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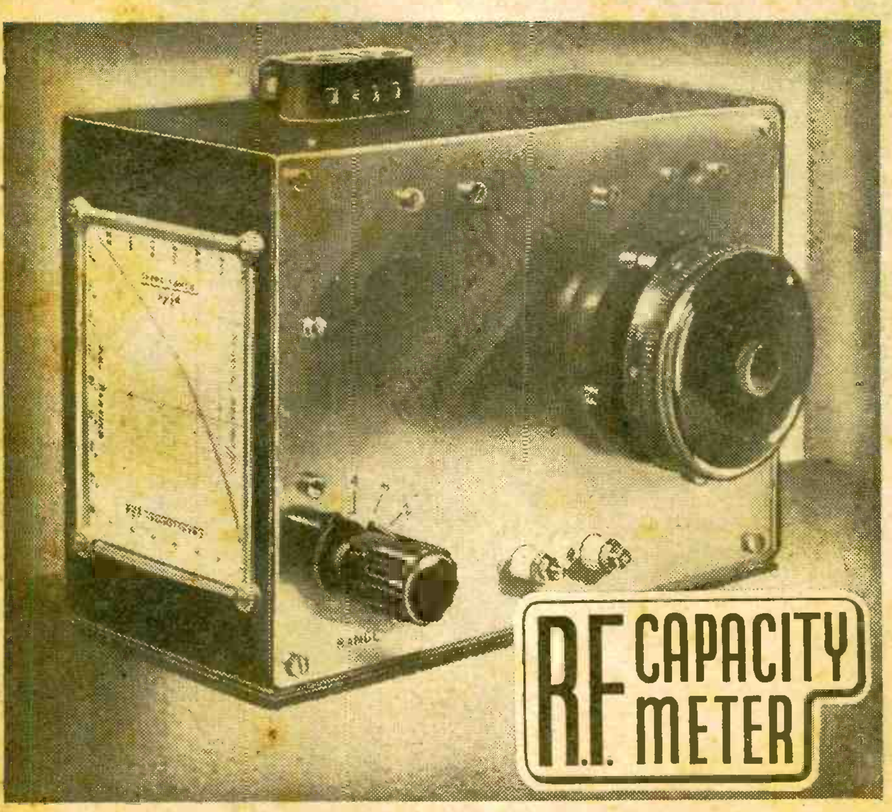
Vol. 26 No. 527
JUNE, 1950

EDITOR:
F.J. CAMM

PRACTICAL WIRELESS



CHIEF CONTENTS

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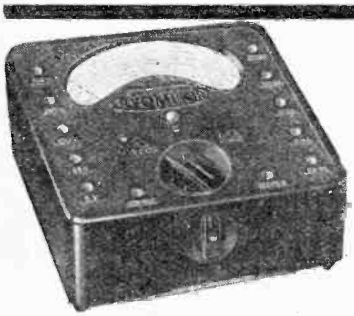

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0—5 volts	0—25 ,,
0—25 ,,	0—100 ,,
0—100 ,,	0—250 ,,
0—250 ,,	0—500 ,,
0—500 ,,	

D.C. Current	Resistance
0—2.5 milliamps	0—20,000 ohms
0—5 ,,	0—100,000 ,,
0—25 ,,	0—500,000 ,,
0—100 ,,	0—2 megohms
0—500 ,,	0—5 ,,
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Practical Wireless
18th YEAR OF ISSUE
EVERY MONTH.
VOL. XXVI. No. 527 JUNE, 1950
Editor F. J. CAMM

COMMENTS OF THE MONTH BY THE EDITOR

The 1950 Radio Show

THE seventeenth National Radio Exhibition will this year be held at Castle Bromwich, Birmingham, from September 6th to the 16th, and it takes the place of Radiolympia. It will, however, be just as national in character as the Olympia shows. It will be held in a large rectangular hall, although the lay-out will be on a less pretentious scale than Radiolympia. There is to be a communal television station, a B.B.C. studio, and, of course, the exhibition control room. These will be situated at the far end of the hall facing the main entrance. Various branches of the government Services will be represented, whilst the exhibits themselves will comprise the manufactures of the industry, such as receivers (both radio and television), accessories, communication and transmitting equipment, electronic and radar devices, and exhibits from supporting industries. The emphasis, however, is to be on television, for this has only comparatively recently been introduced to the Birmingham area.

As the Postmaster General has stated in the House of Commons that in a little over two years television will be available to 70 per cent. of the population of Great Britain, it must be expected that future radio shows, whether held in London or elsewhere, will feature television on increasingly intensive lines.

Great Success of "Practical Television"

THE great success of our companion journal, *Practical Television*, indicates that interest in television is on a vaster scale than the B.B.C. imagined. The sales have not been confined to the two service zones but are fairly evenly spread over the whole country. It is apparent too that there are more television experimenters than had been supposed. The B.B.C. believed that only about 4,000 people were interested in building and in experimenting with television receivers. As we are in very much closer touch with experimenters than the B.B.C., we can assure them that there are over 50,000 people at the present time building and experimenting with television receivers, and the number is likely to increase week by week from now onwards. Hitherto these experimenters have not had a technical journal entirely devoted to their hobby, but now that *Practical Television* has been successfully launched it will increase by tens of thousands the number of experimenters in this fascinating new field.

For this reason, our companion journal in its third issue has suggested to the B.B.C. that they should run an experimental programme at least once a week especially for experimenters. Thus every experimenter would be able to report to the B.B.C. on the results achieved, and provide it with most valuable data, especially in connection with the fringe areas.

In the early days of radio vital information was provided by the amateurs when Writtle (call sign 2MT) radiated its half-hour programme once a week. The genuine experimenter is not so much interested in looking in, as in finding out and improving, and the B.B.C. should take advantage of this pool of knowledge by creating at least 50,000 experimental "looking-in stations" at no cost to themselves. A weekly programme of at least one hour on Sunday mornings, radiating programmes of an experimental technical nature should be of great assistance to them.

The New Wavelengths

OBSERVATIONS made at the B.B.C. wavelength measuring station at Tatsfield indicate that in the main all the long-wave and medium-wave broadcasting stations in the European area were retuned to new wavelengths on March 15th with a high degree of accuracy. More than 400 stations were retuned in this way, and all of the 25 countries who signed the Copenhagen plan appear to have carried out their obligations in connection with it. As announced in a previous issue, under the Copenhagen plan a number of wavelengths are shared by stations that are remote from one another. Up to the time of going to press results show that this has not caused undue interference. The only inconvenience caused by the change has been with owners of receivers whose tuning scales have had to be readjusted. The trade has not been able to meet the demand for the new scales and the public must wait some time for them. 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 February 28th, 1950:

Region	Number
London Postal	2,318,000
Home Counties	1,632,000
Midland	1,713,000
North-eastern	1,877,000
North-western	1,583,000
South-western	1,047,000
Welsh and Border Counties ..	721,000
Total England and Wales ..	10,891,000
Scotland	1,115,000
Northern Ireland	202,000
Grand Total	12,208,000

The above total includes 316,700 television licences. The total decreased by 1,800, whilst television licences increased by 31,200.

Obituary

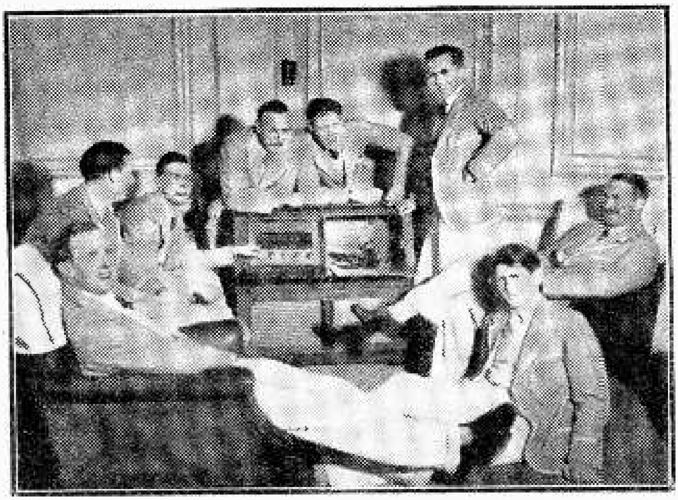
THE directors and staff of Electric & Musical Industries, Ltd., are grieved to announce the death of Mr. Frederick Arthur Cobb, managing director of their associated company, Electronic Tubes, Ltd.

His untimely death at the age of 49 will be a great loss not only to his company but to the country as a whole.

Besides his exacting industrial responsibilities, Mr. Cobb was M.P. for the Brighouse and Spenborough Division of Yorkshire and, although in very poor health since the last election, had attended the House regularly and did not miss one division.

Mr. F. A. Cobb served as a radio officer in the Merchant Navy during the 1914-18 war. He subsequently held an important engineering post in the B.B.C. for some time, and then became chief engineer of the Indian Broadcasting Company at Calcutta.

After returning to this country he held responsible executive positions in several large industrial electronic concerns, and in April, 1947, he was appointed managing director of Electronic Tubes, Ltd., High Wycombe. As a tribute to his great organising ability it is perhaps of interest to note that the output of this factory had reached a record level on the day of his death.



Following a custom of many years' standing, the Marconiphone Co., Ltd., were recently privileged to provide Television and Auto-radiogram facilities for the Cambridge Boat Race crew at their training headquarters, the R.A.C. Country Club, Woodcote Park, Epsom. The crew are seen here relaxing with the Marconiphone Auto-radiogram (Model ARG. 23AE) after a heavy day's rowing.

New Ekco Schools Radio Order

E. K. COLE, LTD., have secured the order to equip a further 19 schools in the County Borough of West Ham with radio and gramophone reproducing equipment.

Reith Lectures 1950

THE B.B.C. announces that this year's Reith Lectures will be given by Professor J. Z. Young, F.R.S., the Professor of Anatomy at University College, London, on the subject of Doubt and Certainty in Science. The lectures will be broadcast in the autumn in the Home Service with repeats in other programmes.

Cable and Wireless, Ltd

IN accordance with the arrangements announced during the passage of the Commonwealth Telegraphs Act, 1949, the stations and offices of Cable and Wireless, Ltd., in the United Kingdom were transferred to the Postmaster-General on April 1st, 1950. From that date the telegraph services of Cable and Wireless, Ltd., in this country will be operated by the Post Office. Telegram acceptance and delivery facilities provided by Cable and Wireless, Ltd. offices throughout the country will continue as hitherto.

Appointment of Superintendent Engineer, Recording

FOLLOWING Mr. M. J. L. Pulling's appointment as Senior Superintendent Engineer, Television, Mr. A. P. Monson has succeeded him as Superintendent Engineer, Recording.

Mr. Monson joined the B.B.C. in 1933 from Creed and Co., Ltd. He became Head of the Transcription Recording Unit in 1941, and Assistant Superintendent Engineer, Recording, in 1943.

B.I.R.E.

THE following list of meetings has been arranged for May, 1950:

London Section.—London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1 (meetings commence at 6.30 p.m.). May 25th, E. G. Hamer (Associate) and W. P. Cole, B.Sc.: "Multi Station V.H.F. Communication Systems Using Frequency Modulation."

North Eastern Section.—Neville Hall, Newcastle-on-Tyne (meetings commence at 6 p.m.) May 17th, Annual General Meeting followed by a technical film.

South Midlands Section.—May 27th, Visit to Sutton Coldfield Television Station.

Note.—These are the final meetings of the 1949-50 session.

Brain Study

AT a recent meeting of the South Midland section of the British Institution of Radio Engineers, Mr. H. W. Shipton, of the Burden Neurological Institute, said that modern methods of studying the human brain were based on engineering methods.

Speaking on "Electronics and the Human Brain," Mr. Shipton said that in the last two or three years engineering technique had been applied to the study of the brain.

What had been done was to apply external stimulus to make the small "rhythms" bigger, and he demonstrated this by means of a special amplifying apparatus which traced the brain reactions in much the same way as a barograph traces the barometric pressure changes.

These recordings are made by connecting electrodes from the amplifier and placing them on the head.

Appointment of Head of Designs Department

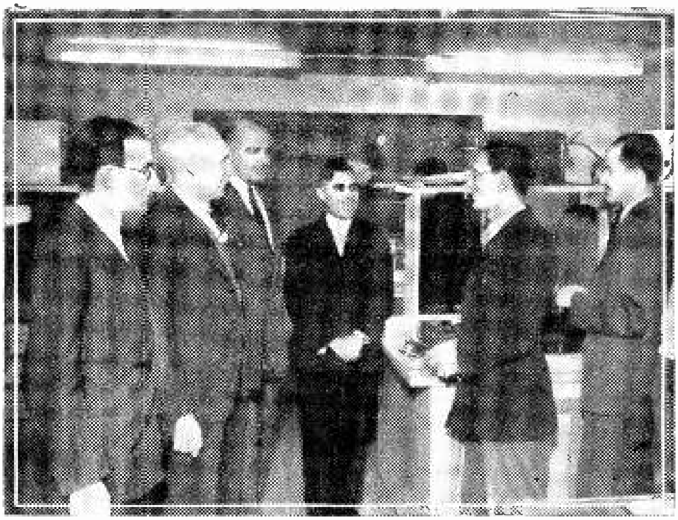
DR. A. RENDALL, Ph.D., M.I.E.E., has been appointed head of the Designs Department following Mr. H. B. Rantzen's resignation from the B.B.C.

Dr. Rendall joined the Lines Department of the B.B.C. in 1935 from the International Standard Electric Corporation, where his work on non-linear distortion on loaded cable circuits earned him the degree of Ph.D. In 1941 he was appointed assistant head of the Lines Department, and in 1947 he became assistant head of the Designs Department.

Cable and Wireless, Ltd.

MR. JOHN INNES, C.B., Managing Director of Cable and Wireless, Ltd., retired from that post on March 31st, 1950. Major-General L. B. Nicholls, C.B., C.B.E., has been appointed to succeed him as Managing Director of the company.

Major-General Nicholls, aged 54, retired from the Army to become a director of Cable and Wireless, Ltd., in January, 1947. Since then he has visited the Far East, Israel and the Mediterranean, and the West Indies for the company.



Brigadier S. Ghawas, of Pakistani Army, newly appointed Liaison Officer in England, recently visited E.M.I. Institutes to meet the first detachment of P.E.M.E. Officers (Pakistani Electrical and Mechanical Engineers), who are taking a three-year course. Left to right: Mr. J. B. McMillan, Director of College Studies, Professor H. F. Trewman, Managing Director and Principal, Brigadier S. Ghawas, his predecessor Brigadier M. Hayau Din, M.B.E., M.C. (who is returning to Pakistan), and P.E.M.E. Officers.

Appointment of Senior Superintendent Engineer, Sound, and of Superintendent Engineer, Studios

MR. E. G. CHADDER has been appointed Senior Superintendent Engineer, Sound, following Mr. L. Hotine's resignation from the B.B.C. Mr. Chadder joined the British Broadcasting Company, as it then was, in 1923, and has since held several senior posts in the Engineering Division. He was successively Engineer-in-Charge at Aberdeen and Washford, and became Assistant Superintendent Engineer, Transmitters, in 1935, Assistant Superintendent Engineer, Studios, in 1937, and Superintendent Engineer, Studios, in 1939.

Mr. Chadder is succeeded by Mr. F. Williams, B.Sc., M.I.E.E., as Superintendent Engineer, Studios. Mr. Williams came to the B.B.C. in 1925, and was successively Engineer-in-Charge of the studio centres at Cardiff, Birmingham and Manchester. He became Assistant Superintendent Engineer, Studios, in 1940, and head of the Engineering Secretariat last year

The "Simpliscope"

Features :— A.C./D.C. Amplifier, Miller Time Base, Sync Amplifier, Flyback Blackout

By F. R. PETTIT

THIS oscilloscope was designed around a 250-0-250 volt transformer and standard value components, and with a view to simplicity of construction. The use of low voltages reduces costs and risk of failure, and also gives greater safety in handling by reducing the danger of shocks. The power supply section uses a standard mains transformer with one 4-volt winding supplying 4 volts 1 amp. for the C.R.T. heater ; one 4 volt or 6 volt winding for the valve heaters ; and a 250-0-250 winding for H.T. It will be seen in the circuit that the H.T. winding is so connected as to give 500 volts A.C. as measured from the chassis. This is rectified to supply the negative potential for the C.R.T. cathode. The 250 volt tap is rectified to supply the positive potential for the valve anodes, etc. Direct connections are made from the valves to the deflector plates for simplicity and to allow the use of a D.C. amplifier, thereby increasing the versatility of the instrument.

The amplifier is a simple pentode class A valve with a negative feedback resistor in its cathode which may be switched into circuit to reduce the gain of the amplifier to approximately unity. This is an alternative to the more usual "direct connection" to the Y plate for handling large signals. It is essential to use an input coupling condenser when this negative feedback resistor is in circuit as the D.C. connection is raised to a positive potential by the cathode current of V3. The amplifier will give a full size trace when a signal of about half a volt is applied to its input. The sensitivity of the circuit could be increased still further by fitting a 50 μF. (12 volt working) condenser across the 250 ohm cathode resistor of V3.

The sweep oscillator or time base valve is

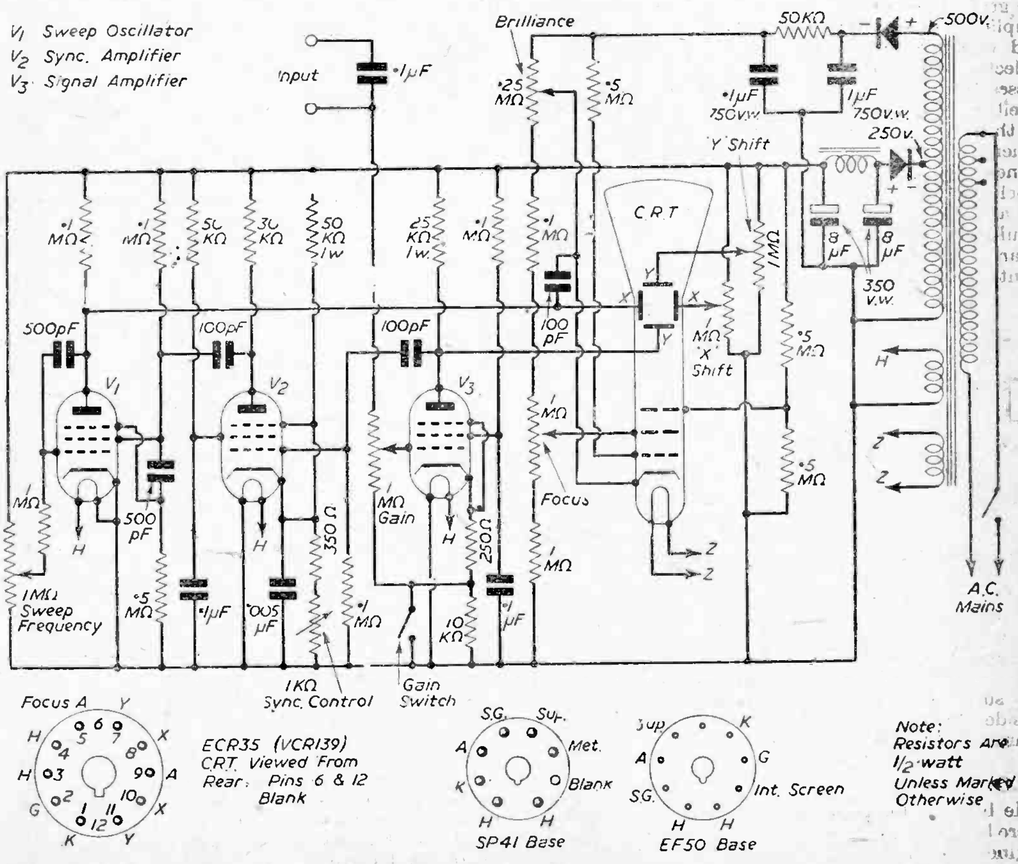


Fig. 1.—Theoretical circuit of the "Simpliscope."

connected as a free running Miller integrator circuit; this is one of the easiest circuits to set up and operate and, owing to the high degree of negative feedback used, the trace is very linear. To synchronise this oscillator so that a stationary pattern appears on the screen a steepfronted negative-going pulse applied to its screen grid or supressor grid is most effective. Such a pulse is generated by the sync amplifier. The 100 pF. condenser and 0.1 megohm resistor in

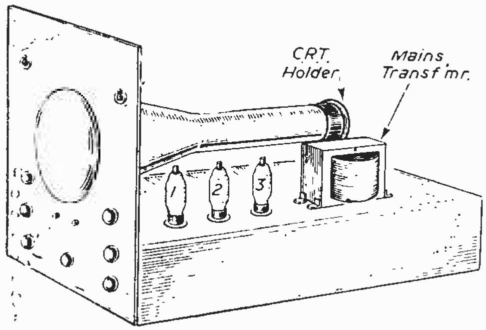


Fig. 2.—Suggested layout for the instrument.

the grid circuit of this valve form a differentiating coupling and pass a spiky pulse of voltage to the grid whenever a sudden change occurs in the Y deflector plate voltage, such as when a sine wave passes through its "zero line." These pulses may be either positive going or negative going according to the sudden change initiating the pulse being either an increase or decrease in potential. As it is a negative going pulse which is required to synchronise the oscillator, the positive pulses only are allowed to be amplified, as these will give the required polarity at the oscillator. To achieve this polarity selection the sync amplifier is biased to a point just beyond the grid cut-off so that a negative pulse has no effect upon the amplifier anode current. A positive pulse, however, produces, a negative going pulse at the anode, and this is passed through a small condenser to the sweep oscillator. The degree of synchronism achieved with this circuit is such that there is always a stationary trace on the screen—even if the signal frequency is varying over half an octave. As an experiment, a sine wave was derived from an unstable buzzer whose note was very erratic; this wave was applied to the 'scope amplifier and a clean, stationary trace was obtained. As the sweep frequency control was rotated there were sudden jumps as the number of waves on the screen altered, but there was no "running" of the pattern.

