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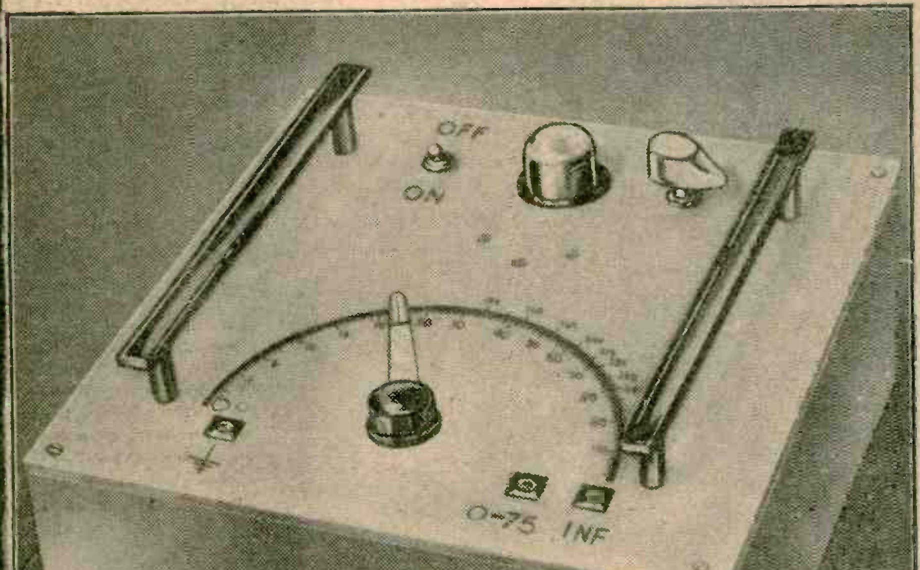
Vol. 28. No. 543
JANUARY, 1952

PRACTICAL WIRELESS

EDITOR: F. J. CAMM



IN THIS ISSUE

Practical Wireless

EVERY MONTH
VOL. XXVIII. No. 543 JANUARY, 1952

Editor F. J. CAMM

20th YEAR OF ISSUE

COMMENTS

By THE EDITOR

PURCHASE TAX

SEVERAL speakers at public functions during the past month have impressed upon the Government the need to remove the Purchase Tax. There are many hundreds of thousands of pre-war receivers still in use which the manufacturers have cast overboard and in which they have decided not to take any further interest, apparently in the hope that people would be persuaded to buy modern sets. Unfortunately, to-day, people are compelled to economise. They cannot afford to pay 66⅔ per cent. tax on new receivers.

One would have thought in view of the material shortage that it was in the national interests that old receivers should be maintained. As that has not been possible there is a case for a reduction of Purchase Tax or even its abolition on an instrument which to-day is as much a necessity as a morning newspaper.

The Purchase Tax not only hits the purchaser but also the retailer.

There is an expectation in the industry that under the present Government these injustices will be removed. Everyone is aware of the high cost of living and spokesmen in the past have been anxious to hide the fact that the cost of living has risen largely as a result of Purchase Tax and only to a smaller extent because of the rise in the cost of raw materials and labour.

A memorandum from the British Electrical Development Association, which presented their case for the removal of Purchase Tax from domestic electrical appliances, was received by every member of the new Parliament when it assembled.

The Association has carried on this campaign for the past six years. During the past year there has undoubtedly been a drop in the sales of radio and television receivers, except in the Holme Moss area. The double Purchase Tax has had its effect.

The new Government, however, finds itself confronted with a bill for national expenditure which cannot be liquidated overnight. It will take some months before it has thoroughly examined the books of the previous Government and ascertained the national commitments. It will be at least a year, therefore, before we can expect any remission of Purchase Tax.

THE BEVERIDGE REPORT

THE new Government has before the end of the year to decide on the future of the BBC and the recommendation of the Beveridge Report. The new BBC Charter must be agreed. In view of the change of Government it is possible that many of the recommendations made in that report will be shelved.

There were hopes that the BBC monopoly would be broken, but business of a more important national character will pre-occupy the Government for some months to come. It can, however, be hoped that the proposal of the previous Government to grab £1,750,000 of the BBC licence money will be dropped.

INTERFERENCE

THE new Postmaster-General will be reminded of the advice of the committee formed under the late Government to take steps to render interference with radio and television illegal, under the Wireless Telegraphy Act, 1949. That committee's report made it clear that such form of compulsion is absolutely necessary, as all appeals for offenders voluntarily to take steps to eliminate interference have failed.

GOVERNMENT SURPLUS

WILL readers please note that when purchasing Government surplus radio apparatus, they should ascertain from the supplier whether it is satisfactory for the purpose they have in view. We cannot undertake to modify such apparatus for individual requirements.—F. J. C.

ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ended September, 1951:

Region	*Number*
London Postal ..	2,343,000
Home Counties ..	1,649,000
Midland	1,746,000
North Eastern ..	1,918,000
North Western ..	1,613,000
South Western ..	1,071,000
Welsh and Border Counties ..	730,000
Total England and Wales	11,070,000
Scotland	1,111,000
Northern Ireland ..	210,000
Grand Total ..	12,391,000

The above total includes 958,500 television licences.

No Relay Radio for Chichester

RELAY CIRCUITS, LTD., of Brighton, were recently refused permission by the Chichester council to operate a relay radio system by means of overhead wires through the streets of Chichester.

A recommendation by the Highways Committee for the erection of the wires was rejected by the council by 11 votes to eight. Although the committee were reported to be satisfied that the erection of the wires would not affect Chichester's amenities in any way, the proposal also met opposition from local traders.

Repairs Delay

REPAIRS and adjustments to wireless receivers in some towns in the north are being delayed through the recently increased number of complaints received from television viewers in the new transmitting area covered by the Holme Moss aerial.

United Nations in Paris

TRANSMITTING on its wavelength of 464 metres, the Third programme transmitter at Daventry will be used by the BBC for broadcasting proceedings at the General Assembly of the United Nations in Paris.

The French P.T.T. and the G.P.O. are collaborating in bringing the programme to London from Paris by line.

Recorded Indian music

IT is reported that a steady supply of recordings of Indian music, made by the External Services Division of All India Radio have been sent out to various foreign stations and as a result instrumental and orchestral music of Indian origin may often be heard from Indonesia, Thailand, Belgium, Germany, Italy, Turkey, Japan, Burma, etc. The Australian Broadcasting Commission regularly radiates "Window on the World," a programme recorded and sent out from Delhi.

Fire risks

THE latest report of the Fire Research Board of the D.S.I.R. indicates that the number of fires per 10,000 licensed listeners has risen from 0.21 in 1947 to 0.34 in 1949, whilst in respect of television equipment the figure dropped from 6.4 in 1947 to 3.7 in 1949.

Solar energy

PHOTO-ELECTRIC generators are included in apparatus being used by the National Physical Laboratory in Delhi in order to try and evolve simple and cheap methods of harnessing solar energy.

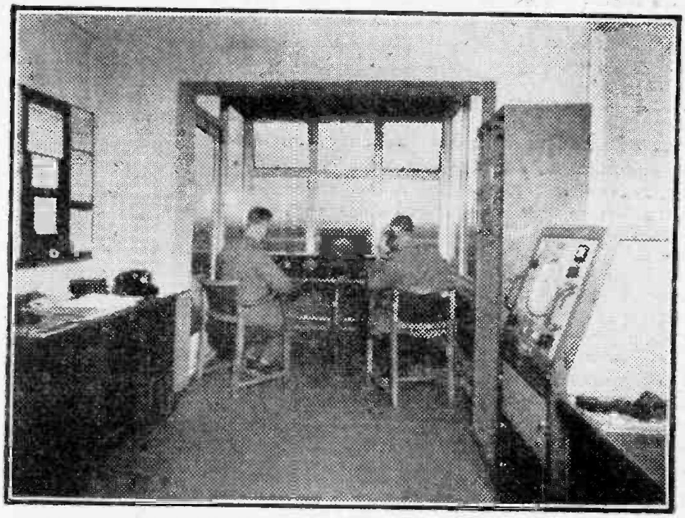
Obituary—Dr. Anton Philips

FOUNDER, with his brother, of the great Philips organisation in Holland in 1891, Dr. Anton Philips died at Eindhoven in October last at the age of 77.

B.I.R.E.

THE following meetings will be held in December, 1951:

London Section.—Thursday, December 13th, 6.30 p.m., London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1: "Electronic Analogues of Physiological Processes," W. Grey Walter, M.A., Sc.D., and H. W. Shipton,



*The Marconi AD.200 VHF DF installation in the control tower at the de Havilland airfield, Hatfield. On the right can be seen the master control console and the twin receivers, and in the centre of the aircraft control officers' desk is a remote bearing indicator and twin loudspeaker.—**See page 8.*

A.M.Brit.I.R.E. (Burden Neurological Institute, Bristol).

North Eastern Section.—Wednesday, December 12th, 6 p.m., Neville Hall, Newcastle-upon-Tyne: North Eastern Television Convention. Details may be obtained from the Programme Secretary.

South Midlands Section.—Wednesday, December 12th, 7.15 p.m., Corporation St. Civic Restaurant. Coventry: "Improvements in and Relating to Loudspeaker Design." R. T. Lakin, A.M.Brit. I.R.E. (Whiteley Electrical Radio Co., Ltd.).

West Midlands Section.—Tuesday, December 18th, 7 p.m., Wolverhampton and Staffordshire Technical College, "Design and Application of Industrial H.F. Heaters," F. W. Budge.

Radio Snow Gauge

ANOTHER use for radio comes from the U.S.A., this time the employment of F.M. to relay from remote points details of snow depths. The latter are gauged by burying radio-active isotopes and using a Geiger tube to measure the intensity of the radiation passing through the snow. The information is often required from some very remote area, and the F.M. relay to a central recording station has proved of great value.

Navigational Aids in Ice and Tropics

TWO interesting orders for unattended radio beacons, to be installed at sites which are completely opposite in climate, have been won by Marconi's Wireless Telegraph Co., Ltd., one through their associated company, Amalgamated Wireless (Australasia), Ltd. Two Marconi beacons are to operate in the Antarctic (South Georgia) and a fully equipped navigational station is to be erected in the tropics, at the dangerous "Penguin Shoals" off Western Australia.

The two radio beacons (Marconi type RB.109) are being constructed for the Administration of the Falkland Islands Dependencies, and are primarily for the use of whaling fleets in the Antarctic.

Home Service Reception

AS announced in June, the BBC intends to improve reception of the Home Service in certain areas where conditions have proved unsatisfactory.

As part of this scheme, a low-power transmitting station, installed at Scarborough, came into operation on Sunday, November 11th, 1951. This transmitter radiates on 261 metres (1,151 kc/s).

The Entebbe runway for jet airliners is the largest in Africa. Africans help to man the airport, and besides comprising the bulk of the ground staff other Africans hold more responsible posts. Here in the radio room weather forecasts are picked up from and transmitted to other airports by these two African operators, Daniel NaSade (right) and Eric Wabomba (left).

The completion of the permanent installation will take some time and a temporary transmitter is being used for the present in order to provide a service before winter sets in. It is not expected that the temporary transmitter will improve reception beyond the immediate vicinity of the town.

Radar Fishery Protection

POACHING off the shores of California has been almost prevented since the fishery protection authorities adopted the use of radar. They are now able to detect the presence of illegal fishing boats during the night or in bad weather, and it is stated that during 1949 and 1950 25 boats and 284 fishermen were arrested. In 1951 only one boat and nine men have been arrested, thus justifying the use of the radar equipment.

Transmitting in Amateur Bands

IT is understood that the Radio Society of Great Britain has once again notified the G.P.O. concerning commercial stations which transmit on frequencies in bands which, in the 1938 Cairo Conference, were allocated to amateurs.

Although the G.P.O. is fully aware of the difficulties experienced in this matter, they are powerless to improve the situation in any way until the frequency table prepared at the conference in Atlantic City in 1949 comes into operation.

Servicing in Hindi

IN addition to servicing courses in English which are being run by the Indiana Radio Institute of Nagpur, India, a new series of courses have now been started in the Hindi medium for the benefit of those who are unable to read English. Each student on the course constructs one complete three-band five-valve receiver.

Duke of Edinburgh—Honorary Member

THE British Institution of Radio Engineers has been honoured by the acceptance of Honorary Membership by his Royal Highness the Duke of Edinburgh, K.G., F.R.S., who gave indication of his knowledge and interest in applied science. It will be remembered that he accepted Fellowship of the Royal Society earlier this year, but the B.I.R.E. is the first of other learned societies to be so honoured.

For the Transmitter

A 5-band V.F.O. Unit

DETAILS OF A 3-VALVE MAINS-OPERATED UNIT FOR THE 1.7, 3.5, 7, 14 and 28 Mc/s BANDS

By Wm. A. Hope

THE variable-frequency oscillator has become very popular with most amateurs, as it possesses the advantage of being able to change frequency when the amateur bands are congested. Truly, the crystal oscillator has excellent frequency stability, but a well-designed V.F.O. will enable the operator to pick a quiet spot on the band, if there is one.

We have briefly stated the advantages of the V.F.O. over the C.O. and, in fairness to the crystal oscillator, the author wishes to emphasise that the following points should be borne in mind.

(*a*) If frequency stability, up to a certain limit, is to be maintained, the V.F.O. output must be low.

(*b*) The oscillator must be followed by at least one buffer amplifier in order to isolate the oscillator completely from the "final" stages of the transmitter.

(*c*) The H.T. to the unit, and more particularly the oscillator, must be well smoothed and stabilised. This is important if the oscillator is to be keyed. The author, however, does not favour keying the oscillator stage and prefers to key the "final" stage of the transmitter proper.

Circuit

It will be seen that a 6SC7 double-triode valve is employed in the Franklin oscillator circuit in Fig. 1. This stage is followed by two 6V6 buffer stages which completely isolate the Franklin oscillator from the transmitter proper.

Denco coils, of the chassis type, are used in the Franklin circuit; these being ranges 3, 4 and 5 as per the Denco catalogue. See Fig. 3 for data on the Denco coils. These three coils are switched by S1 to enable the 1.7, 3.5, 7, 14 and 28 Mc/s bands to be covered. Ranges 1 and 2 are covered by L1; T1 and T2, which are 200 pF pre-set condensers, being used respectively to tune the centre of the 1.7 Mc/s and the 3.5 Mc/s band. On ranges 3 and 4, L2 is used, and again the centres of the two bands are set by T3 and T4. On range 5, L3 is used to cover the 10-metre band, T5 being the bandset condenser. In all cases C.T., the 60 pF bandspread condenser, gives bandspread on all of the five ranges covered.

Construction

The prototype was built as an experimental unit and will, at some later date, be used in the shack. No drilling data will be given, as constructors will use components already to hand and thus layout, etc., will be governed by the sizes of the various components. Where possible, Eddystone components should be used as, being of the highest standard, they are completely reliable. It is advisable to use Eddystone type 1010 chokes in all R.F.C. positions; these chokes have an inductance of 1.5 milli-henries, as well as a D.C. resistance of 10.53 ohms, and are efficient over a frequency range of 1.5 to 60 Mc/s. Good reliable resistors only should be employed, and if surplus resistors and condensers are to be used, then they should be checked to eliminate the possibility of using defective parts.

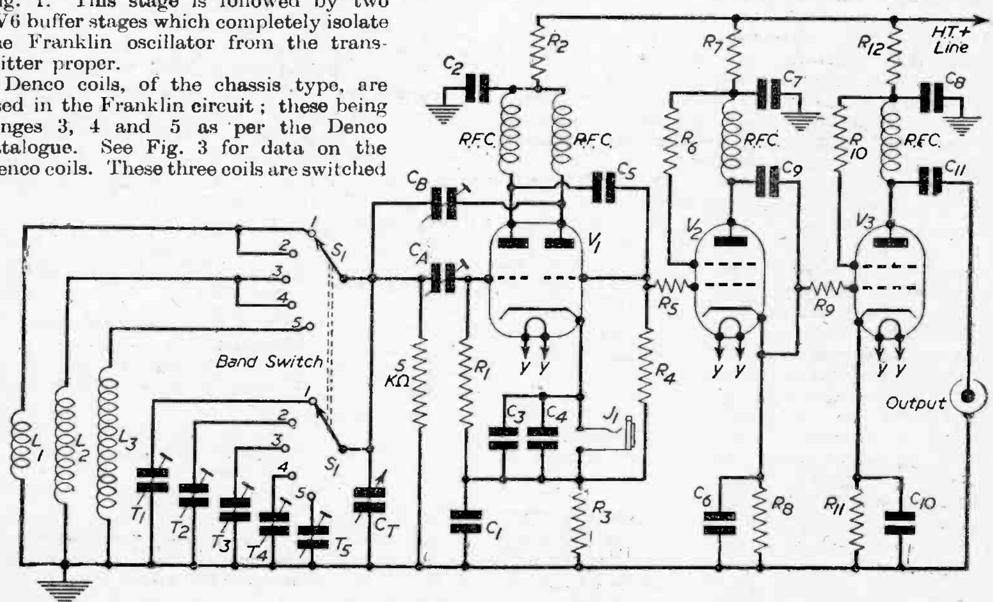


Fig. 1.—Circuit of the 5-band V.F.O. unit.

An Eddystone Full Vision Dial type 598 was used on the original model to bandspread the amateur bands; this enables the V.F.O. to be directly calibrated at a later date. The whole unit could be fitted into an Eddystone General Purpose Cabinet type 609, although the author realises that this is a comparative luxury and is obviously well beyond the pocket of most amateurs. Despite this, a very neat outfit can be built into one of the TU9B units readily obtainable on the surplus market. Constructors using the Eddystone cabinet should have no ventilation difficulties, but if any other cabinet is used be careful to keep the power-pack well away from the oscillator as a variation in frequency will occur. Temperature compensated condensers, if available, should be used in the Franklin circuit. With reference to Fig. 1 again, it will be seen that provision for relay control of the V.F.O. has been made. This, the author considers, is necessary for quick transmitter operation.

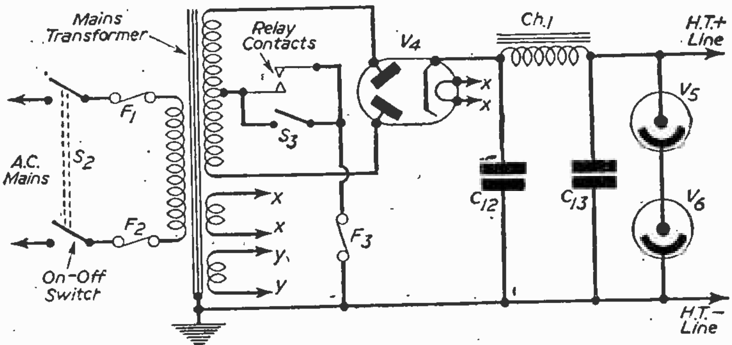


Fig. 2.—The V.F.O. power pack.

Aligning the V.F.O.

In order to set up the V.F.O., the services of the station receiver will be needed. The V.F.O. power supplies should be switched on by means of S2, and all the valve heaters allowed to settle down to their operating temperatures. Range switch S1 is set to the 1.7 Mc/s band, that is range 1, and the bandspread condenser set at half capacity. The station Rx is tuned to the "dead centre" of the 160-metre band, and H.T. is applied to the V.F.O. by closing S3. The pre-set condenser T1 is adjusted until the oscillations are picked up on the receiver with the B.F.O. in operation. If the oscillatory note is rather unstable, then too much feedback exists in the oscillator circuit. In order to cure this, Ca and Cb should be adjusted until the note is clear. In order to test this a morse key should be plugged into jack J1 and the Franklin oscillator keyed rapidly; if the capacities of trimmers CA and CB are correct, then the oscillatory note picked up by the Rx will be sharp. The next step is to make sure that the bandspread condenser CT will cover the entire range. This should be possible as a 5,000-ohm resistor is permanently wired across each of the coils selected in order to produce a good band-width. Each of the four other ranges should be adjusted in the same manner as range 1. When this has been done, the V.F.O. is completed and ready for use.

Using the V.F.O.

