discone. To this Kiwi's sense of artistic humour this was GREAT!

-- "Old Peth", North Island...

((Well, Electronics and Communication seems to be shaping up into something interesting too, and until it went bankrupt, Spectrum spoke nobly for NZ experimentation. And B-I does still have a fair bit of The Spirit but also a dreary amount of the Same Old Thing, no?

Yes, 1972 Bound Vol is now being put together by Brenda, and the price has been adjusted a bit courtesy H.M. Post Office. Item 5a will be easy; I cunningly printed every-other side upside down. Order a Vol, and you'll see --Ed.))

LETTER: Inflation, etc

My opinion on the dilemma facing EEB is: Up the Price, lad; you can't slay the monster, so marry it! A $1.5 EEB is exceptional value, at $2.00 it will still be extremely good value, at $3 it will still be indispensable. I'm talking about its present size, range of subjects etc. Reducing the size will only reduce the number of topics able to be discussed. This will inevitably result in a vast withdrawal of subscribers. Of course upping the price will probably lose a few too, but these will be the skinflints who object to paying a realistic price for an outstanding publication.

I'm afraid it is too late to do very much about fighting or even resisting Inflation, either on a personal or on a national scale. Over here, increasing wages are upping prices which in turn are... etc etc. We no longer have any effective control over wages or prices here. The Arbitration Court used to control the situation, but since its "Nil" General Wage Order of a couple years back, the Unions have ignored it, and wage negotiations go like this:

1) Union makes exorbitant wage demand.
2) Empoyer refuses.
3) Union goes on strike.
4) Stalemate until Minister of Labour gets off his.... (usually several weeks) and appoints Arbitrator.
5) Arbitrator awards increase close to original Union demand.
6) Minister of Finance (or other) moans furiously about "irresponsible wage increases by employers" and introduces Payroll Tax as a punishment.

As you can see, our worthy Government either can't or won't control rising prices and/or wages. The trouble is, where would they start? With prices or with wages? Say they freeze or reduce prices; the retailer, the wholesaler, the manufacturer will still have increasing costs. If wages are pegged, there would be a period in which prices would continue to rise, first rapidly then tapering off, but they would still rise. Either way, some section of the community is going to get hurt.

I believe that prices should be attacked first. Say, a blanket cut of 10% at all levels. Government would have to introduce a massive "loss of profits" insurance scheme or something. After a period of say, six months, when the workers find themselves with excess (sic) cash on their hands, wages could be reduced. This process could conceivably be continued several times until, say the price/wage level of 1950 would be reached. From there on we could start again, but control things a little better.

Of course, the above would never work, human nature being what it is....

As regards your comment about missing mail, sometimes smaller articles either stick to or find their way inside larger unsealed articles. Then, I suppose, a certain amount of mail gets dropped on the floor or on the ground or something, and the postal worker is too lazy to bend down and pick it up immediately, and so it blows away or is swept into a corner or something. Then it could be wrongly delivered, and not sent on; this has happened to me. Then, it is rumoured, your Post Office has a great confetti-making machine in Sydney (and probably elsewhere by now), which is programmed to reduce the volume of mail by 10%!

Do you happen to have any information, circuitry, applications data etc, on an odd bottle called the STV280 in various forms with suffixes such as /80. It is an Olde English voltage regulator tube which offers not one, but four voltages, viz, 70, 140, 210, & 280.

I enclose a published comment on the "Hertz vs Cycles" controversy by someone who obviously thinks he has a position in the scientific world. ((It comes from "NZ Listener" of 14/9/70, from Dr. T. J. Seed, Reader in Physics, Canterbury University. It says in part: "... however misbegotten, the Hertz is the unit for the dimension of reciprocal time, and if used at all should logically be preceded by the physical behaviour occuring per second, e.g. Cycle Hertz for sinusoidal phenomena, Radian Hertz for angular frequency, etc.... (the Hertz) is simply one more non-intuitive quantity, the meaning of which must be learned..." -- Ed.))

-- "Old Peth", New Zealand

((Ed. comment: My, doesn't the situation in NZ sound similar to ours! A good case for federation? I have written further pages and pages on the matter of Inflation, which is good for the Soul I suppose, since I could hardly devote all that space to it in EEB. It is all very depressing, and I feel wretched to have to contribute to the Inflation, however necessarily. But there will obviously have to be a Limit to it all, one day, and when that comes you'd best have a good job and no debts. It is, by all reports, already starting in the U.S.A., and in the usual manner will percolate down to Australasia in due course.

Peth includes considerable detail on a nice CD Ignition, which for various reasons cannot be published; most frustrating. But there are ample designs already available in the Literature, as described last month.

Rod says that the VR valve STV280 is likely four VR valves in one envelope, connected in series, and that you use it as you would any such configuration: apply HT, and draw off current from the branches, avoiding drain which cuts off the branches above it.

On Hz vs cps I have nothing much to say; our J.E. Andersen last month put the case squarely though uncomfortably. I might only observe that quite strictly one would have to say "Hertz-seconds" instead of "Cycles", and that the term "frequency" is also inappropriate. We have an amereage of one ampere, say, even though an amp is a coulomb per second; we don't say a frequency of one ampere. So one would say that one has a hertzage of so many Hertz. On the other hand, in all fairness, we do specify a capacitance in farads, not coulombs per volt; & resistance in ohms, not volts per ampere -- or volt-coulombs per second! I mean, volt-seconds per coulomb. Considering the fact that the gross irresponsibility of technologists in general is going to create a radioactive paradise on earth some day, it doesn't really matter, does it...))

xxxxxxxxxxxxxxxxxxxx

"... there would be such severe damage to this country that our way of life would change.. We would win in the sense that their way of life would change more than ours...."