Construction

The actual layout is not critical provided that the mains transformer is placed behind the tube. The valves could be placed beside the tube and the controls on the front panel in the usual manner; the leads should be kept as short as possible.

A slight increase in sensitivity will be afforded by the use of a metal cap or ring around the edge of the C.R.T. screen and connected to chassis. This helps to remove screen and bulb charges and reduces the natural repulsion of the screen for the cathode rays.

Valves and C.R.T.

If a 4 volt transformer is available, use Mazda SP41 valves (R.A.F. VR65A), with a 6 volt transformer use Mullard EF50 (R.A.F. VR91) or Mazda SP61 valves. No change in circuit valves should be necessary, C.R.T. Mullard ECR30 (R.A.F. VCR139).

The negative supply rectifier must be able to withstand the 500 volt input required.

One word of warning to constructors—do not forget the suppressor grids in the valves. This may sound frivolous, but in wiring up this type of pentode it is very easy to omit the connection to the suppressor grid and the result may well be chaotic.

M.I.M.C. Jubilee

"THIS is an international occasion and I am most grateful to the Ambassadors, Chargés d'Affaires and official representatives of so many nations and the leaders of the great shipping industry who are gracing this occasion with their presence," said Sir George Nelson, chairman of the Marconi International Marine Communication Company, at the company's Jubilee Banquet at the Dorchester Hotel, London, recently.

Fifty years ago after a ship had left port it was not long before it had entirely lost contact with the shore. To-day touch with the land is maintained wherever ships may be. The origin of these achievements was the genius of one man, a young Italian, who succeeded in producing, in his father's house outside Bologna, the new phenomenon of wireless communication.

G.P.O. Support

He brought his primitive apparatus to England, where he obtained the support of Sir William Preece, Engineer-in-Chief of the General Post Office at that date. That equipment was present at the banquet and as a tribute to Guglielmo Marconi, Sir George asked his son, the present marchese, to operate it just as his father did on that momentous evening 50-odd years ago.

Marconi's first message across water was sent in 1897, and from that event the Marconi International Marine Communication Company was formed to develop Marconi's discoveries.

Modern Developments

Sir George outlined the development of wireless communication at sea during the last 50 years up to the present day when there are 12,000 merchant ships equipped with various types of Marconi equipment and over 2,000 Marconi radio officers serving in British ships alone.

"During the last war our casualty rate was higher even than in the fighting services and one man in six in the wartime staff of 6,000 radio officers lost their lives," continued Sir George, and he went on to pay a tribute to the encouragement and assistance which the Marconi International Marine Communication Company and Marconi himself had received in this country in the development of his discoveries.

9-valve All-wave Superhet—2

A Compact Mains-operated Receiver in Two Units

By F. G. RAYER

KEEP the wiring to one stage clear from that of each of the others, as far as possible. In the original receiver it was *not* found necessary to screen any leads in R.F., I.F. or A.F. circuits to preserve stability.

As when wiring up receivers using individual coils of this type, simplification and avoidance of error may be achieved by wiring-in simultaneously only the coils of one type; for example, wire in the l.-w. coils, then the m.-w. coils, and complete by connecting the three s.-w. coils.

When the receiver is completed and first switched on no stations may be heard on the s.-w. band if the circuits are severely out of line. This, therefore, should not be taken as a sign that the s.-w. coils are incorrectly wired. Proper aligning can be undertaken after the amplifier and rectifier section of the receiver is completed.

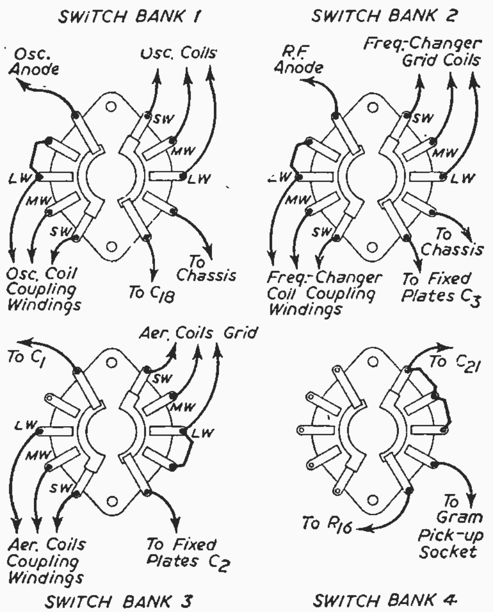


Fig. 5.—Details of wiring to the switch wafers.

The circuit for this is illustrated in Fig. 6. A triode drives the output valves through a push-pull transformer, and this arrangement was found to give more volume than that obtained when an extra triode was introduced for phase inversion. C30 is of a capacity which was thought to give most natural reproduction, but the possibility of fitting a comprehensive tone-control circuit at a later date was not overlooked. The speaker used is a 10in. permanent magnet Rola, and reproduction on both radio and gram is good.

The output valves are individually rated as having a power output of 2.2 watts at the maximum anode voltage of 160, and the rectifier and mains input circuit used can supply ample voltage in these circumstances.

The completed output and rectifier section is bolted to the rear of the radio-unit chassis. This provides the H.T. negative connection and heater return circuit. In addition three leads as follows are required:

From volume control slider to grid of triode. From point marked H.T. positive on radio unit to H.T. positive on output chassis. From triode heater to 2nd I.F. valve heater. Also note that though the mains switch is shown in Fig. 6, this is, of course, integral with the volume control mounted on the radio unit chassis.

Constructional Details

Figs. 7 and 8 illustrate the top and underside of the chassis respectively and it is unlikely any difficulty should arise in wiring up. As R26 generates considerable heat it should be well back to the left-hand corner of the chassis and the cabinet should provide ample ventilation. In the completed receiver arrangement use was made of a radio-gram cabinet about 3ft. high. The speaker was placed in the bottom of this, attached to a baffle. The receiver was situated on a middle shelf, while the pick-up and turntable motor was fitted on the top playing desk, covered by a lid when the cabinet is closed. A Collaro 230/250 volt radiogram motor with turntable was used; this is easy to obtain and fit and has given long, trouble-free service. A B.T.H. magnetic pick-up is employed.

Note that polarity is shown for the smoothing and bias condensers, in Figs. 7 and 8, and this must be observed. Keep leads carrying A.C. away from grid and anode wiring.

LIST OF COMPONENTS

AMPLIFIER AND RECTIFIER SECTION

C24—25 μF. bias condenser
C25—.1 μF.
C26 and C27—50 μF. bias condensers.
C28 and C29—8 μF. smoothing condensers
C30—.005 μF.
R19—1,000 ohms.
R20—30,000 ohms.
R21 and R22—440 ohms.
R23 and R24—5,000 ohms.
R25—100 ohms (all 1 watt).
R26—800 ohm .3 amp. mains dropper.
R27—40 ohms, 2 watt.
Two Octal valveholders, two 6-pin UX valveholders.
3 : 1 push-pull input transformer; push-pull type (centre tapped) output transformer suitable for speaker used.
Smoothing choke.

Valves and Heater Adjustment

For R.F. and I.F. stages 6K7 valves are used. For the frequency-changer a 6K8 triode-hexode is used. The double-diode is a 6H6. In the triode position in the output section a 6C5 is used, with two 43's for output. The rectifier is a 25Z4 and this valve is easily able to deliver the total anode current required. Many equivalents of these valve types exist, and should work equally well.

A dial-light should be placed in position before trying the receiver (6.3 volt .3 amp. type). About two-thirds the total value of R26 will require to be in circuit and one of the clips should be moved accordingly. This clip should subsequently be adjusted so that the heater voltage, measured at one or more of the valves, is correct. If no A.C. meter is available, place the clip in such a position that the receiver attains normal operating temperature within about 45 seconds of switching on from cold.

Do not use a direct earth on the chassis, and do not alter R26 or other connections without withdrawing the mains plug. If an earth is used (and it is scarcely necessary) a condenser of good quality (capacity about .1 μF) should be connected between earth lead and chassis. Hum should not be troublesome. If it is, a condenser of about .05 μF in parallel with the mains leads may be found to reduce it. In a few cases, reversing the mains leads will also give some improvement. Normally, however, there should be no trouble in this direction.

With the switch in the appropriate position, records may be played in the usual way. Some long- and medium-wave stations should also be obtained, but for proper results the various tuned circuits will need adjustment.

Aligning the Receiver

Though there are 15 adjustable cores and nine pre-set condensers, not all are effective on all wavelengths and provided one waveband is taken at a time no great difficulty should be experienced. With the tuning coils, the position of the iron cores influences the inductance, and in consequence the *maximum* wavelength to which the coils will tune. The trimmers, however, have the greatest effect at the *minimum* wavelength end of each tuning range.

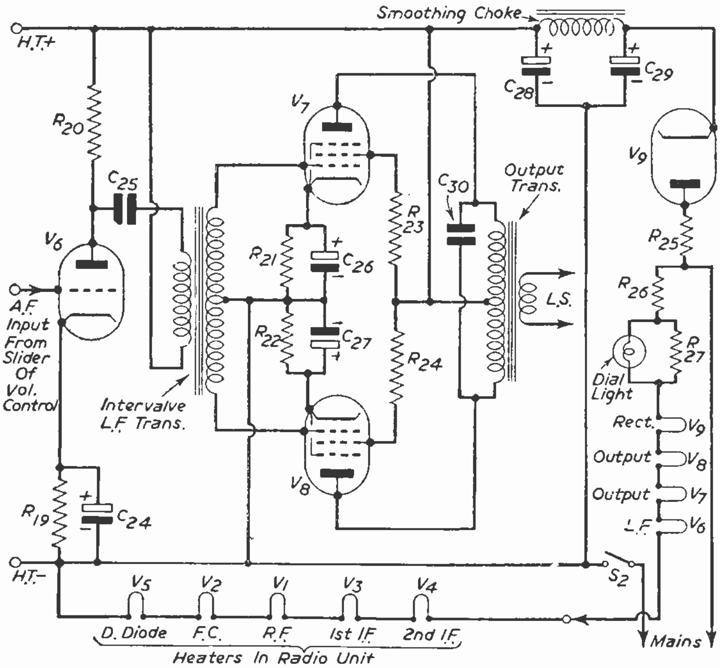


Fig. 6.—Theoretical circuit of output and rectifier unit.

See that the tuning condenser is fully open and the dial at the lowest wavelength setting, and tighten up the locking screw. Medium waves are probably best to begin with, and it will be desirable to put the A.V.C. out of action by shorting the A.V.C. line (Fig. 3) to chassis. Tune in a B.B.C. station of known wavelength near the lower wavelength end of the dial, and adjust the oscillator trimmer until this is best received when the dial indicates the correct wavelength. Repeat this at the high wavelength end of the scale, adjusting the oscillator coil core instead of trimmer,

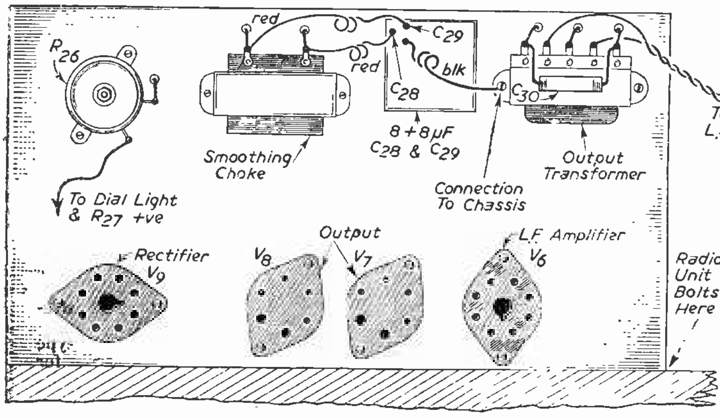


Fig. 7.—Layout of output and rectifier section.

until the dial correctly indicates the wavelength of the station received. During these operations the tuning control will need to be operated while the oscillator coil and trimmer are being set to inductance and capacity values, which will enable the tuning pointer correctly to indicate the wavelengths of the stations received.

It is now necessary to adjust the aerial and frequency-changer grid coils and trimmers for maximum volume. Do *not* move the main tuning control while this is being done, and adjust the trimmers at a low wavelength setting, and the iron cores at a high wavelength setting.

In practice, the whole procedure will be found quite easy, especially if volume is kept down by means of the volume-control.

I.F. Circuits and Other Ranges

After carrying out the above, good medium-wave reception will probably be obtained, but for best results the cores of the I.F. transformers will probably need a little adjusting. To do this, tune in accurately any station of moderate volume and turn the I.F. transformer core-adjusting screws one by one until each is set in the position which gives maximum volume. That completes the M.W. aligning.

The L.W. band can be treated as with the M.W. band, and will present no difficulty. On the S.W. band the adjustment of trimmers and cores will be quite critical, and severe mis-alignment will result in no stations being received. However, if the set is tuned to the 17- or 19-metre band and the trimmers adjusted, some stations should be heard. Once a transmission has been picked up, adjust the trimmers for maximum volume. Then tune to a higher waveband (25 or 31 metres) and adjust the cores for maximum volume. After this it is likely that stations will be received at the highest wavelength end of the scale (probably the 49-metre band is most suitable here), and the cores can then be given any final adjustment necessary.

A high level of efficiency should by now have been achieved throughout all wavebands. However, as some adjustments slightly modify those carried out earlier, it is recommended the whole sequence of aligning as described be gone through again, if the highest level of efficiency of which the circuit is capable is to be attained. This time, however, only very slight adjustments will be found necessary.

Remember that only one waveband is treated at a time, the trimmers being adjusted at the low wavelength end of the dial, and the coil cores at the high wavelength end.

When alignment is complete, remove the lead shorting the A.V.C. line. The action of the A.V.C. can be checked by connecting a high-resistance voltmeter from this line to chassis and tuning through a strong station. The reading obtained will largely depend on the ohms per volt of the meter, being in the neighbourhood of 10 to 15 volts with a 10,000 ohms per volt instrument.

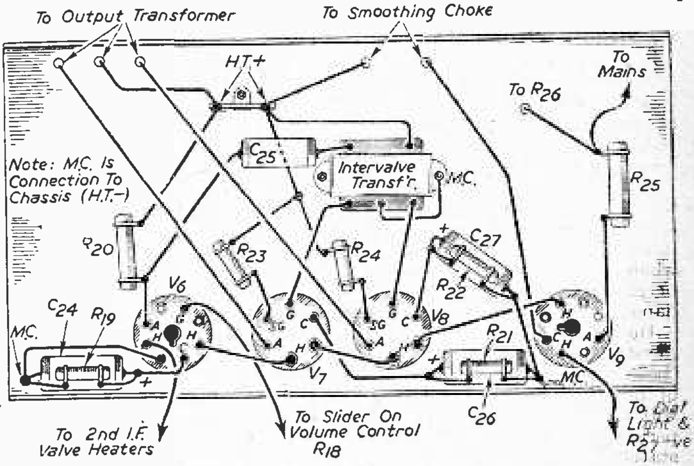


Fig. 8.—Wiring of under chassis.

Plessey Introduce Tv Component Range

A NEW and comprehensive range of television components, embracing deflector coil assemblies, scan output transformers and focusing units as well as control resistances, loudspeakers, electrolytic capacitors, RF, IF and filter coils and chokes and transformers, has recently been introduced by the Plessey Co., Ltd., Ilford, Essex.

Each component has been designed to allow maximum advantage to be taken of contemporary television receiver circuit simplification. In some instances standard radio components have been adapted by special reinforcement of characteristic or modification of construction, and basic components are individually designed to be as flexible as possible to suit the many alternative combinations of circuit, valve range and cathode-ray tube type as well as the possible various electrical operating conditions.

Several of the scanning and output transformers in the range are based on the Plessey special television grade of "Caslam" moulded core material. Low losses at the higher audio and ultra-sonic frequencies, and freedom from objectionable noise producing magneto-striction effects, are claimed to make this material eminently suitable for use in television applications. Produced in block form, it is simple to assemble, reducing damage to delicate windings of the type encountered in scanning components.

Accumulator Charging at Home

W. NIMMONS Discusses an Important Feature for the Battery-set user

THAT there are many people who, having electric light mains in the house, still have a battery wireless set, has been obvious to me for some time. Many of these are working off eliminators as a substitute for the high-tension battery, but they still need an accumulator to heat the filaments of the valves.

For these, and any others so inclined, there is an obvious sastisfaction in charging their own accumulators. There is the satisfaction of seeing that they are properly charged—not taken off just when the most critical point is being reached, or charged at too high a rate, with consequent damage to the plates.

But there is another aspect of the matter which merits attention. To the physically handicapped, those unable to go out to work, there is a means of livelihood in charging accumulators. Details will be given later so that even the most inexperienced can set about arranging a charging station with perfect safety.

First, suppose you merely wish to charge your own accumulator. With D.C. mains this can be done by inserting it (right way round, of course) in series with a lamp. But this would be both tedious and wasteful. A 60-watt lamp, for instance, consumes a little over a quarter of an ampere, whereas we may need from 1 to 2 amperes of current.

True, two 150-watt lamps will pass about 1½ amps., which is about right for the majority of cells, but they will have to stay on for at least 48 hours to charge the larger type of cell. During that time they will consume about 16 units of electricity which, with the current at 1d. a unit, would be 1s. 4d. Obviously, the shop could do it much cheaper.

With a rotary transformer, however, the picture is changed. A small rotary transformer will run for 48 hours at a cost of about 2d. When it is mentioned that up to four cells can be charged at a time from such a machine it will be seen that the cost is only ½d. each.

Such machines can be had very cheaply from war surplus stores. For about 10 or 15 shillings you can obtain a rotary transformer which will repay for itself within a short period. By arranging that each batch of cells is charged in 24 hours, 28 cells can be disposed of in a week. This, at 6d. per cell, represents 14s., less 6d. for current—nice pin-money for somebody. The machine will pay for itself in a week and then begin to earn.

For more ambitious work there is a machine costing 50 shillings which will charge about 20-30 cells at a time, representing about 150 a week. Allowing for slack periods there should be no difficulty in earning £2 a week by this means.

D.C. Supplies

The above are for D.C. mains only. For A.C. mains there are rectifier units to choose from, ranging from the trickle charger which will keep one cell in condition to elaborate charging boards which will deal with hundreds of cells a week.

Naturally these will cost more, ranging in price up to about £15, but since they will repay the cost in a few weeks it is worth while budgeting for a larger charging board than seems desirable at the time. Your practice may spread, and it saves wasteful scrapping of plant to budget accordingly.

You will need a room to yourself if any considerable amount of charging is to be done. This should be equipped with a mains plug and a long table or bench to accommodate the batteries. You will be wise to cover this table with thin sheet rubber in case any of the acid gets spilt.

There are two items of equipment which you will need. One of these is a voltmeter, and the other is a hydrometer. The voltmeter is for measuring the voltage of each cell on charge, and the hydrometer is for measuring the specific gravity of the acid. Instructions for using both these instruments will be given later. Neither is expensive. You can obtain the voltmeter for about 10s., and the hydrometer for about 5s.