Normally the V.F.O. will be connected to the transmitter by a short length of screened co-axial cable and will, for easy manipulation, be placed near the receiver. When used in a relay-operated station, the V.F.O. will be switched on automatically when the transmitter is operated.

Let us, for the benefit of the newcomer, assume that the V.F.O. has to be set on a "spot-on" frequency on the 7 Mc/s band where the station operator hears, for example, a GM station calling CQ. The range switch is set to the 40-metre range and the H.T. applied to the V.F.O. by means of S3. The bandspread condenser is then adjusted until the V.F.O. note coincides with the GM's frequency on the station receiver. Switch S3 is opened and the operator waits until the GM "signs off." All that is required

LIST OF COMPONENTS

COILS

L1—Denco range 3.
L2— ,, ,, 4.
L3— ,, ,, 5.

CONDENSERS

T1—220 pF pre-set.
T2— ,, ,,
T3— ,, ,,
T4— ,, ,,
T5— ,, ,,
CT—60 pF bandspread.
CA, CB—3-30 pF trimmers.
C1—8 μF at 450 volts working.
C2— ,, ,, ,, ,,
C3— ,, ,, ,, ,,
C4— ,, ,, ,, ,,
C6— ,, ,, ,, ,,
C7— ,, ,, ,, ,,

Condensers (cont.)

C8—8 μF at 450 volts working.
C10— ,, ,, ,, ,,
C12— ,, ,, ,, ,,
C13— ,, ,, ,, ,,
C5—100 pF tubular.
C9— ,, ,,
C11— ,, ,,

RESISTORS

R1, R4—.75 MΩ.
R2—60 kΩ.
R3—10 kΩ.
R5, R9—100 Ω.
R6—3 kΩ.
R7, R12—5 kΩ.
R8, R11—250 Ω (w.w.).
R10—8 kΩ.

SUNDRIES

R.F.C.—Eddystone type 1010 (see text).
S1—2-pole 5-way.
S2—Double-pole mains switch.
S3—Single-pole 1-way.
J1—Self-shorting jack.
CH1—Choke 22 henries at 120 mA.

VALVES

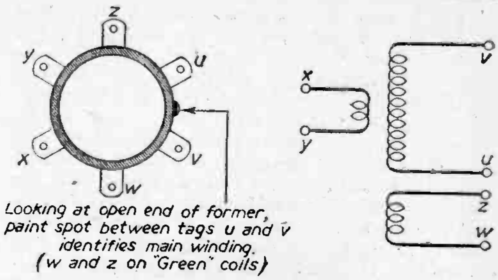
V1—6SC7 (CV1969).
V2—6V6 (CV510).
V3—6V6 (CV510).
V4—5Z4 (CV1864).
V5—VR150/30 } Stabilisers.
V6—VR150/30 }
F1, F2—1 amp. fuses.
F3—100 mA. fuses.

now is to press the master relay switch and you are on the air right on the GM's frequency.

The mains transformer used in the original was of the type having secondaries rated at 350-0-350 at 80 mA, 6.3v. at 1.5A and 5v. at 2A. If any other type is employed having a higher H.T. secondary voltage, a dropper will have to be employed to reduce the H.T. to that given by the original.

Conclusion

This V.F.O., though experimental, operated satisfactorily during the initial tests and should prove to be of great value to the amateur who has just gained his transmitting licence. There are, of course, other oscillators which can be used in V.F.O.s; these are the Clapp and the Electron-coupled oscillators. It is, of course, possible to build an exciter unit which employs a variable oscillator such as the Clapp, and a crystal oscillator running at a pre-determined frequency. These two frequencies are combined and the resulting variable frequency will cover one of the selected amateur bands. By frequency doubling the other amateur bands can be covered also, providing that the sum of the frequencies of the variable and crystal oscillators has a minimum frequency value of 1,715 kc/s, and a maximum frequency value of 2,000 kc/s. Such a unit will be dealt with later.



Coil Colour	u	v	w	x	y	z
Blue	Earth or A.V.C.	Grid	—	Aerial	Earth	—
Yellow	Earth or A.V.C.	Grid	—	R.F. Anode	H.T.	—
Green	Earth or A.V.C.	Grid	Anode Reac'th	Aerial or R.F.	H.T. or Earth	Reac'th
Red or White	Earth or Padder	Grid	—	Anode	H.T.	—

Fig. 3.—Denco coil data.

Jet Navigation

THE ever-increasing speeds of modern aircraft—particularly since the advent of jet propulsion—necessitates complementary advances in many other aeronautical techniques and services. One of the earliest problems to arise, as speeds rapidly increased, was the liaison between ground and aircraft for navigational purposes and, in particular, positioning.

Previously direction finding was done by a ground operator using aural-null methods, but the time lag required for tuning, checking for true or reciprocal bearings, reading off, and transmitting the information to the aircraft made this method useless when an aircraft approached an aerodrome at speeds in excess of 300 m.p.h. In fact, if a request for a bearing was made when the aircraft was 30 miles distant from the aerodrome it might well be past by the time the ground operator obtained a first-class bearing.

A Solution

Over three years ago this problem was effectively dealt with by Marconi's Wireless Telegraph Co., Ltd. Their scientists and engineers set about designing and building a modern D/F installation which would allow ground operators to read off bearings instantaneously to the pilot of a high-speed aircraft. Many more points were taken into consideration.

The equipment had to be compact enough to be unobtrusive in control towers, the main transmitters-receivers would have to be sited somewhere else and remotely controlled from the tower. Instantaneous reading of bearings called for visual presentation. If large meters were used for this purpose then a duplication service could be incorporated allowing people in other rooms and offices to follow the bearings on repeater meters.

All these things were, indeed, incorporated into the design of what is to-day one of the greatest advances in aeronautical wireless equipment—the Marconi AD.200 V.H.F. D/F installation.

Nearly two years ago the de Havilland Aircraft Co., Ltd., co-operated with Marconi's in what amounts to one of the most searching tests that wireless equipment can possibly have; an AD.200 was installed in the control tower at Hatfield, and has been in constant use ever since. Its performance has drawn the admiration of the ground staff and the highest praise from aircrews.

Both Wing Commander C. A. Pike, Aerodrome Manager, and Mr. T. F. Pilcher, Chief Aircraft Controller, instance numerous highlights of the short career of this equipment at Hatfield. During the recent Royal Aero Club meeting, which had to be cancelled owing to bad weather, Group Captain John Cunningham made an air inspection of the course in very bad conditions. On his last turn he was in cloud at 400ft.—yet, by flying on the V.H.F. D/F, he went around safely, finding the end of the runway with complete confidence.

Efficiency

The amazing rapidity with which the control tower personnel read-off has occasionally created suspicion in the minds of pilots new to the technique. On one occasion a pilot took a deliberate 90 degrees turn and called for a second bearing; he expressed his surprise when a spot-on bearing came back.

Constant users of the system are other manufacturers' test pilots flying in the vicinity. After first use all pilots become enthusiastic and come to rely on it implicitly. They become so used to giving the briefest of calls and getting instantaneous bearings that they are apt to be monosyllabic at times and do not call sufficiently.

From the ground staff's point of view, Mr. Pilcher maintains that the visual indication of bearings gives operators great confidence. It also enables other personnel to check the accuracy of the operator.

A STABLE AUDIO OSCILLATOR

A TEST UNIT GIVING A PURE SINE-WAVE OUTPUT FROM 30 c/s TO 33 k/cs

By N. J. Wadsworth, B.Sc.

THE author has long felt the need for a simply-built audio oscillator with high frequency stability, a long scale and a good waveform whose output amplitude could be relied on to remain constant over the whole audio range. This last point is almost an essential when testing amplifiers at different frequencies, since it eliminates the necessity for constant checking of the oscillator output. The oscillator should also be able to produce a square wave of good form, and with a short rise time for testing transient and low-frequency response.

The oscillator described below fulfils these requirements providing a pure sine-wave output continuously variable in frequency from 30 c/s to 33 kc/s in six overlapping switched ranges—30-100 c/s, 100-330 c/s, 300-1,000 c/s, 1-3.3 kc/s, 3-10 kc/s, and 10-33 kc/s, each range occupying 270 deg. of rotation. The amplitude of the output is constant to within ± 2 per cent. = 0.2dB over the whole frequency range and is independent of mains voltage or valve variations. It also dispenses with the use of bulky ganged capacitors and very high impedance circuits. It will produce a square wave within this frequency range with a rise time of 2·3 μs at the high-frequency end and negligible "sag" at 30 c/s. Both the frequency and amplitude of the sine-wave output are independent of mains or valve fluctuations. All components but the thermistor are available on the surplus market. The latter may be obtained from Standard Telephones & Cables, Ltd.

Circuit

The circuit is shown in Fig. 1. It will be seen that the oscillator uses a R-C phase shift circuit (V1-3) with a thermistor stabiliser. The frequency of oscillation is given by

$$f^2 = \frac{1}{4\pi^2(R1+VR1)R2.C1.C2}$$

This formula enables the frequency to be calculated should any changes in component values be made. VR1 is the fine frequency control and S1 switches the ranges. Owing to the use of a thermistor and to the large amount of negative feedback applied to each valve, the output is independent of valve or voltage changes. The anode and cathode resistors of V1 and V2 must be equal to ±2%, thus R4+R5+R6=R7±2% and R11+R12=R13±2%. If normal carbon resistors are used for these and for R1, R2 and R19, they should be of as high wattage as possible for increased stability. C6 is used to counter the effect of the capacity to earth of C7 (4μF) and thus may need adjusting to suit the particular component. If the output amplitude tends to fall at the extreme high-frequency end, C6 should be increased. The switch S2 is used to switch from sine to square-wave output. In Fig. 1 it is shown in the former position. It will be seen that a sine-wave of suitable amplitude is tapped off from the junction of R5 and R6 and fed into a cathode follower V5. The output is taken from a potentiometer in the cathode circuit. This ensures a low-impedance output. When S2 is changed over, V4 is brought into action. This is a heavily over-loaded limiter or squarer, and produces flat-topped square waves which are then fed to V5 where they are again limited. In this way a very short rise time is achieved with no overshoot. In the interests of economy, SP61s were used throughout, as they are readily and cheaply available on the surplus market. It should be possible to replace them by EF50s if desired with no alteration in circuit values.

Power Pack

The power pack shown is quite satisfactory, but is by no means critical; any circuit using components available which gives about 50 mA at 250 volts may be used. The smoothing should be as good as possible, as the oscillator may tend to "lock" at 100 c/s if

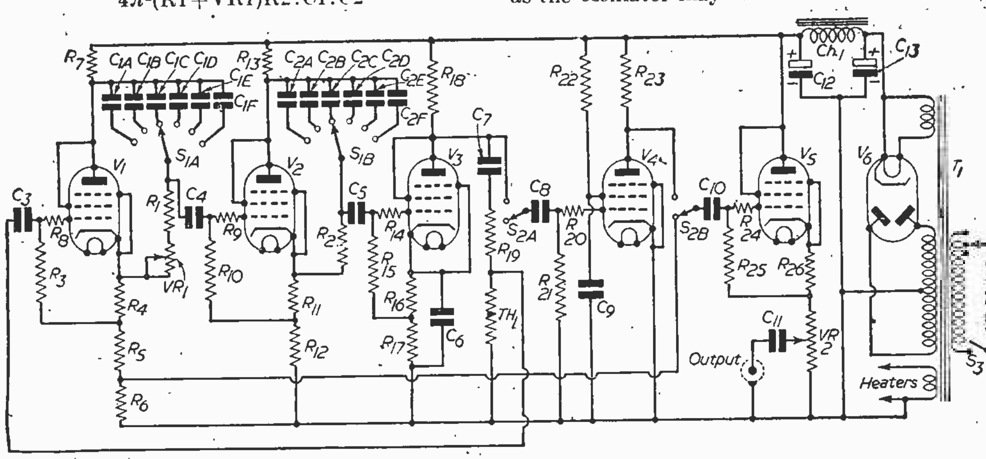


Fig. 1.—Theoretical circuit of the oscillator.

the H.T. is very "ripply," although no trouble has been experienced in this matter.

A list of approximate electrode voltages as measured relative to chassis with a 1,000 Ω/V meter is given for checking. These will vary slightly with the actual components used.

Electrode Voltages Switched for Sine-wave with 250 Volts H.T.

	V1	V2	V3	V4	V5
A	208	208	175	30	250
G2	208	208	175	50	250
C	42	42	26	0	11

Layout

This will depend on the sizes of the components used, the mains transformer, the choke and the two 4 μF capacitors being the deciding factors. In view

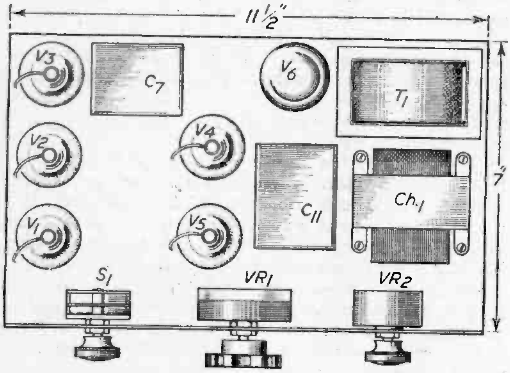


Fig. 2.—Layout of chassis.

of this the arrangement used by the author is shown in outline only to act as a guide. The design may, however, be radically altered with no ill-effects if desired, the chief points to bear in mind being that wires should be as short as possible and components fixed so they cannot move. It is also important that all grid-stoppers be wired direct to the valve-top caps.

Calibration and Testing

There are many ways of calibrating the finished oscillator. The most satisfactory is direct comparison with a standard by means of "Lissajou" figures on a cathode-ray oscilloscope. If the capacitors C1 and C2 are accurate, then a calibration curve taken on one range may be used for all others with a suitable change in frequency scale. It is as well, however, to check the highest frequency range, as stray capacities will affect the frequency slightly here. In the absence of any other frequency standard it should be remembered that over the week-end the mains frequency is rarely more than 1 or 2 per cent. away from its nominal 50 c/s, and so the oscillator may be calibrated to this accuracy from this. The high-frequency range may be calibrated using the 200 kc/s carrier of the long-wave Light Programme as a standard frequency and, for a spot check, the tuning notes radiated before the commencement of B.B.C. programmes (1,000 c/s Home and Light, 440 c/s Third) may be used. These three frequencies are maintained to better than 1 in 10^6.

If the constructor has no access to a cathode-ray oscilloscope, the oscillator may be calibrated by feeding the output into an amplifier and thence to a loudspeaker, and comparing the note with a recently tuned piano or other musical instrument.

If necessary, the calibration curve may be calculated from the formula given at the beginning with quite good accuracy (say, within 2% on all but the highest range).

When checking the square-wave output on a cathode-ray oscilloscope, care must be taken that the amplifier and coupling circuits have a time-constant of not less than 0.5 seconds. If this condition is not satisfied, the top of the 30 c/s square-wave will appear sloping. This, in fact, is a very stringent test of a good C.R.O. amplifier.

If the constructor follows these notes no trouble should be experienced with the construction of this useful and stable oscillator.

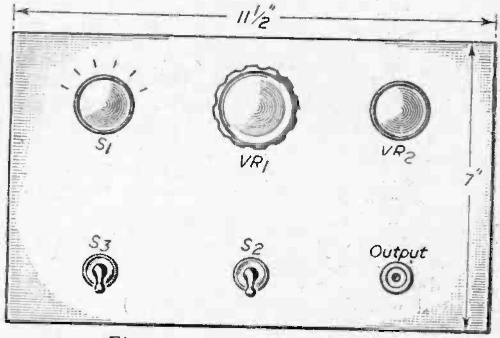


Fig. 3.—Layout of panel.

LIST OF COMPONENTS

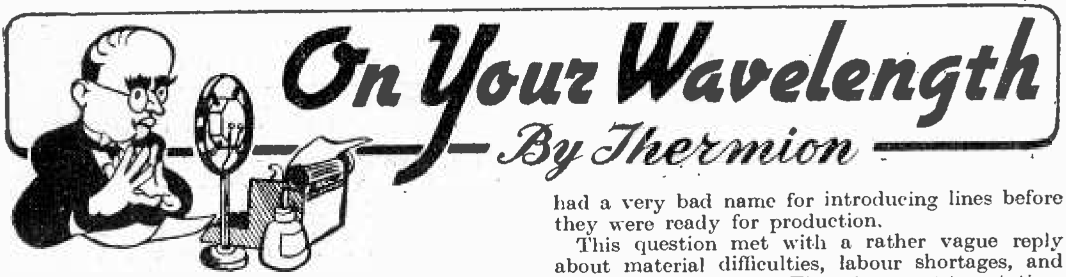
R1—9.2 KΩ.
R2—22 KΩ.
R3—1 MΩ.
R4—150Ω.
R5—2.7 KΩ } See text
R6—2.2 KΩ } See text
R7—5 KΩ } See text
R8—10 KΩ.
R9—10 KΩ.
R10—1 MΩ.
R11—150Ω } See text
R12—4.7 KΩ } See text
R13—5 KΩ } See text
R14—10 KΩ.
R15—1 MΩ.
R16—150 Ω.
R17—5 KΩ.
R18—15 KΩ.
R19—20 KΩ.
R20—1 MΩ.
R21—500 KΩ.
R22—250 KΩ.
R23—100 KΩ.
R24—68 KΩ.
R25—220 KΩ.
R26—220 Ω.

VR1—100 KΩ ww
VR2—1 KΩ ww
C1a, C2a—0.1 μF } See text
C1b, C2b—0.03 μF } See text
C1c, C2c—0.01 μF } See text
C1d, C2d—0.003 μF } See text
C1e, C2e—0.001 μF } See text
C1f, C2f—0.00025 μF } See text
C3—0.1 μF.
C4—0.1 μF.
C5—0.1 μF.
C6—300 pF.
C7—4 μF.
C18—0.1 μF.
C9—0.1 μF.
C10—0.1 μF.
C11—4 μF.
C12—16 μF., 350v. DC.
C13—8 μF. 350v. DC.
S1—2-pole 6-way.
S2—2-pole 2-way.
TH1 Stantel Thermistor A1522/100.
S3—1-pole on-off.
CH1—20H—40 mA.

(All resistors are ¼-watt except R7, R12, R13, R17 and R18, which are ½-watt.)

T1 Mains Transformer 250-0-250v., 60 mA., 5v.2A, 6.3v.3A.

V1—V5. SP61—VR65. V6—5Z4.



Playwright Producers

THE plays broadcast by the BBC should not be produced by their authors. No playwright is the best critic of his own work, and on those misguided occasions when the BBC has allowed the playwright also to produce his play the result has been something comparable to the boring broadcasts of Shaw. Everyone knows that Shaw would not allow a comma to be altered or any of the dialogue to be cut. As a result all his plays are far too long and boring.

I am afraid that most of these specialist writers of BBC plays endeavour to imitate Shaw, and when they become their own producers they make quite sure that nothing is cut.

I was reminded of this the other evening when looking in to Sieveking's "Tomb with a View." Quite apart from the fact that it was a thoroughly bad play which left my audience wondering what it was about, it occupied far too much programme time, and would have been greatly improved by pruning.

I do not believe in encouraging the belief of some playwrights who feel that not only can they write a play, but that they can also produce it, act in it, and write the lyrics and music for it.

Standardisation

THE radio industry is busily preparing standards for components. I suggest that this is a matter for the British Standards Institution. Many members of the radio industry belong to this Government-sponsored body, and it seems unwise, therefore, for the industry to add to the confusion by creating standards which sooner or later will be set aside by the B.S.I. The industry should approach the latter body if it requires standards, and ask them to prepare the standards. The institution was formed with the object of preventing particular industries introducing standards which conflicted with those of other industries, for there could not be standardisation under such conditions.

I do not think that the radio industry is the best equipped to standardise. In the past it has produced some monstrosities. Its limits have been far too wide and the workmanship poor.

Delivery Dates

I WAS present at a trade function the other day when a new and worthwhile piece of wireless apparatus was introduced. It was demonstrated in the room to the satisfaction of all concerned, and it was backed by an N.P.L. Report. When question time came one of the journalists present asked when the new device would be available, pointing out that the radio industry had a very bad name for introducing lines before they were ready for production.