-- Secretary Mc Namara, Washington, D.C.

CODE AS NERVE MEDICINE

-- C. C. Drumeller, W5JJ

((From Collector/Emitter, Nov 1970))

Do you ever get "the jitters"? Especially if you're trying to get to sleep? Try a shot of International Morse Code as a palliative -- maybe even a cure! It may be a total failure if you're an accomplished radiotelegraph operator. But if you're one of the group which finds copying the code an undertaking requiring total attention, then you've got it made!

Most "jitters" are due to tension, an inability to relax fully. And that inability to relax usually may be traced to some conscious or unconscious concern that's bugging you. Get that concern out of your mind and the tension melts away.

Here's my recipe for overcoming "jitters" and wooing sleep: Put on headphones and copy a slow-sending CW station. Pick one that's in the clear, no interference, no atmospherics, no strays. If you can get a long-winded rag-chewer, so much the better. Its best that the sender's speed be slow enough that you can copy him with ease; if its slow enough to be a bit boring to copy, so much the better. It helps to have the signal just a wee bit weak, just enough to make you "squint your ears" a tiny bit to copy solid.

You may be content to listen only or you may want to get into a two-way contact. If you react the way I do, it won't be long before you get too sleepy to bat the brass.

Then's the time to sign off and roll it into thesack for a relaxed snooze. Try it. It may work for you!

XXXXXXXXXXXXXXXXXXXXXXXXX

((Me, I've tried everything, like that and like drugs and boring books and the rest. The only thing that worked at all well was Yoga. Doesn't require as much equipment, either. -- RLG))

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LETTER: New Computer Boards; Xtal Oscilators.

Computer Boards now available here are better and cheaper than some before. With most transistors marked with their 2N--- numbers, and with plenty of 1N914 (etc) diodes, also marked. And lotsa boards with ICs, the going price for the IC boards being 10c per IC, and the transistors, diodes, etc being a "bonus". This is from local surplus outlets.

I also acquired several GE PA-238 ICs in a trade with a local amateur. I believe they're OP-amps, but when I sent to G.E. for a data/applications sheet, guess what they sent me? A photocopy of an item in the "Wall Street Journal" which said that G.E. was retiring from the Integrated Circuit Business.

Keep up your Editorials. They are an important feature of EEB. Another feature of great value to me is the extensive bibiliography you append to many articles. I read all issues from front to back and then reread them again!

I've built and tried out many crystal oscillators, both tube and transistor, for testing the surplus FT241 crystals. Most circuits tried were not so good. But that G3OGK oscillator in Amateur Radio Techniques (3rd Ed., p. 197) is a gem. If the crystal is between 300kc and 3Mc (nertz to Hertz!) it will oscillate in this circuit if it is a good or fair crystal. The circuit worked with any of a dozen computer board transistors I tried. But since it worked best (most output) with a 2N2369A, I used that one.

To indicate comparative output I connected to the output of the oscillator a shunt 8K resistor, series germanium diode, and a 50c 100μA meter (from a defunct exposure meter) which was shunted with protective silicon diodes.

The beauty of G3OGK's circuit is: NO coils, chokes, or tuned circuits. I've never found an FT241 crystal that failed to oscillate in this circuit, which could be made to oscillate in any other circuit.

-- Jack D. Clement, W6NTR, 6612 Andasol Ave, Van Nuys, California 91406, U. S. A.

((We hear that G.E. has retired from several other fields of endeavour too. We provide W6NTR's address for those folk who may wish to write him about the source of availability of the newer Computer Boards. From what I have seen of the U.S. adverts, the nicer boards do cost more than the old-faithful types we have been obtaining for some years from Brooks Radio, and which we are still selling at a modest mark-up, for 10c per transistor, postpaid. The way I look at it, if you want a simple and reliable transistor for an audio or other noncritical application, the 033/083 types serve admirably. And if you want fancier items in silicon the prices of same are now so reasonable (relatively) that it doesn't pay to muck about with surplus. No? -- Ed.))

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Making Sandsoap

Tired of nice-smelling soap which does Nothing? Cut up one bar of soap, put into saucepan with one quart of water, and stir over the fire until dissolved (the soap, not the pan). Then stir in one quart of clean fine sand, and one quart of white wood ashes. Remove from the fire and stir occasionally until it begins to set. Cut into bars while soft, and allow to harden for a week. Works fine for removing grease, tar, and giving children's cheeks the fine rosy glow like they used to have in the olden times.

The Frog

When he sit he stand almost
When he hop he shy almost
He ain't got no sense hardly
He ain't got no tail hardly either
When he sit he sit on what he ain't got,
  hardly.

-- (Author??) (Relayed by Kathy Shoobridge)

LETTER: A Jewel beyond price?

I sincerely hope the grizzlers are few. Have they never had a labour of love? It's a stupid conditioned-in attitude that EEB is something to be bought.