Even if you intend to charge only your own accumulator a voltmeter and hydrometer are very desirable as without them you cannot ascertain the state of the charge.

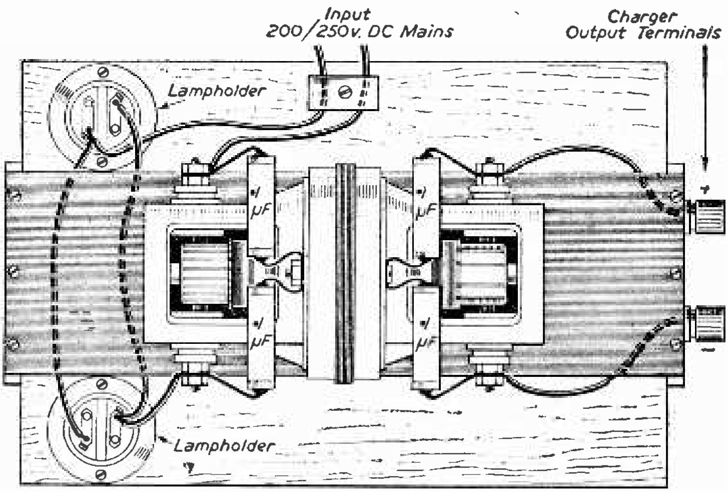


Fig. 1.—Rotary transformer charger details.

It is assumed that you have obtained a rotary transformer if on D.C. mains, or a rectifier unit if on A.C. The next thing you will want to know is how to charge the batteries. Fig. 1 shows a small rotary transformer suspended on a piece of motor-car inner tube; this keeps the noise down by preventing the machine from communicating its vibration to the table. It will be noticed that it is mounted on a sort of frame, and this frame you can make for yourself. Notice also the two lamp-holders—the purpose of these will be explained later.

The Frame

To make the frame simply nail two uprights of 6in. by 4in. wood to the baseboard, which can be 12in. by 9in. of ½in. stuff. A cross-bar 13in. by 1in. will keep the whole affair firm, but do not put this on until the rubber sheeting is in place.

Stretch the rubber loosely across the two uprights; it should be 15in. by 4in. Then put on the cross-bar by driving in two screws. When the rotary transformer is placed on the rubber, as in Fig. 1, the rubber will sag owing to the weight of the machine and it will be held securely. If desired a rubber band may be placed around the rotary on top of the rubber, and this will prevent it rolling off, though this is not very likely. This should be done before attaching one side of the rubber sheeting to the frame.

One of the mains leads is connected to one of the high-tension brushes of the rotary, while the other is connected via the two lampholders to the other high-tension brush. The two lampholders should be connected in parallel, as shown, so that either one or two lamps may be used. The purpose of the lamps is to limit the primary current, and hence the charging current.

The output is taken from the two low-tension brushes, which go to terminals to facilitate the work of connecting up the batteries to be charged. A switch to break the current is useful here, though not absolutely essential; it should be placed in one or both of the low-tension leads to the terminals.

The high-tension leads should terminate in a plug, so that they can be plugged into the mains supply. When this is done the rotary will revolve, attaining a high speed if no current is drawn from the low-tension winding. The rotary transformer is really a motor on one side and a dynamo on the other, all in the one machine.

There is one thing to be done to it, however, before it is fit to undertake the charging of batteries—when it will be running for long periods at a stretch. This is to fit suppressors to combat the electrical interference which such a device will set up in your own and neighbouring wireless sets.

Such suppressors are very easily fitted and will provide a complete cure. You will need four .1 μF. condensers, and two are needed for each set of brushes. Connect one side of one condenser to one high-tension brush of the rotary and one side of the other to the other high-tension brush; join the remaining sides together and connect the junction to the frame of the machine. Do the same with the low-tension brushes. Fig. 1 should make this clear. The rotary will then run interference-free.

Addresses of the firms supplying the rotaries, etc., can be had by writing to me care of the editor. Next month we will explain how to make use of the rotary for charging purposes. This will give you time to procure the rotary of your choice, and you will then be in a position to follow the instructions given.

It is presumed that the reader has now obtained a rotary transformer, if on D.C. mains; A.C. mains will be treated later. It has been explained why it is uneconomic to charge direct from the mains—because the bulk of the voltage goes to waste. What is wanted is some means of changing, or "transforming," the voltage of the mains to a lower and more convenient voltage and this is precisely what the rotary transformer does.

Suppose you wish to charge only your own accumulator, then a small rotary costing only ten or fifteen shillings will be required. These rotaries cost about £5 to make, but being war surplus are disposed of very cheaply.

The first thing to do is to insert a lamp into the lamp holder (Fig. 1) and plug into the mains. The size of the lamp depends upon the charging current required. A 60-watt lamp will give about 2 amps. output on the low-tension side, while two 60-watt lamps in parallel will give 3-4 amperes. Since this is considerably more than the current required by most wireless batteries it is as well to limit it.

To do this, connect a motor-car headlamp bulb in series with the battery. These are usually 24-watt bulbs, i.e., 6 volts at 4 amps. That is, they will glow at full brilliancy when 4 amps. are passing, and at proportionate duller brilliancy for lower currents. It will be seen that we have here a means of gauging the current passed.

As a matter of interest, it may be stated that the filament of one of these bulbs begins to glow at a dull red heat when 1.5 amps. are passing. At 2 amps. the filament is orange, and at 3 amps. bright yellow.

Read the instructions on the accumulator and see what the recommended charging current is. If this is 2 amps. then you are safe in running the bulb at a good bright orange colour. If only 1 amp., then it may be better to use two 6-volt 3 watt sidelamp bulbs, which will pass half an amp. each.

Single Cells

Fig. 2 shows the set-up for charging a single cell. As previously mentioned, this can be done for a cost of from 1d. to 2d., depending on the size of the cell. But since it costs no more to charge up to four cells it is even more economical to charge this number. You cannot charge more than four cells from a small rotary, since the voltage of the cells will then be equal to, or greater than, the rotary's output. The voltage output of the rotary must always be greater than that of the cells to be charged.

To ascertain the right way round to connect the cell, you must make use of the voltmeter. With the rotary running, but no accumulator connected, join the voltmeter terminals to the low-voltage terminals of the rotary. The rotary itself will be marked positive and negative. Join the positive terminal of the meter to the positive terminal of the rotary, and the negative terminal to the negative. If the meter reads, say, 10 volts all is well, and you should mark the rotary in a conspicuous manner with a cross for the positive and a dash for the negative, and always connect the accumulator in such a way that the positive terminal of the accumulator goes to the positive low-tension brush of the rotary, and the negative to the negative.

Should the meter read backwards, however, that is, if instead of the needle going up the scale it goes towards the left, then it indicates that the mains plug needs reversing. When this is done the needle of the meter will move correctly, that is, towards the right over the scale.

With a 60-watt lamp in the lampholder of the rotary unit, and a single cell on charge, the respective currents will be: From the mains, about .1 (one-tenth) ampere in the primary and about 2 amps. in the secondary. That is, we put one-tenth of an ampere in and take two amperes out. This is a measure of the efficiency of the system. Of course it is not a means of getting something for nothing; the voltage is simply stepped down and the current stepped up. As a matter of fact the efficiency is not better than 50 per cent., but since we are only interested in a comparatively low voltage the discrepancy does not matter. The wattage of the electric light bulb is no criterion of the true voltage consumed, since it runs at reduced brilliancy owing to the back voltage of the rotary.

With a larger rotary transformer, say one giving 14 volts at 14 amperes, we are in a position to charge cells for profit. In this case the mains are connected directly to the rotary, and the various cells are grouped together in a certain way when they are being charged.

With a rotary of these dimensions, from twenty to forty cells can be charged at a time, but they must be connected up in a certain way. The easiest way to grasp this is to take, say, five cells and connect

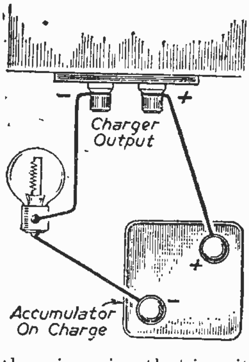


Fig. 2.—Set-up for charging a single small cell. Note the use of the series lamp to regulate the charging rate.

them in series, that is, with the positive of one to the negative of the next, and so on. Since each cell has a voltage of two, the five cells will have a total voltage of ten to begin with, but as this rises on charging to 2.6 volts per cell, the total voltage across the five cells at the end of a charge will be 13 volts. This is close to the 14 volts which the machine will deliver, and if we connect a motor car headlamp bulb in series with the five cells the charge will tail off nicely as the voltage of the cells rises.

But this will only draw two amperes out of our total of 14 amperes. So we can connect another five cells, also in series, in parallel with the first five, making ten in all. These second five cells will also have a motor car bulb in series. We can, furthermore, connect a third five cells in parallel with the other two, making 15 in all.

Continuing in this way, with two amperes

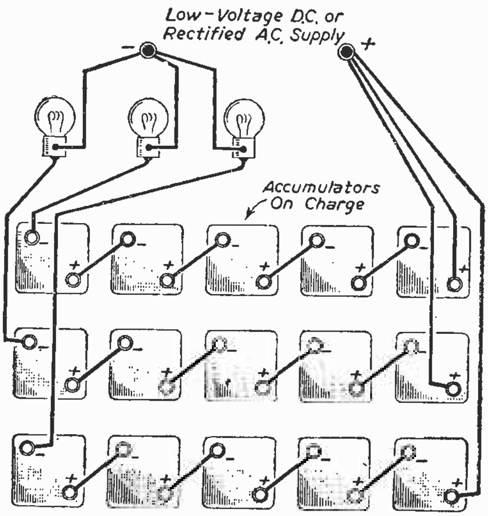


Fig. 3.—Series-parallel connections to draw full load from the rotary.

passing in each group of five cells, we can have seven groups in all, making up the 14 amperes of current, or 35 cells in all. Fig. 3 should make this clear. Of course, if only one ampere were passing through each group of five cells, then we should be able to have 14 times five, or 70 cells in all.

Small Cells

For small cells only requiring half ampere, a sidelamp passing this amount should be used, as previously mentioned. Note that you cannot have less than five cells in parallel with the other fives, say one or two. You should endeavour to connect them up in fives—or fours or even threes, depending upon the quantity coming in.

The arrangement for A.C. mains is similar to Fig. 3, except that a rectifier unit is employed in place of the rotary transformer. There are no moving parts in this, but the cost is in most cases higher because there is no war surplus of this class of goods to be had; you might, however, manage to secure a rectifier battery-charger second-hand.

It has been stated that it is uneconomic to charge direct from D.C. mains. This is only true when a small quantity of cells are to be charged. Since we can charge 50 cells at the same cost as one, by connecting them in series, it is obviously a practical proposition to do so. When this is done no special apparatus is required, but the operator must be on his guard against possible shocks. He should switch off at the mains every time he removes or adds a cell, and in this way the procedure is quite safe.

(To be continued)

An Efficient Cone Repair

A Simple Method of Replacing a Cone without Speech Coil Complications

SOMETIMES the cone of a loudspeaker becomes useless through mechanical damage, or by reason of acid being spilt on it, leaving the speech coil and spider intact and in good condition. In such a case the obvious thing to do is to fit a new cone; but, as this implies taking out the speech coil and removing the spider (which may be riveted in) the average constructor avoids doing this in case he may not be able to fit it back again.

There is a second alternative, however, which may have been overlooked. This is to fit on the new cone with the speech coil and spider in position; this is not so awkward as appears at first sight, and is to be recommended for the average constructor with little mechanical knowledge of working to close tolerances.

First, dealing with the speaker which has the spider at the back of the cone. This is usually riveted to the frame, and consists of three bent arms which are arcs of circles. The front of the cone is quite bare at the centre, so that the polepiece can be seen.

With a razor blade slice off the old cone at the intersection of the cone with the speech coil. This can be done quite easily if the first cut is made an inch all around the intersection, thus permitting the removal of the cone. This will enable the junction to be got at, and a clean cut should then be made, following the line of the upper edge of the speech coil.

Celluloid Supports

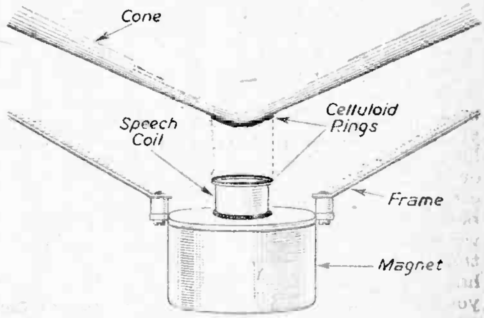
Next have two rings of celluloid, of a suitable diameter so that the speech coil will fit on the centre of the rim of the ring; this rim can be ¼in. wide. Dissolve some scrap celluloid in amyl acetate and cement one of the rings on to the top of the speech coil. The other ring is similarly cemented to the bottom of the cone.

When this cement has hardened by the following day the two celluloid rings, the one on top of the speech coil, and the one at the apex of the cone, are brought into contact with a smear of the celluloid cement. At the same time the rim of the cone is fastened to the rim of the frame with glue or other adhesive, and the ring of felt or other material replaced. It is helpful to secure a sound joint between the two rings of celluloid to hold them in position with small metal grips or even crocodile clips.

The same procedure is applied if the spider is on the front of the cone. In this case larger rings will be required, to fit at the extreme edge of the circular spider.

Cone Material

If no proper cone is to hand one can readily be made. Choose good quality paper with a dull, rough surface rather than a smooth, shiny one. Certain grades of blotting paper, stiffened with collodion after driving out the water content by heating before the fire, are suitable. It is best, when cutting out the cone, to cut the segment out a little at a time in case the angle of the cone is made too steep. Also, cut to the centre of the circle of paper and, after gluing the edges and letting the glue dry, cut the hole in the centre with a sharp razor blade to the correct size; this obviates the lopsided hole which often appears after the edges of the cone have been glued, and which renders the cone useless.



The figure shows the new cone ready to be lowered into position; the two celluloid rings are cemented firmly with amyl acetate. Speech coil suspension not shown.

The ribbing at the edge of the cone can be made as follows: Bend the paper right back on itself all round towards the back of the cone at 1in. from the periphery. Then bend it again towards the outer edge at a point ¼in. nearer the rim. Continue in this way until two or three well-defined corrugations have been made, when the cone is ready to be fitted.

Book Received

SHORT-WAVE RADIO AND THE IONOSPHERE.
By T. W. Bennington, of the Engineering Division, British Broadcasting Corporation. Second Edition. Published on March 30th, 1950, at 10s. 6d. (postage 4d.) for "Wireless World," by Iliffe & Sons, Ltd. Size 8¾in. by 5½in. (Demy 8vo). 138 pages and 61 illustrations.

ALL who carry on radio communication over long distances by short waves—whether professionals or amateurs—must be interested in the role of the ionosphere, which is one of paramount importance.

This book presents all the available information in simple form so that it is of use to those with only a limited technical knowledge. The author is a member of the Engineering Division of the British Broadcasting Corporation, and has been able to draw freely on the Corporation's experiences in the development of short-wave overseas services.

The use of mathematics has been avoided, and the physical processes involved are explained in simple descriptive language. The author has kept the practical side of the subject in mind throughout, and shows how existing ionospheric data can be applied to everyday problems of short-wave transmission and reception.

This new edition of the work first published six years ago (under the title "Radio Waves and the Ionosphere") is to all intents and purposes an entirely new book. Mr. Bennington has completely rewritten it; it has been reset in new type and 56 new illustrations have been added.

Contents include: Preface; Fundamentals of Long-distance Communication; Formation and Structure of the Ionosphere; Radio Waves and the Ionosphere; Measurement of the Ionospheric Characteristics; Ionospheric Variations—Short-wave Transmission; Multiple-hop Transmission and Ionospheric Forecasting; Amateur Transmission on High Frequencies; Radio Noise, Ionospheric Absorption, and the Low Limiting Frequency; Ionospheric Storms and Other Phenomena; Conclusion; Index.

On your Wavelength

by THERMION

The Bearded Boys Club

IT must be very galling to, say, a skilled musician to have to go for an audition before a youth who probably does not know a note of music or, if he does, is too young to express a mature opinion. The modern tendency amongst the youthful intelligentsia and cognoscenti is towards jazz, bebop, hip-wagging, and Harlem music and methods generally. A musician in his forties or fifties resents being told by one of these curious youths, who seem to have descended like a plague of locusts upon the B.B.C., that his pedalling was bad, or that he fluffed the double sharp. No wonder Sir Thomas Beecham said recently that if all the beards in the B.B.C. were placed end to end, they would stretch from Sodom to Gomorrah! I suggest that auditions should be carried out by those who have passed the age of forty, and not by sloppy youths dressed in suede shoes, corduroy trousers, and who grow beards to hide the receding asinine chin.

This fulmination is a result of a visit to the office the other day of a highly-skilled musician who, in 1939, gave up his musical practice and entered the Army. Up to that time he had been giving three piano broadcasts a week, and after demobilisation represented himself to the B.B.C. in an effort to re-establish his connections. He was given an audition, but was told that his pedalling was bad—by a callow youth! He has made many similar applications during the past two years, but without results. The B.B.C. has forgotten its old skilled servants, and, whilst other industries are compelled to re-engage staff returning from the Services, the B.B.C. apparently is not under such obligation.

Do these bearded people belong to some secret society of which the beard is a sign of membership? I have observed that some of these characters have curious political views, and none of them seems to work very hard. That may be due to lack of supervision in the B.B.C., for it cannot be said that all of the staff is overworked. It is very like the Civil Service, where the mere thought of working eight hours in a day makes the civil servants turn in their grooves. Of course, I cannot blame the present B.B.C. administration. Their lack of planning and plurality of departments, the overstaffing and the lack of cohesion between the departments cannot be eradicated in a year or so, if at all.

Radio Birmingham

IT is only fair that Midlanders should expect Londoners to undertake a journey this year to visit the National Radio Show. Whether they will do so in large numbers remains to be seen. Personally, I doubt it, for the very good reason that Birmingham is not able to accommodate a large influx of visitors as is London. As the exhibition is also to be on a somewhat smaller scale than Radiolympia, it may not have the same attraction. There was something attractively euphonious about that word Radiolympia which is lacking in National Radio Exhibition. Your "Thermion" will, of course, be there, never having missed a show from the very commencement of the series. I am as good a historian of the radio industry as anyone else, and if in the passage of the years I have noticed the intimacy of the earlier exhibitions gradually merge into an atmosphere of hard commercialism, I must console myself with the thought that it is inevitable, and that it has its compensations in the better quality of receivers and components, and the freedom from charlatanry which characterised some of the earlier exhibitions, where almost any swindler was allowed to exhibit his racket. The trade is a little more choosey these days. However, Midland readers who want to join in the annual hobby of haunting our stand, to discover the identity of the elusive "Thermion"—who is always incognito as well as incommunicado—will this year have a chance of doing so. For one thing, I want to look in under Sutton Coldfield conditions and form a comparison with Alexandra Palace transmissions.

"Pallydrome"

I LIKE the Editor's coined word "Pallydrome" instead of the somewhat guttersnipe appellation "Ally Pally," which smacks of a sixpenny hop in the 'Emmersmiff District. I do not know what cognomen he will apply when the television studios are opened at Shepherds Bush.

The P.W. Television Receiver

THE PRACTICAL WIRELESS television receiver was demonstrated to me the other day, and I must say that I think it superior to most of the commercial receivers I have seen up to the moment. Its picture is as steady as a rock, and although operating close to an electric motor and in a steel building, it was entirely interference-free. It was as good, in fact, as any high-quality home cinematograph. I understand that it is to be exhibited at the Birmingham exhibition.

Wire Recorders

THE latest acquisition in the PRACTICAL WIRELESS editorial offices is a wire recorder which has replaced the wax record type of recorder hitherto used. The publishers of this journal believe in keeping abreast of the times. Our publisher, for example, keeps in touch with his travellers by means of radio, their cars being radio-equipped. At the top of Tower House will be seen the transmitting aerial, radiating signals on one of the commercial wavelengths.

The wire recorder is a complete unit in itself, in that you may instantly record and play back, using the wire over and over again. You may dictate over an existing recording.

Radio Valve Review–3

The Subject of This Month's Review is Frequency Changers

AN extended description of the super-heterodyne system of reception is beyond the scope of the present series, but for the sake of completeness its main features may be recalled.