This question met with a rather vague reply about material difficulties, labour shortages, and the usual ifs and buts. There is a great temptation, when a manufacturer has something good, to tell the world as soon as possible. The result is that the Press arouses great interest, the manufacturer is inundated with letters and orders and finally has to disappoint the public, which his too early enthusiasm has interested. If a thing is not available when the pubic calls for it, it may be difficult to arouse enthusiasm when it is ready. It has transpired that the criticism in this case was well founded.

The Problem of D.C.

ALMOST every month I receive a wail from some reader complaining that little is done for those unfortunates whose houses are still served by D.C., and asking me what I am going to do about it. By far the majority of houses are now supplied with alternating current, and those on D.C. will be changed over as soon as possible. This journal has in the past sponsored a number of D.C. designs, but there are problems associated with the supply of components which make it difficult to publish further designs.

For what is the purpose of publishing a design for a D.C. receiver if the components are not available? I know that there are thousands interested in television who are in this plight. This is a matter, in view of the expanding television service and the development of the grid scheme, for Government action.

Low Cost Radio Reception

THE title of this paragraph is also the title of a pamphlet published by Unesco, in which it is averred that only by large-scale buying and exemption from import duties will it be possible to use radio as an efficient means of popular information and education. Broadcasting, it is pointed out, is almost unknown in some countries. For example, in Burma the number of inhabitants per radio receiver is 3,400 and in India 1,490. This compares with 7.4 in Switzerland and 3.3 in Sweden. The British Radio Equipment Manufacturers' Association in a spirited rejoinder to this pamphlet states that if these projects are to receive the full support of radio receiver manufacturers, then it must be shown that the authorities responsible have the funds and facilities available. The British radio industry is able to supply large quantities of the type of receivers which Unesco has in mind, but more tangible evidence is necessary of the intention of responsible Governments to proceed with plans for purchase before manufacturers will be prepared to submit estimates.

In other words, foreign governments want the goods but they have not the money to pay for them.

FREQUENCY MODULATION

A NEW SERIES

4.—THE R.F. AMPLIFIER AND THE I.F. AMPLIFIER

By J. F. Golding

(*Continued from page 536 December 1951 issue.*)

THE impedance of a half-wave dipole is about 75 ohms. A twin feeder having this value characteristic impedance should, therefore, be used, matching to the receiver input circuit being effected by means of a centre-tapped coupling winding as shown in Fig. 12.

The R.F. Amplifier

This is a desirable though not essential stage in the receiver. Although, using a directional aerial beamed on the local transmitter, the likelihood of serious second channel interference may be regarded as negligible, a reasonably selective input circuit certainly helps to eliminate any possible overloading of the subsequent stages due to powerful unwanted signals breaking through.

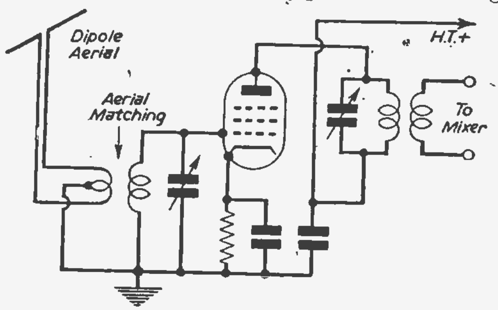


Fig. 12.—The functional circuit of a V.H.F. amplifier stage.

There is also the question of providing that sufficient signal is applied to the frequency changer to ensure efficient mixing. The gain of an amplifying stage at V.H.F. cannot be large; it seldom exceeds a factor of 10. Nevertheless, even a small improvement in signal strength is important when it is realised that a total gain of the order of 100 db may be required at fringe areas before the signal is fed to the demodulator.

A low-capacitance, short-grid-base pentode valve is the most suitable. Special types have been designed for operation at these frequencies. Acorn and similar special valves were very popular before and during the war but these have now been largely replaced by the more modern glass-based valves of the B9G and B7G type.

The diagram in Fig. 12 shows a typical input circuit and R.F. stage, including the method of coupling to the mixer stage. The grid circuit of the amplifier will be loaded by the aerial and by the grid input impedance of the valve, reducing its magnification and thus broadening its frequency band. It may well be found, therefore, that variable tuning is unnecessary for the input circuit and that quite satisfactory results can be obtained by fixed tuning at the centre of the band to be covered. It will probably not be necessary to cover a total range of more than about ± 6 Mc/s. In any case, accurate tracking of the R.F. tuning is not necessary as it is difficult to achieve a band-width of less than about 3 Mc/s, due to the comparatively low R.F. input resistance of most valves at V.H.F.

The Frequency Changer

This comprises a mixer of one type or another, together with a local oscillator. At medium and short wavelengths, it is common practice to combine the two into one valve such as a triode, hexode or heptode. This type of frequency changer is quite efficient at television frequencies and it may well

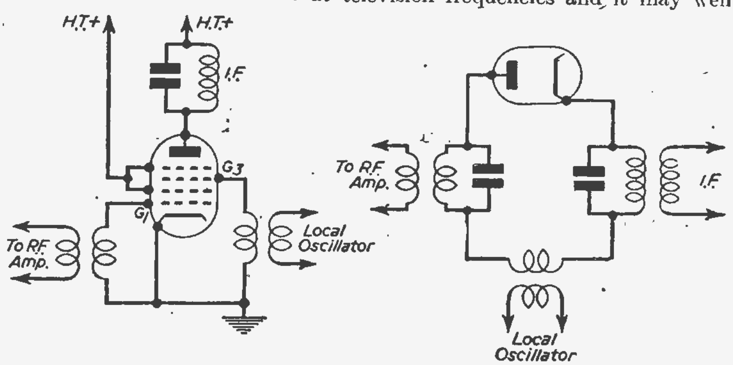


Fig. 13.—Two types of mixer circuits for obtaining the heterodyne beat between two frequencies.

be adopted by manufacturers for use in the meter band.

However, at 90 Mc/s, frequency changers of this type are approaching the upper limit of their frequency range and a diode or germanium crystal mixer is generally equally, if not more, efficient.

For comparison purposes the circuits of both types of frequency changer are shown in Fig. 13. In order to understand the action of the diode mixer, it may be as well first to consider the manner in which a hexode mixer operates.

This may be regarded as a valve, the mutual conductance of which is varied by the voltage applied to grid 3. Then, if a high-frequency voltage is applied to grid 1, the anode current becomes

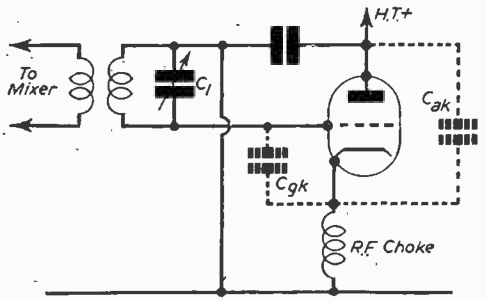


Fig. 14.—The modified Colpitts oscillator circuit—suitable for use as the local oscillator of a V.H.F. receiver. The anode is effectively earthing at R.F. so that C1 may form part of a two- or three-gang variable capacitor.

proportional to this voltage multiplied by the voltage at grid 3. If, therefore, an alternating voltage is applied to the latter grid, the anode current will be of the form of the signal at grid 1, amplitude modulated by the signal at grid 3. Since any amplitude modulated signal carries with it two side-bands of frequencies equal to the sum and difference of the carrier and modulation frequencies, the anode circuit of the mixer may obviously be tuned to the lower of these two and the resulting beat frequency signal applied to the I.F. amplifier.

The fact that the "modulating" frequency is nearly equal to the "carrier" makes no difference; the principle still applies, the beat frequency being simply the lower side-band of an amplitude-modulated signal.

The diode mixer operates in exactly the same way except that its loss is varied by the local oscillator instead of its gain.

If a D.C. voltage was applied across the diode acting in the forward direction so that the diode conducted, it would offer a very low resistance to the applied signal. If, on the other hand, the D.C. voltage acted in the reverse direction, the diode would offer a very high resistance to the applied signal.

In practice this D.C. voltage is replaced by the R.F. output from the local oscillator, which switches the diode from the "conducting" to the "non-conducting" condition at a rate equal to the oscillator frequency, thus modulating the signal frequency. The lower side-band of beat frequency is selected by the first I.F. transformer.

The main advantage of this method, over the hexode type of mixer, is its extreme simplicity and, at high frequencies, its efficiency. The diode mixer has, of course, no gain and presents an input circuit load of approximately half the "non-conducting" resistance. However, this performance may well be better than that of the hexode mixer which, almost certainly shows a gain of less than 1 at 90 Mc/s and presents to its input circuit, a capacitive load shunted by an effective resistance due to the electron transit time becoming comparable with the wave time.

The local oscillator is usually in the form of a modified Colpitt's circuit as shown in Fig. 14, the splitting capacitance to cathode being formed by the grid-cathode and anode-cathode inter-electrode capacitances.

This type of oscillator is less prone to blind spots and squeggering than the more orthodox types of Hartley or feedback oscillators. For the sake of convenience, the anode is at chassis potential so far as R.F. is concerned, allowing a standard type of two- or three-gang tuning capacitor to be used.

Since accurate and stable tuning is essential to the operation of a frequency-modulated receiver, special precautions must be taken to ensure a high standard of frequency stability of the oscillator. The H.T. supply, therefore, is stabilised, and additional smoothing provided in the oscillator supply system to prevent any frequency modulation of the oscillator output by hum or ripple voltages.

The I.F. Amplifier

The gain of this amplifier must be sufficient to provide an R.F. voltage at the demodulator of not

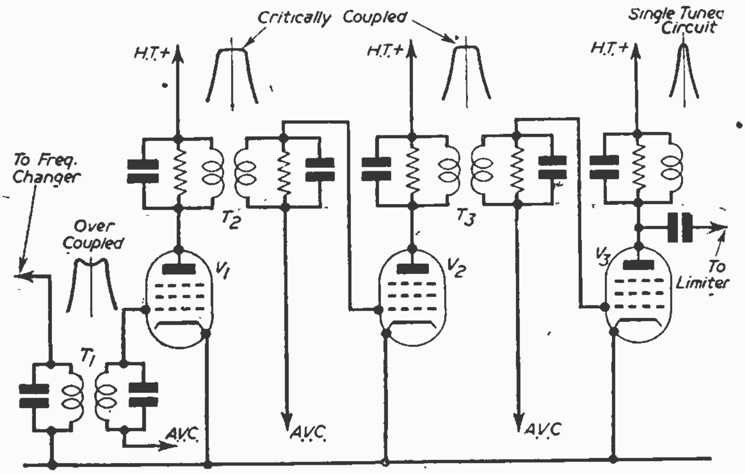


Fig. 15.—The functional circuit of a wide band I.F. amplifier for F.M. reception. An approximate shape of the frequency response curve is outlined above each stage of tuning.

less than about 10 volts from an input signal which may be as low as 100 micro-volts. At the same time it must not be too sharply tuned or very serious distortion will result from loss of side-bands. We may say, therefore, that for broadcast purposes where a 75 kc/s deviation is used, the I.F. amplifier must have a maximum gain of not less than 100 dbs and a bandwidth of at least 200 kc/s.

In order to obtain this wide pass band, an intermediate frequency of 2 Mc/s minimum is required. The possibility of interference due to second channel response is reduced by increasing this frequency, whereas it may be easier to obtain the required gain by keeping the frequency at its minimum. Experience has shown, however, that an I.F. of about 4.5 Mc/s gives the best results.

It is necessary, in order to obtain sufficient gain, to use a multi-stage amplifier. As the required band-width eliminates the use of high Q circuits, it is probable that a stage gain of about 35 db is the maximum obtainable. This means that three stages of I.F. amplification are necessary.

The ideal frequency characteristic of the amplifier would be a completely flat response over the frequency range 4.4 to 4.6 Mc/s with a sharp cut-off at these frequencies. This, of course, is not possible in its entirety, but it can be approached by using various methods of staggered tuning.

The coupling between the stages may be in the form of critically coupled band-pass circuits, the centre frequencies being staggered to cover the complete band.

A much more satisfactory method, however, is the arrangement shown in Fig. 15. In this three stage amplifier, I.F. transformer T.1, is over coupled to give a double hump characteristic covering the total bandwidth. Transformers T.2 and T.3 are critically coupled and have a lower Q while the anode load to valve V3 is a single tuned circuit. By careful design of the transformers, having special regard to the Q values and the coupling factors, the response of the amplifier can be made to approach the ideal.

The coupled circuits shown in the diagram are of the most common form, using mutual inductance coupling. Similar results, however, can be obtained by using a mutual capacitance as shown in Fig. 16.

In this circuit, capacitor C3 is common to both circuits.

For wide pass-band work, this type of coupling unit has the advantage that it is easier to tune and, by making C3 variable the band width of the circuit can be made adjustable. It is particularly suitable, therefore, for use as the over-coupled transformer.

The Frequency Demodulator

The method of operation of this part of the circuit was outlined in the previous article of this

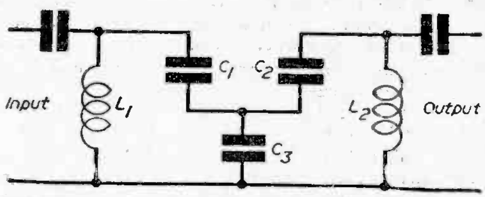


Fig. 16.—An I.F. transformer using mutual capacitance instead of mutual inductance coupling. The high frequency hump is tuned by means of C1 and C2 while the low frequency hump by means of C3.

series. As we have already seen, it consists of a limiter stage and a phase or amplitude discriminator circuit.

Owing to the more complex tuning of the amplitude discriminator, the phase discriminator is more popular with modern designers.

Fig. 17 shows the arrangement of a typical modern F.M. demodulator unit. Valve V1 is the limiter stage, the negative bias being provided by capacitor C1 and resistor R1. Resistors R2 and R3 are a voltage dropping circuit to provide the anode bend limiting of the positive peaks of the R.F. signal. The primary circuit of tuned transformer T1 is shunted by resistor R7 in order to increase the bandwidth.

The circuit of the discriminator itself is a modification of the basic circuit given previously, arranged in such a way that one side of the output circuit may be connected directly to chassis. The values of capacitors C2 and C3 are such that they present a negligible load to the A.F. output but are effectively a short circuit at the intermediate frequency.

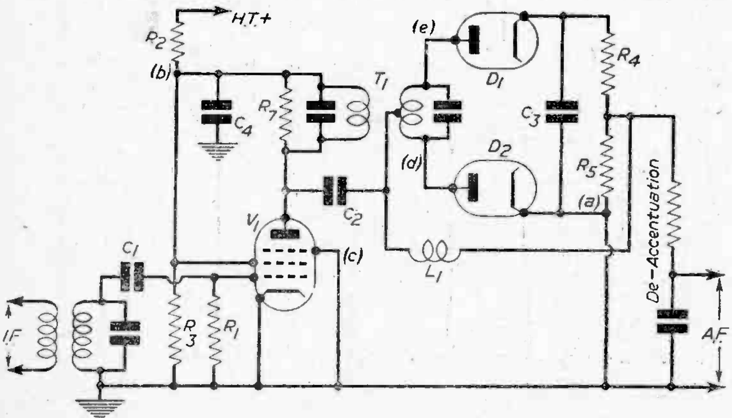


Fig. 17.—A frequency demodulator consisting of an amplitude limiter and a phase discriminator.

Operation

The operation of the modified circuit is naturally the same as that of the basic circuit. The values chosen for capacitors C2 and C3 are such that their impedances are negligible at the intermediate frequency, although C3 must not be a sufficiently high value appreciably to load the audio-frequency output. Choke L6, on the other hand, must appear as a dead short-circuit to the A.F., but on the other hand presents a high impedance to radio frequencies.

(To be continued.)

Two-valve Station Getter

A SIMPLE BATTERY RECEIVER WITH PROVISION FOR 160-METRE BAND RECEPTION

By Wm. Nimmons

THIS set was primarily designed for bedside reception. At my location, which is in Northern Ireland, it gives the Home and Light Programmes (which are very close together on the dial) free of each other; also the Third Programme, Scottish, North, Athlone, and numerous foreign and home stations, in addition to the amateurs on 160-metres, all on the loudspeaker, on an inside aerial.

The coil is home-made, but is far more efficient than some factory-made coils. Small, screened coils are all right when there are plenty of valves to make up for their inefficiencies. A small primary winding gives all the step-up needed when there is a high-efficiency pentode to tack on to it. But in this set there is only the detector valve to take care of the H.F. energy, so we have none to throw away.

Screening is a prime cause of inefficiency in a coil. In fact, it is by screening that many modern sets are "held down." If it were not for the screening they would be hopelessly unstable. As there is only one circuit proper in the present set, screening is unnecessary, because it is only when two or more circuits interact that instability results.

In addition, there is only one tuning coil—a primary coil linked by inductance to the main secondary coil is not used. The aerial is tapped in half-way down the coil; this is the most efficient method. Selectivity would suffer if the tapping were carried towards the top of the coil, while volume would suffer if it were carried towards the bottom. A compromise is necessary, and this is to take the tapping to the middle.

Now if it were connected up like this, the first impression you would get would be that the set was hopelessly unselective. We therefore connect a small condenser in series with the aerial. With this matters are improved, but the set still gives the impression of inselectivity; the Home Service spreads a lot, interfering with the Light Programme, though it is noticed that distant transmissions do not spread, even though they are received at the same time as the near and powerful ones.

Coil Design

What we have to do, therefore, is to fit wave-traps so that the near and powerful stations are reduced in volume and spread to the dimensions of distant ones. This clears up the dial, the powerful station being reduced to, at most, a couple of degrees, and leaves us free to receive the more distant stations.

This is achieved without sacrificing any of the sensitivity of the circuit. A simple set which gets its selectivity by means of a small primary coil has the strength of the weaker stations so reduced that they can only be received, if at all, by juggling with the reaction control on the verge of oscillation. Using the method I have described they can be received well clear of the oscillation point.

So much for the virtues of a large, unscreened coil. The coil itself, if you want to duplicate my results, should consist of 45 turns on a 2in. former, with a tapping, as previously mentioned, at the mid-point. The wire should be No. 22 gauge, either enamelled or D.S.C., with the turns just touching side by side. A quarter of an inch below the winding is wound the reaction winding, which consists of 35 turns of No. 28 gauge wire, enamelled or D.S.C.

This coil will tune from 150 metres to around 480 metres, with a standard .0005 μF tuning

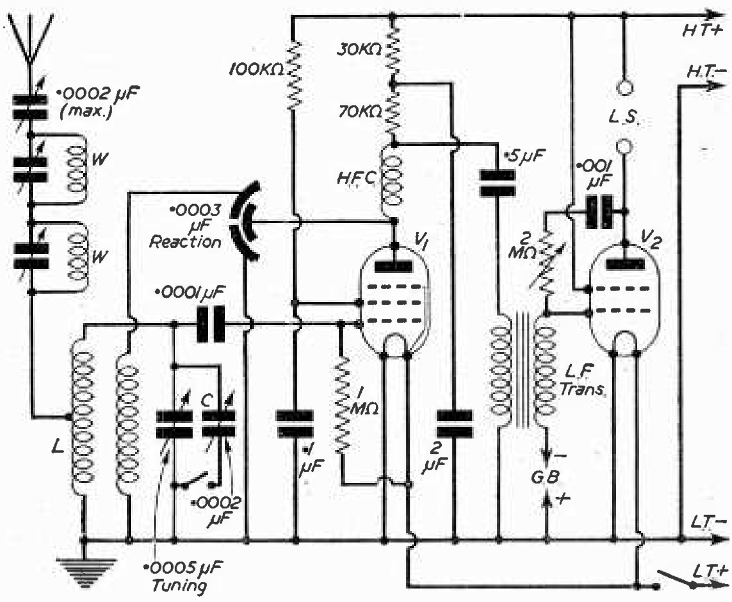


Fig. 1.—Theoretical Circuit. Note the wavetraps W, the coil L, and the condenser C which extends the waverange.

condenser. It is obvious, therefore, that if we want Athlone on 531 metres we will have to arrange for an extra condenser to be switched in when we want to receive that station, or any station above 480 metres in wavelength. This added condenser can be either a fixed or a variable one. A pre-set of .0002 μF capacity can be used, or different fixed condensers tried until one is found which gives the desired coverage. As a general guide, it would be well to start with a .0002 μF, though as no two condensers are alike you may have to try several.