EEB comes across as people, with the Added Extra Bonus of a little (sorry, lots of) information. For heaven's sake, don't fold, even if EEB goes half-yearly and doubles in price (along with postal charges and land values in post-Casino Sandy Bay.....).

Anyhow, thanku x 10^6 ... and please keep up the Good Oil.

-- Bruce Bonamy, Balmain, NSW.

((No, we don't intend to fold, but it would certainly be nice if Chris Pitcher could take over in a few years. Trouble is he would have to increase his Typing Speed a bit... -- RLG)) FLASH NEWS!: Chris is learning how to type! Heh heh....

++++++++++++++++++++

HANNA HINTS -- The Problem of Fading.

-- by Ralph Hanna, W8QUR ((ARNS Bull 6/72))

The problem of fading is one that has always been with us. There are several causes of fading, as well as several types..

One of the most familiar types is the one present when changing from daylight to dark and is caused by the height of the sun which in turn changes the height of the Heaviside layers. This type is expected and is the transmission that enables us to work greater distances at night on the low-frequency bands.

The fading that gives grief at all times is the type that is caused by the same signal arriving by one (or two) separate paths. Under these conditions it is possble for one signal to be out of phase with the other and thus cancel one another. Examples of this would be a one-hop signal and a ground wave, or a two-hop signal and a three-hop one. These can occur anywhere from several fades a second to once every few minutes. Of course, when the signal arrives in phase, the apparent signal is much stronger than would normally be expected from the particular output of the transmitter.

Since SSB has come to us, we hear that it is not affected by selective fading. The latter is a phenomenon that will cause the carrier and possibly one sideband to fade while not affecting the other. Sometimes only the carrier fades and at other times only the sideband fades. ((On AM)) this results in a type of monkey-chatter that cannot be copied.

Sudden fadeouts occur for some unknown reasons and can last from a few seconds to several hours. Usually only the lower frequencies are affected, and when one does happen you think your receiver has gone dead because the atmospheric noise also fades out -- since most of it originates at distant points and arrives via the skip path. The only signals that can be heard during the true fadeout are those that arrive over a ground path or are above about 25MHz.

These sudden fades are always associated with sun erruptions and affect only the portion of the earth that is in daylight.

Several methods have been devised to improve reception when fading is present. One method is the use of two antennas spaced a wavelength apart. Still better is the dual diversity receiver that is really two receivers and two antennas. In this case the loudest signal is the one heard in the speaker.

It has been said that single sideband is not affected by selective fading. This is true only to the extent that the signal is not all chopped up, as there is only one part to go out and not three as with conventional amplitude modulation. Selective fading can take out all of an SSB signal just the same as it could a CW signal.

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THE AMATEUR RADIO NEWS SERVICE

This is an organisation highly recommended for all editors of publications of any kind at all, from simple spirit-process to elaborate offset productions.

The ARNS has the prime purpose of aiding and assisting magazine and newspaper editors in anymanner possible, to improve their publications. Additionally the ARNS provides a common central point for cooperation of public relations individuals concerned with amateur radio.

Each month the Amateur Radio News Service issues a Bulletin. Although this is an American magazine it often contains much information of value to eidtors in other parts of the world, as can be deduced from the free use we have made of their interesting material reproduced in EEB (as above).

Articles range from a wide variety of hints and techniques covering every possible aspect of printing and duplicating, to humour and public-relations information. We at EEB have benefited enormously from the material covering printing methods, and indeed we were probably influenced by ARNS to try our Offset format.

Other regular features include the numerous "Heard on the Party Line" by WØCCT, "Hanna Hints" (as above), and SWOOP, by Elise White of Denver, who seems to have a terrible time with her husband Joe! Additionally quotes from various radio club bulletins are included, and these are often of much general interest.

A sample copy will be provided on request, from the Editor:

R. V. Anderson, KØNL
528 Montana Ave.,
Holton, Kansas 66436

And oh yes, the Contests! See Editorial in January here.

LETTER: The mysteries of Exalted Carrier

Everything started in my interest many years ago after I had read an interesting article by Murray G. Crosby about reception with the so-called "exalted carrier". I also consulted a copy of his original U.S. Patent describing a working model. An important point (also suggested by D. E. Norgaard) was the special rejection of interference by the phasing method and the use of audio phasing networks.

((Editor's Note: If you are not familiar with Exalted Carrier Reception, I suggest that you consult the summaries of it contained in Amateur Radio Techniques (RSGB) by Pat Hawker. Quite tantalising.))

Supportive work included that of D. G. Tucker, John P. Costas, again D. E. Norgaard and many others. Years ago I nearly dropped the whole idea, but I picked up a very old magazine containing something about the old Synchrodyne of Tucker -- with a rich mass of related correspondence.

About four years ago Wireless World published the research work of Dr. Macario who followed closely the idea suggested by a Felix G. Apthorpe in the abovementioned correspondence (Electronic Engineering, July 1947). Considering the storm of correspondence resulting from Dr. Macario's work his results weren't terribly conclusive, but demonstrated mainly the truth of Mr. Apthorpe's ideas. It is illuminating to quote from the latter:

> "... It is first necessary to derive a wave from the received signal... so that it can be used to provide a steady phase synchronising signal. This is readily provided by full-wave rectifying or producing a harmonic of the received signal, which can then be filtered, limited, and applied to the local oscillator -- since it is possible to use a harmonic to lock the local oscillator to the fundamental. Since each pair of sidebands in the received signal will, when rectified, produce the second harmonic of the carrier a substantial second harmonic component should be present even if the carrier is absent, as in suppressed carrier transmission or when selective fading eliminates the carrier from a normal transmission."