In the super-het the wanted radio-frequency signal, bearing, of course, the programme modulation, is combined with a continuous unmodulated "local" oscillation, i.e., one generated within the set, having a frequency which differs from the signal frequency by a pre-determined amount. This difference is, in current practice, usually 465 kc/s.

As a result there appears in the output of the valve in which this "mixing" takes place a complex current which includes the following components, all of which carry the programme modulation:—

(a) A component of original signal frequency.

(b) A component of local oscillation frequency.

(c) A component having a frequency equal to the sum of the signal and local oscillation frequencies.

(d) A component having a frequency equal to the difference of the signal and local oscillation frequencies.

(e) Various harmonics of (b), (c) and (d).

By means of a tuned circuit in the output of the mixer valve, the "difference" frequency (d) is selected, and is then transferred to one or more amplifying stages termed intermediate frequency amplifiers.

Thereafter, detection and A.F. voltage and power amplification take place in the normal way.

The advantages of the super-het receiver may be briefly summarised as follows:

(1) Amplification at intermediate frequency is inherently more efficient than amplification at radio frequency.

(2) If only one I.F. amplifying valve is employed the set will include at least five tuned circuits—the tuned R.F. circuit and four circuits tuned to the intermediate frequency. The selectivity of such a set is, therefore, of a very high order.

(3) This high degree of selectivity is achieved with the use of a 2-gang variable capacitor only—the I.F. transformers have fixed tuning so that only the R.F. input circuit and the local oscillator have to be adjustably tuned.

The stage in which the programme modulation is transferred from the R.F. carrier to the I.F. carrier is termed the frequency changer stage. In principle, it comprises two units—(1) a valve or at least an electrode system which, with a suitable circuit, generates the local oscillation and (2) a valve or electrode system to which are applied the radio frequency signal and the local oscillation, and from which is drawn the I.F. signal. These two units are respectively termed the "oscillator" and the "mixer."

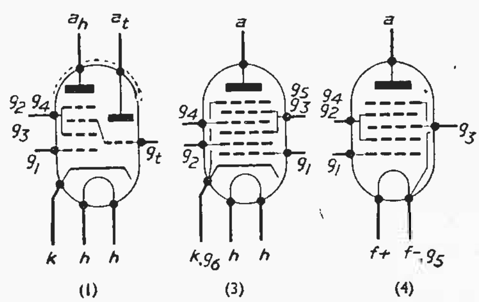
Separate Valves

In the original superhets, oscillator and mixer were two separate and distinct valves—and there are still applications in which separate valves may be used with advantage. But in most radio receivers oscillator and mixer are usually contained in the same bulb, either as two separate electrode systems in one envelope or a single electrode system, part of which functions as the oscillator and part as the mixer.

The oscillator, where this is a separate electrode system, is usually a triode, but if a separate valve is used it may be a pentode. A circuit employing a pentode oscillator was reproduced at Fig. 1 in part II of this series of articles.

Theoretically, the mixer may be of any type, even a diode, but normally it is a pentode, or a hexode. Where a single electrode system is employed as combined oscillator and mixer, it is either a heptode or an octode.

This article will deal only with those frequency changers in which all the functions are performed



Figs. 1, 3 and 4.—Theoretical diagrams of a triode-hexode, an octode, and a heptode frequency changer.

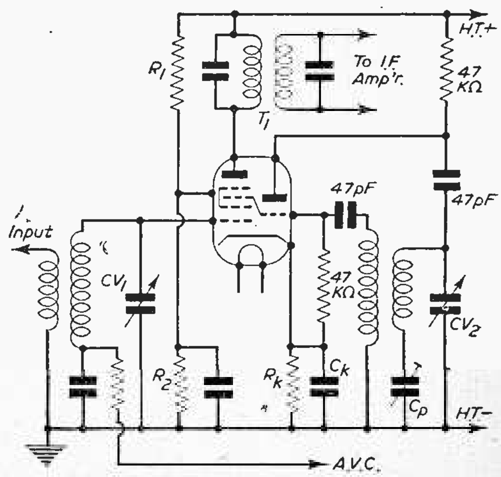


Fig. 2.—Basic circuit for a triode-hexode frequency changer.

in a single envelope, either with separate electrode systems for oscillator and mixer or a single electrode system performing both functions.

The fundamental difference between the two forms—as used in current receiver practice—is that where separate oscillator and mixer sections are employed, the R.F. signal is applied to the first grid of the mixer and the local oscillation to one of the subsequent grids, whereas those frequency changers employing a single electrode system are so connected that the local oscillation is generated at the electrodes nearest to the cathode, and the R.F. signal is introduced at one of the subsequent electrodes.

Typical of frequency changers having two electrode systems in a single bulb is the triode-hexode, shown in symbolic form in Fig. 1. Here, *k* is the common cathode, and *gt* and *at* the grid and anode of the oscillator section. In the hexode section, *g1* is the control grid to which the R.F. signal is applied; *g2* and *g4* are accelerator grids; *g3* is connected to *gt* and it is here that the local oscillation is "mixed" with the R.F. signal; and *ah* is the hexode anode.

Triode-hexode

A basic circuit for a triode-hexode frequency changer stage is given in Fig. 2. The R.F. input circuit, tuned by CV1 is conventional and is connected between the control grid of the hexode and the cathode. The resonant anode circuit of the triode oscillator is tuned by CV2, CV1 and CV2 being ganged. The padding capacitor CP serves to maintain the constant difference between the signal and local oscillator frequencies. T1 is the first intermediate frequency transformer, the primary of which is included in the anode circuit of the hexode. Primary and secondary are pre-tuned to the intermediate frequency, and the secondary is included in the control grid circuit of the following I.F. valve. A similar I.F. transformer is, of course, used to couple this valve to the next stage.

As an example of the type of frequency changer employing a single electrode system the octode may

Type	Description and Application	Construction and Base	Oscillator						Mixer						
			V_h (V)	I_h (A)	V_a (V)	I_g (mA)	R_g (KΩ)	V_{osc} (V)	V_a (V)	Scr'n V'tge (V)	Signal Grid V'tage (—V)	I_a (mA)	Screen Current (mA)	r_a (MΩ)	g_c (ma/V)
	Mullard **(1) A.C. MAINS TYPES**														
	Equipment Types														
ECH42	Triode-hexode ..	All-glass B8A	6.3	0.225	100	.2	47	—	250	85	2.0	3.15	3.15	1.0	.69
ECH35	Triode-hexode ..	Octal Base	6.3	0.3	100	.2	50	—	250	100	2.0	3	3	1.3	.65
ECH21	Triode-heptode ..	All-glass Loctal B8G	6.3	0.33	100	.19	50	—	250	100	2.0	3	6.2	1.4	.75
	Replacement Types														
ECH3	Triode-hexode ..	Side Contact	6.3	0.2	100	.2	50	—	250	100	2.0	3	3	1.3	.65
EK32	Octode	Octal ..	6.3	0.2	200	.3	50	—	250	50	2.0	1	0.8	2	.55
EK2	Octode	Side Contact	6.3	0.2	200	.3	50	—	250	50	2.0	1	0.8	2	.55
FC4	Octode	British 7-pin	4.0	0.65	90	—	50	8.4	250	70	1.5	1.6	3.8	—	.6
TH4B	Triode-heptode ..	British 7-pin	4.0	1.45	100	—	50	8.0	250	100	2.5	3.25	6.0	1.5	.75
	(2) D.C./A.C. MAINS TYPES														
	Equipment Types														
UCH42	Triode-hexode ..	All-glass B8A	14.0	0.1	100	.2	47	—	200	84	2.0	3.2	3.55	1.25	.69
UCH21	Triode-heptode ..	All-glass Loctal base B8G	20.0	0.1	100	.95	50	—	200	100	2.0	3.5	6.5	1.0	.75
CCH35	Triode-hexode ..	Octal base ..	7.0	0.2	100	.2	50	—	250	00	2.0	3	3	1.3	.65
	Replacement Types														
FC13	Octode	Side Contact	13.0	0.2	90	—	—	8.4	200	70	1.5	1.6	3.8	—	.6
FC13C	Octode	British 7-pin	13.0	0.2	90	—	—	8.4	200	70	1.5	1.6	3.8	—	.6
TH21C	Triode-hexode ..	British 7-pin	21.0	0.2	130	—	—	20	250	70	1.5	4.0	6.0	—	1.0
TH30C	Triode-heptode ..	British 7-pin	29.0	0.2	100	—	—	8.0	250	00	2.5	3.25	6.0	—	.75
	(3) BATTERY TYPES														
	Equipment Types		V_f	I_f											
DK91	Heptode	All-glass B7G	1.4	0.05	67.5	.25	100	—	90	67.5	0	1.6	3.2	0.6	.3
DK32	Heptode	Octal base ..	1.4	0.05	45	.35	200	—	90	45	0	.6	.7	0.6	.25
	Replacement Types														
KCF30	Triode-pentode ..	Octal Base ..	2.0	0.2	100	—	—	8	120	40	0.3	.55	.95	—	.285
KK32	Octode	Octal Base ..	2.0	0.13	135	—	—	8.5	135	45	0.5	0.7	0.7	2.5	.2
FC2	Octode	British 7-pin	2.0	0.1	135	—	—	7.3	135	70	0	0.95	3.75	—	.2
FC2A	Octode	British 7-pin	2.0	0.13	135	—	—	7.5	135	45	0.5	0.7	0.7	2.5	.27

be quoted. These valves are sometimes termed "electron-coupled" frequency changers.

In the symbolic diagram, Fig. 3, k is the cathode, $g1$ and $g2$ serve respectively as the grid and anode of a triode oscillator, g3 and g5 are accelerator grids, and $g4$ the grid to which the R.F. signal is applied. The sixth grid, $g6$ is a suppressor grid and performs the same function as the suppressor grid in a pentode; a is, of course, the anode. The heptode is similar to the octode but there are only five grids, the usual form being as indicated in Fig. 4, the first accelerator grid serving also as the oscillator anode.

A basic circuit for a heptode frequency changer is given in Fig. 5.

It must not be thought that the sole function of frequency changers of the types described is to generate the local oscillation and to perform the mixing process. The mixer section of a frequency changer is equivalent to a pentode or hexode, and is therefore capable of a very substantial degree of voltage amplification, and in this way the frequency changer contributes to the overall sensitivity of the receiver.

The sensitivity of a frequency changer is indicated by the ratio between the I.F. component of the anode current and the R.F. signal voltage, a ratio termed the conversion conductance. It expresses the change in I.F. anode current (in milliamperes or micro amperes) per volt change in control grid voltage. As the conversion conductance depends upon the value of the oscillator voltage it is necessary, when giving the conversion conductance, to specify the oscillator voltage, or what amounts to the same thing, the oscillator grid current and grid leak resistor, the product of which is a measure of the oscillator voltage.

It is not quite so easy to set out in convenient and compact form the leading data on current types of frequency changer, partly because there are so many different kinds—triode-pentodes, triode-hexodes, heptodes, octodes, etc.—and partly because performance greatly depends upon correct choice of very many circuit constants. The tables on p. 245, however, have been compiled from manufacturer's published data and will serve for general comparison.

The mixer sections of frequency changers are

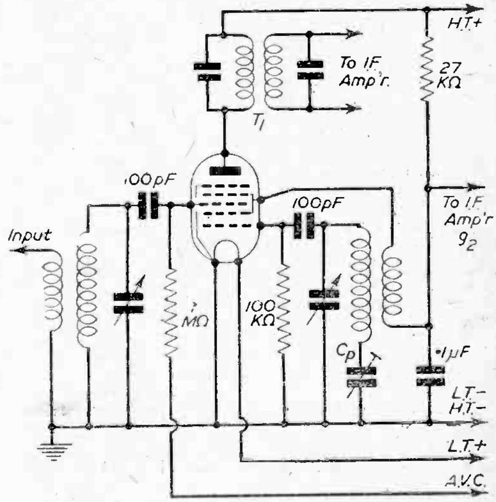


Fig. 5.—Basic circuit for a heptode frequency changer.

usually designed with variable-mu characteristics so that A.G.C. can be applied to the frequency changer. In the tables, the value of the conversion conductance is that corresponding to maximum sensitivity under the stated conditions.

P.T.F.E.

POLYTETRAFLUOROETHYLENE, known also as P.T.F.E., or Fluon, is a resin-like substance with valuable properties as an insulant, which is coming into use in radio and associated industries. The polymer was first produced during the course of work on new refrigerants. Further development work was undertaken in 1943, by the Du Pont company, in the United States of America, at which time pilot plant production of commercial quantities of the resin for war purposes was commenced. Since the termination of hostilities, the polymer has been produced in England by Imperial Chemical Industries, Ltd.

P.T.F.E. is produced by polymerising gaseous Tetrafluoroethylene under pressure, and in the presence of a catalyst to yield a solid granular polymer, which is a very stable substance. It is unique among organic compounds in its chemical inertness, in its toughness over a wide range of temperatures, and in its low dielectric losses over a wide range of frequencies.

The resin withstands the attack of all materials except alkali metals. It can be boiled in alkali hydroxides, hydrofluoric acid, fuming nitric acid or aqua regia with no change in weight or properties. It also resists the attack of all high-boiling solvents and other organic compounds. This inertness is explained on the basis of its molecular structure, which shows each carbon atom shielded by a fluorine atom.

General Characteristics of P.T.F.E.

P.T.F.E. resin has no true melting point. It decomposes slowly from its solid phase at 327 deg. C., accompanied by a sharp drop in strength. Yielding first the gaseous monomer, it gives off other gaseous fluorine derivatives at around 400 deg. C. Minute amounts of fluorine-containing gases escape at temperatures above 205 deg. C., and since the toxicology of these gases is not fully understood, good ventilation must be provided.

The material has zero water absorption, high impact strength and form stability, a far greater resistance to chemicals than either gold or platinum, and retains its strength and dielectric properties at temperatures ranging from minus 100 deg. C. to plus 288 deg. C. Its tendency to cold flow under pressure is not excessive.

The electrical losses of P.T.F.E. are substantially constant over a frequency range of 60 c.p.s. to at least 80 mc.p.s., and are lower than those of polystyrene and polythene. Its resistance to surface arc-over is good and, on failing, it vaporises instead of carbonising to leave a conducting path.

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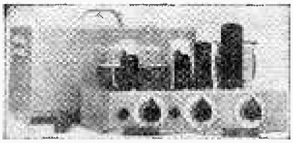

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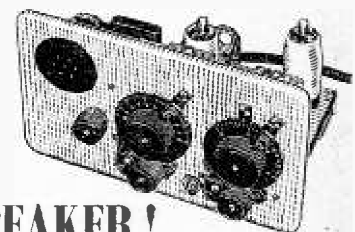

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By T. W. DRESSER

WHILST it would appear that a signal generator is an essential part of the equipment of every real radio enthusiast it is a fact that many still trust to the hit-or-miss method of tuning a receiver by ear. The idea may be fine and dandy on a powerful medium-wave station—although even then it is a pretty safe bet the alignment is a mile out—but on short waves it is hopeless to attempt to get the utmost out of the set by such means; a signal generator becomes a necessity, and the fact cannot be emphasised too strongly.

We have printed many articles on this subject and have given a variety of designs suitable for amateur construction. In general, the majority of these designs followed standard practice in that they almost invariably used one valve as R.F. oscillator with a separate valve as audio oscillator, and often involved the use of a commercial coil unit which undoubtedly raised the cost considerably and also dampened the zeal of the keen constructor who likes to know what is in his unit, and as a direct consequence prefers to build it himself. The writer offers no apology, therefore, for presenting the circuit of yet another signal generator, which the constructor can build at very low cost, and which demands the minimum of bought components. Further, the fact that only one valve is used ensures low replacement costs, no small consideration where the builder's pocket is inclined to be shallow. The generator has been designed around a heptode valve and the circuit schematic, Fig. 1, shows it used with a 6SA7 valve, which is readily obtainable on the surplus market, but with a simple modification it can be used with a 1R5. The essential difference between the two is simply one of current consumption; the 6SA7 requires 6.3 volts at .3 amps and 100/250 volts at 9 to 12 mA. for its best operation, while the 1R5 functions happily on 1.3 volts at .05 amps and 90 volts at 4.7 mA. H.T. But with either valve the generator functions quite well, with no apparent difference in performance.

The choice of valve is, therefore, left to the reader and circuits are given for both valves.

The heptode, as has already been stated, is used as an R.F. oscillator. The coils used are simple tapped coils, readily wound without complications, and they do cover the stated range shown in Table I which also indicates the turns, gauge of wire and spacing. A departure from the orthodox is shown in the A.F. oscillator, which is simply a standard neon tube and functions automatically when the generator is switched on. Moreover, as the neon

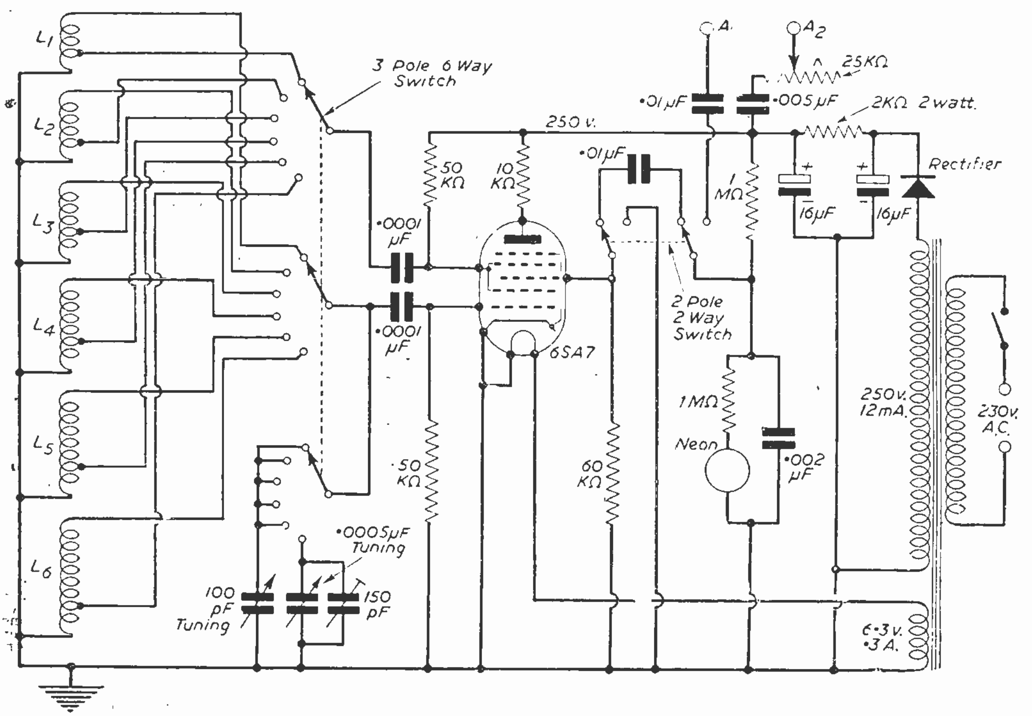


Fig. 1.—Theoretical circuit of the generator.

lights up in use it can also be used as an indicator light if desired. An ideal tube for this purpose is the G.E.C. "Tuneon" of which there have been a number on the surplus market at a reasonable price. However, practically any neon lamp will do provided it is not the type with a resistor in the base, and that the writer used was one obtained from a piece of American equipment, a NE16/NE48. The audio signal from the neon is injected into the signal grid of the heptode R.F. oscillator through contacts on the first position of the two pole two-way selector switch. With the switch in this position

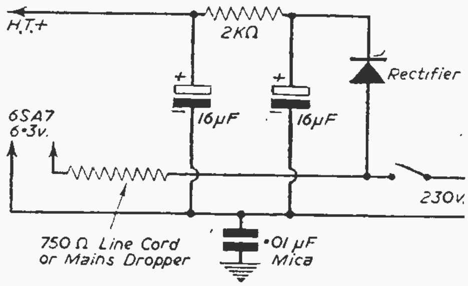


Fig. 2.—An alternative power supply.

modulated R.F. is available at the output socket, A2, the actual voltage available being controlled by the potmeter antennator K in the diagram. In the second switch position, unmodulated R.F. is obtainable at A2 and A.F. at A1.