In the writer's locality there is considerable activity on the 160-metre band, and this is the simplest way of getting down to this band. As there is only one coil it presents no difficulty at all—unlike more complicated sets with several coils. The standard coil, of course, tunes from around 200 metres to around 550 metres, thus missing out this important band. As a general rule, the set will give city-wide coverage of amateur transmissions, which are usually 10 watts on this waveband.

Wavetraps

It will be seen from Fig. 1 that two wavetraps are employed. These are to cut out the Home and Light Programmes, or rather to reduce their strength to that of a distant station. If only the Home Service gives trouble by spreading, then only one wavetrap need be used. If, on the other hand, the Third Programme also spreads, it may be necessary to use a wavetrap on this as well, making three in all; the three wavetraps would be connected in series in the aerial lead.

All the wavetraps are similar in construction, and consist of a coil of 85 turns on a 1¼in. former, the wire being No. 30 gauge D.S.C. This is tuned by a .0005 μF pre-set or small bakelite condenser. Two wavetraps should not be placed close together, and they should be at right-angles to each other to minimise cross fields. They should also be kept well away from the main tuning coil, as undesirable effects may be produced should their fields interact. They need not be screened provided reasonable precautions are taken, otherwise they may be screened with a cocoa tin or something similar.

The Circuit

As will be seen from the diagram, a pentode detector is employed. This may be either a non-variable-mu H.F. pentode such as the Mullard SP2, or a pentode specially designed for detection, such as the Cossor 220 I.P.T., which, although a battery model, is indirectly heated. In either case, although the SP2 is designed to work with the same high voltage on the screen as on the anode, a 100,000-ohms voltage dropping resistor should be included in the screen circuit, otherwise the reaction will be somewhat jumpy.

The rest of the circuit does not seem to call for any comment, except for the rather novel method of tone control-cum-volume control. This, it will be seen, takes the form of a simple negative feedback system between the anode and grid of the output valve. This is a real benefit when the set is used as a bedside receiver as it renders the reproduction sweet and mellow, without at the same time masking the high notes.

It consists of a .001 μF condenser in series with a resistor, the whole being connected between anode and grid. What is wanted is a variable resistor which, when the whole of the resistance is in circuit, will have no effect on the reproduction. As the knob is turned, making the resistance less, more and more negative feedback is applied, which quietens down the set. The same effect is achieved by turning down the reaction knob, of course, so far as volume is concerned. By manipulating these two knobs it is possible to achieve a class of reproduction which can be said to be pleasing. A 2-megohm (maximum) variable resistor, therefore, is required.

Telescribe for Air Traffic Control

DELEGATES to the Commonwealth Conference on the Operation of Gas Turbine Aircraft recently saw the Mullard Electronic Telescribe in experimental use at the Ministry of Civil Aviation, Air Traffic Control Experimental Unit, London Airport. The experimental set-up showed how this instrument could be used to speed up the transmission of traffic information between units of an air traffic control organisation.

Extremely rapid and reliable means of exchanging information between such units is essential in order to ensure efficient control and economic operation of all aircraft flying in areas of dense air traffic. The potentialities of the Telescribe in this field are being investigated by the Staff of the Air Traffic Control Experimental Unit. The ease of presenting data for transmission and its display in a convenient position and form is also being given equal consideration.

The purpose of the demonstration was to show how information can be exchanged between an Aerodrome Air Traffic Control Unit positioned, say, at Northolt, and an Air Route Traffic Control Centre at, say, Uxbridge—some four miles away. The importance of the Telescribe in such transmissions is governed by the fact that verbal/telephone liaisons are too slow. Moreover, during the period of high air traffic, they are already up to saturation level.

The Telescribe was originally devised by Mullard engineers to demonstrate practical possibilities of certain electronic principles, and it attracted a great deal of public interest when it was first demonstrated on the Mullard Stand at the National Radio Exhibition, at Earls Court. It enables written messages, tabulated information, maps, drawings, printed matter, photographs, etc., laid down or written on a glass plate, to be transmitted to a distant receiving unit where the data is instantaneously reproduced on the screen of a cathode-ray tube. In addition it will allow the superimposition of written messages, symbols, drawings or maps on any television or radar display.

The Ministry of Civil Aviation are already placing an order for a Telescribe equipment. With this they intend to explore all the many potential applications of the instrument to information transmission problems and, in addition, to P.P.I. radar displays.

Radio Receiver Design at V.H.F.—3

MORE ABOUT TUNED CIRCUITS

By G. P. Lowther

(*Continued from page 542 December issue.*)

Analysis of Fig. 6

According to normal transformer theory the optimum value of $r=\sqrt{\frac{R_L}{R_g}}$

Impedance reflected across anode circuit by grid $=r^2 R_g$.

Therefore total effective anode impedance

$$=r^2 R_g \text{ in parallel with } R_L.$$

$$=\frac{r^2 R_g}{2} \text{ since } r^2=\frac{R_L}{R_g}$$

Voltage reduction from anode to grid $=r$

$$\text{Therefore gain}=\frac{G_m.r.R_g}{2}$$

It follows that if r is made greater or less than the optimum value the gain is reduced.

$$\text{Band-width}=\frac{1}{2\pi CR}$$

But capacity thrown across anode circuit by grid $=\frac{C_g}{r^2}$

$$\text{Therefore total anode capacity}=C_a+\frac{C_g}{r^2}+C_t$$

$$\text{Hence band-width}=\frac{1}{2\pi\left(C_a+\frac{C_g}{r^2}+C_t\right)\frac{r^2R_g}{2}}$$

$$=\frac{1}{\pi r^2R_g\left(C_a+\frac{C_g}{r^2}+C_t\right)}$$

$$\text{Gain} \times \text{Band-width}=\frac{G_m}{2\pi r\left(C_a+\frac{C_g}{r^2}+C_t\right)}$$

Taking the example given for the previous circuit,

$$r=\sqrt{20{,}000/2{,}000}=3.16$$

$$\text{Then gain}=6\times10^3\times2\times10^3\times3.16/2$$

$$=\underline{\underline{19}} \text{ times or } \underline{\underline{25.5}} \text{ db}$$

$$\text{Band-width}=\frac{1}{\pi\times10\times2\times10^3[7+\left(\frac{10}{10}\right)+20]10^{-12}} \text{ c.p.s.}$$

$$=\underline{568} \text{ kc/s.}$$

These results are very much better than those obtained without tapping down the tuned circuit, but, as the frequency is raised, this type of circuit becomes more and more unsatisfactory owing to stray capacities making tuning difficult, and series circuits are best used.

Another factor setting a limit to the use of parallel-tuned circuits is the inductance of the grid lead which, though small, tends to resonate with the grid capacity as Fig. 11 shows.

If the grid is near the top end of the tuning coil, although L_2, the grid-lead inductance is small, L_3 is considerably larger than L_1 and so tends to resonate at about the same frequency as the anode circuit, thus assuming the form of Fig. 12 (see Fig. 9).

In view of these considerations, the practical limit to parallel-tuned circuits is about 250 Mc/s. Above this frequency series circuits are better used, the great advantage being that not only are the anode and grid capacities separated, but the effective tuning capacity is the *series* sum of these two.

Analysis of Fig. 7

If $C_a=C_g$, the performance of this circuit is similar to that of an untapped parallel-tuned circuit. To obtain the full advantage of increased gain and selectivity, C_g must be adjusted by means of external capacity until it is matched into the anode circuit.

$$\text{The optimum value of } \frac{C_g}{C_a}=\sqrt{\frac{R_L}{R_g}}$$

(neglecting C_t which should be as large as practicable).

Then the impedance reflected across the anode circuit $=R_g\left(\frac{C_g}{C_a}\right)^2$

$$\text{and the total anode impedance}=\frac{R_g}{2}\left(\frac{C_g}{C_a}\right)^2$$

$$\text{The voltage reduction from anode to grid}=\frac{C_g}{C_a}$$

$$\text{Therefore gain}=\frac{G_m R_g}{2}\times\left(\frac{C_g}{C_a}\right)^2\div\frac{C_g}{C_a}$$

$$=\frac{G_m R_g C_g}{2C_a}$$

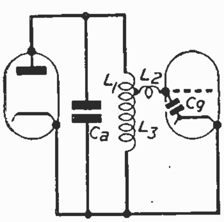


Fig. 11.—Showing the effect of the grid lead.

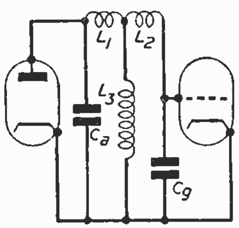


Fig. 12.—Compare this circuit with Fig. 9.

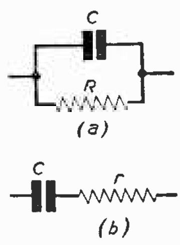


Fig. 13 (a) and (b).—These two circuits are actually identical.

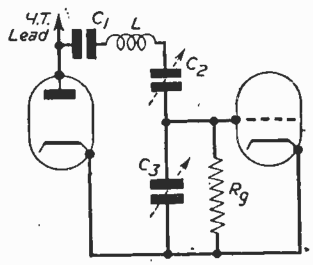


Fig. 14.—A series circuit as referred to on the following page.

It may be shown that Fig. 13a is equivalent to Fig. 13b, where $r = \frac{1}{R(\omega C)^2}$ providing r is much less than the reactance of C.

Therefore equivalent series resistance due to

$$r_g = \frac{1}{R_g(\omega C_g)^2}$$

and equivalent series resistance due to

$$R_L = \frac{1}{R_L(\omega C_a)^2}$$

But as already postulated, $\frac{C_g}{C_a} = \sqrt{\frac{R_L}{R_g}}$

or $C_g^2 R_g = C_a^2 R_L$.

Hence total series resistance $= \frac{2}{R_g(\omega C_g)^2}$

Let C_a in series with $C_g = C$

Then band-width $= \frac{1}{2\pi CR}$

But $R = \frac{L}{Cr}$

Therefore band-width $= \frac{C.r}{2\pi CL} = \frac{r}{2\pi L}$

But $\omega^2 = \frac{1}{LC}$ (from which is obtained $f = \frac{1}{2\pi\sqrt{LC}}$)

or $L = \frac{1}{\omega^2 C}$

Hence band-width $= \frac{r}{2.\pi \div \omega^2 C} = \frac{\omega^2.C.r}{2.\pi}$

$$= \frac{2.\omega^2.C}{2\pi R_g \omega^2 C_g^2}$$

$$= \frac{C}{\pi R_g C_g^2}$$

But $C = C_a$ in parallel with $C_g = \frac{C_a C_g}{C_a + C_g}$

Therefore band-width

$$= \frac{C_a C_g}{\pi R_g C_g^2 (C_a + C_g)} = \frac{1}{\pi R_g \frac{C_g}{C_a}(C_a + C_g)}$$

Gain × band-width

$$= \frac{G_m R_g C_g}{2C_a \pi R_g \frac{C_g}{C_a}(C_a + C_g)} = \frac{G_m}{2\pi(C_a + C_g)}$$

In the example given for the previous circuits, the optimum value of $C_g = C_a\sqrt{\frac{R_L}{R_g}}$

$$= 7\sqrt{10} \text{ pF or } 22 \text{ pF.}$$

Thus, an additional 12 pF must be connected between the grid and earth for optimum performance.

Then gain $= \frac{6 \times 10^{-3} \times 2 \times 10^3 \times 22}{2 \times 7}$

$= \underline{19}$ times or $\underline{25.5}$ db.

Band-width $= \frac{1}{\pi \times 2 \times 10^3 \times \frac{10}{7}(10+7)10^{-12}}$ c.p.s.

$= \underline{150}$ kc/s.

Thus, the performance is almost the same as that obtained by tapping down a parallel-tuned circuit, but the band-width is considerably reduced and the inductance may be made much larger (alternatively, a higher frequency may be used), as the effective tuning capacity even under optimum conditions (i.e., with the addition of 12 pF) $= \frac{C_g C_a}{C_g + C_a} = 5.3$ pF.

There is, however, a disadvantage involved in the use of series circuits, namely, the greater difficulty of tuning. Referring to Fig. 7, it will, of course, be realised that C_a, C_g, R_L and R_g are largely associated with the internal construction of the valves and are only drawn in the positions shown for the sake of convenience. Moreover, these diagrams are purely for analysis and do not indicate methods of H.T. feed, etc. If variable tuning is desired a small air-dielectric trimmer should be inserted in series with the inductance as shown in Fig. 14.

In this diagram components representing valve constants are omitted and those shown serve the following purposes. L is the tuning inductance, C_1 is a blocking condenser to keep H.T. from the trimming condenser and must be large compared with C_a and C_g, e.g., 200 pF—500 pF. C_2 is the tuning condenser which should be as small as possible physically in order to minimise its self-inductance, while C_3 represents the trimmer for adjusting the grid capacity to the optimum value. This value is best found by trial and error, adjusting the condenser for maximum gain. Alternatively, various small fixed capacitors may be tried until an optimum value is found. The grid-leak R_g may be between 20,000Ω and 50,000Ω.

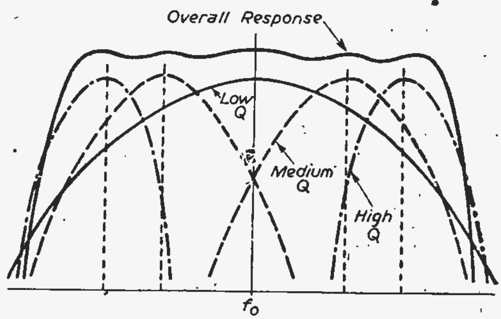


Fig. 15.—The combined effect of a number of stagger-tuned circuits.

Whereas with a parallel tuned circuit one side of the tuning condenser is at earth potential, it will be seen that both sides of C_2 are "hot." It must, therefore, be well separated from the chassis in order to avoid stray capacity to earth, and unless an insulated tuning tool is used, hand capacity will be troublesome. It has already been shown that in a typical case the effective tuning capacity may be about 5 pF. Thus, to vary the tuning, C_2 must be comparable with this value. It will be seen from Fig. 15, however, that C_1, C_2 and C_3 form a potential divider and, therefore, as C_2 is reduced (i.e., as its impedance is increased) the voltage across C_3 is reduced. Hence C_2 must be kept as high as possible and the tuning range should be restricted to the minimum required. A suitable value is about 30 pF—50 pF max. As the capacity is reduced in tuning, so the gain will drop and the selectivity increase. It should not be reduced below 10 pF—15 pF.

(*To be continued.*)

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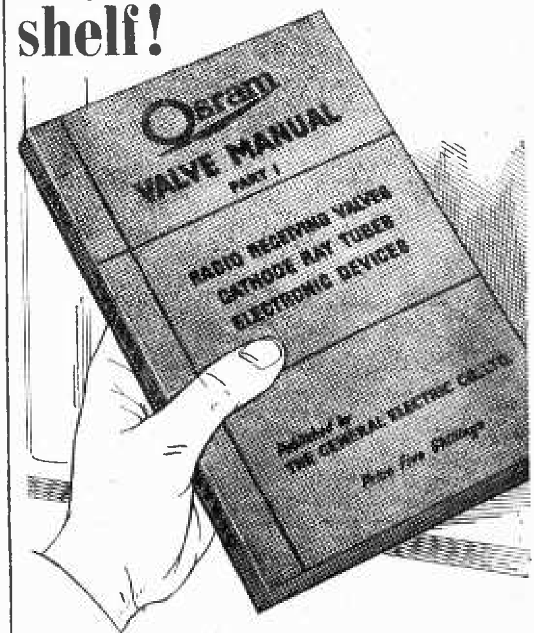

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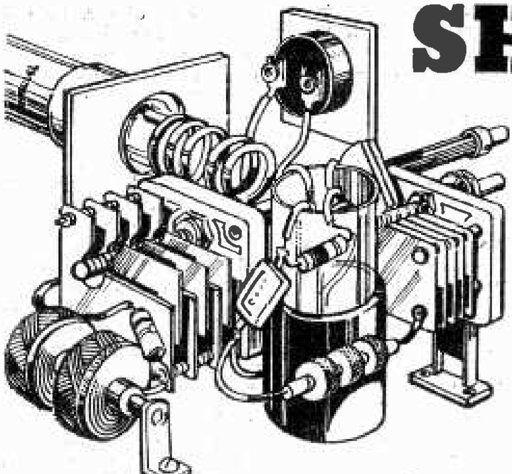


SHORT-WAVE SECTION

CIRCUITS AND SUGGESTIONS FOR SHORT-WAVE EXPERIMENTERS

By A. W. Mann

THOSE who read and study published DX logs will have noted that the best lists are not always those which have been compiled by the operators of the more expensive short-wave receivers.

In some instances some of the rare catches are listed by users of simple one-valve regenerative receivers. This applies especially in the case of listeners who specialise in the reception of amateur C.W. transmissions.

The main reason for the popularity of such simple apparatus is because of the high signal-to-noise ratio, which to the C.W. man is a great asset, as it enables him to hear at times extremely weak signals which would be below the noise level of multi-stage receivers.

The occasion arises, however, when the desire for a little more amplification is felt. The most satisfactory way of obtaining this, and at the same time obtain a satisfactory signal-to-noise ratio, is to add one or more high-frequency stages. In the interests of selectivity and low noise ratio they should be tuned.

This, of course, will require a little extra outlay unless the necessary components are to hand. While readers will appreciate the advantages of H.F. amplification, there are perhaps some who hesitate, for the time being, to incur the necessary expense.

R.C.C. Amplification

Fortunately, there is a very useful alternative available, which can be used to advantage, and at low cost. Fig. 1 shows a simple arrangement in theoretical form which will prove to be a good compromise. This is in the form of a regenerative detector, followed by a stage of resistance capacity coupled LF amplification.

It should be realised that a receiver built along the lines suggested will not provide the amount of L.F. amplification associated with any of the L.F. transformer coupling arrangements. As a matter of fact it will be much less. The C.W. enthusiast will, however. find that the additional gain to be obtained can be used to good purpose.

The additional components required are few and inexpensive. Apart from the L.F. valve and holder, the rest of the components can be arranged below the chassis. A receiver of this type may be built on conventional lines, and in a very compact form.

S.W. Converters

While short-wave converters are extensively used by the amateur transmitting fraternity, the short-wave listener seems to prefer a complete receiver, even of the most modest design.

Some of them have, no doubt, an old T.R.F. or superhet receiver stored away, or know a dealer who has a similar one of the broadcast type taken in part exchange. If one of these old models, which as a broadcast receiver has outlived its usefulness, is overhauled, and coupled up to a short-wave converter, loudspeaker reception of a very high order is within the bounds of possibility.

I qualify those remarks by adding that I followed the procedure outlined, many years ago, and remember that the most successful DX listener of those days used an old superhet in conjunction

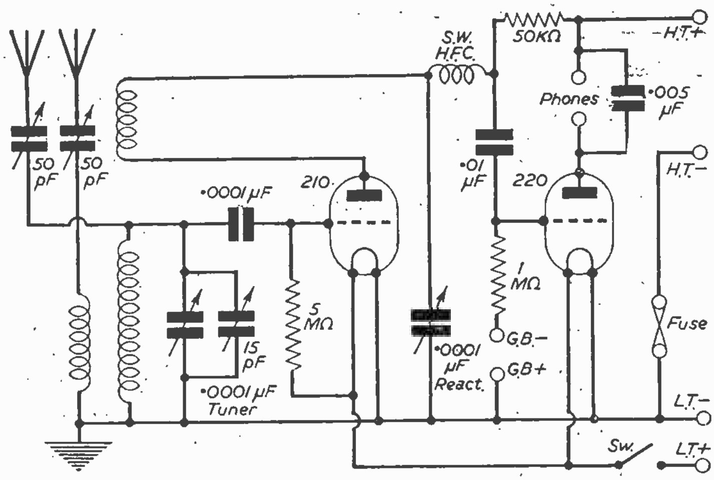


Fig. 1.—Theoretical circuit of a simple two-valver.

with a commercially-produced converter. What is more, he won at least one DX listening competition using that combination, and all on 'phone reception. Old hands will remember Bob Everard.