Considering carefully those principles it becomes obvious that the carrier can be regenerated locally inside the receiver without any use of local oscillators, simply by the abovementioned process of full-wave rectification, filtering, limiting, and finally dividing by two to obtain the required carrier again.

The whole subject is of particular interest in these days when the "Reciprocating Detector" is attracting so much interest. You must surely notice some similarity between it and an Exalted Carrier system.

It is my opinion that Dr. Macario partly failed in his purpose because he kept the idea whole and insisted on synchronising a local oscillator against the incoming signal; in conditions of poor reception his oscillator kept walking about -- not synchronised.

In consequence I'm sticking to my own idea, and buying quartz crystals custom made at 910kHz, the second harmonic of the conventional i.f. of 455kHz, and hot carrier diodes to try along that line. One IC of the logic family will provide nicely the required binary frequency division by two, and -- well, wait and see what will happen

For other experiments on exalted carrier reception but along different lines, I am ordering from PYE a few Signetics PLL Linear ICs type NE561B...

-- Eugenio Muratore, C/- BHP -- GEMCO, Alyangula (Groote Eylandt), N.T.

((We have furnished Mr. Muratore's address in event readers may wish to correspond with this avid and enthusiastic experimenter. Do let us know what happens. -- RLG))

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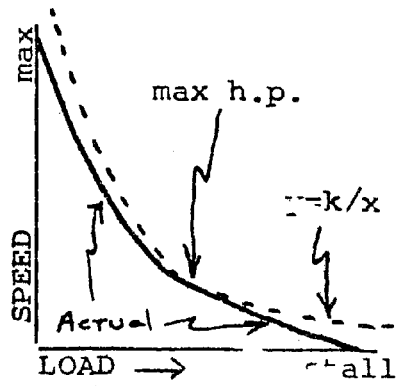
LETTER: Series d.c. Motor Operation

Concerning the Puzzle about the Series d.c. Motor on p. 68 (June 1972): If you examine the speed/load curves of a series motor, it is similar to the graph of y = k/x. If it were identical to y = k/x it would be a constant horsepower motor (rather like 100% efficiency).



The actual speed/load curve of the motor is "flatter" (less curvature) and cuts the axes at stalling and at max (no load) speek. The part of this curve which fits closest to y = k/x is therefore the most efficient, and gearing should be chosen to use this speed. This is the maximum horsepower available from the unit, and depends on the design of the motor. I think that this explanation is more satisfying than r.p.m. figures since the latter do not apply equally to all designs.

-- A. R. Tuck, VK5BT, Mitchell Pk, S.A.

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LETTER: More Parts Availability Crisis

The components supply situation is now becoming critical to all small users in industry despite increasing component supplier advertising. We have considerable difficulty in maintaining a constant supply incoming up here in central Queensland.

-- Brian James, Mt. Morgan, Qld.

DIGITAL INSTRUMENTS -- Part IV

-- by N. D. Lorimer (VK7)

Last month we examined a method for approximate determination of t_r and t_f, and risetime and falltime of the switched collector current. These were obtained as a function of the current gain (in common-emitter configuration) and a frequency at which that gain began to drop significantly. Applying this to the whole system of an oscilloscope* we saw that if in general, bandwidth x risetime = 0.35, a 50 MHz bandwidth results in a risetime of 7 nanoseconds.

Similarly, a pulse with 1 ns risetime can only be observed properly on an oscilloscope with $0.35/10^{-9}$ = 350 MHz bandwidth. The relationship, $0.35/f_{h_{fe}}$ mentioned previously assumes pure exponential form, but this is not necessarily the case.

When base current flows, collector current increases exponentially (with time-constant $1/2\pi f_{h_{fe}}$) towards its limiting value of $h_{FE(sat)}I_b$. The maximum current which can flow is, however, V_{cc}/R_c, and if this is less than $h_{FE(sat)}I_b$, the collector current will rise exponentially to this level and then be limited. This base current "overdrive" reduces t_r, as the initial rate of rise is unaffected; the transistor is unaware of the current limit until I_c reaches V_{cc}/R_c. So, if

$$R_b < h_{FE(sat)}R_c, \quad t_r < 0.35/f_{h_{fe}}.$$

For example, if $R_b = h_{FE(sat)}R_c/2$, I_c rises exponentially towards

$$h_{FE(sat)}I_b \simeq h_{FE(sat)}(V_{cc}/R_b) = \frac{h_{FE(sat)}V_{cc}}{(1/2)h_{FE(sat)}R_c} = 2V_{cc}/R_c$$

and limits at V_{cc}/R_c.