Six Bands

In order to provide reliable calibration points on short and ultra-short waves, six wavebands are used, five of them covering 5 to 206 metres and the sixth covering the medium waveband, with an extension by means of a trimmer to include the 465 to 473 kc/s I.F. frequencies. Thus each band of a few metres only is spread right across the dial and the accuracy of calibration is consequently so much greater, quite apart from the fact that it is possible to set up a frequency on a repeat alignment with a fair assurance that it will still be on the same setting, which is not always possible on a cramped scale. Provision of a signal on 5 metres will be found useful on amateur transmitting gear and can also be used to some extent in aligning Tv receivers (on which it is proposed to base a future article), while the absence of a long-wave band is of no great moment. The majority of readers, it is felt, are primarily interested in short and medium waves and, moreover, the writer is firmly

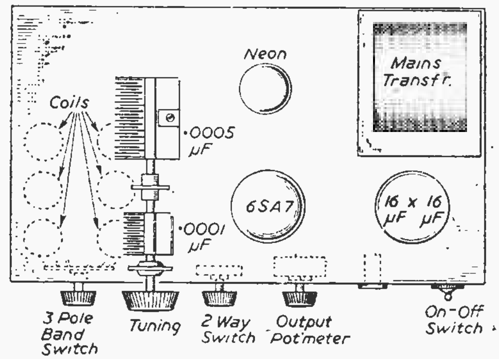


Fig. 3.—Chassis layout.

convinced that long waves have had their day and will disappear from the radio spectrum when someone gets around to it!

The power supply follows normal practice but uses probably one of the smallest mains transformers. The total power required for the 6SA7 for both filament and H.T. is 4.9 watts and the size of the transformer core is 2¾in. × 1¾in. × ¾in. stack! For the original model laminations from a midget O.P. transformer were used and proved very satisfactory.

For the 1R5 the current drain is somewhat less, of course, and the core will accommodate the windings even more easily. Incidentally, a word

Coil	Metres	Turns	Wire Gauge	Spacing	Tapping Point *
L_1	5–12·6	2	18 s.w.g. Enam.	Wire Diam.	½ Turn
L_2	11–22·5	5	18 s.w.g. Enam.	Wire Diam.	1½ Turns
L_3	21–49	13	20 s.w.g. Enam.	Wire Diam.	3½ Turns
L_4	47–98	29	24 s.w.g. Enam.	Wire Diam.	7 Turns
L_5	96–200	70	28 s.w.g. Enam.	Close Wound	18 Turns
L_6	198–650	115	32 s.w.g. Enam.	Close Wound	29 Turns

* From Earth End Of Coil

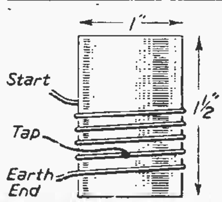


Fig. 4.—Coil details.

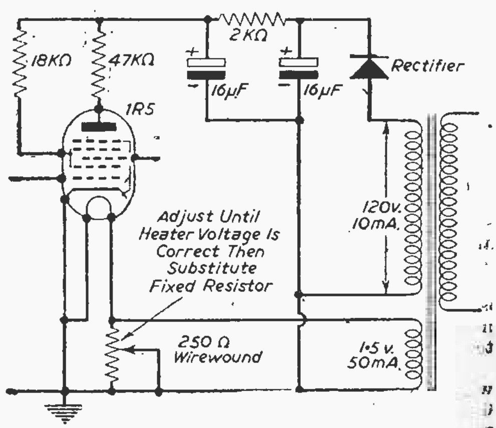


Fig. 5.—Modification for using a 1R5 valve.

of warning is necessary here. To ensure reasonable life from a 1R5 the filament voltage must not exceed 1.3 volts at any time. A careful check should be made when the signal generator is completed and any excess voltage reduced by a shunt resistor. Half-wave rectification is used in the H.T. circuit and a meter rectifier capable of carrying 5 to 10 mA. will serve adequately as well as assist in keeping down the size of the unit.

D.C. Supplies

An alternative power supply circuit is given in Fig. 2 for those readers who are on D.C. mains, and while it will function equally well on A.C. there is no saving in cost over Fig. 1 due to the higher rating of the rectifier and the cost of line cord.

The prototype was built on a chassis 7in. × 4in. × 1¾in. cut from 18 s.w.g. aluminium, with a front panel 7in. × 5in. of the same material. Most of the front panel, incidentally, was taken up by the dial! No snags were encountered either in the building or in the testing. The generator was calibrated by the usual zero beat method. A signal from a reliable commercial generator was injected into a receiver tuned to the generator frequency, together with the signal from the one valve generator. The tuning of the latter was then adjusted until the null point was found in the beat of the combined signal. In the absence of a good signal generator the instrument can be calibrated against B.B.C. transmission on 13, 16, 19, 25, 31, 41, 49 metres, and the Light and Home programmes on 247 and 330 metres, and against strong amateur signals on 10, 80 and 160 metres and also against Sutton Coldfield T.V. signals on 5 metres. Provided some care is taken calibration against these signals will not materially differ from that obtained against another signal generator and will provide sufficient check points to allow the entire dial ultimately to be marked in.

A Radiogram for Export

AN interesting example of how a product has been designed for the needs of the export market is given by a club-model radio gramophone made by The General Electric Co., Ltd. In response to the requests of a number of overseas customers, the G.E.C. has produced a large automatic radio-gramophone assembly of high power output, with self-enclosed loudspeakers for local use, external loudspeaker output terminals and external microphone input terminals. The whole apparatus is capable of handling high-quality speech and music and incorporates full public address facilities in a cabinet which has the styling of high-grade furniture and which includes space for record storage. It has the simplicity of operation of a domestic radio-gramophone. Typical uses for this radiogram would be in hotels, medium-sized dance halls, indoor public functions in assembly rooms and the like.

Two features which have been included especially to appeal to the export market are that alternative radio chassis can be fitted into the cabinet such as the "Overseas Seven" model or the "Super Bandspread" model or the newly-introduced G.E.C. Communications Receiver (BRT. 400). The second feature is that the design is such that the equipment can be supplied complete, or the basic units can be shipped abroad for local assembly, which allows the use of cabinets made from woods available locally and chosen to fit the customers' decorative schemes. Where the cabinet is manufactured abroad, detailed drawings of its design are sent together with full instructions for the assembly and interconnection of the various chassis. This ensures that any of the company's overseas branches or agents will be able to instal an instrument which is identical in design and performance with that made under the supervision of the company's technicians in Great Britain.

As normally supplied, the radiogram is fitted with a 30-watt output amplifier capable of feeding 6 to 40 loudspeakers, and a "Garrard" automatic record changing unit with a miniature high-fidelity pick-up. If desired, a 60-watt amplifier can be supplied, capable of supplying twice the above number of loudspeakers.

Ancillary apparatus recommended is the G.E.C. moving-coil microphone complete with floor stand, and the "Multibeam" loudspeaker. This loudspeaker can be finished to match any decorative scheme.

The moving-coil microphone is very suitable for general announcements and for the use of an M.C. during dances where gramophone records provide the music.

Provision is made for three external loudspeaker circuits controlled by keys on the control panel. Two "Multibeam" loudspeakers could provide music in the dancing area and the other two circuits could feed smaller loudspeakers for low-level music in lounges or in the restaurant.

A brief specification of the radio-gramophone is given below :—

Power output.—30 watts, normally 60 watts, to order.

Mains input.—190/250 volts or 95/130 volts A.C. 40-60 c/s, via an autotransformer.

Power consumption.—200 VA average (depends on the combination of units).

Dimensions.—53in. wide by 44in. high by 21in. deep.

Weight.—3 cwt. approximately.

R.F. Capa

A Useful Test Instrument

THIS article describes the design and operation of an instrument to measure small condensers of from 1 pF to approximately 1,400 pF. Good accuracy is obtainable on all values above about 10 pF, lower values are indicated approximately.

Since high stability silvered mica and silvered ceramic condensers of close tolerance are now quite common in radio receivers, it is very important to be able to say definitely if a condenser is within its limits, and whether it will, at R.F., in fact behave as a true condenser, and not have a considerably smaller effective capacitance.

The conventional impedance bridge found in most service workshops gives only a rough indication of the smaller condensers, and, most serious limitation of all, only measures at a very low frequency, usually only 50 c/s.

Principle of Operation

The instrument works on the following principle: a variable frequency oscillator tuned by a calibrated variable condenser is heterodyned against a R.F. signal; the unknown condenser is then connected across the C.V.C. and the amount by which the C.V.C. must be reduced in capacity to beat again with the R.F. signal, is a measure of the unknown capacitor.

Practical Design

Referring to Fig. 1, V_1 is an EF50 pentode in a Hartley oscillator circuit. L_1 is the oscillator coil. C.V.C. is the calibrated variable condenser, the method of calibration being described later. S_1 selects the range of capacity which can be measured in four ranges, viz.:

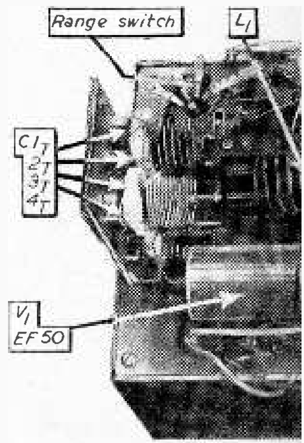
Range 1	..	0 to 360 pF
,, 2	..	360 to 720 ,,
,, 3	..	720 to 1,180 ,,
,, 4	..	1,180 to 1,430 ,,

The only components which require special mention are C.V.C. which is a 2-gang 180 pF section variable condenser of rigid construction taken from the tuning pack of an ex-R.A.F. 1154 transmitter. The EF50 was bought for 3s. 6d. from a war-surplus dealer. The slow-motion dial is a type now widely offered for sale at about 7s. 6d. This particular one was an ex-R.A.F. dial by Muirhead, engraved 0°—180° in two deg. steps. All fixed condensers associated with the tuned circuit are of the silvered mica high-stability type by U.I.C. The four trimmers, $C1_T$—$C4_T$, which set accurately the range, are air-spaced types taken again from ex-service equipment, this time an ex-Army No. 11 transmitter-receiver.

Stable Working

The instrument is run for half an hour to stabilise it, then switched to Range 1 and C.V.C. turned to maximum. On placing the aerial wire of a set receiving the 1,151 kc/s B.B.C. Northern Ireland or North Regional programmes a whistle should now be heard. If not adjust $C1_T$ until zero is obtained. Next, take a 500 pF 3-gang condenser and strap all three sections, connecting it across the X terminals. Turn C.V.C. to minimum capacity and adjust the gang precisely for zero beat; more than one whistle may be found, so choose the strongest one. Next switch to Range 2 and turn C.V.C. to maximum, leaving the gang undisturbed. Adjust $C2_T$ for zero beat. This procedure is repeated for Ranges 3 and 4.

The four ranges of the instrument are now set up without gaps or overlaps ready for calibration to read from 0 pF to 1,430 pF. This method is adopted both for initial and ultimate simplicity in use so that only one calibration chart is needed for all four ranges. We can now calibrate Range 1, the "master range." The calibration is done by turning C.V.C. to maximum and setting to Range 1, when a "beat" of a few c/s should be heard from the set. A number of close tolerance silvered mica condensers up to 360 pF are then taken and connected in turn across the X terminals, and the new setting of C.V.C. needed to return to zero beat is noted for each. For the greatest accuracy as many condensers of the same nominal value should be used for each setting, and the average of the settings of C.V.C. taken as the correct one. Finally, the exact "swing" of the C.V.C. is obtained by paralleling several silvered micas until the C.V.C. must be reduced exactly to minimum to restore zero beat. This value is most important, and should be obtained via several different combinations of silvered micas, and the average value taken as the



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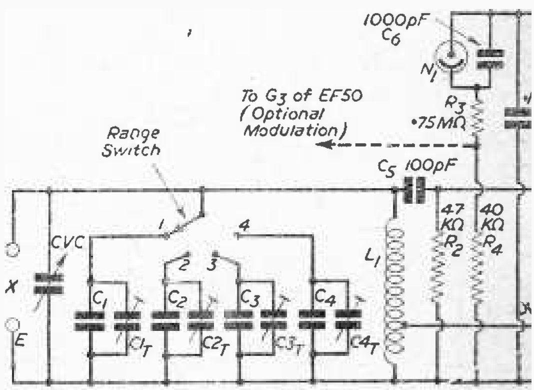


Fig. 1.—Theoretical circuit of the

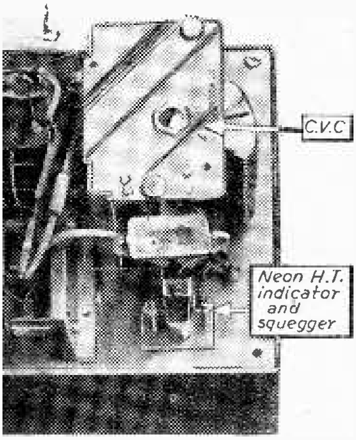
city Meter

By R. K. QUIGG

correct one. With care, it should be possible to measure the "swing" within 3 or 4 pF of the correct value. For convenience these values are now plotted on a graph and a smooth line drawn through the series of dots obtained.

Using the Meter

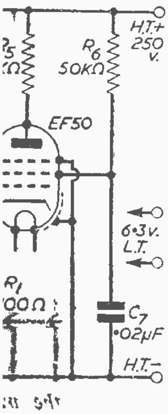
We are now ready to measure condensers of unknown value and as an example we will assume that we want to know accurately the capacitance of a condenser of roughly 400 to 500 pF, since the markings are obscured. C.V.C. is turned to maximum, range-switch to 1 and the unknown condenser connected across X. C.V.C. is then turned from maximum to minimum, but no whistle is heard, so the condenser is not o./c.; Range 2 is turned to, and on turning C.V.C. to 148° (say) we obtain zero beat. From the graph 148° corresponds to 90 pF, and because we are on Range 2, we add to this 360 pF, the "swing" of this particular condenser, and obtain 450 pF, which is, therefore, the capacitance of the condenser. On Range 3 we would have added twice the "swing" (720 pF), and on Range 4 three times the "swing" (1,180 pF).



view of the meter.

A method of extending the range, which has not been tried out yet, might be to tap the tuning coil L_1 at mid-point, thus making an effective addition across C.V.C. of roughly one-quarter the value of the unknown capacitance, the range thus being extended to roughly 5,700 pF. Referring to Fig. 1, an additional use for the neon N besides acting as an H.T. indicator is to act as an oscillator to modulate the suppressor grid of the EF50 should this prove desirable.

A means of opening out the first 6 pF of Range 1 is to use the white spot on the slow-motion knob as a vernier acting against the 0°—180° calibration on the main body of the dial.



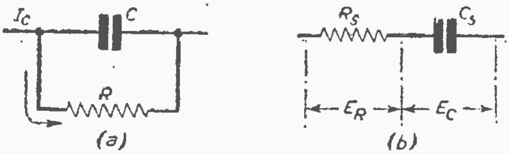
LIST OF COMPONENTS

- C.V.C. = Calibrated Variable Condenser. Approximate "swing," 358-360 pF.
- C1 = 1050 pF (made up of 1,000 pF and 50 pF).
- C2 = 690 pF (made up of two selected 350 pF condensers).
- C3 = 320 pF (made up of 300 pF and 20 pF).
- C4 = 10 pF.
- C1T—C4T = 50 pF air-spaced trimmers.
- L1 = Oscillator coil, approx. 15μH.
- N1 = A miniature tubular neon, specially fitted in a P.O. type signal lamp holder.
- V1 = EF50 valve. Any "small" valve of the 6J7, VR65A class should serve equally well.

APPENDIX 1

To prove that a condenser behaves as a lower value of C at increased frequencies due to series resistance

let True C = 500 pF.
,, Series R = 1,000Ω
,, Low freq. = 50 c/s.
,, High ,, = 1.0 Mc/s.



We must first develop and simplify the method of expressing a parallel circuit in terms of its equivalent series circuit (b).

Parallel Circuit

$$I_R = \frac{E}{R}$$

$$I_C = Ej\omega C.$$

$$\therefore I_{TOTAL} = E\left(\frac{1}{R} + j\omega C\right)$$

Series Circuit

$$E_R = I.R_s$$

$$E_C = -I\frac{j}{\omega C_s}$$

$$\therefore E_{TOTAL} = I\left(R_s - \frac{j}{\omega C_s}\right)$$

$$\text{and } I = E\left[\frac{1}{R_s - \frac{j}{\omega C_s}}\right]$$

Now, these two circuits are identical at any one particular frequency $\frac{\omega}{2\pi}$, therefore we can equate them so:

$$\frac{1}{R} + j\omega C = \frac{1}{R_s - \frac{j}{\omega C_s}}$$

$$= \frac{j\omega C_s}{1 + j\omega C_s R_s}$$

$$= \frac{(j\omega C_s R_s - 1)(j\omega C_s)}{1 - \omega^2 C_s^2 R_s^2}$$

$$= \frac{-\omega^2 C_s^2 R_s - j\omega C_s}{1 - \omega^2 C_s^2 R_s^2}$$

$$=\frac{\omega^2 Cs^2 Rs + j\omega Cs}{\omega^2 Cs^2 Rs^2 + 1}$$

$$\frac{1}{R} + j\omega Cs = \frac{\omega^2 Cs^2 Rs + j\omega Cs}{\omega^2 Cs^2 Rs^2 + 1}$$

Equating real and imaginary parts to obtain the equivalent parallel resistance and capacitance we have:

$$\frac{1}{R} = \frac{\omega^2 Cs^2 R}{\omega^2 Cs^2 Rs^2 + 1}$$

$$\therefore R = \frac{\omega^2 Cs^2 Rs^2 + 1}{\omega^2 Cs^2 Rs} \quad \ldots\ldots\ldots\ldots (1)$$

$$\text{and } j\omega C = \frac{j\omega Cs}{\omega^2 Cs^2 Rs^2 + 1}$$

$$\therefore C = \frac{Cs}{\omega^2 Cs^2 Rs^2 + 1} \quad \ldots\ldots\ldots\ldots (2)$$

From these two equations we can work out the effective capacitance at 1.0 Mc/s compared with that at 50 c/s and with the true value. At 50 c/s, taking the numerical values given above, we have

$$C = \frac{5.\ 10^2\ \ 10^{-12}}{(4.\pi^2.\ 2.5.\ 10^2.\ 2.5.\ 10^5.\ 10^6.\ 10^{-24}) + 1} \text{ pF.}$$

$$= \frac{5.10^{-10}}{9.872.\ 10^{-10} + 1}$$

$\therefore$ since the denominator is almost exactly equal to 1, $Cs = C$ within about 1 part in 10^9.

for $f = 1.0$ Mc/s we obtain

$$C1.0\ \text{Mc/s} = \frac{5.\ 10^2.\ \ 10^{-12}}{(4.\pi^2.\ 10^{12}.\ 5^2.\ 10^4.\ 10^6.\ 10^{-24}) + 1} \text{ pF}$$

$$= \frac{5.\ 10^{-10}}{\pi^2.\ 10^{12}.\ 10^{12}.\ 10^{-24} + 1}$$

$$= \frac{500.\ 10^{-12}}{10.872} \text{ pF.}$$

$$= 42.3 \text{ pF.}$$

Since this is the effective capacitance at 1.0 Mc/s, it can be readily seen that measurement at 50 c/s is useless for determining the state of a condenser with a capacitance much less than .01 μF.

"Autoselector" Automatic Tuner

THE Equipment Division of Mullard Electronic Products Limited, Century House, Shaftesbury Avenue, London, W.C.2, have secured from Messrs. Philips Telecommunications Industries the U.K. sales, design and manufacturing rights of a new "Autoselector" automatic tuning and selecting mechanism.

These autoselectors are used to turn shafts repeatedly to pre-set positions with speed and accuracy. Automatic electrical remote control is employed, and the setting accuracy is such that the positions selected never differ by more than $\pm$0.050 deg. from those which have been pre-set in the mechanism. This accuracy does not vary with different operators, speeds of operation or other varying conditions.

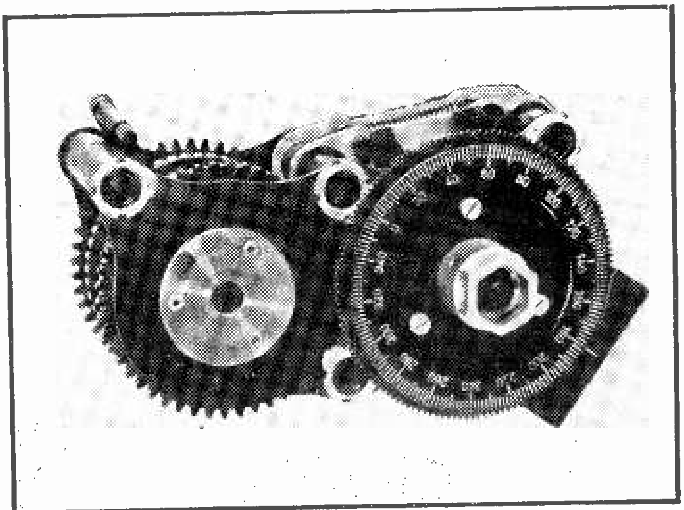
The applications of these new autoselectors are many and varied, both in radio engineering and in industry. For example, they enable the frequencies of radio transmitters and receivers to be speedily and accurately selected.