As the operation of short-wave converters appears to be well understood, I am presenting only a theoretical circuit diagram, Fig. 2. This can be used with a battery-type receiver. For use with an A.C. receiver an A.C. type is recommended.

Before going further, I must add that this type of converter, while capable of providing good results, is productive of second-channel effects and is out of date when compared with the triode hexode and triode pentode types. It is therefore presented only with the idea of providing the experimenter with circuit details of the most simple converter in order that he can build it for tests in conjunction with an old B.C. type superhet or T.R.F.

Should the results obtained prove that the construction of a modern type converter would be well worth considering, he could go ahead with confidence and some experience of converter operation. The modern type, however, should include at least one H.F. stage.

'Phone Output Filter

Users of regenerative short-wave receivers are sometimes troubled with headphone lead capacity. While the inclusion of output choking arrangements of the L.F. type, if included in the receiver, will in some instances cure the trouble, this is not always the case. Much depends on the receiver design and layout.

Those who have receivers in use which are prone to this defect might care to try the idea as outlined at Fig. 3. This could be built into a suitable metal box which should be earthed, or a wooden box fitted with an earthing terminal or socket respectively.

This headphone output filter unit incorporates two standard short-wave chokes and two fixed condensers. Jack sockets or other arrangements for coupling are a matter of choice. An additional output jack socket could be wired in parallel, allowing two pairs of headphones to be used when required.

Troubles

This brings to mind other troubles usually associated with regenerative short-wave receivers. In an effort to obtain smooth regeneration it is worth while including a variable by-pass condenser between the detector anode and earthed side of filament. A .0001 μF trimmer type is the most suitable.

With the lowest wavelength coil plugged into the coil-holder, tune in a transmission at the lower end of the scale and adjust the by-pass condenser to the point where the smoothest regeneration is obtained.

As is well known, wander plugs should be made to wander and various voltages tried on the detector anode, and H.F. valve anodes and screens, the full 120 or 150 volts being applied to the anode of the output valve.

If an H.T. battery eliminator is used in place of an H.T. battery, extra decoupling and smoothing may be required, depending on the suitability of the eliminator for use with short-wave receivers.

A useful aid to stability, and also a help in removing slight traces of mains hum when using some types of H.T. eliminator with regenerative short-wave receivers, is a .1 μF non-inductive fixed condenser between the "earthy" end of the grid coil and the chassis. Note here that the type of fixed condenser specified has a black ring around the body at one end. This end goes to earth. Also, while satisfactory when tuning down to 13 metres, when incorporated in receivers tuning down to ten, regeneration is in some instances unobtainable with triode detector circuits.

Not everyone is successful when first using screen-grid valves as detectors. While they follow circuit recommendations, regeneration is uneven, due to dead spots in tuning. Now the secret of success with this type of detector is to make

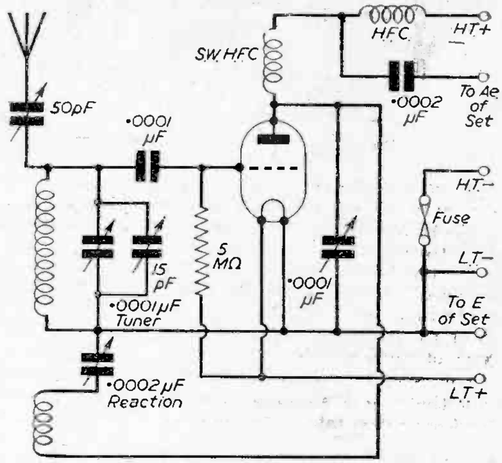


Fig. 2.—Simple one-valve converter.

provision, via a potentiometer, for varying the screen voltage. In some circuits a 100 KΩ type is specified, but I find that one of half that value is more satisfactory.

Dead spots have been dealt with by the writer and others on several occasions, and I do not propose to deal fully with them here. There are two points worth mentioning concerning them. A series aerial pre-set condenser is not always the final remedy in removing them throughout the full tuning range. The same applies to untuned H.F. stages.

Much depends on the general design of the receiver, the voltages used on anode and screens, the suitability of the H.F. chokes, also coil design and wiring. Dead spots may be of the absorption type or cancellation type. The point to note is that while the application of one suggested idea may prove to be an effective cure in some instances, a quite different approach may be necessary in others, irrespective as to type.

L.F. Amplification

One of the most popular methods of transformer coupling as applied to short-wave receivers is parallel feed. Here again some experimenters fail to achieve satisfactory results in applying this form of coupling.

This is usually because a standard type of L.F. transformer is used. Several standard types may be used successfully, while there are others which are unsuitable. If possible use a transformer specially designed for the purpose. Failing this, run comparative tests with the standard models you have to hand. Satisfaction is, of course, assured when a specially designed model is used.

It was common practice here and in the United States some years ago to build straight circuits and T.R.F. types in which two stages of transformer L.F. coupling were used. This type of receiver when built by inexperienced constructors proved to be most unsatisfactory, due to instability.

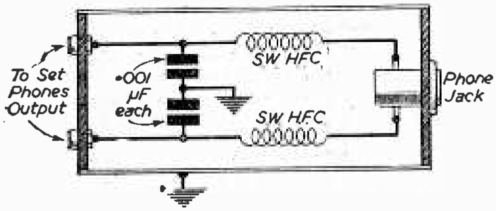


Fig. 3.—A useful phone filter.

Much better receivers of this type could be built today, because decoupling would be included. It is far better either to use one R.C.C. stage followed by a transformer-coupled stage, using a really first-class L.F. transformer, or on the other hand to use one stage of L.F. with the pentode type of output valve.

This would be more satisfactory considering the fact that signal-to-noise ratio is a factor which must be taken into consideration.

Plug-in Coils

Plug-in coils can be wound successfully on standard commercial type formers. Published data should be followed if a full set of coils are to be wound to meet specific requirements. By following this procedure and adhering to the specifications, success should follow.

While one may follow "cut-and-try" methods in the case of a single coil, it is not advisable in the case of a full set, as threaded formers do not lend themselves to repeated unsoldering, unless of the detachable base type. Even then it is unwise to apply a hot soldering iron too often, or loose pins may result. "Cut-and-try" methods are best confined to valve base and paxolin former type coils.

Band-spread

You may or may not be in favour of band-spread tuning. I have read references to it as being unnecessary in some particular design, as a slow-motion dial was included. Every one to his fancy, of course, but at the same time it is a good idea to leave sufficient space for an additional bandspread condenser dial.

Mechanical or some method of electrical band-spread may be used, and while I have nothing against the former method, of which there are some fine examples, personal preference is for the electrical methods.

Volume Control

Every type of receiver with more than two valves should be fitted with one or more volume controls. A two-valver using triodes need not be fitted with such controls, although in the case of a pentode output stage being used, an L.F. volume control would be an asset for cutting down the volume of the most powerful transmissions. Where H.F. stages are used, the screen voltage potentiometer will effectively reduce the input volume to the detector. Variation of this control will, however, have an adverse effect on the tuning dial calibration.

The fitting of both H.F. and L.F. volume controls is strongly advised in the case of loudspeaker short-wave type receivers. It is surprising how background can be reduced and weak signals built up under noisy receiving conditions, when mush is predominant.

Ultrasonic Testing

SOUND waves of so high a pitch that they cannot be heard by the human ear are now being used to examine tyres for flaws which can be neither seen, felt nor detected by X-rays.

Passed through water, these ultrasonic waves, as they are called, will detect in a tyre an air film as thin as 15/1,000in. Research workers at the Dunlop Research Centre and the General Electric Company have therefore jointly designed an instrument which generates ultrasonic waves under water by quartz crystals coupled to a source of high-frequency electrical impulses.

Crystal Oscillator

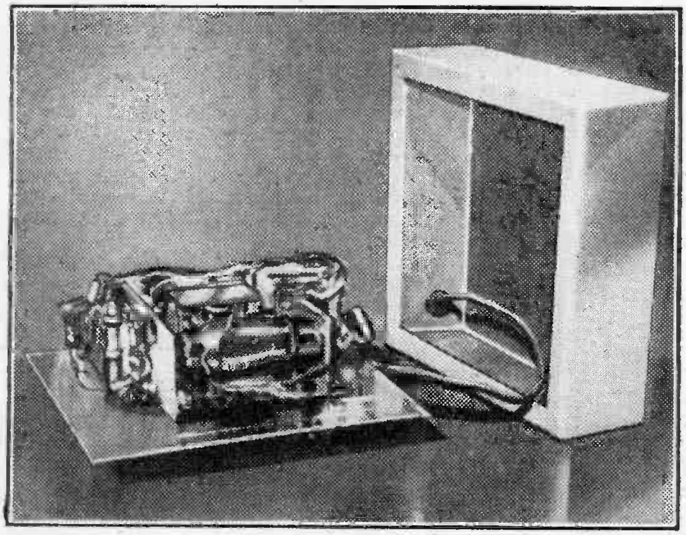
A quartz crystal generator is placed within the arc of a tyre cover slowly turning round with the lower part under water and the waves pass through the cover in all directions. If there is the slightest lack of adhesion between the 70 or 80 pieces from which the tyre may be built, an air film will be present and the waves will pin-point the flaw on a dial.

The new technique should prove a valuable addition to possible existing inspection methods, and will be particularly useful in dealing with covers returned from service to be retreaded. The first of the new instruments has been installed at Fort Dunlop and will be used for a wide range of covers from 14in. to 24in. in rim diameter, 4½in. to 17in. in width and up to 300lb. in weight.

A CAPACI

A 1 Mc/s TE

By J. S.



The compact assembly may be seen here.

Constructional detai signed to measure fro pF in two ranges. material can be obtaine new material is specifie

WITH the coming of television to many areas that were not previously served, the need for a 1 Mc/s capacity bridge at a reasonable price has arisen, especially in those shops and laboratories that do servicing and experimental work. Whilst it cannot be said that the readings at 1 Mc/s are as accurate as those made at, say, 50 Mc/s, they are a far better guide than those made at, say, 50 cycles. This 1 megacycle bridge will measure up to .001 μF in two ranges, 0-75 and 75-1,000. Most of the components can be obtained on the ex-W.D. market, but I do not recommend that valves other than those specified be used, as the operation of the circuit is rather critical but quite robust.

The principle of the bridge is very simple, it is that when a resonant circuit is in tune with an oscillator and loosely coupled with it, the voltage developed across the tuned circuit is at a maximum when tuned to the same frequency as the oscillator. If, then, there is a variable condenser in the tuned circuit and at maximum it resonated with the oscillator, and a small condenser is connected across the circuit, an amount equal to the capacity of the new condenser will have to be taken out on the variable condenser before the balance can be restored. For this type of circuit it will be realised that balance between the two circuits is essential, and also that the oscillator must be stable.

The oscillator, which incidentally has to supply quite an amount of power under load conditions, employs a Mullard EL33 triode connected. This valve was chosen because of its very high slope (10 mA/V) and exceptional stability, although several other types were tried. The only other type worthy of mention is an A.C./D.C. type for those who want to make a universal version of the bridge, and that is the KT33C made by Osram. The two coils are wound with 28 S.W.G. wire on to opposite ends of a piece of broom handle 6in. long; that for the oscillator is of 60 turns, tapped at 20 turns up from the chassis end for the cathode connection, whilst the other coil consists of one winding of only 55 turns. The object of the lower number of turns is to allow less capacitance to be used in the oscillator circuit to enable a higher "Q" to be obtained for that circuit. The small components of the oscillator circuit can be mounted on the valve-holder of the EL33.

All the small condensers in this piece of apparatus should be of the silvered mica type, or ceramics, as paper types are of very little use as they greatly reduce the "Q" of the circuits, with the result of greatly impaired accuracy.

The detector consists of a 6C5 connected as a delayed leaky-grid detector with a 3KΩ cathode load to provide the delay voltage. The use of a delayed detector allows a "magnification" of the peak by rectifying the voltage developed across the circuit only when it has reached a certain value. In this particular instrument an accuracy of 1/100

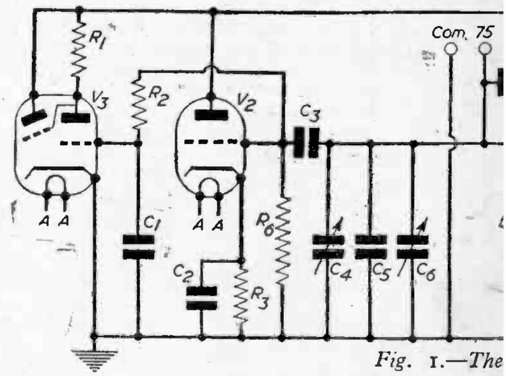


Fig. 1.—The

LIST OF C

V1—EL33.
V2—6C5.
V3—Y63.
R1, R2 and R6—1MΩ.
R3—3KΩ.
R4—30KΩ.
R5—1.5 KΩ 5W.
C1, C2, C3 and C7
C4—5 pF variable.
C5—520 pF (see te
L1—55 turns of wire wound in a single
L2—60 turns of wire wound at other

Y BRIDGE

TRUMENT

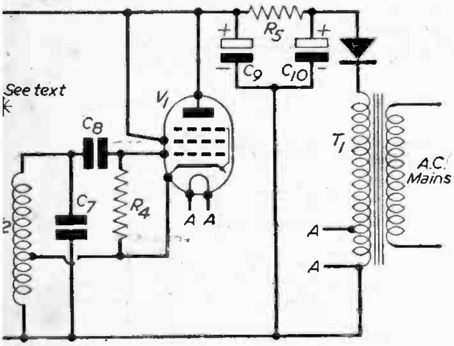
DALL

part of the scale can be easily obtained. The coupling from the detector to the Y63 is by means of a 1 megohm resistor decoupled with a 500 pF condenser. The Y63 is readily available but suffers from the disadvantage that it is of the variable mu type. If it is possible to obtain, a Y62 would be much better as it has a "straight" characteristic; the Y61 is not suitable as it will not handle the voltage required.

an instrument de-
pF and 75-1,000
ugh some of the
e ex-W.D. market,
is far more reliable.

The Condenser

The tuning condenser used is a 0-75 pF ceramic variable, but if so required a 0-100 can be used, but then a scale different from the one given will have to be used, and worked out. The small 5 pF condenser across the indicator is for balancing out the capacity of leads by removing up to its own capacity from the circuit. In practice I find that it is very rarely used, as on the high range the strays can usually be ignored, whilst on the low range they can be read off the scale and subtracted from the total. The 520 pF is made up of 500 pF in silvered mica condensers, with a 5-40 pF ceramic trimmer of



al circuit.

ONENTS

f pF.

C6—75 pF variable.

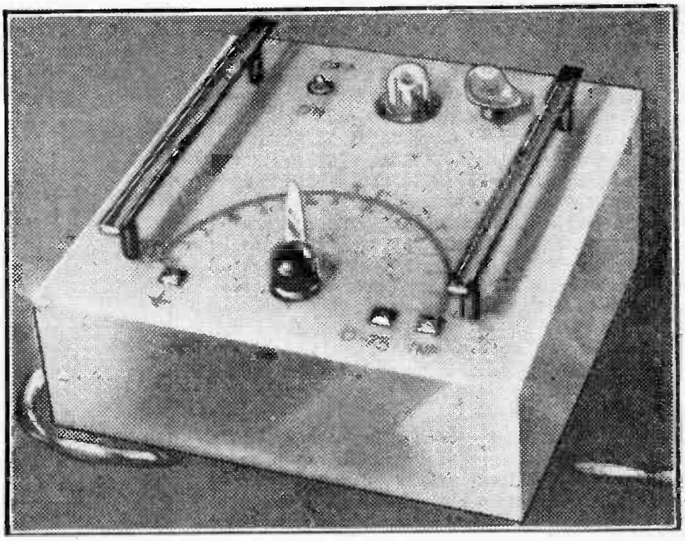
C8—.001 μF.

C9 and C10—16-16 μF 350 v.

T1—Elstone pre-amp. transformer.

on a piece of 1in. diameter wood.

of former, tapped at 20 turns.



The finished instrument in its case.

the type made by Erie mounted across them. The method of obtaining the balance between the two circuits is by setting the two variables to maximum capacity, then setting the trimmer to balance—that is the condition where the shadow is the largest on the Y63. The instrument must be put into a case made of metal in order that the stray radiation (which is in the broadcast band) may be kept to a minimum.

The Power Unit

The power unit consists of a metal rectifier and an Elstone pre-amp. transformer. This transformer has a 6.3 volt and a 250 volt winding, and as the full H.T. current is not drawn, the slight overload on the heater supply is of no consequence. The smoothing is not in the least critical, and the 16-16 μF condensers used just happened to be handy, and the resistor is a 1,500 ohm 5 watt vitreous type that was also at hand. All the other resistors can be of ½ watt rating.

The actual design of the mounting brackets for the components will depend on the cases at hand. If the maker is not too particular there is one ready-made form of case which is available from the grocer's shop and that is the half-sized biscuit tin. The writer, who has his own small press shop, made his case out of a square of 22 G steel sheet 18in. by 18in., and the four corners are cut out 4in. deep and out of each side a piece ½in. square is cut out. The first folds are made ½in. in on all sides, to form the top flange on which the top panel rests; the folds for the sides are then made. This type of case can be beaten out, using a block of hard wood. This mode of fabrication will not, however, be as neat as a pressed job. The final operation is to solder the seams. For this latter operation there is nothing to beat Arrax solder, made by Multicore Solders, Ltd., as it will take readily on slightly tarnished steel without the aid of spirits. When finished, joints made with this solder should be washed to remove any surplus flux.

The panel can be best made out of a 10in. square of 16 G aluminium. This metal can be finished very nicely if rubbed in one direction only with fine emery cloth, being very careful not to touch the panel with the fingers. The surface when so treated will take indian ink very easily, and if by any chance a slip is made it can be removed by washing with water. The scale can best be drawn with the aid of a pair of compasses ; in order that the centre can be found accurately a small cork should be inserted into the hole where the "tuning" arm will protrude. The printing and figures will look really professional if done with the aid of Uno stencils. The panel should be given a coat of clear copal varnish for protection, and allowed to dry well before assembly.

Making the Scale

With the 75pF tuning condenser, it is quite an easy job to divide the scale into 15 equal parts and then sub-divide these into 5. Fig. 3 shows how the scale is divided with the aid of a set square and compass. The main lines are drawn in very lightly with the aid of a set square, and the resulting divisions again divided by "bisecting" the angle with the aid of compasses ; the remaining divisions can be gauged by eye.

The handles, which serve as guards for the pointer and the top of the Y63, are made out of ½in. by ⅛in. brass strip 8in. long. The pillars that support the handle are made of ¼in. diameter brass rod, and are 1¼in. long with ¾in. of B.S.F. thread. This was used as it is finer than Whitworth, and just over ¼in. is cut on the other end. There is a tapped hole in the handle to take the top of the stud, which is screwed in tight, and the small, protruding part of the stud filed off level with the handle. The two spacers are made out of a piece of suitable tube ⅜in. diameter and 1in. long, and fixing is by means of a nut which holds the handle in place. The use of handles on cases not only makes the instruments more portable but protects them.