Its 10% level is now 10% of V_{cc}/R_c = 5% of $2V_{cc}/R_c$. So, using the exponential 10-90 approach mentioned above, it is seen that

$$0.05 = 1 - e^{-t_1/T}$$

$$0.45 = 1 - e^{-t_2/T}$$

so $$t_2 - t_1 = T \log_e \frac{0.95}{0.55} << T \log_e 9,$$

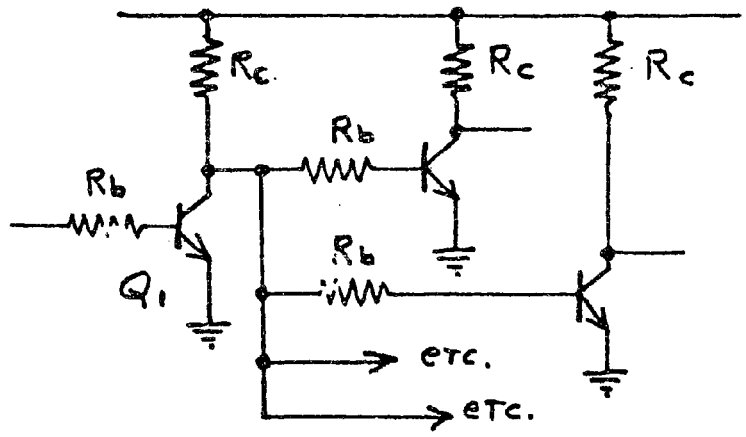
the reduction being from 2.2T to 0.55T, a 75% reduction. Overdriving may also cause an increase in t_s due to the greater charge storage which results.

A similar effect is obtained by connecting a capacitor in parallel with R_b in fig. 3.2(a) (see last month's article). As the voltage across a capacitor is a function of stored charge, which in turn is the time-integral of current, a voltage change across a capacitor requires time to occur. As the input voltage changes instantaneously, the voltage on the capacitor cannot "follow", so the entire input voltage is applied instantly between base and emitter, causing a large transient I_b until the capacitor charge takes up the correct steady-state value. Base current is then fixed by R_b, which can be "normal" in value to hold the transistor just in saturation during its "on" period. t_r is thus reduced without increasing t_s.

When the input reverts to 0, the charge stored on the capacitor results in the base being driven negative, with a reverse action to the t_r reduction, so this "speed-up" capacitor also reduces t_{off}. The capacitor value is critical, and can be derived from charge parameters, its value being of the same order as the internal capacitance of the transistor.

3.4 Interconnection Problems

The output of a transistor switching circuit will typically drive one or more further switching elements, each of which will draw base current. The diagram below illustrates the problem:-



(As is typical in practice, identical circuits have been assumed) When transistor 1 is on, its output is at 0, so subsequent transistors draw no current. When transistor 1 is off, its output tends to 1 but, although its collector current is zero, current still flows in R_c to provide base current for subsequent transistors. If there are n base resistors "in parallel" fed from the output, the total parallel resistance of them is R_b/n. The total series resistance from the supply rail to the bases of the "on" transistors is thus $R_c + R_b/n$, and the current flowing via R_c is $V_{cc}/(R_c + R_b/n)$. As this current is divided equally between the n bases, the base current of each transistor is $V_{cc}/(nR_c + R_b)$

The minimum value of Ib is $V_{cc}/(h_{FE(sat)}R_c$. So, for saturation,

$$\frac{V_{cc}}{nR_c + R_b} > \frac{V_{cc}}{h_{FE(sat)}R_c}$$

$$\text{or } nR_c + R_b < h_{FE(sat)}R_c$$

$$\text{so } n + R_b/R_c < h_{FE(sat)}$$

Hence, the value of n, the "fan-out" of the switch is limited to $h_{FE(sat)} - R_b/R_c$, (Inte-

*In case you were wondering what happened to the footnote of the previous page, here it is. I overlooked it, because this is jolly hard copy to type. In my summary I did not dare to use our favourite "CRO" to describe oscilloscope, because Norman is adamant that a "CRO" is a large black bird, and is generally not to be found in electronics laboratories! --RLG

ger values).

Clearly R_b must be < $h_{FE}R_c$ if any further inputs are to be driven. For maximum fan-out $R_b = R_c$, and fan-Out = $h_{FE(sat)} - 1$.

In the case of "building brick" logic systems, the manufacturers specify the fan-out of each unit.

A further "loading" problem arises due to the input capacitance of the driven transistors, and also to wiring capacitances. Like the device capacitances considered in section 3.3, these must be charged before a transition can be completed, and rise and fall times are consequently increased. Care must be taken in system layout to minimise wiring capacitance.

4. REALISATION OF LOGIC GATES

4.1 Introduction

A gate, in this context, is a circuit which allows or prevents the flow of signal information in accordance with one or more applied command signals. Most gates are "active", incorporating transistors, although "passive" gates, formed solely from diodes and resistors, are occasionally used. A wide range of integrated-circuit gates is now available, and the various types, togethher with discrete-component circuitry, are considered below.

Factors affecting choice of gates include:-

(a) Compatibility: Reliability is improved if all parts of a system utilise the same supply voltage levels (and power supply cost is reduced); if signal levels differ in different parts of a system, interfaces are necessary, adding to cost and complexity.

(b) Speed: Signal transmission through a gate involves a delay, the length of this delay depending on the type of circuitry. In a sequential logic system, this propagation delay can impose a limit on maximum speed of operation. As high-speed (short-delay) operation is usually associated with high-cost devices, cost-optimisation may require that compatibility be down-rated in importance, with high-speed and low-speed gates used where appropriate with interfacing where necessary.

(c) Capacity: The fan-in (number of inputs a gate will accept) and fan-out (number of inputs of a similar type of gate which the output of a gate will drive without malfunctioning) of the gates chosen either must be adequate for the intended system or will impose requirements such as paralleling of gates (to provide fan-in) or provision of driver stages (fan-out). "Wired - OR" operation, in which the outputs of gates are directly connected to provide the OR function, reduces fan- out.