The speed of operation of a series of autoselectors is such that, using small transmitters, the system reaches the required setting within two seconds of the operation of the selector switch. Using larger transmitters, the setting time is less than ten seconds. As a result of this, tuning adjustments are much more rapid than with manual tuning.

Two types of autoselectors are at present available. These are similar in design, but are of different capacities. The small type SZT.101 can transfer a max. torque of 2.4 lb.-ins. (3 kg.-cms.) and is intended for small apparatus such as aircraft radio equipment. It can stop a shaft in any one of twelve pre-set positions. The large type SZT.102 can transfer a max. torque of 12 lb.-ins. (15 kg.-cms.) and is used in larger apparatus. This type can stop a shaft in any one of eleven pre-set positions, and has additional facilities for manual adjustment of the controlled spindle. Autoselectors capable of transferring a max. torque of 80 lb.-ins. (100 kg.-cms.) will become available.

The pre-set positions can be chosen at will and may be changed at any time.

Combinations of autoselectors may be driven by small electric motors. In such arrangements, after a new position has been selected remotely, the motor rotates the autoselector combination until the controlled spindles have, one by one, reached the positions required. The motor is then automatically switched off.



Autoselector type SZT.102 for setting shafts automatically to any one of 11 pre-set positions and with one additional position for manual adjustment.

Six-pin Short-wave Coils

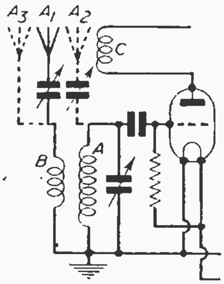
Methods of Coupling and Adaptability of the Components

By A. W. MANN

WHILE the efficiency of modern short-wave coils of the six-pin, plug-in type is well known to short-wave experimenters, there are, perhaps, some who are not fully aware of their adaptability. The purpose of this article is to discuss these coils and the various ways in which they may be used in short-wave receivers.

Windings

At Fig. 1 the connections and the relation of the windings is shown, when used in triode regenerative detector circuits. Briefly, A is the grid



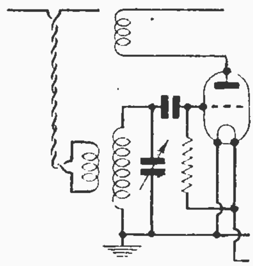


Fig. 1 (left).—Standard three-winding coil. Fig. 2 (right).—Modification to enable a dipole aerial to be used.

winding, B is the aperiodic or primary winding, and C the reaction winding.

As a matter of interest, at A2 the dotted lines show how the aperiodic winding may be cut out and the aerial coupled to the top of the grid coil.

Old and New

Modern six-pin coil windings are fixed with relation to one another. Some of those used in the early days were single and complete units, each winding being mounted on a separate plug. Thus, we had three plug-in coils and three separate baseboard mounting coil sockets.

While these coils were very efficient, they were of comparatively large diameter, and had a much greater magnetic field as compared with modern coils.

Due to the latter defect the building of a stable receiver was by no means an easy matter. In order to obtain satisfactory aerial coupling and smooth reaction it was necessary to devote some time to the spacing of the coils with relation to each other. That one could do this and thus obtain smooth reaction and freedom from dead spots was a great advantage.

The usual method of winding modern coils is with the grid and reaction coils suitably spaced, with spaced turns, side by side. The aperiodic winding is inter-wound with the grid coil. This applies to all coils other than that for 160 metres. In this instance the three windings are side by side.

The magnetic field of these modern coils is comparatively small. This has, in the writer's opinion, contributed in large measure towards the home construction of really stable short-wave receivers.

When it is found difficult to obtain regeneration over the full tuning range of the receiver, using aperiodic coupling, a small pre-set condenser of .00005 μF capacity in series with the aerial is recommended. This may prove to be unnecessary on the 80 metres range, and it is better to cut it out on the 160 metres range.

The method of doing this is shown at Fig. 1, A3.

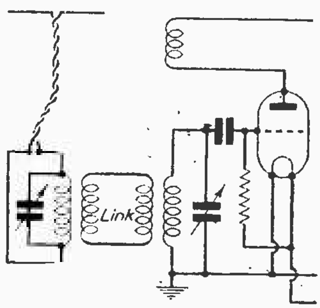
Dipole Aerial Coupling

Fig. 2 shows how the primary winding may be used to couple the grid coil of a regenerative receiver to a dipole, or doublet aerial, in conjunction with twin feeder cable of suitable impedance. Twin; side by side; twisted pair; co-axial; or separate leads transposed with standard transposition blocks, may be used according to individual requirements.

Link Coupling

In Fig. 3 we have a more complicated arrangement. It is, however, a very practical one, and has the grid coil of the receiver link-coupled to the aerial tuning coil. This arrangement could be tried out using standard four-pin coils in the aerial tuner position. It would be much better, however, to wind special coils, and duplicate the grid and aperiodic windings of the receiver coils, rather than use the reaction winding of a standard four-pin coil as a coupling medium in the tuner.

This method provides good selectivity, and the aerial can be tuned and so ensure the maximum signal gain. While the writer is not keen on this type of aerial, it has advantages in locations where electrical interference is troublesome.



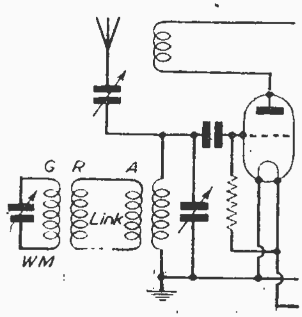


Fig. 3 (left).—A link-coupled winding arrangement. Fig. 4 (right).—Link-coupled absorption wavemeter.

The theoretical arrangement shown at Fig. 4 is one which was used by the writer for many years. This was fully described in one of the early issues of this journal.

It is that of a link-coupled absorption wavemeter. A is part of the closed link circuit, which is formed by coupling it with the coil R. A is fitted close to the aperiodic coil of the receiver, or alternatively as shown, to the grid coil when four-pin coils are

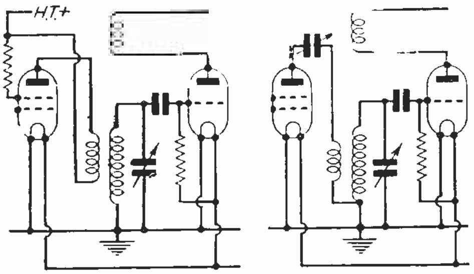


Fig. 5 (left).—Inter-valve H.F. coupling. Fig. 6 (right).—An alternative arrangement.

used. R is the reaction winding of a standard four-pin coil, and G is the grid winding.

The grid coil of the receiver is thus inductively coupled to A, and R is inductively coupled to G, the latter being tuned with a .0001 μF variable condenser.

Coupling Leads

I have used this type of wavemeter with leads over 6ft. long. These coupling leads, which with the coils R and A form a closed link, should be spaced ¼in. apart. Flex can be used, but it must be untwisted and spaced as outlined, otherwise complications will develop.

The link coil at the receiver end can be home wound, and its position near to the coil in the receiver found by experiment. The more common type of absorption wavemeter will give a sharp cut-off if correctly placed. The link-coupled type, however, is much sharper and also makes a very good wavetrap.

H.F. Stage Couplings

Fig. 5 shows a method of coupling a tuned or an untuned stage of high frequency to the grid coil of the detector. The coupling is inductive and is one strongly recommended by the writer. At Fig. 6 we have another method in which by means of a .00005 μF, or alternatively a .0001 μF pre-set condenser, we can increase or decrease the degree of coupling between the two stages within limits. Incidentally, we can also improve the selectivity.

Dead Spots

Some constructors of non-H.F. receivers find it necessary to fit a series aerial condenser when using six-pin coils, in order to overcome dead spots in tuning. They also find it difficult to decide as to the best setting of this condenser. A compromise setting which provides good selectivity and sensitivity with reasonable volume should be the aim.

Once the receiver is calibrated, this condenser should, in the interests of calibration, be left alone. Whilst a little inconvenient, perhaps, during adjustment, it is quite a good idea to mount it under the chassis as near as possible to the aerial terminal. This will ensure that it is left alone.

H.F. Chokes

There are a number of very efficient short-wave high-frequency chokes available. Make quite sure in choosing one or more that they are designed to work efficiently throughout the full coverage of the contemplated receiver, with entire freedom from resonant peaks.

Slow-motion Dials

It is sound advice to say that the best slow-motion dial you can afford should be used. These are components which should be entirely free from mechanical noise. This also applies to tuning condensers, which should be of sound mechanical and electrical design, and specially produced for use in short-wave receivers.

Band Spread

Some are of the opinion that band-spread tuning is unnecessary. In the writer's opinion every non band-spread receiver would be vastly improved if this system could be incorporated. In home-constructed receivers using a .0001 μF tuning condenser, a 15 pF variable condenser wired in parallel and fitted with a slow-motion dial will be suitable, and remove any doubt as to improvement. I consider this electrical method of band-spreading to be well worth consideration. The one disadvantage is that two settings of the band-setter are necessary in order to cover the 160 metres band.

Band-setter, band-spreader, and reaction condenser should all be fitted with slow-motion dials. Where an H.F. stage is used, this and the detector stage could be ganged, if commercial coils are also to be used.

Bad Practice

Do not use cut down broadcast receiver condensers for short-wave tuning in order to try out short waves for the first time. Apart from trouble in various forms, results will be misleading. Discarded L.F. transformers, resistors, fixed condensers can be used if desired. Old valves should not be considered.

In this article the writer has given what he considers to be some useful ideas and advice which will help beginners. There is a tendency to associate short-wave reception solely with the modern communications receiver. I am extremely interested in all types of short-wave receiver and get equal enjoyment from operating an o.v.1 with its very low noise level as I do from the communications-type superheterodyne.

Push-button Volume Control

A Unit Designed to Avoid Wear and Tear on an Essential Control

By D. CAVE

SOME years ago the writer designed a high-quality two-station receiver for home use consisting of one R.F. amplifier stage, a negative feedback detector, one audio-frequency amplifier, phase splitter and push-pull triode output. The receiver is fitted with an extension speaker to the kitchen and is in use for many hours of the day, consequently the volume control receives a good deal of wear and has had to be replaced twice. Recently it showed signs of wear again and the writer decided to replace it by a push-button system. The decision to do this was partly made by the need to have some form of pre-set volume control on the receiver when using the kitchen extension speaker, since it was not convenient to provide the latter with an independent control.

An ex-Government push-button unit with 5 buttons in a case was purchased; all the unnecessary parts were removed and a mains on-off switch fitted to replace that on the original volume control. The unit was required to replace a 500,000 ohms volume control used at the grid of the audio-frequency amplifier valve, consequently it was wired with the values of resistances, and in the manner shown in the diagram. The values of the resistances were chosen to give approximately even changes of volume level between the push-buttons. The principle on which the calculations of resistance values were made being as follows:—

To get even changes in volume level at the loud-speaker we require that the signal voltage applied to the grid of the audio-frequency amplifier valve from each button should bear a definite ratio to the voltages from the buttons above and below it. Now the changes in power output level from the loud-speaker are most conveniently measured in decibel units. The decibel unit is a logarithmic ratio of power levels and is most suitable for this purpose since the ear has a logarithmic response to sound intensity. Broadly speaking, large changes of power output are required to obtain a small increase in audibility.

Now the power output depends on the signal voltage applied to the grid of the amplifier valve, consequently we may more conveniently study the problem from a voltage point of view. The decibel ratio of two different voltages, V1 and V2, derived from the same resistance is given by the formula:—

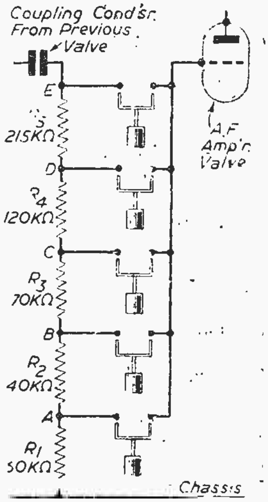
db.=20×log. V1/V2.

It has been found from experiment that the ear can just distinguish a difference in volume level of about 3 db. It would have been very desirable, therefore, to have calculated the resistances used in the unit to give 3 db. changes in volume level; but owing to the fact that only 5 push-buttons were available in the push-button unit purchased, it was decided to calculate the resistances for 5 db. changes. For those readers who have other push-button units available, however, there will be found appended a list of resistances for other values of decibel change.

Owing to the fact that the control used in the position indicated in the diagram is working into a circuit of very high impedance (the grid-cathode circuit of the audio-frequency amplifier), we can rewrite the formula as:—

db.=20×log. Rb/Ra.

because the signal voltage applied to the grid will be proportional to the resistances used in the control. Note that Rb is the *total* resistance from point B



This diagram shows the circuit arrangement adopted in the push-button or switched method of controlling volume.

in the diagram to the chassis line (R1+R2), and Ra is the total resistance from point A to the chassis line. Since, in the unit under consideration, we have 5 push-buttons, the total change in volume level from maximum to minimum will be 20 db. This will usually be sufficient for a receiver of 3 or 4 watts output. If this range is found to be insufficient, then 6 db. may be used between the buttons, giving a total change of 24 db.

For those readers who wish to make their own calculations of the resistances they require from the above formula, the following procedure may be adopted:—

(1) Note the value of the volume control to be replaced (such as 500,000 ohms).

(2) Count the number of push-buttons available and subtract 1. Call the answer P.

(3) Decide the decibel range to be covered by each button. Multiply the db. range of each button by the number P to get the total db. range.

(4) Calculate the lowest resistance in the chain (Ra) from the formula:—

Total db. range=20×log. value of volume control/Ra.

(5) Find the total resistance at the next highest point in the chain by using the formula:—

db. change for each button=20×log. Rb/Ra.

From this formula will be obtained the percentage difference in resistance of any point in the chain from the resistance of the point below it.

For the convenience of readers there is appended a table of resistance values calculated on the basis of 100 ohms volume control, and giving either 3 db., or 5 db., or 6 db. changes. The figures shown are approximately correct, and have only to be multiplied up for the value of the volume control required. Thus, if they are intended to replace a 500,000 ohms volume control, multiply the figures given by 5,000. When this is done it may be found difficult to obtain resistances of the correct value; the constructor need not worry, however, since resistance values differing by as much as 10 per cent. from the values given might be used without producing any very noticeable difference in results.

To use the tables proceed as follows:—

(1) Choose the column with the db. range required, and multiply all the resistance values given, by the number of times that the volume control to be replaced, is greater in resistance than 100 ohms.

(2) Count down the column of resistances one less than the number of buttons available. Select the resistances counted and connect them between the push-button contacts as shown in the diagram.

(3) Add together the remaining resistances in the column. Find a resistance of this value and connect it between the lowest push-button contact and chassis.

The unit is now ready for use and should be wired to the receiver as in the diagram.

TABLE OF RESISTANCES BASED ON A VALUE OF 100 OHMS

3 db.	5 db.	6 db.
28.2	42.7	50.1
20.0	24.1	25.0
14.4	13.6	12.5
10.3	7.7	6.3
7.3	4.4	3.1
5.3	2.5	1.6
3.5	3.2	1.6
1.8		
1.3		
3.1		

Message from a "Mermaid"

By means of the new "Mermaid" radio-telephone equipment, recently introduced by Messrs. Philips Electrical, Ltd., trawlers, launches, yachts, fishing vessels, and other small craft, are now able to send out messages over water up to distances of 100 to 400 miles. This means that a small craft installed with a "Mermaid" need rarely be out of touch with other vessels or with coast stations.

This compact little transmitting/receiving set, which is almost as simple to operate as an ordinary household telephone, is always ready for any occasion—aid in distress, calling other ships, collecting the latest prices from port, and even listening to the football results from the B.B.C. The equipment is fully self-contained, and can be quite easily installed in the smallest cabin, with the added advantage that it can be operated by any of the crew, from the skipper to the youngest deck-hand. This is vitally important, for it means that in the event of trouble at sea, any member of the crew can use the equipment without having to rely on a specially trained operator.

The equipment comprises a transmitter, receiver, power unit, speaker and control, all rigidly mounted as separate units in a single compact case, 24ins. high, 16¼ins. wide, and 7⅞ins. deep. The total weight of the equipment is 90lb. It gives a highly efficient performance, and is particularly easy to service since the separate units can be quite easily removed and, if necessary, spares can be readily fitted without extensive dismantling.

Eight Spot Frequencies

On the transmitter, the selection of any one of eight spot crystal frequencies between 1.6 and 3.8 Mc/s is carried out by means of a click mechanism which, by means of a spring-loaded device, locks the tuning condenser to a pre-set frequency by a single operation. The crystal oscillator, which has a stability of better than 0.02 per cent., is capacity-coupled to a power amplifier capable of delivering approximately 10 W. into a small ship's aerial. An aerial circuit trimming capacitor control is fitted to allow for small changes in the aerial properties due to icing, etc. The power consumption of the transmitter, with the press-switch on the handset open, is 100 watts, and with the press-switch closed, 180 watts.

The receiver employs a superheterodyne circuit in which the oscillator is crystal-controlled for fixed channel working. A manual control is also available for continuous tuning so that a wanted station can be tuned in accurately even if it is slightly off its proper frequency. Any one of seven spot frequencies within the range 1.6 to 3.8 Mc/s may be selected by means of a click-mechanism control. In the eighth position on this control the selector mechanism is automatically disengaged, and the receiver may then be continuously tuned over the whole frequency range. In addition, a broadcast switch permits reception on 1,149 kc/s (261 metres) or wavelengths close to this. The sensitivity of the receiver is better than 10 μV., for an output of 1 mW. into the handset or 50 mW. into the loudspeaker. Receiver radiation is low, at one nautical mile from the receiver, the field produced being not greater than 0.1 μV. per metre. The power consumption of the receiver is 70 watts.

Battery-convertor

The filaments of the valves in both the transmitter and receiver are fed directly from a battery. This battery also supplies a rotary converter which is incorporated in the equipment for supplying the H.T. batteries of 12 or 24 v. can be used.

The control panel at the bottom of the cabinet is provided with the following switches: supply—on/off; power — reduced/full; loudspeaker — on/off and setting—watch/transmitter-receiver.

I.F. Gramo. Reproduction

An Unusual Method of Pick-up Connection

By W. NIMMONS

THE ordinary pick-up is used in such a manner that only the L.F. stages of a set are in operation. This means that, in the case of a superhet., the frequency changer, the I.F. stage or stages, and often the second detector valves are inoperative, though still alight—unless, of course, the designer has arranged that these be switched off when the pick-up unit is being employed. In the rare case of gramophone reproduction in an A.C./D.C. superhet. the redundant stages cannot, of course, be switched off.

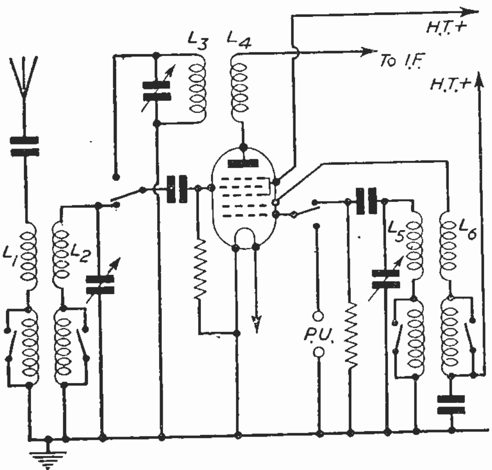


Fig. 1.—Main details of the scheme for using a pick-up at the intermediate frequency of the receiver.

If we want to use all the stages in the set for gramophone we have to fall back on the wireless link method of reproduction, in which the L.F. impulses of the pick-up are used to modulate the H.F. output of a separate valve.

This constitutes a weak transmitter, and it is not generally realised that the Post Office frowns upon this sort of transmission. In fact, the user is liable to prosecution if, as is likely, the signals spread to neighbouring houses. The only method that is safe in this respect is that employing screened cables connecting the wireless link to the set, so that all outside interference is obviated.