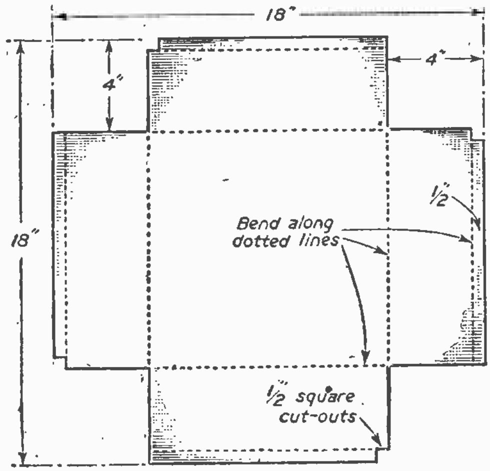
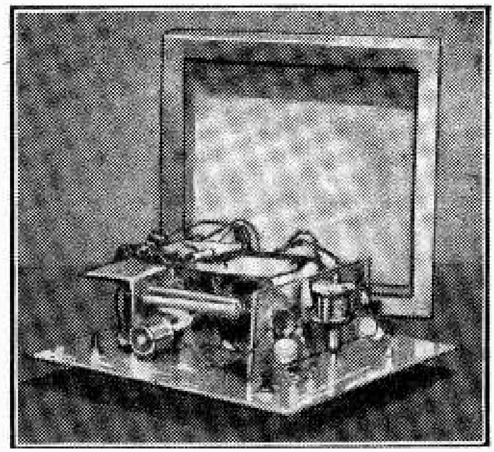


Fig. 2.—Details of the chassis.

The pointer was made from an old knob with a standard ¼in. drilling stuck to it, and was cut out of Perspex. The material used for cement consisted of a quantity of Perspex made into a jelly with chloroform, and thinned out to a usable state with equal parts of ether and trichlorethylene. This

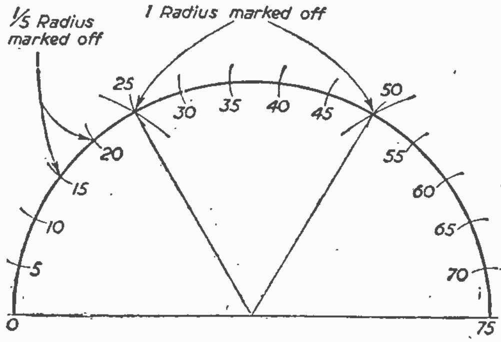


Another view of the interior of the meter.

cement will stick almost any plastic, as nearly all are soluble in one or more of these three solvents, so that the resulting job is nearer to being a weld than the normal "glued" joint.

The high range is obtained by placing a 75 pF

(*Concluded on page 42.*)



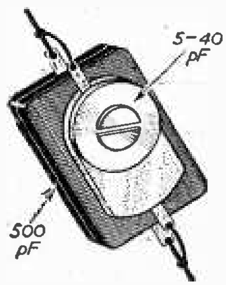


Fig. 3 (above).—How to mark out the dial.
Fig. 4 (below).—How the condenser is made up.

SUPERHET *versus* T.R.F.

A REPLY TO SOME CRITICISMS, AND SOME DIFFICULTIES EXPLAINED

By W. J. Delaney (G2FMY)

A NUMBER of criticisms have been received lately concerning the range of T.R.F. circuits which have been published in these pages. Quite naturally, the critics are those who, for some reasons or another, favour the superhet type of receiver, but there is a widespread opinion that the superhet is a better receiver than the T.R.F. It is proposed, therefore, to try and show here that this is not necessarily so, and that in the hands of the average amateur a T.R.F. circuit may give very much better results than a superhet, at a lower cost, and with much less difficulty—either in construction or in maintenance. Let us take, first of all, a general survey of two four-valve receivers of each class. In the superhet these would be employed as frequency changer, I.F. amplifier, second detector combined with first L.F., and an output stage. The T.R.F. would consist of either one H.F., detector, L.F. and output, or two H.F.s, detector and output—the former being more common. Now on the score of expense the valves for the superhet would cost slightly more, due to the frequency-changer valve, but the coils would be much more expensive. For the T.R.F. there would be just two sets, the H.F. or aerial coils and the intervalve coupling coils. Ignoring for the moment the type of coils, that is whether they are simple dual-range or four or five-range coils, in the superhet we have the aerial or H.F. coils as with the other receiver, and in place of the intervalve coils are the oscillator coils. These will have to have padding or tracking condensers associated with them which result in a slight increase in price, but in addition to these there are needed two I.F. transformers. These will cost, say, 10s. the pair. For the rest of the two circuits there may be a slight increase in parts for the superhet due to the A.V.C. circuits, which are generally included. Therefore a superhet is dearer to construct.

Range and Stability

The next and most important point is the performance which is given for the amount of money which is expended, and it is here that there should be a difference. Fig. 1 shows a block diagram of a T.R.F. receiver of the four-valve type, which we are taking as our standard for

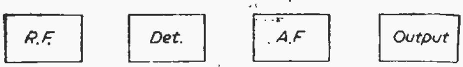


Fig. 1.—Block diagram of a standard type of four-valve T.R.F. circuit.

comparison purposes. It will be seen that the signal is amplified by one stage before rectification and that the remaining stages merely provide A.F. amplification. Therefore, all that can be done regarding selectivity, etc., must be done in the one stage and the amplification will depend upon the type of valve which is used. In the following figure we have the comparable superhet in which the detector is now the third of the links and consequently the signal has passed through two stages with the associated tuning devices. It is natural to suppose, therefore, that it will receive greater amplification, and due to the additional tuning

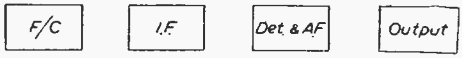


Fig. 2.—Block diagram of a standard type of four-valve superhet circuit.

stages it will be simpler to separate closely adjacent signals—in other words, it should be more selective. Actually, of course, that is the real position—the superhet for the same number of valves should have a greater range of reception and should be much more selective. But there is a big snag to this, and that lies in the following explanation. For the purpose of this explanation, of course, intricacies such as second-channel interference, image rejection, etc., are being ignored, although they complicate the superhet circuit. For those who are not too sure of how the superhet works it may be repeated that, briefly, the tuning between the aerial and the first valve is exactly the same as with any other receiver—a coil is tuned by a variable condenser to the frequency of the desired signal. Between the frequency-changer and the I.F., and between the I.F. and the detector, however, are further tuned stages, and it would be a difficult matter to tune all of these circuits to exactly the same frequency. Consequently, the two latter sets of coils are tuned to one frequency only (known as the intermediate frequency) and arrangements are made in the frequency-changer stage to convert or change the signal frequency to this intermediate frequency. There is, therefore, another tuned circuit which is ganged with the main aerial tuning circuit, but the coils have different values or are adjusted by means of small pre-set condensers to have values such that as the signal is tuned the ganged tuning condenser adjusts this other set of coils at a different rate and produces the difference frequency which is passed on. It should now be obvious where the first big snag in the superhet arises. The fixed-tuned coils between the first three valves are each of the transformer type and are, in fact, called the I.F. (intermediate frequency) transformers. The diagram on p. 28 shows in very skeleton form the arrangement so far described. L1 is the ordinary tuning circuit, and the variable condenser across it is ganged with the condenser across L2, which is the oscillator coil and which has to be tuned to a point slightly different from L1, so that a beat or difference frequency may be set up within the frequency-changer valve for subsequent amplification.

Coils L3, L4, L5 and L6 must all be accurately tuned to this difference or intermediate frequency, and obviously if one of them is slightly out or off-tune, amplification and selectivity will suffer. Usually these I.F. transformers are supplied with the trimmers ready adjusted by the manufacturers to the commonly used I.F. (465 kc/s), but there will be stray capacities introduced by the wiring which will vary with each individual receiver, and these call for a slight re-adjustment of the trimmers.

The Oscillator

By far the most important circuit, however, is the oscillator stage, which is the coil marked L2 in Fig. 3. As already stated, this has to provide the I.F. from each signal which is tuned, and without going into a lot of detail and calculations it may be said that it is extremely difficult to obtain the exact I.F. at every setting of the tuning condenser on one coil. When all-wave coil sets are employed the difficulty is increased. It becomes obvious from what has been said that some apparatus is required whereby one can be certain, firstly, that the I.F. transformers are all correctly tuned to the required I.F., and secondly, that the oscillator circuit is correctly adjusted that the I.F. is produced at as many points as possible, and this means that a reliable signal generator is required. Very few amateurs possess such a piece of equipment and therefore they will be unable to get the best from a superhet. With the T.R.F. as shown in Fig. 1, however, all that is necessary is to trim or adjust the two sets of coils at all settings required, and this may be carried out on a received signal comparatively easily. It might be pointed out here, that with most superhets, even those of commercial design, the tracking or alignment of the tuned and oscillator circuits is usually carried out at three points on the dial—at each end and in the centre of the scale, and as a matter of interest it is instructive to take a laboratory-aligned superhet, tune to a signal about two-thirds of the way round the dial (preferably a very weak one) and then carefully adjust the oscillator trimmer or tracker for that particular range. In most cases it will be found that the signal strength may be improved, but the trimmer should be put back to its original position, otherwise the tracking will be out at some other part of the scale—and perhaps the error may be very large at some particular setting. It is obvious, therefore, that the correct adjustment of all these variables without a signal generator is a difficult proposition, and, although very good results may be obtained on one or two stations, the overall performance of the receiver may fall far short of that obtained with a T.R.F., in which such a high standard of accuracy is not required.

A Misconception

Incidentally, before closing it may be desirable to correct a popular misconception concerning the lining-up of a superhet without instruments. One often hears the instruction given to the amateur to adjust the I.F.s first by using the A.F. volume control and adjusting the I.F. trimmers for the loudest background noise. This, of course, merely indicates that all the I.F. circuits are tuned to the same frequency and gives no indication that they are tuned to the correct setting. For instance, they may be 465 kc/s components, in which, due to stray capacities, one circuit is slightly high. If the amateur does not hit on that particular circuit when he goes to trim for loudest background noise, he will adjust all the other circuits to that single faulty one and thus will have all his I.F.s at, say, 468 or even 470 kc/s. Obviously, therefore, if he adjusts the oscillator circuit on one station to maximum results, he will have adjusted the

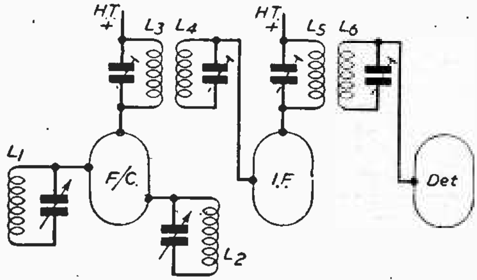


Fig. 3.—Simplified diagram of the tuning found in a circuit of the Fig. 2 type.

oscillator to provide a beat of 468 or 470 kc/s, and the design of the coils will not permit of the tuning holding that difference throughout the tuning range, and as a result he will find that the receiver is perhaps completely dead at one end of the scale whilst in one small area it is quite lively.

To sum up, therefore, unless you have access to a reliable calibrated signal generator, a superhet may give a worse over-all performance than a simple T.R.F. receiver.

Radio Direction-finding

DURING the war much progress was made in Germany in radio direction-finding. For example, there were devised some novel arrangements to improve the accuracy of both direction- and position-finding. Radio Research Special Report No. 21, published for D.S.I.R. by H.M.S.O. and now on sale price 3s. 6d., contains translations of nine papers written by German technical experts in this field of radio. Seven of the papers were presented originally at an official German conference on navigational aids and allied problems held at Landsberg in 1944, and two are later contributions. The report should be of considerable interest to contemporary scientific and technical workers on this subject.

Some of the papers contain the results of fundamental investigations designed to demonstrate the limitations in the accuracy of finding a position or direction imposed by wave propagation and other conditions. The relative merits of determining direction by the measurement of phase difference and time of arrival of the various component waves are discussed. Other papers describe the principles and experience obtained with new techniques demonstrating the influence of aerial spacing, a topic which has now become familiar to all those concerned with recent developments in the subject of radio direction-finding.

The papers are published under the name of the original author and the translations were provided by the Admiralty.

Noise Limiters

IMPROVEMENTS TO LONG-DISTANCE RECEIVERS

By T. W. Dresser

THE primary aim of all short-wave listeners and transmitting amateurs being to receive the desired signal as loud and clear as human ingenuity will permit, it follows that a noise-limiting arrangement in the circuit is a necessity, particularly within city areas where car ignition systems, refrigerators, vacuum cleaners, flashing neon signs and other unsuppressed apparatus can play havoc with reception.

The trouble, hitherto, has been that large numbers of limiting circuits have been published, many of them involving considerable wiring changes and receiver re-alignment, and quite a lot laying claim to special virtues, and in consequence many amateurs either consider them not worth the trouble involved or become confused by the multiplicity of types available and by the claims made for them.

This article, therefore, has been written in an endeavour to clear up the situation as far as possible and also to show that wiring a limiter into any receiver need not necessarily mean a lot of hard work or major changes.

First, let us get a clear idea of the purpose of a limiter. Expressed very simply, it is that any noise limiter is there to remove or reduce signals of high amplitude and short duration which occur at irregular intervals in time. This definition covers noise due to the types of electrical gear mentioned in paragraph one, similar interference signals from other electrical and medico-electrical apparatus and also that caused by atmospherics, more commonly known nowadays as static, which embraces distant thunderstorms and cloud discharges generally. As these noise pulses occur at irregular intervals (see Fig. 1) their average power is low; but the peak power of any one pulse may be, and often is, many times greater than that of the desired signal. As a result the wanted signal is blanked out and some sections of the receiver are severely overloaded by the noise pulse. Fortunately, however, the duration of these pulses is usually very short and the receiver can be silenced for such a short period of time without the human ear detecting the break.

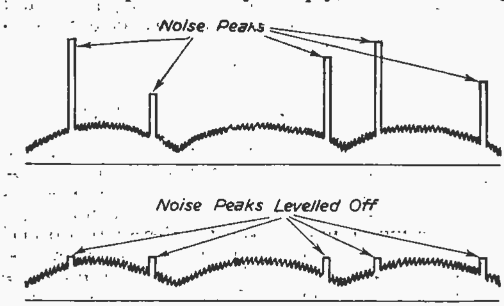


Fig. 1.—Noise peaks and the effect of clipping them.

Two Types

There are two common types of limiting circuit in use to-day, the "clipper" or shunt circuit and the series or "gate" arrangement. The clipper was the first circuit of the sort devised purely for noise elimination and its method of operation was to reduce the level of all signals to a predetermined figure by means of a manually adjusted potentiometer. The method had one big disadvantage in that a change of signal strength was usually followed by a burst of noise or a considerable amount of distortion, and ultimately the limiting circuit was tied in with the AVC system in order to overcome this defect and to provide automatic operation. Modern clipper circuits remain substantially the same, the diode functioning as a one-way conductor of low resistance which shunts the valve anode load resistance until little or no noise signal remains in the anode circuit (Fig. 2).

The series-type limiter also utilises the one-way conductivity of the diode but in a different manner. It can be compared with a gate allowing all signals to pass except those which reach a certain level—generally about 60 per cent.—above the carrier level or AVC voltage. A pulse of such magnitude promptly causes the diode to cut out for the period of its duration.

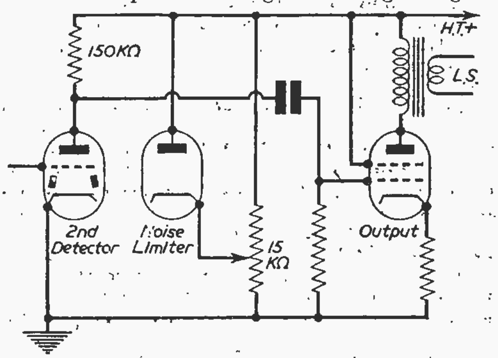


Fig. 2.—Simple clipper circuit.

Except in certain instances germanium crystals may be used in place of diode valves and in some cases are to be preferred. In the simple form of limiter shown in Fig. 2, for instance, a crystal cannot be used as it may be damaged by stray high voltages. But on the other hand, a crystal is to be preferred for the shunt circuit of Fig. 3 because its lower forward resistance, of about 350 ohms as compared with the diode's 1,000, ensures a better performance. This circuit is probably one of the cheapest there is to install, using only two additional components. Moreover, it provides automatic adjustment, no reduction in audio signal voltage, and it introduces no noticeable distortion at modulation levels up to 100 per cent. It can also be used with infinite impedance detectors by changing-over the crystal connections.

The circuit functions in the following manner: the condenser C charges up to the level of the D.C. voltage appearing at point A, as the forward resistance of the crystal diode is so low. That is, on an unmodulated signal.

When the signal is modulated the condenser charges to the peak value of the modulation and retains the charge indefinitely since the resistance of the crystal against discharge is hundreds of thousands of ohms. Similarly, where noise and signal exist in the circuit the condenser voltage remains substantially constant and the noise peaks are cut down to the level of the peak value of the wanted

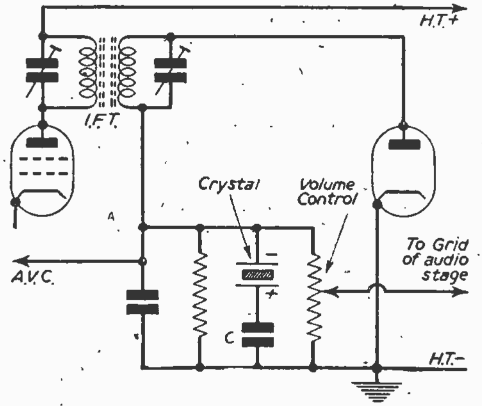


Fig. 3.—In this shunt circuit a crystal diode is used.

signal. For all practical purposes a condenser of about 0.4 or 0.5 μF. is very suitable. Other values are likely to upset the AVC timing or cut the low-frequency response.

Favourite Circuit

A favourite noise limiter with many amateurs is that given in Fig. 4. It is an excellent arrangement for removing high-level ignition and similar noise

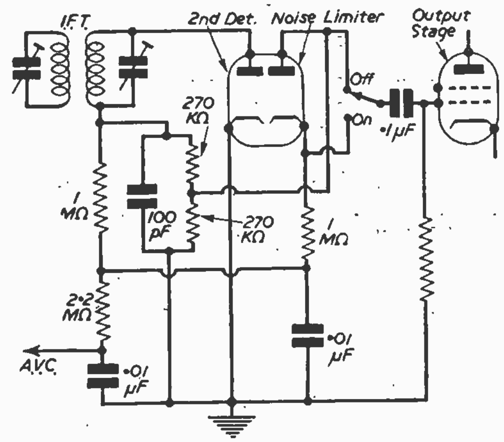


Fig. 5.—Series type limiter not suitable for music reproduction.

pulses, although it does involve some additional components and another diode valve. Here again a crystal cannot be substituted as the limiter is across approximately two megohms resistance and the forward resistance of the crystal is too low for good operation.

In Fig. 5 is shown a series-type limiter which will give a good performance on most signals but is not very satisfactory on music as it introduces a fair amount of distortion. This is a minor matter with amateurs, however, as they are principally interested in speech and code, but a switch has been incorporated to cut out the limiter and thereby allow normal operation, on music.

In considering adding a limiter to a receiver the amount of work involved must depend upon the circuit used. The majority of commercial all-wave receivers use double-diode triodes as second detectors and when these have cathode biasing it is not a simple matter to make the change. In fact, probably the easiest way is to add another double-diode to the circuit, using one-half as limiter and the other as second detector and use just the triode section of the original DDT in its normal function of

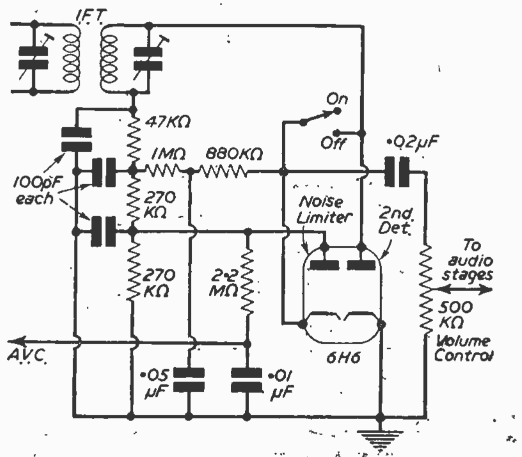


Fig. 4.—A favourite circuit for noise limitation.

first audio amplifier. Where the second detector is a simple double-diode, as in many communication and home-built receivers, the modifications are few in number and quite easy to carry out.