(d) Uniformity: To reduce the number of types if IC used, four-input gates may be used as three-input gates, e.g. This can simplify maintenance and faultfinding.

The usual considerations of cost and reliability naturally apply. Order of importance depends on circumstances, e.g. speed is a relative concept -- the cheapest (and slowest) IC gates can be used in the majority of systems.

4.2 Logic Conventions

Most modern systems utilise a "positive logic" convention, i.e., the more positive signal level represents logic "1". With (typically) a supply rail positive to earth, this means zero volts represents logic "0" If supply rail were negative to earth, zero volts would be "1", with a negative voltage representing "0".

"Negative logic" is occasionally encountered, in which the more negative signal level is "1".

Hybrid systems are occasionally encountered in which a combination of positive and negative logic is employed to provide (surprisingly!) simplification of the system (e.g., A positive-logic NAND gate is a negative-logic OR gate).

In general, positive logic referred to a positive supply rail will be encountered in the following pages.

4.3 Ndse Immunity

In all practical situations there exist the possibilities of supply voltage fluctuations and of impulsive "noise" entering the system. The ability of a gate to ignore such random influences is termed "noise immunity", and two conditions are of interest:

4.3.1 D.c. Noise Immunity

The specified logical "1" and "0" levels of a given system may be two arbitrarily-chosen voltage (or current) levels. These levels will vary slightly throughout the system due to differences in elements, attenuation, etc., and it is possible that these variations may be cumulative. The d.c. noise immunity of a gate is specified as the difference, under full-load conditions, between the maximum value of the lower logic level and the minimum value of the upper logic level. This value represents the change in d.c. level which can cause a misinterpretation of the state of a gate, and thus indicates acceptable fluctuation of supply levels, attenuation, etc.

4.3.2 A.c. Noise Immunity

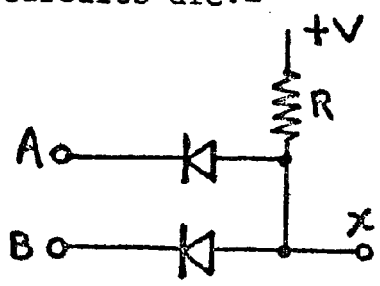
Impulsive interference, caused typically by sparking or arcing of contacts in heavy-current circuits, is particularly prevalent in industrial environments, and may be mains-borne or/and radiated. Reduction by

electrostatic screening and supply filtering is not always effective, so a measure of the effect of impulsive noise on a logic circuit is necessary, in order to assess the likelihood of a change of state of a gate when one or more of its inputs is subjected to such interference.

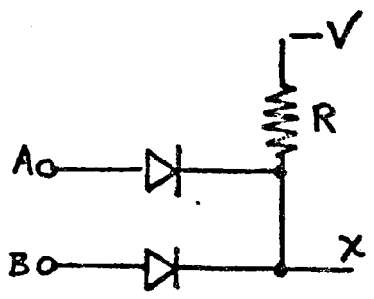
As the likelihood of an output change due to impulsive noise depends upon the amplitude and the length of the impulse, and also upon the impedance feeding the gate, a.c. noise immunity is usually quoted as an energy (in joules).

4.4 Diode Logic

Diode logic (DL) gates, being passive, can only provide AND and OR functions, and are limited in application because of their limited fan-out, although fan-in is no problem, and diode gates provide a cheap solution to insufficient fan-in of IC gates. Propagation delay can be small (depending only on the diode used), but noise immunity, particularly d.c. is poor with large fan-in. Basic two-input circuits are:-



AND



OR

In the AND case, if A or B is at 0 volts (logic "0") the associated diode conducts, so X will be low. If A and B are at +V, the diodes are non-conducting, so X goes high.

Note that if A and B are ideal (0 volts), X will be > 0 volts due to the diode forward voltage drop.

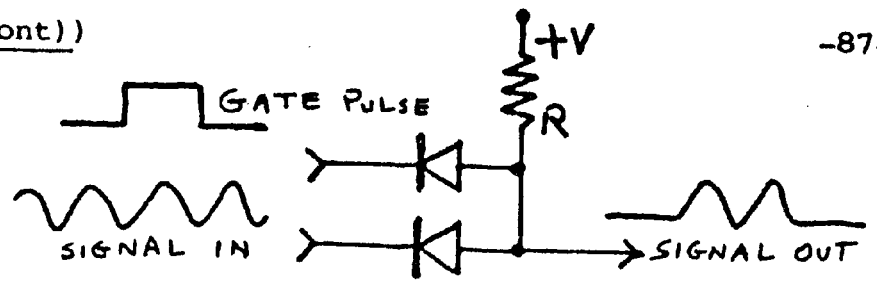
In the OR case, if one input is positive, the associated diode will conduct and X will rise to a voltage slightly less (due to the diode drop) than the input level, whilst the other diode will cut off. With both inputs "0", both diodes conduct so output is 0.

Both AND and OR draw current from the driving source, and resistors R must be large compared to the source impedance to minimise this loading. This clearly raises difficulties with cascaded diode gates, as does the volt-drop across the diodes (cumulative in cascaded systems).