The writer has given much thought to the task of employing all the valves in a set for gramo. reproduction, and has finally arrived at a workable scheme which, while offering all the advantages of the wireless link system of reproduction, has none of its drawbacks. As in the general scheme of the radio as distinct from the audio method, a frequency changer valve is used, this, incidentally, being the same valve as performs the normal function of frequency changing in the set.

Modulated I.F.

In this case the pick-up actually modulates the I.F. coupling in a manner to be described, and at the same time, by means of switching, the set can be used for its ordinary duties of receiving the wireless programmes.

Fig. 1 is a simplified diagram of the actual methods employed. The valve shown is a battery heptode, but could just as readily be any frequency changer, battery or mains. The coils L_1 and L_2 are the ordinary signal frequency coils, which may be the ordinary dual-range coils, the coils of an all-waver (not shown), or one part of a band-pass tuner.

The coils L_5 and L_6 are the ordinary oscillator coils, comprising the tuned coil and the " reaction " coil. This, except for the simple switching, is a straightforward part of a normal frequency-changer stage.

The two coils, L_3 and L_4, however, are not a part of any normal set, and will be new to readers. Their function is bound up with the gramo. function of the set, these being not used in the ordinary wireless sense.

They are inductively coupled so as to produce oscillations when the gramo. unit is in operation. At the same time, the oscillator coils proper are prevented from generating oscillations by the grid coil being switched from the coil proper to the pick-up. This effectually changes the operating conditions of the valve so that, when the switches

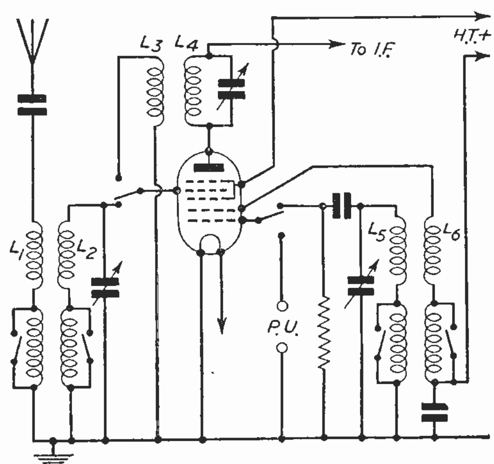


Fig. 2.—Circuit for a tuned-grid coupling.

are in the proper positions, the valve now oscillates between its anode and signal grid electrodes, instead of, as formerly, between its first and second grids.

If the frequency at which the coils L_3 and L_4 oscillate were different from the intermediate frequency of the set there would be very little acceptance of the former by the latter. Hence the frequency at which L_3 and L_4 oscillate must be the same as the I.F. of the set, so as to obtain the greatest acceptance.

The set-up now is: The signal grid is isolated from the aerial coil or coils, and is transferred instead to the new and supplementary coil which acts as a reaction coil to the "tuned anode" properties of its associated coil; and the pick-up is connected to the first grid of the valve, high tension being applied to the second grid in the normal way through the reaction coil, L_6 (now inoperative).

The pick-up now modulates the H.F. energy present in the anode of the valve in the normal way for a circuit of this type. The modulated "signal" thus obtained is fed to the I.F. valve or valves in the set in the normal manner, is demodulated by the second detector, and then amplified by the L.F. stages. Volume control, if obtained on the D.D.T. valve, is operative in the ordinary way.

An Alternative

A variation in the "tuned anode" circuit of Fig. 1 is the tuned grid of Fig. 2. This is the more practical circuit, since there is included a condenser and grid-leak which evens out the oscillations and prevents such troubles as "squegging" and too fierce oscillation. The value of the condenser is .0001 μF., and of the grid-leak 50,000 ohms.

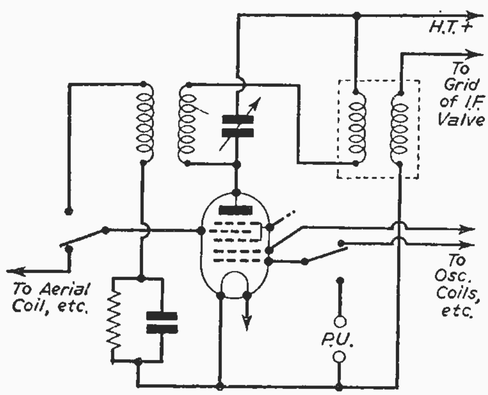


Fig. 3.—Showing the split primary of the I.F. transformer, in which the total inductance is sufficient to resonate at 465 kc/s.

It will be noted that the coil in the anode circuit is now the reaction coil, and is untuned; this does not matter so long as the primary of the I.F. transformer following is tuned in the normal way, to, say, 465 kc/s., but if preferred the inductance of the two coils (with added capacity) may be such that they resonate at 465 kc/s. That is, the the inductance is split into two parts, one part being the reaction coil in the anode circuit of the frequency changer valve, and the other part being the primary of the I.F. transformer. As the part actually in the I.F. transformer will then be less than if the whole inductance had been incorporated in the transformer, the half actually in the transformer should be closer to the secondary in order that the same amount of energy may be transferred. This is shown in Fig. 3, but as it necessitates altering the commercially made I.F. transformer, not many experimenters will care to try this method. It has been given, however, for the sake of completeness, and in order that a comparison may be made between the different means of terminating the frequency changer stage, which in this case, of course, does not change frequencies in the accepted sense but simply modulates an H.F. signal.

A more practical way is to use an H.F. choke, as in Fig. 4. The anode circuit is tuned to 465 kc/s.

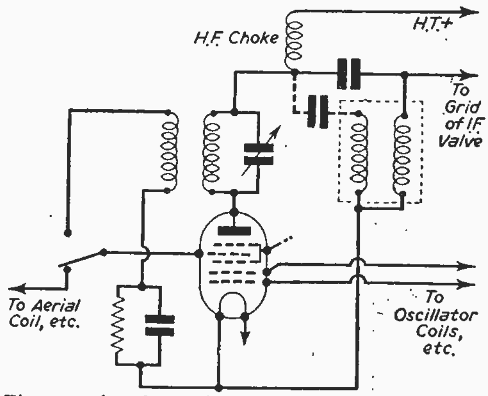


Fig. 4.—An alternative method of coupling, using an H.F. choke.

The anode and grid circuits are, of course, regenerative.

An H.F. choke is connected to the "cold" side of the anode coil, the other side of the choke going to H.T. Then a capacitor of about .0005 μF. is taken from the same side of the anode coil to either the primary or secondary of the first I.F. transformer. In most cases it will suffice if it is taken to the secondary, as in Fig. 4, the primary being left unconnected; but rather more selectivity can be obtained if the primary is used, as shown in the dotted lines.

This method has the merit that the anode circuit of the frequency changer valve is unaltered whether we are using radio or gramophone, and the demerit that it departs from standard practice insofar as the I.F. transformer is concerned.

Another Scheme

A method making use of the original aerial coil of the set, thereby doing away with the special coils, is shown in Fig. 5. When the set is used for radio it is normal in every respect; but when switched for gramo. it is necessary to turn the tuning condenser to its maximum capacity. Thus the set will be somewhere in the region of 550 metres, or 545 kc/s. To add on the necessary 100-odd metres, thus bringing it to 465 kc/s., a .0005 μF. preset is switched into circuit; at the same time the oscillator coils are rendered inoperative by being switched from the grid oscillator coil to the pick-up.

In order that the signal grid and anode may be mutually regenerative, thereby satisfying the conditions for modulation by the L.F. impulses from the pick-up, an additional coil is required to be switched into circuit when gramophone is required.

This is wound on the same former as the aerial coil; in the correct manner to produce oscillations. As the regenerative tendency would be inimical to radio, a switch is included to cut out this coil except when gramophone is required.

A preset is included in series with this additional coil. Only sufficient capacity should be included in circuit to induce oscillation, otherwise some of the "signal" will be diverted to earth instead of passing through the I.F. transformer in the usual way.

It will be seen that Fig. 5 necessitates the least departure from standard practice in the matter of superhet design. Such a scheme might be made up in the form of a converter, to be attached to any existing receiver employing one or more H.F. stages, or a superhet. In this case it could cater for short-wave reception, with provision for gramophone in the manner described. Oak or Yaxley switches with the necessary number of contacts are in plentiful supply, and some profitable hours can be spent planning the necessary arrangements. This article is only meant to show the way, and in conclusion it need only be said that the quality of reproduction with the radio method is superior to that of the orthodox L.F. method.

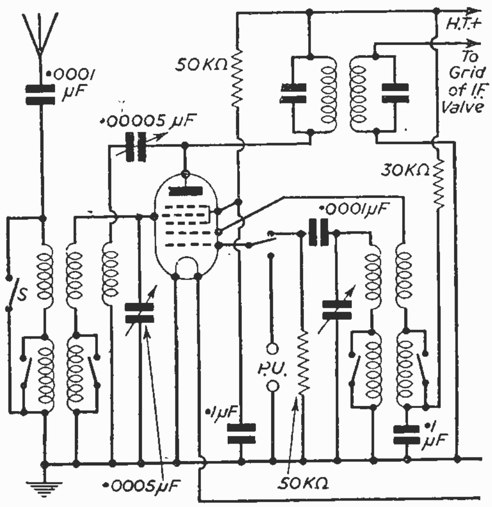


Fig. 5.—A method using the original aerial coil of the set. Note the switch S which renders the set non-radiating.

Leakage Resistance

An Easy Method of Measuring the Resistance of Condensers

By L. H. NAPIER

ONE method of finding the leakage resistance of condensers is to charge them from a battery and find the time taken for the charge to leak away. Resistances of the order of 10,000 megohms may easily be measured like this.

The condensers must first be checked to make sure they are not short-circuited and then connected in series with a milliammeter and touched across a 120-volt H.T. battery. The size of the momentary deflection or "kick" of the pointer is noted. The condenser is then removed and, say, ten seconds timed. On connecting the condenser across the battery again the size of the second "kick" shows how much of the original charge has leaked away, and from this the leakage resistance can easily be calculated. Tests with a 120-volt H.T. battery and an avometer model 40 switched to the D.C. volts ranges, show that electrolytic condensers and paper condensers down to 0.1 μF can be tested in this way. For smaller values a more sensitive meter is needed.

The value of leakage resistance is found by noting the time for which the second kick is 0.63 (roughly two-thirds) of the first one, then:

$$R = \frac{t}{c}$$

Where R is the leakage resistance in megohms, c is the capacity in microfarads and t is the time in seconds. A really first-class paper condenser of one microfarad can be expected to have a resistance of 10,000 megohms and when tested will still have a third of its charge after 17 minutes. A metallised paper condenser of 1 μF would be about 50 megohms and hold a corresponding charge after 50 seconds. A typical value of electrolytic condenser of 8 μF. and 350 volts working can be expected to be three or four megohms.

Manufacturers' Tolerances

The above values will be found in condensers made to service requirements and most manufacturers give the following data on their condensers to comply with them. The leakage resistance is given in a general form so as to cater for all sizes of condenser such that the product of leakage resistance in megohms and capacity in microfarads is not less than a certain value. The minimum values for the chief types of condenser are as follows. Paper and mica condensers should be not less than 2,000 megohm microfarads with a minimum resistance of 10,000 megohms, and metallised paper types not less than 50 megohm microfarads.

For electrolytic condensers after 30 minutes "forming" at the working voltage the maximum leakage current in micro-amps. must not be larger than 0.15 times the product of volts and capacity in microfarads with a maximum of 100 micro-amps. and from this the resistance is easily found.

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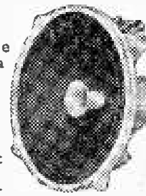

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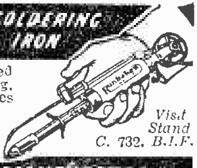

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Programme Pointers

This Month, Our Contributor, MAURICE REEVE, Deals with Some More Recent Programmes

UNDOUBTEDLY the most important event since I last wrote was the General Election. Though not, perhaps, calculated to stir the imaginations of those who seek naught but entertainment from their sets, there seems no reason why it should not combine both that and the factual all-night repetition of results rather more than it has in the past. I don't know how these things are ordered in America, but I can't help feeling that greater pep and bite would have been introduced into it over there, with benefit to all. By the time the programme closed down at 4.30 a.m., even the ranks of Tuscany forbore to cheer, but yawned their way upstairs, too tired to gloat or moan, as the case might be.

As the, rightly, strictly controlled partisanship of the B.B.C. ends with the polling—or, possibly, with the Prime Minister of the day's speech over the air—would a little good-natured political horse-play, of purely entertainment value, be so terribly out of place? Supposing two non-professional politicians, men, say, of Mr. Priestley's type, engaged professionally in walks far removed from Westminster, but experienced broadcasters and men of keen political views and opinions, were to give half-hourly summaries in the way that commentators summarise the play and prospects of a Test Match? Another idea is brief little political histories of the more famous constituencies and their turning of their political coats, more especially when a sensational result comes through.

The fact remains that there were six hours of "results broadcasting," at least three of which must have been of the most innocuous and goody-goody music. Heaven forbid the introduction of either jazz or classics. I think that multitudes enjoyed it—I certainly did—but there is usually room for improvement in most things.

Three Pianists

THREE pianists gave more than usually exacting programmes and all covered themselves with much credit, if not glory. Arnaldo Estrella, from S. America, tackled Liszt's "Sonata" and some Villa Lobos eccentricities; Mdlle. Monique Haas, the formidable Ravel suite, "Gaspart de la Nuit," and Pouishnoff the electrifying transcription by Busoni of Bach's "Chaconne" for violin solo. All the works are top ranking masterpieces for the instrument, and complete satisfaction can only be given by virtuoso pianists of the top flight. Of the three, Pouishnoff's performance of the "Chaconne" seemed the most complete, and his brilliant technique was given full rein in its enormous technical and emotional range. But it wouldn't be Pouishnoff if he didn't make some pouishnoffian alteration to the score. In the present instance, it was not so blatantly vulgar as what he does to the end of poor Chopin's "A flat Polonaise". He also played Grieg's most beautiful and unaccountably neglected "Ballade".

The "Ravel," especially the third section, was a little too much for Mdlle. Haas, as it must be for all women and everyone bar about six men. Most executants rank it to-day as the most difficult of all existing works for the piano. The Liszt "Sonata" was beautifully played by Señor Estrella, with many original Iberian touches. It is impossible to believe that all but one hundred years have elapsed since this wonderful work was first conceived. What a seer into the future Liszt was!

Symphony and Choral

THE B.B.C.'s symphony concert, with the combined Goldsmiths and B.B.C. Choral Societies, under Sir Malcolm Sargent, was a brilliantly eclectic affair. Delius's "Songs of Farewell," Holst's "Hymn of Jesus," and Walton's "Belshazzar's Feast" forming a most brilliant and dazzling programme, with Sir Malcolm in his very best form. What a gorgeously barbaric display the Walton is? It is now so famous and established that one should no longer refer to Walton's "Belshazzar's Feast" any more than to Bach's "St. Matthew Passion" or Handel's "Messiah."

Plays

THREE interesting plays, out of others, were given, namely Gerald Savory's "George and Margaret" (a repeat), Pamela Hansford-Johnson's "Corinth House," and A. G. Street's "Holdfast," both the latter being adaptations. The latter, I thought, made a particularly entertaining play. The age-old theme of the young woman who thinks that her home and hearth are the only places on earth where her genius can shine and flourish, until the crisis comes—in this case the war—and she finds herself managing her husband's farm in his absence and, willy-nilly, twice the woman she had ever been before. Mr. Street knows how to write about the agricultural side of country life as few other contemporary writers do, and his skilful weaving of the country and the social pattern was most engaging. George Holloway and Gwen Howell brought out both the lighter and serious sides of their parts, as they occurred, most effectively.

Our French Guests

IT seemed a mistake to damp down the speech at The Guildhall of Monsieur Auriol, the French President, in order to superimpose the English translation over it. A lot of us greatly enjoy hearing a well-delivered oration in French. Opportunities of doing so are rare, and there are few things of its kind more stimulating, when they are good. Also, there is the chance of putting our own knowledge of the language to the test and seeing how we come out of it. Presumably, person or persons did not consider there were enough of us with sufficient knowledge of French to warrant their letting Monsieur Auriol's words speak for themselves.

Critics Criticise

"THE Critics" and "We Beg to Differ" have recently been criticising each other; the former of their own volition, and the latter, of course, in reply to listeners' questions. Whilst

"The Critics" were very laudatory of their colleagues, the members of "We Beg to Differ" rather missed the point, I thought, in their views. They suggested that "The Critics" were excellent so long as their various specialists kept to their various specialities, but were not quite so good when they got talking about each other's subjects, of which, it was suggested, they sometimes knew little or nothing. That is surely the chief attraction of both programmes: hearing highly intelligent men and women express their views on important and interesting topics, whether we agree with them or not. The only proviso is that it must be intelligent—it need not be expert. Kay Hammond and Co. are not specialists in anything they discuss, and I have heard them express views on serious things which—well, let's leave it at that.

In conclusion, may we always have a woman among "The Critics"? They are always at their best when one has a place.

News from the Clubs

A typical club night

COVENTRY AMATEUR RADIO SOCIETY

Hon. Sec.: C. J. Goddard, "Dovedale," Birmingham Road, Warwick.

THE annual dinner and social of the above Society was held on March 24th, when G3DO and G6DL were among the chief guests. After the customary toasts, the Society's trophies were presented by Mrs. F. Miles (wife of G5ML, vice-president).

The trophy winners for this year are:—

G2LU Cup, presented to Mr. J. H. Whitby (assistant secretary).
G2FDC Cup, presented to Mr. W. Montgomery for best piece of home-made apparatus.
G2YS Cup, presented to G3FAB (winner of QRP Contest).
G5GR Cup, presented to BRS16990 (winner of the DX-RX contest).

This month, G3FAB and G5GR will be "Answering Questions," to help members who are preparing for the forthcoming R.A.E.

SOUTH MANCHESTER RADIO CLUB

Hon. Sec.: M. I. Wilks (G3FSW), 57, Longley Lane, Northenden, Manchester.

MEETINGS during March have been well attended, and now the average attendance is 40, with new prospective members coming along each time. The classes in preparation for R.A.E. are drawing to a close, and question-papers from previous years are being used to get candidates used to the form of the paper.

A small group under Mr. A. Wood (G5SI) still work at morse instruction from about 8 p.m. until 10 p.m., and are making good progress.

Meetings for May are the 12th and 26th and fortnightly as usual.

The Club D/F event is being held on May 27th (Wx permitting). A group will operate with the club station portable on 160 metres in Cheshire. So far, four teams have entered, and the event will take place between 2.30 p.m. and 5 p.m., and arrangements are being made to conclude the day with high-tea at a suitable café.

A "Hamfest" is to be held at Parker's Café, Gatley, Cheshire, and the date has been provisionally fixed for October 7th. The programme will include an exhibition of gear being entered in the "Home-built Gear" competition, demonstrations, high-tea, presentation of cups and prizes, and social evening. Tickets for the event will be strictly limited and in the region of 7s. 6d. inclusive, fuller details to be announced later.

NEWARK AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: J. R. Clayton, 14c, Barnbygate, Newark, Notts.

THE inaugural meeting of the above Society was held recently, when the following officers were elected: chairman, Mr. C. Crisp (G3EIJ); vice-chairman, Mr. G. Riby; secretary, Mr. John R. Clayton (B.R.S.); treasurer, Mr. W. A. G. Davidson (G3EVG).

Until suitable headquarters have been found, meetings will be held fortnightly at the home of the secretary, 14c, Barnbygate (above Whates, Tobacconist).

A comprehensive programme is being arranged covering matters of interest to all short-wave enthusiasts. It is hoped that during the coming summer several field events will take place, and that teams representing the Society will be entered for the various national contests organised by the R.S.G.B. and I.S.W.L.

The chairman and the treasurer will run a morse class to help members desirous of obtaining a licence.

It is also hoped to arrange visits to places of radio interest, to have lectures and demonstrations of radio gear, etc.

Prospective members are invited to communicate with the secretary at his address for further information.

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: W. A. Higgins, 28, Kingsley Road, Kingswinford, Nr. Brierley Hill.