In conclusion do not expect any limiter to reduce mains hum or any other sinusoidal noise signal. They are not built for that. Hum and interference signals from apparatus in your own home can be suppressed easily enough with 0.1 μF. mica condensers to ground from the mains connections and these precautions will give your limiter a better chance to do its job properly. One thing you will discover, however, is that the little labour used in fitting a noise limiter is well repaid by the marked improvement in your short-wave reception.

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GERMANIUM CRYSTAL DIODES, wire ends, midget size. The ideal Crystal Detector, G.E.C. or B.T.H. 4/6 each.

THREE-PIECE AERIAL

Ex U.S.A. copper-plated steel, highly flexible with non-stick screw joints, tapering ⅜in. to ⅛in. Brand new, in container, 6/9, packing and carriage, 1/6. Insulated Base, 2/6.

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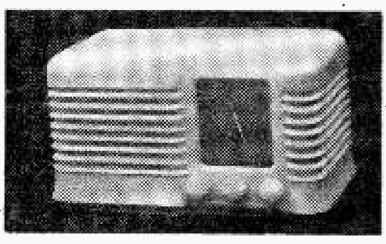

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Engraved Glass Dial, 180-550 and 800-2,200 m., 1/- with station names, new wavebands.

T.R.F. COILS 180-550, 800-2,200 metres, pair	6/6
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SEND 1/6 FOR EASY-TO-FOLLOW, POINT-TO-POINT DIAGRAMS AND CIRCUIT DIAGRAM, which show you how YOU can build the Receiver illustrated at HALF TO-DAY'S PRICE.

THE COMPLETE KIT to construct a 3-valve plus rectifier TRF Receiver for use on 200/250 v. A.C. mains can be supplied at £6 9s. 6d., plus 2/6 packing and carriage.

Each Kit is complete in every detail, nothing has to be made or improvised. Easy-to-follow, point-to-point diagrams are supplied, making construction very simple. The Dial is illuminated and the Receiver, housed in a Bakelite Cabinet size 12in. x 5in. x 6in., presents an attractive appearance. The valve line-up is 717A—H.F. Pentode, VR116—Detector, ATP4—Output, and Metal Rectifier.

Waveband coverage is for the medium and long bands. Choice of Walnut or Ivory coloured Cabinet.

EX U.S.A. U.H.F. AERIAL, with Untuned Detector Stage consisting of VR92 Valve. Brand new 5/-.

CRYSTAL MICROPHONE

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IMPORTANT ANNOUNCEMENT: Premier Radio Co. no longer have a branch at Fleet Street, London, E.C.4. Premier products can be obtained at our only address, 207, Edgware Road, W.2. We cannot accept responsibility for, or guarantee any kit or component sold as a Premier product by firms other than ourselves.

Simple Inductance Measurements

A USEFUL IDEA FOR THE EXPERIMENTER

By E. Palmer

THIS article has been written to assist home constructors who do not have access to the more elaborate test equipment normally required. The use of mathematics has been reduced to a minimum, for the benefit of those not quite so interested in the "why and wherefore." It must be pointed out that as the methods explained are essentially simple, the accuracy is not 100 per cent., but nevertheless it is well within working tolerance.

The basis of these methods is a resonant frequency graph (Fig. 1), the only difference being in the manner used to determine the frequency applied to the tuned circuit.

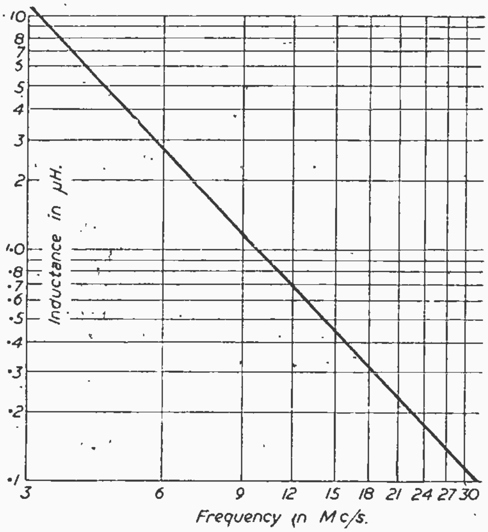


Fig. 1.—Resonant graph used in the method described here.

First, to prepare the resonant frequency graph, use is made of the well-known formula

$$f=\frac{1}{2\pi\sqrt{LC}}$$

Without going into mathematical proof, the above formula has been corrupted thus : $f=\frac{159}{\sqrt{LC}}$

Therefore $L=\frac{159^2}{f^2C}$

And also $L=\frac{25281}{f^2C}$

It can be seen that by making C equal 252.81 pF (say 253 pF for easier handling) $L=\frac{100}{f^2}$

The graph can now be drawn as follows:

$$\text{Log } L=2-2 \text{ Log } f$$

Frequency Determination

Now for the various methods of determining the frequency applied to the tuned circuit. Assuming that the reader has no test equipment whatever, all he requires is a reliable receiver, preferably of the superhet type, and, in some cases, a buzzer or any other external source of artificial noise.

The inductance to be measured must be parallel tuned by a capacity of 253 pF (Fig. 3). This tuned circuit constitutes a high impedance to its resonant frequency, and can therefore be placed across the mixer section of the superhet receiver. If the receiver is tuned to any other but the resonant frequency of L1C1 the mixer section will be damped by the low impedance of this tuned circuit, which will in turn reduce the receiver noise level. Another factor in reducing noise whilst in this condition is the fact that the L1C1 circuit will have either more capacitive or inductive reactance, and so will throw the mixer section out of gang.

When the receiver is tuned, an increase of receiver noise will be found, which corresponds to the resonant frequency of L1C1.

Of course, if the receiver has an R.F. amplifier stage, the L1C1 circuit can be placed across this instead of the mixer section (Fig. 2), but it was found in practice that best results were obtained from the latter set of conditions.

In any case, this should not incur any difficulty, as the grid of the mixer section is usually the top cap of a valve, and is normally quite accessible.

Should the receiver have a low noise level, it may be difficult to find the resonant frequency of L1C1 but this can be overcome by producing the noise artificially. One method of doing this is with a simple buzzer placed near the input of the receiver. It should be fairly easy to pick up the noise from this, and when the L1C1 circuit is connected this noise is tunable in the manner already described.

Having tuned the receiver to the peak of the noise, the receiver dial will then show the resonant frequency of L1C1. If the dial is calibrated in wavelengths, this must first be converted into

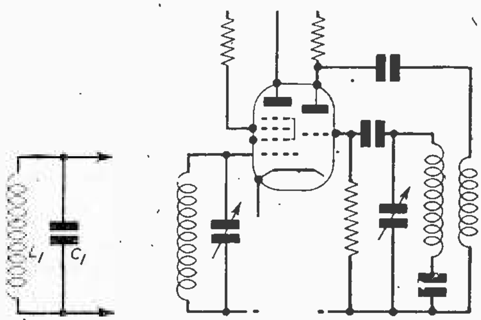


Fig. 2.—The test circuit and a typical frequency-changer stage.

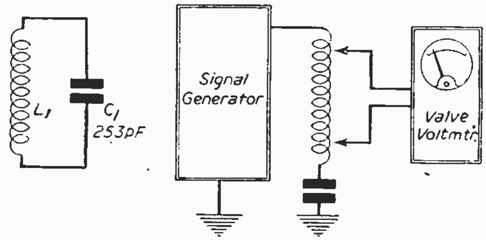
frequency. By referring to the graph the inductance L can then be seen at a glance.

With a Generator

This method can be further elaborated if the reader is fortunate enough to possess a signal generator. The signal generator should be modulated and connected to the input of the receiver, and both signal generator and the receiver tuned in step until the signal is heard and tuned to peak output.

Again, an even further elaboration is possible by the use of a valve voltmeter. No receiver is necessary in this case. The L1C1 circuit is placed in series across the signal generator output, and the valve voltmeter is connected across the inductance (Fig. 4). The signal generator should then be tuned for maximum voltage on the valve voltmeter.

The reader can probably think of other ideas and suggestions for using the graph, and, if he wishes, he can construct other graphs, using capacities other than the 253 pF so described. However, it is hoped that having read these notes



Figs. 3 and 4.—The test circuit and method of using a signal generator.

he can go ahead and construct his own coils and test the inductance to a reasonable degree of accuracy without worrying too much as to where he may obtain the necessary test equipment.

Dry Battery Regenerator

REMARKABLE claims by one of the oldest firms in the British radio industry, Messrs. Amplion, Ltd., to have evolved an instrument for extending by four to six times the life of dry batteries has received convincing support from the National Physical Laboratory.

The system, which Amplion call "reactivation," enables practically any type of radio or deaf-aid battery, whether for H.T. or L.T., to be given greatly extended life by "feeding" the battery periodically from the electric light mains through an instrument called the Activette.

The Activette is a metal box measuring 4in. × 1⅞in. × 2¾in. Working on normal A.C. mains, it does its job of activating dry batteries at almost negligible cost. According to the National Physical Laboratory its consumption from the mains is approximately 3 watts.

One model, the Type RB costing £2 19s. 6d., is designed specifically to reactivate dry batteries used in radio sets. A second model, the type HB, is being prepared for use with sub-miniature batteries employed in deaf-aids.

Extended Life

The "reactivation" of dry batteries has hitherto been deemed impossible. Many attempts have been made to find a solution to the apparent scientific impossibility of regenerating the expensive dry cells. They have all failed.

It is well known that listening with a battery receiver is many times more expensive than the cost of operating a mains-driven set. The miniature batteries sold for the "personal" type of receiver are exhausted at a rate which can cost as much as 5d. an hour.

The Activette makes no claim to put new life into "dead" batteries. But, if used in accordance with the manufacturer's instructions, it has been proved capable of extending the life of a standard radio battery many times. Prolonged tests in the Amplion laboratories, where the Activette was developed, have shown that expensive hearing-aid batteries can be given a useful life ten times longer than is usual.

Operation

The operation of the Activette is simple. After the battery has been in use for a few hours it is plugged into the Activette, which is in turn connected to the electric light mains. The unit is switched on and "reactivation" is continued approximately for the same length of time as the battery has been in use.

The National Physical Laboratory tests are being carried out on normal combined H.T. and L.T. batteries similar to those widely used in receivers of the "personal" type. Nominal output of the batteries is 69 volts H.T. and 1.5 volts L.T.

Half a dozen of the batteries manufactured by a world-famous maker were purchased at random by the N.P.L. scientists for the tests. Three of them were discharged in the normal way without "reactivation," and were pronounced "dead" within nine days of four hours per day discharge—36 hours useful working.

The other three batteries were discharged at precisely the same rate, but in between each period of discharge they were "reactivated" by the Amplion unit. After 30 days (120 hours' working) they had shown a negligible voltage drop. The N.P.L. tests on these three "activated" batteries still continue.

In exactly the same way as the "non-activated" batteries, the three under test were discharged at their normal working rate of approximately 7 milliamps for the H.T. and 250 milliamps for the L.T. A 10,000-ohm load was put on the H.T. and a 6-ohm load on the L.T. The batteries which were not activated were assumed by the N.P.L. scientists to be "dead" when the L.T. voltage had dropped to 0.9 volts after 36 hours work. The H.T. by that time had fallen to 36 volts.

The interim report from the N.P.L. (Ref. E.T.D. 266.51) shows that the average voltage of the activated batteries after 92 hours' work had fallen only by a few volts on the H.T. side and by only 0.075 volts (75 millivolts) on the L.T. side.

Programme Pointers

A MONTHLY CRITIQUE BY MAURICE REEVE

FOUR out of six talks comprising the series, "Music in our Time," were given in the period reviewed in this month's article. They were by Messrs. Alec Robertson, Anthony Hopkins—two—and Christian Barnton. This series appealed to me as one of the best organised, presented and delivered over the radio this year. Admirably instructive yet always entertaining, the speakers convincingly showed how modern musicians, whilst having their roots firmly planted in the past, do, nevertheless, earnestly strive after new ideas. That their success should be more or less in exact proportion to their individual geniuses is readily understandable. All three speakers signalled out Stravinsky as the particular bright star in the modern firmament. Mr. Robertson's introductory talk was a model for such occasions.

Two famous pianists gave recitals. One old favourite, Walter Gieseking, again demonstrated his extraordinary flair for French, of which he played some glorious examples. No living pianist is a greater exponent of the Gallic genius. The other master, Wilhelm Kempf, is new to this country, though he has a gramophone reputation of many years standing. He is an exceptionally gifted artist, with an enormous technique which is always used in the composer's service. A pianist of the highest integrity. He played Handel and Schubert.

Free Trade Hall

Hail, Manchester! In having rebuilt and triumphantly reopened the famous war-destroyed Free Trade Hall, you have held the capital city up to shame. London's war-shattered Queen's Hall remains a shell to mark our greater apathy and indifference to such matters. The Royal Festival Hall is neither substitute nor excuse. Manchester could have built a Royal Festival Hall just as easily. But the Mancunians have proved themselves the wiser.

Highway Code

Most listeners must be heartily sick of hearing about the depressions stationed over Iceland, the strength of the wind in Malin and the state of visibility in Forties, facts which only concern a very small number of people anyway, but whose importance I do not wish to underrate. But there is something else which does vitally concern every one of us, and that is, namely, the Highway Code. I would commend to the BBC the suggestion that, in small doses, we be given the multitudinous provisions of the Code—a few at a time—together with brief analyses and explanations. It could be done in the same manner as savings and one or two other things, are.

"Taking Stock"

The General Election "Taking Stock" programme was rather a wasted and ill-conceived affair. Taking place on the Friday evening after election day, when the result was still sizzling hot, tempers were high and judgments consequently immature. The voters in five constituencies were followed by four editors, the *Daily Herald*, *Birmingham Post*, *New Statesman and Nation*, and the *Huddersfield Examiner*. These were in turn followed by the three candidates from mid-Bedfordshire and the three party officials, Messrs. Morgan Phillips, Philip Fothergill and Miss M. Maxse.

The whole thing was ill-balanced, and tilted too much leftward to leave one with a feeling of complete impartiality on the part of those responsible for it. But the great gaffe came at the end. The programme was due to be wound up by a distinguished French journalist, over here covering the election. However, in the result the poor man was scarcely permitted to complete one solitary sentence. This was bad manners as well as bad radio.

Somerset Maugham

No more delightful radio talk could be imagined than Mr. Somerset Maugham's annual lecture to the National Book League. Recorded earlier in the day, it was, actually, the annual lecture, given this year by Mr. Maugham. Full of the pungent wit and social philosophy which have justly made his many books world famous, Mr. Maugham also indulged in many profound remarks on the art of writing, as he has found it in a lifetime's experience. Beautifully delivered, it made a captivating 45 minutes.

PROFESSOR BOFFIN

"I'm working on a second model to go inside the helmet."

Newsreel

"Radio Newsreel" celebrated its fourth anniversary recently. It has well merited its success. It is at its best when reporting non-political events; in these it sometimes seems to take for granted that everyone listening to it is in full agreement. But it is at all times interesting, accurate, entertaining and fully justified. The Sunday evening weekly resumé is, perhaps, rather less so.

A Comedian

"Oliver Again," a weekly programme, starring, of course, Vic Oliver, strikes me as being as funny as any of this type of show now running. Mr. Oliver is that rare merchant, a comedian who acts his lines and infuses meaning into them, instead of just reading them. The result is most refreshing.

"The Guinea Pig"

How many more versions of "The Guinea Pig" are we to have? Surely enough is as good as a feast.

The Narrator!

The current Sunday serial, "The Last Chronicles of Barset," has that same old doddering, repetitious unwanted bore, the narrator, who seems to take up half each session recounting the previous week's events. Together with coming on the air and signing off, with its interminable reading of cast, producer, director, script writer, etc., etc., there cannot be more than a bare 15 minutes or so for actual story telling. Dreadful in the extreme.

"Anna Christie"

That highly-strung play of Eugene O'Neill's "Anna Christie," was given a powerful performance by a cast headed by Constance Cummings, Laidman Browne and Liam Redmond. The old theme of shall a girl tell her lover of her past and risk losing him, or leave him in ignorance and build their happiness on a sham, sets all, or most of, the elemental passions in full hue and cry. Strong stuff and good radio.

News from the Clubs

BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: R. T. Parsons, 14, Carlyle Avenue, Brighton, 7.

THE club is hoping to participate, in the near future, at a Hobbies' Exhibition which is being held locally. A committee has been formed and details are being worked out. A complete station operating on all bands from 14 to 1.7 Mc/s will be set up and will be using 'phone and C.W. The club programme continues during December with a demonstration of a home-constructed tape recorder on the 11th, and an informal evening on the 18th. January 1st sees the second instalment in the film-strip on the cathode-ray tube.

THE HOUNSLOW AND DISTRICT RADIO SOCIETY

Hon. Sec.: A. Pottle, B.Sc., 11, Abinger Gardens, Isleworth, Middx.

THE new 150-watt P.A. stage of the club Tx G3FHD is now cured of its teething troubles and is 100 per cent. T.V.I. proof. A new folded-dipole three-element rotary beam on a higher tower has enabled many good DX contacts to be made.

Constructional meetings on Sunday mornings are gaining in popularity with members.

LIVERPOOL AND DISTRICT SHORT-WAVE CLUB

Hon. Sec.: Arthur D. H. Looney, 81, Alstonfield Road, Knotty Ash, Liverpool, 14.

THE club has got under way for the winter by moving into their own quarters, the Tx is ready to go on the air, and it is hoped to make contacts on top band during the coming months. On November 8th members of the club paid an evening visit to Messrs. B. I. Callenders' Cables, Prescot; many local amateurs were also invited and a good time was had by all; the weather, unfortunately, was not at its best. The club meets every Tuesday at 8 p.m., and a welcome is extended to any visitors. Morse classes will be starting in the near future.

EDINBURGH AMATEUR RADIO CLUB

Hon. Sec.: C. L. Patrick, 19, Montgomery Street, Edinburgh.

THE club continues to meet weekly on Wednesdays at 7.30 p.m. in Unity House, 4, Hillside Crescent, Edinburgh. Talks will be given on December 5th and 19th, and the club transmitter (GM3HAM) will be on the air on alternate weeks. New members and visitors will be very welcome.

THE WATERLOO RADIO SOCIETY

Hon. Sec.: J. C. Henderson, 47, Maple Street, Cheetham, Manchester, 8.

MEETINGS continue to be held weekly on Thursdays at 7.30 p.m. and on Saturdays at 2.30 p.m. A slow morse class is held at all meetings, full use is being made of the workshop by all members. A film show is being arranged for January as well as several other interesting events. A series of lectures are to be given during the winter months for the benefit of those members who are going to enter for the R.A.E. next year. The club still needs further members, and all interested are asked to roll up at any meetings. Details of membership may be obtained from the hon. sec.

SOUTH MANCHESTER RADIO CLUB

Hon. Sec.: F. H. Hudson, 21, Ashbourne Road, Stretford, Manchester.

THE annual general meeting was held on October 26th at which a new committee was elected. The new hon. sec. is Mr. F. H. Hudson. Highlights for the future include a lecture and demonstration of automatic key and a demonstration of home-made television receivers.

THE EXETER RADIO AND TELEVISION CLUB

Hon. Sec.: L. R. Jenkin, 16, South Avenue, Exeter.

THIS is the new title of the "Exeter & District Radio Society." The new secretary is as above.

These changes were made at the A.G.M., and a new President was elected, Mr. G. H. McKay, B.A.(Hons.).

The future programme consists of: December 13th, "The A.F. Amplifier Stage" (talk and demonstration); December 20th, Annual Dinner; December 27th, No meeting; January 3rd, Junk Sale; Newsletter published; January 10th, "The Detector" (talk and demonstration); January 17th, Competition—home-built equipment (prizes).

All meetings are on Thursdays at 7.30 p.m. and are held at the Exeter Hobbies' Association Hut at the top of Haldon Road, Exeter.

READING RADIO SOCIETY

Hon. Sec.: L. A. Hensford (G2BHS), 30, Boston Avenue, Reading, Berks.

THE Annual Hamfest this year was held at the Abbey Gateway, and was this year an all-male get-together. After an introductory address by Capt. Benbough (the President), members and visitors got together with "Questions and Answers."