A diode AND is sometimes used when pulses of varying amplitudes must be handled. As the output of the gate cannot go more positive than +V, large pulses can be limited by feeding them via a DL AND gate in which the reverse breakdown voltage of the diodes is larger than the largest pulse likely to be handled. This can safeguard comparatively delicate IC gates.

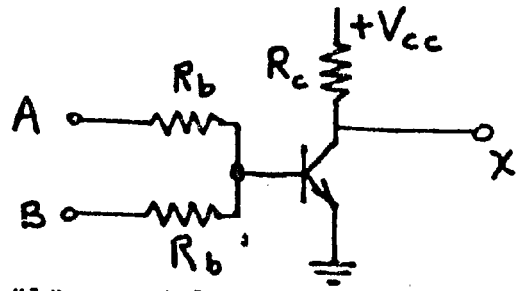
Diode AND gates are also used as "linear" gates to provide gating of waveforms other than pulses in communication systems. This is illustrated by the following example:

(See top of next column)



4.5 Resistor-Transistor Logic (RTL)

Also known as DCTL (Direct-coupled transistor logic) RTL gates, formed simply from discrete components, provide the NOR function only when positive logic is used; the NAND function is possible by using negative logic. As a single-input NOR is a NOT gate, a combination of such gates can provide any logic function. A two-input NOR circuit is:



A "1" on either input (or both) will drive the transistor into saturation, resulting in the output going to "0".

The minimum acceptable "1" level will be

$$V_{be(sat)} + I_{b(sat)}R_b$$

in order to ensure that the transistor saturates. The maximum acceptable "0" level will depend on R_b and h_{FE}; ideally the "0" level should be less than the cut-on voltage of the transistor (typically 0.5 V for Silicon, but only 0.1 V for Germanium, hence the preference for silicon switching transistors), but higher "0" levels can be tolerated (espectially with low-gain devices) provided that the base current resulting is so small that the output "1" is unambiguous. This mode of operation reduces d.c. noise immunity, which is the difference between the maximum value of collector saturation voltage and the minimum voltage required to give saturation in the worst case, i.e. in the case of the highest-gain transistor (c.f. Section 4.3.1).

((Next month we continue with Loading and other considerations of RTL, followed by DTL and TTL, ECL, etcetera.))

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II.5: Firmness of delivery dates is inversely proportional to the tightness of the schedule.

II.6: Dimensions will always be expressed in the least usable term. Velocity, for example, will be expressed in furlongs per fortnight.

II.7: An important Instruction Manual or Operating Manual will have been discarded by the Receiving Department.

II.8: Suggestions made by the Value Analysis Group will increase costs and reduce capabilities

TRANSPORTATION DIFFICULTIES
(From Bulletin of the ARNS, QSP Nortopics of the Nortown ARC, Toronto, Ontario, Canada.)

The Connecticut Bus Company received the following letter from a disgruntled rider who lives in Hartford, Connecticut:

"Gentlemen: I have been riding your buses for the past two years and the service seems to be getting worse every day. I think the transportation you offer is worse than that enjoyed by the people of 1000 years ago. Sincerely, Johnathan Doe."

The Connecticut Bus Company replied as follows:

"Dear Sir: We have received your letter and believe that you are somewhat confused about your history. The only transportation 1000 years ago was by foot."

To which Mr. John Doe replied:

"Gentlemen: I am in receipt of your letter and I think that you are the ones who are confused about your history. If you will read the Bible, in the Book of David, the ninth verse, you will find that Aaron rode into town on his ass. That, gentlemen, is something that I have not been able to do in your buses for the past eight or nine months."

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this ELECTRONICS EXPERIMENTERS BULLETIN IS PRINTED WITH LOVE, AS TIME ALLOWS. PROSPECTIVE AUTHORS SHOULD SEND FOR OUR "MANUSCRIPT POLICY" SHEET. ARTICLES EARN FREE SUBSCRIPTION CREDIT (only). IF YOU HAVE A TECHNICAL FACT OR OPINION OR RECIPE, HERE IS YOUR OPPORTUNITY TO SHARE IT WITH OTHERS.

EDITOR: R. Leo Gunther (VK7RG). ASST. ED.: Chris. Pitcher (VK3). ASSOCIATE EDITORS: Dick Ferris (VK7ZDF), Rod Reynolds (VK3ZAR), Les Yelland (VK3), and Rich. Maddever (VK3). SUBS MANAGER: Bob Walton. DRAUGHTSMEN: RLG and Ron Parker. SECRETARIES: Brenda Ford and Alice Gunther. A most impressive list, but Leo and Brenda still have to do most of the work!

AUSTRALIA: $1.55/yr, $4.20/3-yrs to R. A. Walton, 396 Rokeby Road, Howrah, Tas. 7018; P.O.'s preferred.
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ELSEWHERE: £1.50/yr to Jim Coote (G3UGD), 56 Dinsdale Ave., Kings Estate, Wallsend, Northumberland NE28 9JD, England, U.K.

BOUND VOLUMES: (1971, 1972, 1973 when ready): $A2.75; $NZ3.50; $US5.25; £2.25 from National Representatives, as above, posted from Tasmania. These exorbitant figures include inflated post as well as inflated sum for Registration, needed for reliability to Overseas, alas.
BACK ISSUES: Available only for 1973, 30c ea (50c US).