THE annual general meeting of the Society was held on Friday, March 10th, 1950. The following officers and committee were elected: president, J. Timbrell (G6OI); chairman, H. Littley (G2NV); vice-chairman, N. Harper (G4MI); hon. treasurer, C. E. D. McLean (G2CLS); hon. secretary, W. A. Higgins (G8GF). Committee: B. Whitehouse (G6WF), F. Bills (G3CLG), F. Meredith, N. C. Heathcock, and D. Weaver. Membership at the end of February was 60. Mr. D. A. G. Edwards (G3DO), R.R., No. 3 Region, R.S.G.B., was the visiting speaker, who came at short notice to take the place of Mr. J. Clarricoats (G6CL), general secretary, R.S.G.B., who had been taken ill and was unable to attend. Mr. Edwards spoke at length on R.S.G.B. matters and very ably dealt with many questions from members.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: F. C. Ward (G2CVV), 5, Uplands Avenue, Littleover Derby.

ON Friday, March 17th, the Derby and District Amateur Radio Society held their second annual dinner and social in the Irongates Hotel, Derby.

The president, Mr. A. G. G. Melville, F.R.C.S., in his address stated that with the increase of membership meetings were now being held weekly. The major drawback was the installation of the Society's station, G3ERD, and it was hoped that a hut or similar accommodation would be obtained for this purpose.

Among those present were Dr. E. S. G. K. Vance (G8SA), and Mr. R. Bonner Williamson (G5RW), the regional and county representatives.

Other speakers included the Society's chairman Mr. W. A. Mead (G5YY) and Mr. C. M. Swift.

WATFORD AND DISTRICT RADIO AND TELEVISION SOCIETY

Hon. Sec.: R. W. Bailey, 32, Cassiobury Drive, Watford, Herts.

THE 1950 spring session was inaugurated at the annual general meeting held in the club rooms, Cookery Nook, The Parade, Watford. A full programme of meetings, demonstrations, competitions and station visits has been arranged. Meetings are held twice monthly on the first and third Tuesdays at 7.30 p.m. at the club rooms. The secretary will be pleased to welcome any prospective members at any of the meetings, or they may get in touch with him at the above address (Tel.: Watford 5403).

WORTHING AND DISTRICT AMATEUR RADIO CLUB

Hon. Sec.: A. A. Forge (G3FRG), 2, The Plantation, Worthing.

MEETINGS of the above club are held on the second Monday of the month at 7.30 p.m., at the Adult Education Centre, Worthing.

Trade Notes

Miniature Neon Indicators

A SMALL range of miniature neon indicators is being marketed by the General Electric Co., Ltd., for use in all branches of industry, chiefly as visual indicators for "live" electrical circuits. The small space which the indicators occupy and their negligible power consumption make them ideal for use with practically any type of electrical equipment. They are designed to operate from 200-250 volt supply mains, with an external resistance of 0.25-0.5 megohm in series. This resistance is essential, but it can be of the 1-watt radio variety.

Details of the range of indicators are summarised below.

Type of Indicator	Class of Supply for which suitable	Nominal Operating Current	Type of Cap	List Price
F	A.C.	0.5 mA	Small Edison screw	4/6
G	A.C.	0.15 mA	Miniature bayonet, centre contact	3/6
"Tuneon"	D.C.	0.5 mA	Small Edison screw	4/6

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MESSRS. HUNT'S telegraphic address is now as follows:

Telegrams: Capacitors, Put, London.
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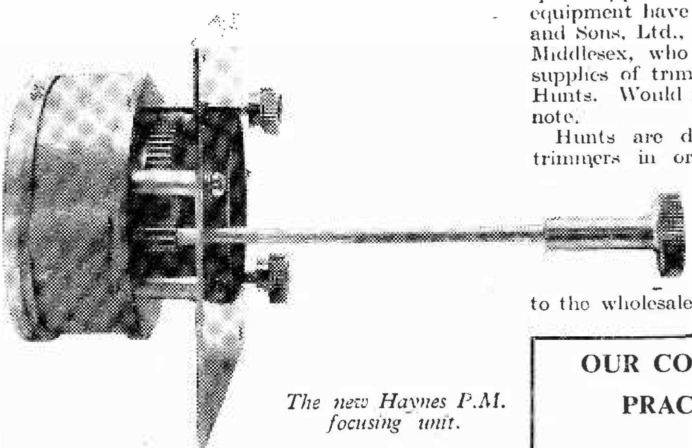
New Exide Cell

THE latest addition to the range of batteries and accumulators manufactured by Chloride Batteries, Ltd., of Clifton Junction, near Manchester,



The new Haynes P.M. focusing unit.

is the new Exide PRA3U unspillable cell for use with "photo-flash" equipment.

Designed as a free-acid replacement for the Exide PRA3S gel-cel (introduced some years ago for deaf-aids, miniature radios and photo-flash units), the new cell is contained in a celluloid case and fitted with separators of "Lignex"—a highly absorbent material which leaves very little "free acid" in the container, whilst maintaining the same characteristics as a completely free acid cell.

The Exide PRA3U has a greater capacity than the older-type cell, and is slightly wider and taller.

Specification:

Voltage, 2; capacity, 3½ Ah at 20-hour rate; charge rate, ¼ Ampere; dimensions, 2 13/32in. wide by 1 5/32in. long by 3⅞in. high (with terminals screwed down); weight (charged), ¾lb. approx.

Haynes P.M. Focusing Unit

TWO new types of TV focusing units have been introduced, the PM15A and the PM20A, for use with tetrode and triode C.R. tubes respectively. These are fitted with vertical and horizontal shift controls conveniently placed at the back, as well as a focusing adjustment operating at the rear and beyond the base of the tube. Shift is produced by a slight movement of a "shuffle" plate which engages only a small part of the flux in the region of the gap and the picture may be critically centred without derangement of focus. Resort to tilting is thus unnecessary, the focusing unit being firmly mounted with its axis aligned and concentric with the neck of the tube for which support is provided. The focusing control by variable gap works through gears and the control knob may extend out at the rear of the cabinet affording the same ease of adjustment as that offered by the variable resistance used with focusing coils.

Alcomax III or equivalent alloy is used for the magnet ring. Fully described in Haynes Technical Publication No. 44. Retail price 36s.

Hunt's Trimmers

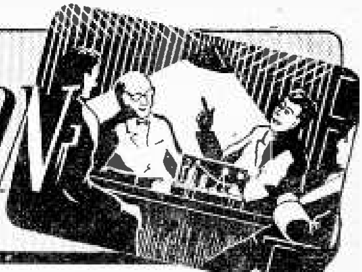
FROM April 1st, 1950, the production of trimmer capacitors by A. H. Hunt, Ltd., was discontinued.

In order to ensure continuity of supplies of the special types manufactured by Hunts, the tools and equipment have been acquired by Sydney S. Bird and Sons, Ltd., Cambridge Arterial Road, Enfield, Middlesex, who will be pleased to continue the supplies of trimmers previously manufactured by Hunts. Would manufacturers of equipment please note.

Hunts are discontinuing the manufacture of trimmers in order to devote their energies to fixed capacitors, which involve much more process work than trimmers.

Arrangements have been made for supplies of trimmers to be available from A. H. Hunt, Ltd., to the wholesale and service trades as hitherto.

OPEN TO DISCUSSION



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).

Indoor S.W. Aerial

SIR,—I am taking the liberty of writing to express appreciation on the very helpful and informative article on page 164 of the April issue.

Upon receiving my copy through the mail I immediately scanned the pages and came across the article. In less than half an hour I had the indoor aerial constructed and installed, and I was very pleasantly surprised at the results obtained from it.

After a little experimenting with it, taps, etc., I have come to the conclusion that it is the most efficient indoor antenna I have tried so far. I am really enthused about it and passed the news along to some other radio men.

On the antenna here the direction has been reversed. The open ends are pointed towards Europe.

Since the short time I have had this antenna operating I have noticed an increase of signal strength from one to three R's in ordinarily relatively weak signals. I find it quite directional, too. I am still "working" on it and perhaps find more about it as I go along.

The receiver here is an home-made autodyne affair with a stage of T.R.F. and seems to work very well with this type aerial.—SAMUEL M. MACK (Lowell, Mass., U.S.A. Ex W1DAE—W1CRO.)

Delivery Dates

SIR,—The comments in your column of PRACTICAL WIRELESS, re "Delivery Dates," in April number, make interesting and illuminating reading.

A valve (rectifier) purchased by me early in January developed a fault in a few days. The filament was intact. Where the "lead-in" wires entered the bulb from the "Glass Pinch," arcing occurred between a filament wire and anode wire. I applied to my retailer for the usual form to be returned with valve to manufacturers. This was forwarded about January 27th. It is now seven weeks away and I still have no word from the manufacturers. I am advised that this is not an unusual delay.

Surely makers cannot expect customers to buy two valves to keep a set going.

It must be obvious that a set must remain out of action during the time taken for the faulty valve to be "tested." Alternatively, the purchaser must buy a second valve. Retailers have n obligation to replace faulty valves.

Perhaps not many valves are returned for test so for the few it "doesn't matter." Somehow, think it "matters very much!"—L. C. BAKE (Bristol).

Electronic Organ

SIR,—Your contributor's article on an electroni organ is very interesting, and opens up a interesting field for experiment to those capable o the engineering involved.

Of course, Mr. Pannell's scheme is, in reality, th basis of the original Hammond organ. Indeed almost everything in the field of electronic instru ments is covered by Meissetters patents, but ther is no reason why those interested should not experi ment for their own pleasure.

I have been interested in electronic instrument for many years, the first I made was a one-stringed fiddle, using a portion of a high resistance ear piece as a pick-up. Twelve or 14 years ago I com menced an organ in which the frequencies were generated by a steel reed vibrating in close proximity to a magnetic pick-up, similar to that described in the recent article. I only completed two octaves of this since the steel reeds were not easily obtained in this country, but my short experiments proved the scheme to work well. It had an advantage over the rotating wheel in that the reeds were vibrated by air, in this case blown, whereas the rotating wheel is dependent on the frequency of the mains, and we all know how this varies to-day, so it is not easy to maintain the correct philharmonic pitch. I also adapted a scheme to a piano. and later found the same thing on sale.

My really successful electronic organ, however, was built on the condenser microphone system, and that also is actually on the market. This was built with a normal organ vibrating brass reed adjacent to which was a brass stud, forming the two plates of a condenser for each note. One side of all condensers and the D.C. energising supply was earthed, the other plate of each condenser was fed by the live side of the supply, contact was made to each individual condenser through the normal key and so through to the pre-amplifier. This was a single keyboard instrument of five octaves, but I had plans to add another three manuals and other refinements, unfortunately the war intervened.

A point about these electrophonic instruments, as I prefer to call them, is that the single frequency

;enerated by a wheel sounds very thin, overtones ınd harmonics are essential. The reed generator loes provide some overtones, but even in this ype, for satisfactory results, certain mixing is iecessary, as are precautions against clicks and)angs when a key is depressed. There is another, :ommercial, type of condenser organ which uses 'evolving discs, and in another sound on film is ısed. It is a big field and an interesting one.— R. H. COWTAN (Rickmansworth).

Receiver 1116A

SIR,—I enjoyed the article by A. W. Mann on the 1116A as I have one of these very fine 'eceivers. Other owners may be interested in my 'fforts to improve performance. In its original :ondition the 1116 as Mr. Mann states "gives *reasonably* good loudspeaker volume." To my way)f thinking this state of affairs was not good enough 'or six effective valves including QPP output, so [pried and poked about trying to find where gain vas being lost. On studying the circuit two main 'easons became apparent:

(1) The H.T.+ve feed to the QPP output trans'ormer passed through a 5,000 ohm resistor, and :his was dropping the voltage on the QPP valve to ıbout 80 v. on load. This resistor was shorted ıcross and an increase in volume resulted. This 'esistor can easily be located on the resistor-panel 'or the output section.

(2) The detecting diode network was examined ınd it was found that most of the drive to the audio stages was being lost here. The diode decoupling 'esistor was 250,000 ohms and the audio voltage vas being developed across a 50,000 ohm resistor. This circuit was rearranged on orthodox lines so hat the diode was decoupled by the 50,000 ohm 'esistor and the A.F. voltage was developed across :he 250,000 ohm resistor. This is not a straight'orward reversal, as it would seem, because in the AVC position of the switch the AF voltage is leveloped across a separate 50,000Ω resistor on :he switch.

These alterations improved performance ncredibly. The overall gain is now such that an AF volume-control had to be fitted, for when using AVC on commercial and powerful stations the receiver was greatly overloaded. On local mediumwave stations it is impossible to bring the aerial tuner into line with the oscillator because the resultant overloading causes considerable distortion even when using manual bias.

Anyone desiring details of these alterations can obtain them from me on receipt of a S.A.E.

In my opinion the 1116, complete with a twostage preselector, is the battery-man's answer to the H.R.O.—A. E. ASHBY, 40, Eastbourne Terrace, Baghill, Pontefract, Yorks.

Studio Audiences

SIR,—Maurice Reeve in "Programme Pointers" of your May issue states that studio audiences for humorous shows are essential, but that they require some form of restraint. I am in full agreement.

It seems hardly credible that in 1950, jokes of the ". . . 'Who was that lady you were with last night?'—'That was no lady, that was my wife.'" calibre, should be able to evoke spontaneous, wild applause.

I have attended variety theatre outside broadcasts, when, as the time draws near, the show stops and an air of expectancy prevails. Not content with that, the manager comes on to the stage and (as if the audience didn't know), tells us that we shall be "on the air" in a few moments.

"Come on, then," he calls, "let's show everyone that we are enjoying ourselves."

If this state of excitement can be provoked at one's own local theatre, then what is to be expected (without provocation) when one finds himself in a "real live studio" to see his favourite radio show, after making a special journey to London for the "privilege"?

I have been privileged (without inverted commas) to visit Alexandra Palace. Here, the atmosphere is very different, passes being issued with reserve and the "tour" being conducted prior to commencement of transmission. Thereafter, you are placed downstairs in order to watch the programmes on a television set.

However, a few fortunate visitors occasionally find themselves occupying a limited number of chairs arranged along one side of the studio. As the hands of the clock approach programme time, the studio manager walks over and says, "We shall be 'on the air' in a minute, I don't want any laughing or talking—absolute silence." And absolute silence it is, until someone does, or says, something *really* funny, then—well, it just can't be helped and the studio manager joins in too.

At the viewing end, I derive considerable pleasure upon hearing semi-suppressed mirth emanating from "hard-boiled" camera crews, and visitors whom I know are pledged to silence.

Hence, if an audience at a radio show were encouraged to laugh only when they couldn't help themselves, it would not only be more acceptable, in my opinion, to listeners, but possibly ensure that comedians would take more pains in the preparation of their scripts.—R. P. MACKRELL (Peterboro').

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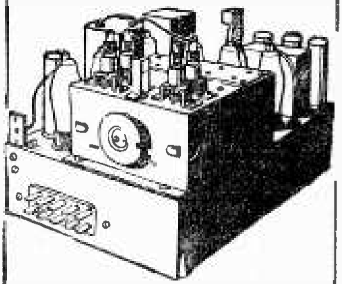

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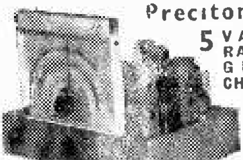

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Impressions on the Wax

Review of the Latest Gramophone Records

THE talent of Josef Strauss in the waltz-world of nineteenth-century Vienna was second only to that of his brother, Johann, as will be seen by the lilting invitation of "Transaktionen," played by the Vienna Philharmonic Orchestra, conducted by Herbert Von Karajan on *Columbia LX*1257. It is characteristic of the melodies of Johann and Josef Strauss that, although written for small orchestral combinations, they will stand amplification on a full symphony orchestra, with picturesque and immensely satisfying effect. These tunes were written for dancing. They serve us extremely well for listening.

Bartok's Piano Concerto No. 3, for piano and orchestra, was written in 1945, during the last months of his life. When he died he left the score unfinished by seventeen bars, which were filled in by his friend and pupil, Tibor Serly. This work has now been recorded on *Columbia LX*1271-3, by the Philadelphia Orchestra, conducted by Eugene Ormandy with Gyorgy Sandor playing the solo part. Sandor was also a friend and former pupil of Bartok and is acknowledged the composer's finest pianistic interpreter.

Of outstanding interest is a recording of Haydn's Symphony No. 102 in B Flat, by Sir Thomas Beecham, Bart., conducting the Royal Philharmonic Orchestra, on *H.M.V. DB*21042-4. Actually ninth in order of composition in the Salomon set, this work is in four movements. A slow opening leads soon to a brisk Allegro vivace. The second movement Adiagio is beautiful. Then the standard Menuetto and Trio is followed by a robust finale Presto. This symphony is an ideal example of the skill with which Haydn brought orchestral music to a singular perfection.

Also of interest is the recording of Gwydion Brooke, with the Liverpool Philharmonic Orchestra, conducted by Sir Malcolm Sargent on *Columbia DX*1656-7. This is an outstanding performance by an outstanding bassoonist. Gwydion Brooke is a son of the composer Joseph Holbrooke.

Vocal

The first Columbia record by Margaret Eaves (issued in March, 1950), was extremely well received and that will apply no doubt to her latest record, "I Remember the Cornfields" and "Give Me Your Hand," on *Columbia DB*2679. The first tune was written by Harry Railton, who had the unhappy experience of being imprisoned in Buchenwald concentration camp where, incidentally, he did receive some kindness and obtained eventual release through the prison doctor falling in love with one of his songs.

Two lesser-known operas are introduced this month by the great Italian singer Gigli. He sings arias from Alfano's "Don Juan de Manara," Act 2 and Mascagni's "L'Amico Fritz," Act 3 on *H.M.V. DA*1937.

Marimi Del Poza, a remarkable Spanish soprano, makes her début on H.M.V. this month with a recording with "Ardon gl'incensi" from Donizetti's "Lucia di Lammermoor," Act 3. Sir Julius Benedict's variations on the popular Italian air, "The Carnival of Venice," has long been a regular choice among coloratura sopranos, and makes an unusually contrasted companion piece to the first side of this record—*H.M.V. C*3967.

Isobel Baillie's interest has always roved a wide musical scene and "Creep Afore Ye Gang" and "Feetikins," which she sings on *Columbia DB*2662, are evidence of her catholic outlook. "Character sketches" in words and music have always appealed to her, particularly when there is the suggestion of northern dialect to arouse her Scottish background. These examples by Diack to words of three different writers are as entertaining as their intriguing titles indicate, with piano parts that become doubly interesting in the hands of Gerald Moore.

Variety

The fascinating little tune, "C'est si Bon" is one of the many lovely features of the London Casino show, "Latin Quarter." It has lifted itself out into the wide sphere of broadcasting absolutely on its own merits. This excellent dance band "edition" of it, by Geraldo and his Orchestra on *Parlophone F*2409, will be welcomed. It is coupled with "Enjoy Yourself."

That charming singer, Mary Martin, and comedian Arthur Godfrey, have combined in a charming little duet, "Bill Loves Mary, John Loves Joan, but me, I Love You." This record should prove to be exceedingly popular.

Sometimes new songs come here from America with such reputations that their success is assured, particularly if they are given a recorded send-off by Frank Sinatra. Two such songs are "The Old Master Painter" and "Chattanoogie Shoe-shine Boy," which he sings on *Columbia DB*2664.

The "Top of the Bill" variety attraction, the Radio Revellers, have made two novel titles of especial appeal. The "French Can-can Polka," a contemporary adaptation of a work by Offenbach, is irresistible. The tune is catchy in the extreme, and the piece is further enhanced by the somewhat racy character of the lyrics. With "Cherry Stones," the above number is given a perfect coupling—*Columbia DB*2666.

Dance Music

Most of the hit-tunes of the moment have been recorded. Joe Loss and his Orchestra play "Chattanoogie Shoe-shine Boy" and "My Foolish Heart" on *H.M.V. BD*6067, others being "Why Not Now" and "Don't Cry, Joe," by Oscar Rabin and his Band on *Parlophone F*2404, and "Music ! Music ! Music !" and "The Old Master Painter," by Geraldo and his Orchestra on *Parlophone F*2406.

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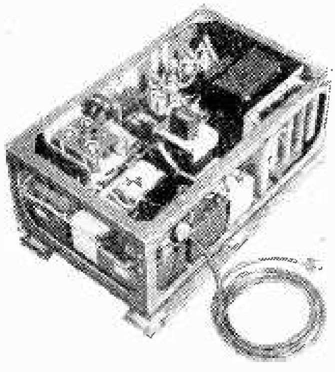

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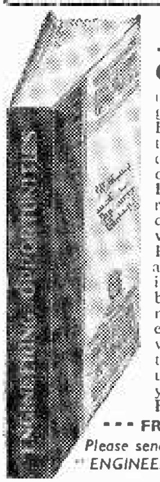

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