Tea was served after this and then the judges got together to judge the entries for the Nash and Lewis cups presented each year for the best home-constructed equipment. Many very fine pieces of equipment were entered again this year and the judges had a hard time picking the winners.

A film show was next on the list and some very interesting films were shown. The Hamfest ended with the usual "ragchew" between members and visitors.

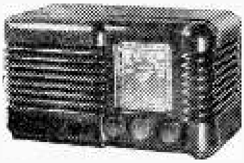
The instruction section meetings run by Mr. Woodhouse (G2AHY) is still going strong, and the lectures, etc., for the main monthly meetings are still well attended.

CRAY VALLEY RADIO TRANSMITTING CLUB

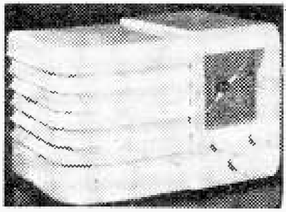
General Secretary: A. Swindon (G3ANK), 135, Station Road, Sidcup, Kent.

MEETINGS of the C.V.R.T.C. are held on the fourth Tuesday of each month at the Station Hotel, Sidcup, Kent, at 7.30 p.m.

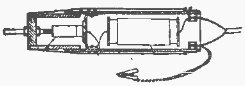
SETS YOU CAN MAKE



You will find that the building of our all-mains radio receivers is simplicity itself, and the more you make the less time each takes; everything down to the last nut and bolt is supplied, and everything fits together in a professional manner. When finished the receiver looks and plays as well as those being offered in radio shops at anything between £10 and £14. The one illustrated above we call "The Occasional" in a choice of colours Ivory, Walnut or Green, and the T.R.F. costs just less than £6 to make, while the superhet costs approximately £9. The other radio illustrated we call "The White Lady"; this is an extra fine cabinet of pure white. The complete T.R.F. receiver costs about £6/5/- to build, and the superhet receiver costs about £9/5/- to build. Constructional data for either set is available at 1/6 post free.



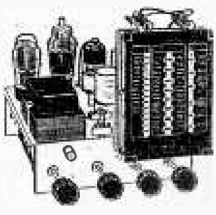
RADIO STETHOSCOPE



A novel device aptly called a Radio Stethoscope is described in a recent edition of the *Radio Constructor*; this is compact and can be slipped into the pocket rather like a fountain-pen. With it, in most districts, a receiver can be checked from the grid of the first valve right through to the output without a signal generator; the stethoscope will operate in both L.F. and R.F. circuits without alteration. It is a complete fault-finder. The only parts needed to make the simple circuit tracer are a pair of crocodile clips, a germanium crystal, and a paper tubular condenser, and we will supply the whole outfit for 6/6 post free, and with each outfit we will give reprint of the article as it appeared in the *Radio Constructor*.

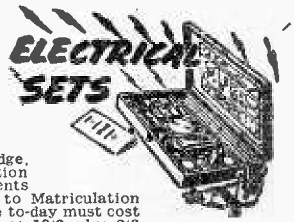
NOTE.—If you wish to make it up as a pocket unit, then you will need a few odds-and-ends, solder tags, etc., from your spares box.

3 WAVEBAND 5-VALVE SUPERHET CHASSIS



Brand new, tested and ready for immediate operation, full vision scale (size 6in. x 8in.) covering the long-wave 200-500 metres, medium wave 37-100 metres, and short-wave 13-37 metres. Complete with valves and covered by our six months' guarantee. First-class parts; Parmeko mains transformer, Erie resistors, Hunt's condensers, etc. Special points include (1) Flywheel tuning, (2) Dust Cored I.F.s, (3) Sockets for extension speaker and pick-up, (4) 4 watts output, (5) Coil assembly removable as a unit. Price complete with 8in. speaker, £10/10/-, carriage, packing and insurance 7/6 extra.

BASIC ELECTRICITY EXPERIMENTER'S OUTFIT



If you want to help someone with their electrical studies this is an ideal gift. Made pre-war, this contains an assortment of over 50 bits and pieces, including switches, galvanometer, resistance wire for making motors, Wheatstone bridge, meters, and an instruction book detailing 31 experiments which cover the course up to Matriculation standard. This outfit if made to-day must cost £4 to £5. Limited quantity at 19/6, plus 2/6 postage and packing.

RADIOGRAM CABINET

Full-size console type; really well made with highly polished walnut finish. Designed to take standard type auto-change gram unit and radio chassis. Size 2ft. 6in. high x 2ft. 6in. wide x 1ft. 3in. deep.

You can have these at £12.10s.0d. each, which means a brand new radiogram for less than £30; for we can supply a 5-valve 3-waveband chassis at £10.10s.0d. (some adaptation will be necessary, of course), and gram units from £5.5s. 0d. upwards.

Please note, as our storage is limited, it is as well to confirm that these cabinets are actually at the branch before calling, especially for one. Also note we can deliver these only within our van area; delivery charge will depend on distance.

ELECTRONIC PRECISION EQUIPMENT

152-153, Fleet Street, E.C.4.

Windmill Hill, Ruislip, Middx.

AVOID DELAY, SEND LETTERS TO RUISLIP. ADDRESS TO DEPT: 7.

SOUTHERN RADIO'S WIRELESS BARGAINS

WALKIE-TALKIE (TRANSMITTER-RECEIVER). Type 38 Mark II. Complete with 5 valves, Throat Microphone, Headphones and Aerial. 7 mc/s Amateur Band, suitable for field use. Powerful Superhet Receiver. Modulated Transmitter. Guaranteed ready for the Air, less batteries, £3/10/-.

R.3515 TELEVISION UNITS. Complete with 21 valves. 6 Stage 14 mc/s. I.F. Strip. Ideal for T.V. Conversion. Brand New in original wooden cases, £3/10/-.

LUFBRA HOLE CUTTERS. Adjustable from ⅞in. to 3½in. for use on Wood, Metal, Plastic, etc., 5/9. LUFBRA FLY CUTTERS, 14/6.

LIONEL "BUG" KEYS. Genuine U.S.A. Automatic Morse Key, Type 136. Few only, £3/7/6.

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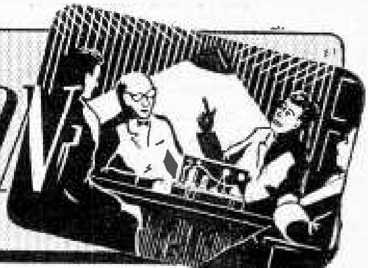


The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Give Your Address!

SIR,—In our efforts to give a prompt and efficient service to readers of PRACTICAL WIRELESS, we trust you will find space once more to stress the need for a reader to quote his address when writing to advertisers for literature, etc.

The enclosed is a typical example of this annoying matter. The reader sits back and invariably believes the firm just ignores his request. During the past 12 months we have recorded 22 examples of no address having been given.—JOHNSON'S RADIO (Worcester).

[*The letter enclosed by the above firm was from a Mr. Street, envelope post-marked "Sleaford," and enclosed a stamp for a catalogue, but had no address of any kind.*—ED.]

"P.W." in South Africa

SIR,—I have been a reader of PRACTICAL WIRELESS since it was first published—I still have one or two of the data sheets issued with the magazine in the very early days! I moved out to this country almost a year ago, and find a great number of Hams working—even in this small town of about 3,000 people there are four, not counting myself, as I am still building although I have received my licence and call-sign (ZS5NB). Your paper enjoys a sale of about four copies which, considering the size of the town and competition from American radio magazines, is good going. Your paper certainly lives up to its title; most of the articles *are* practical, and mainly I find it very interesting reading, and I have utilised many of the circuits and ideas. I certainly prefer P.W. to any other radio magazine—British or American. Naturally I have one or two brickbats! And a few suggestions.

Having said that your magazine is practical I should not be so ready to admit that it is always *wireless*! So many of the articles, such as those on wire recording, and the band-searching unit of a few months ago, I feel would be more at home in a magazine devoted to mechanics. Other readers may not agree, of course.

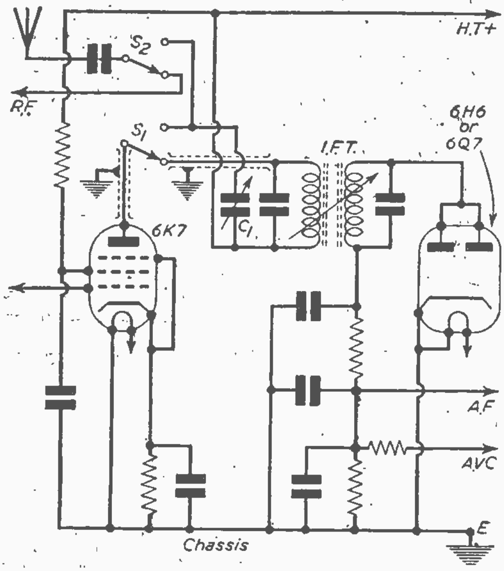
Some time ago I converted the TR1196 into a broadcast receiver *exactly* as recommended by your contributor, using the Osmor coil pack as specified. The receiver type 25 that I obtained was brand new, as was the mains unit. Yet the receiver never worked really well. Quality was excellent, but I found the I.F. transformers would not peak up—the set went into oscillation as resonance was approached, and there was a terrific superhet hiss. I tried for weeks to eradicate the faults, but all the stock cures failed—lower osc. voltage, I.F. decoupling, screened leads all over the place, etc., etc. The receiver is still the same. Then more recently I made up the superhet from your May, 1951, issue by "Electron," who affirms that the set is free of hiss and mains hum. I got both, to excess! Again I tried various remedies, but all to no avail. No components from the first receiver mentioned were used in the second one, so a common dis component is ruled out. Perhaps some reader can suggest a cure?—J. ROBINSON (Natal, S. Africa).

Long-wave Reception

SIR,—Many communications receivers have no long waves incorporated, the Light Programme, when required, being tuned on the medium wave, with resultant "blasting" in many parts of the country.

A fixed capacitor was wired into the last I.F. of an American "Scott" receiver to switch in the Light Programme on Droitwich, with extremely good results.

This was accomplished by wiring in a trimmer



The arrangement referred to by Mr. Hook.

and fixed mica condenser amounting to about 275 pF on the primary, with the aerial-switched as shown in the illustration on page 41. A 2-pole, 2-way switch is all that is needed. The I.F. in this particular instance was 455 kc/s, but experimenting with various capacities for other values is quite simple, attention being paid to screening, where possible.

In the case mentioned a three-position selectivity switch had two spare wafers which were useful, thus cutting out the use of the "broad" position of the switch and leaving this to be utilised for reception on 200 kc/s.

It may be found that with a single-ended output stage possibly two stages of amplification may be needed, but not if push-pull is used.

We hope that this information may be of use to many readers.—S. F. HOOK (Ebley, Stroud).

The General Purpose Amplifier

SIR,—I feel I must point out to you that there is a snag in F. G. Rayer's General Purpose Amplifier circuit given in the centre pages of the December issue of PRACTICAL WIRELESS.

Although he states that "the circuit is not particularly dangerous with reasonable care," the fact remains that using a 2-pin plug on A.C. mains, the chances are 50-50 that the chassis will become live, whilst with D.C. supplies (the +ve side of which is usually earthed at the power station) the circuit will not operate unless the anode of the 25Z4G is +ve and hence the chassis live.

This means that any screened lead connected to the input, as well as the casing of any microphone or pick-up, becomes live with respect to earth, and anybody touching these components would receive a shock which could easily prove fatal.

The remedy is not easy to find, as large numbers of houses are fitted with 2-pin or B.C. sockets and correct connection cannot be guaranteed when the amplifier is handled by inexperienced persons. On D.C. mains a live chassis cannot be avoided.

Perhaps a .1 μF paper condenser of 350 V.W. could be connected between the earth end of the volume controls and the —ve H.T. line.

If troubles due to hum are experienced, the chassis may be earthed via a .1 μF 500 V.W. paper condenser.—P. A. WEST (London, W.9).

Amateur Co-operation Wanted

SIR,—I have recently completed the conversion of type R25 (TR1196) ex-R.A.F. set into a medium-wave set (hope to add short-wave later). I based the conversion in the article in the August 1949 issue but did not use a pre-aligned coilpack. The result, therefore, though quite good, is not 100 per cent., as I lack that vital instrument—the signal generator.

Can any enthusiastic P.W. reader come to my assistance, please, particularly those living in the Mitcham, Tooting, Streatham area, of course.—J. B. PHILLIPS (20, Pentlands Close, Mitcham, Surrey).

Frequency Modulation

SIR,—While the description of the phase discriminator given in the third article on frequency modulation is quite correct, even if somewhat vague, I should like to point out that both the sign and amplitude of the output signal bear a definite relationship to the direction and amount of deviation.

When a signal is applied to the discriminator the output voltage from the cathodes of the diodes has a polarity, plus or minus, depending on the direction of the deviation above or below the mean frequency, and an amplitude depending on the amount of deviation.

These two effects are always additive; and if the discriminator is correctly designed to handle deviations of ± 75 kc/s no amplitude distortion of the signal will result.

Furthermore, although the circuit of the phase discriminator shown is only a basic diagram, the D.C. blocking condenser between the anode of the discriminator valve and the centre tap of the secondary winding should have been included. If this is omitted the circuit becomes most misleading as well as inaccurate.—J. C. DONSETT-MARSH (Rayleigh).

A CAPACITY BRIDGE

(Continued from page 26)

condenser (marked * in Fig. 1) in series with the condenser being measured. This condenser must be of a very high order of accuracy, and can be made by soldering a small Erie ceramic trimmer across a 50 pF silvered mica, as is shown in Fig. 4. The method of setting this condenser is to short-circuit out the two sockets used for the high range (a short-circuit is the same as using a condenser of infinite capacity in this case) and adjusting the trimmer until a peak on the Y63 is obtained with the pointer at the 75 pF mark on the low range.

Case Error

After the instrument is assembled it will be found that there is an error introduced by the action of the case. This can be measured on the scale, as the alteration is an increase, and a reduction in the variable condenser will give the value directly. The instrument is then taken out of its case again and the trimming condenser altered to compensate for the error. The best way to do this is to place a condenser in the bridge, balance it, then reduce the reading on the pointer by the desired amount; then adjust the trimmer until balance is obtained. The best way to reduce the drift when handling the bridge is to lace the wires where possible; this has the effect of increasing the wiring capacities but also holding the wires rigid one to the other.

One last point concerns the type of sockets used. By far the best for this type of use are those known as the O-Z sockets; they are a little expensive but they are thoroughly reliable.

This instrument can be finished with almost any paint or enamel to suit the owner's taste, and, of course, rubber feet should be fitted.

Calibration for 75 to 1,000 pF.

75	against	37.5	250	against	58
100	,,	41	300	,,	60
120	,,	45.5	400	,,	63
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42	9/6	6AM6	11/6	KT66	11/6
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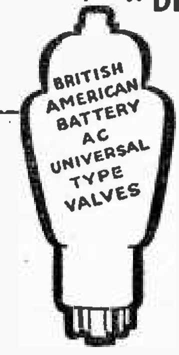

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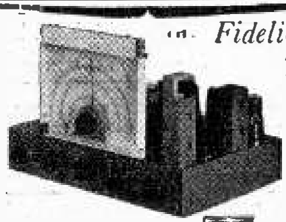

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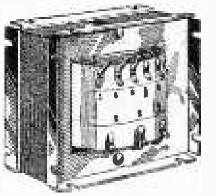

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Review of the Latest Gramophone Records

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Artur Schnabel's "Rhapsody for Orchestra" is the seventh of the series of hitherto unrecorded or unknown works to be issued within the last year on Columbia. Under the auspices of the Maharajah of Mysore's Musical Foundation, this rhapsody makes its first appearance on records. It is played by Paul Kletzki, conducting the Philharmonia Orchestra, on *Columbia LX*8843-4. It was this same orchestra who gave it its first European performance at the Royal Albert Hall on April 27th, 1950.

The deft touch of Beecham is ideal for Rossini's "La Cambiale di Matrimonio—Overture." It is his first opera, and was written for production at the Teatro San Moise, Venice, in 1810. Sir Thomas conducts the Royal Philharmonic Orchestra in this recording on *Columbia LX*1458.

There are, of course, many different versions of the Tchaikovsky "Concerto in D Major, Op. 35"; this, by Jascha Heifetz (violin), accompanied by the Philharmonia Orchestra, conducted by Walter Susskind, is exceptionally good. It was recorded in London when the violinist was over here last year. He has played the Tchaikovsky concerto many times in his world-wide concert tours, and it is an ideal work for his technique, which is heard to advantage on *H.M.V. DB*21228-31.

The second in the new series of ballet music recordings by Parlophone is Ponchielli's "La Gioconda" (Dance of the Hours), recorded on *Parlophone E*11489 by the Royal Opera House Orchestra, Covent Garden, conducted by Hugo Rignold. The ballet contains a series of dances representing the various times of day—morning, noon, evening and night.

Other outstanding orchestral recordings this month are Sir Thomas Beecham, Bart., conducting the Royal Philharmonic Orchestra in Handel's "The Great Elopement" on *H.M.V. DB*9672-3, Sir Adrian Boult conducting the London Philharmonic Orchestra in Brahms' "Academic Festival Overture, Op. 80," on *H.M.V. DB*9670-1; and Arthur Fiedler conducting the Boston Promenade Orchestra in Von Suppé's "The Beautiful Galathea," on *H.M.V. C*4120.

Vocal

A new record by Lily Pons is always of interest, and for this issue she sings the principal theme from Johann Strauss's "Tales from Vienna Woods" waltz—regarded by many as his best waltz. On the reverse side she sings "Pretty Mocking Bird," in which the singer imitates the song of the bird she is addressing. Her husband, Andre Kostelanetz, accompanies her in the recording which appears on *Columbia LX*1462.

"Abide with Me" and "The Lord is my Light" are the two titles chosen by the talented contralto Jean Watson for her recording on *Columbia DX*1793, whilst another contralto, Olive Gilbert, makes her début on Columbia this month with two of Ivor Novello's songs—"Pray for Me" and "We'll Gather Lilacs," on *Columbia DB*2964.

Variety

The story of "South Pacific" is adapted from James A. Michener's novel, "Tales of the South Pacific"; Richard Rodgers' score is very far from the accepted South Seas convention of steel-guitar music. *H.M.V. C*4121 is a "South Pacific" selection played by the accomplished Melachrino Orchestra, which should find a place among your favourite recordings.

"I Wish I Wuz" and "Cold, Cold Heart" are two of the latest numbers that Donald Peers has put on wax. The number of the record is *H.M.V. B*10158.

For the first time on records Ronnie Ronalde uses a male-voice choir to provide a descant to his solo singing in a new ballad by Stephen Gale and Leo Paris called "Grandfather Kringle," on *Columbia DB*2941. He backs up this intriguing item with a purely whistling version of Emil Waldteufel's well-known "Skaters' Waltz."

Doris Day has recorded two songs from her latest film, "Lullaby of Broadway," on *Columbia DB*2932. They are "I Love the Way you say Goodnight" and "In a Shanty in Old Shanty Town."

Humour is supplied by Arthur Godfrey, who delivers a couple of homespun ballads, "If it Wasn't for Your Father" and "If I had You on a Desert Island," on *Columbia DB*2493.

Dance records are supplied by Joe Loss and his Orchestra with "Rosaline" and "Tulips and Heather," on *H.M.V. BD*6110 and again in dance tempo with two foxtrots, "Some Enchanted Evening" and "Bali Ha'i," on *H.M.V. BD*6113.

Harry Davidson continues with his Old Time Dance Series with a "Paul Jones," on *Columbia DX*1789. This includes examples of The Veleta, Dinky One Step, Military Two Step, etc.

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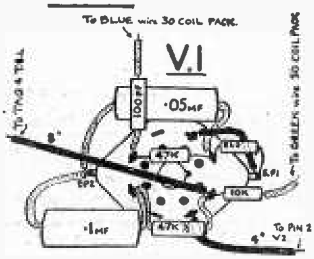

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PRACTICAL WIRELESS, JAN. 1952.

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