RENEWALS: PLEASE INCLUDE YOUR ADDRESS LABEL!!!!!!!!!!!! and do not renew until you receive a renewal notice.

COMMERCIAL ADVERTS.: $A10/pg, $A6/half. Circ. ca 1000.
PRINTING: Advance Publicity Co., Hobart 341-817. Yes.

THE OPINIONS published in this magazine are not necessarily those of contributors or the editor or anyone.

SWOOP -- by Elise White (YF/KØCNV)
((From Am. Radio News Serv. Bull, May 1972))

Antennas are the most fascinating things, according to Joe, since sliced bread. This disease seems fairly prevalent among amateurs

I've listened to theories for the past ten years and some of the screwball ideas that have been propounded leave me breathless

For instance:

You need 122 radials of assorted lengths to assure a perfect ground and you can talk to the world.

Epsom salts work much better than regular salt to ground an antenna.

You can climb a tower and raise an antenna on the darkest night, but Dod, oh Dod, how do you get off the tower?

The group that ripped out the complete repeater station, overhauled it and then all of a sudden found that someone had cut the co-ax lead!

Or the man who swore he couldn't hear the east coast on a long wire because it was the wrong end. The man in Kansas who hooked onto an unused telephone line 5-miles long. Or the man in Texas who had a 4-mile square rhombic. Or the kid with one rabbit ear that worked the world.

Each and every one has his pet and will defend it until the death. But let the guy across the street try it and it won't work.

Of course, you understand that if it's higher or lower or wetter or dryer, it works beautifully. Most amateurs are convinced that their particular baby is the best and the arguments rage hot and heavy.

Yes, antennas are wonderful.

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ELECTRONIC GUIDE TO WOMEN
by Charley Vorderberg, WØCCT
((From Auto-Call, Nov. 1970))

If she talks all night -- Interrupter.
If she isn't the right kind of girl -- Transformer.
If she jumps into your arms -- Receiver.
If she jumps right back out again -- Controller.
If she gets steamed up -- Condenser.
If she wants to eat -- Feeder.
If she seems a little off-key == Tuner.
If she turns the wrong way -- Rectifier.
If she starts to gain weight -- Reducer.
If she wants her way too often -- Regulator.
If she wants to get married -- Resistor.
If she's heading down that Primrose Path -- Conductor!

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Or peering into coffee cup: "There are enough grounds here for a divorce." ((WØCCT))

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"Published Periodically"

Dear Friends,

For some nine years now the EEB has been churning out, but with ever-increasing sporadicity. It started when we got behind after some legal trouble a while ago, and I never have really got back properly.

As most of you realise, we have been unable to publish at all in 1974, and I am typing this in August 1974. I wish to make sincere apology to all old and new subscribers, and tender as explanation only the increasing weariness with such a sustained heavy burden, together with numerous personal and professional pressures.

I have often received comments that EEB should continue, and I am inclined to agree; too many other good publications have fallen in recent years. But the sane thing to do in this instance will evidently be to declare a one-year moratorium on all subscriptions. This comes an an opportune time as we change to the Elliott Addressing System -- hopefully our last addressing-system change!

The Solution

I propose this: I shall now get stuck into the December 1973 issue (and I'll make it juicy). And then the next issue, Vol. 10, will be January 1975. So, everyone's subs will be advanced by one year. Simple, no?

No, it has deprived you of EEB for awhile, but it has given me an essential breathing space to regain equilibrium and keep EEB going.

If you have not yet received an EEB this will be startling news, but at EEB everything tendsto be odd -- and interesting. Wait for the "Dec. 1973" issue, and you'll see, EEB's a nice drop.

If you have not yet received an EEB this will be startling news, but at EEB everything tendsto be odd -- and interesting. Wait for the "Dec. 1973" issue, and you'll see, EEB's a nice drop.

Bound Volumes, Sample Copies, Technical Articles

If you are new (or old) you can still get our several Bound Volumes (1971, 1972, 1973 when the Dec issue out; $A2.75, $NZ3.50, $US5.25, £2.25, each,) as available. Incidentally, since 1973 the Australian Inflation has become frightening, and prices become obsolete as soon as they are published. But we'll keep these prices for the Bound Volumes, and merely take less of the modest profit we would obtain for them. And we'll keep the subscription rate the same, but publish only quarterly rather than bimonthly (also helping to ensure more regularity): $A1.55 p.a... Even so, the news of impending postal charges are truly frightening, and I can envisage a postal bill well in excess of $100 for a single issue. Will you people in Canberra please do something about this? It makes it difficult to publish anything -- and to pay the rent.

If you have sent for a SAMPLE COPY, you 'll receive the December issue when it appears; we have gone right through all extra back numbers and none is left! If you have responded to the adverts offering various TECHNICAL ARTICLES, you'll receive them in the December 1973 issue; simplest that way.

Free Diodes

If you have responded to an advert offering free diodes with subscription, you'll receive the diodes soon, and the December issue in due course. Incidentally we'll be offering free diodes (as per Electronics Australia adverts, middle 1974) to subscription renewals too. I obviously landed a good cheap source of diodes. But the adverts were placed long ago before I realised how tough things were.

TOROIDS!

If long ago you ordered 88mH Toroids, well, y'know what, they have arrived, FINALLY. It took a long time. They'll be sent out too, this week, so please be patient.

Thank you, all of you, for your patience. 73, Leo RIG