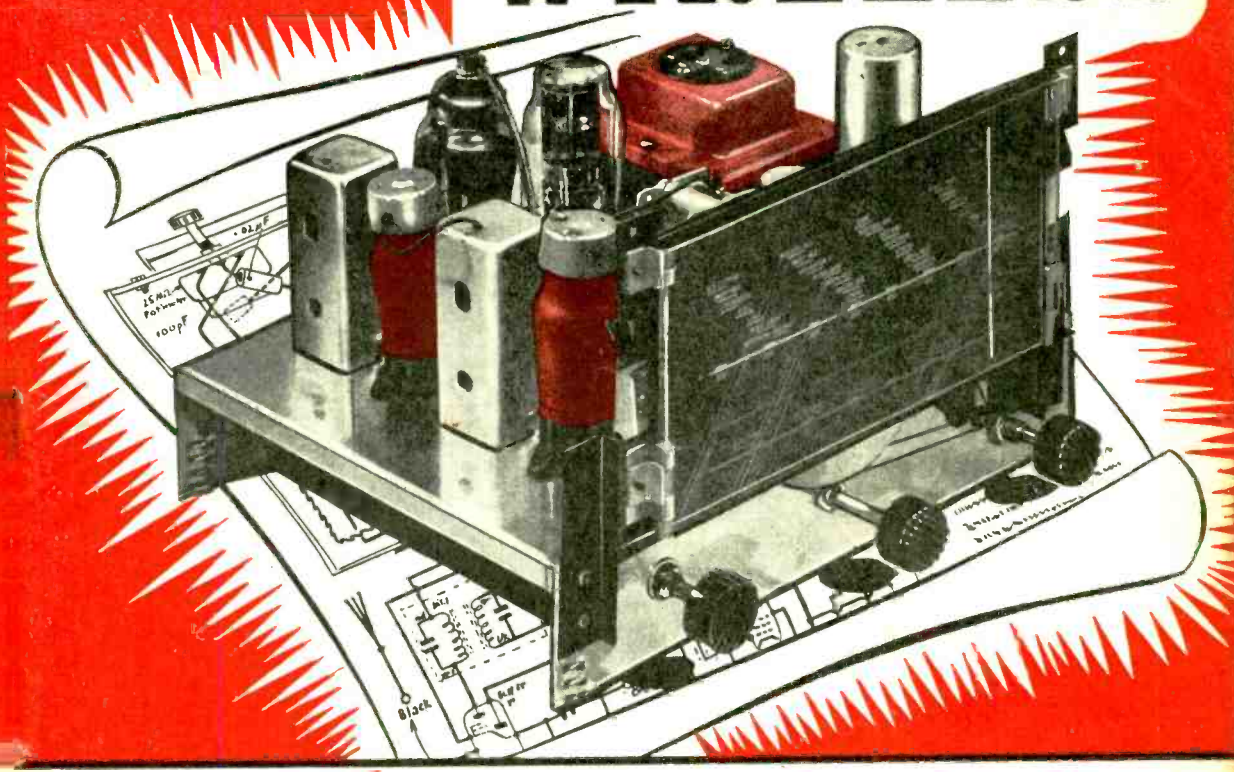
96 PAGES!

21ST BIRTHDAY NUMBER!

1/-

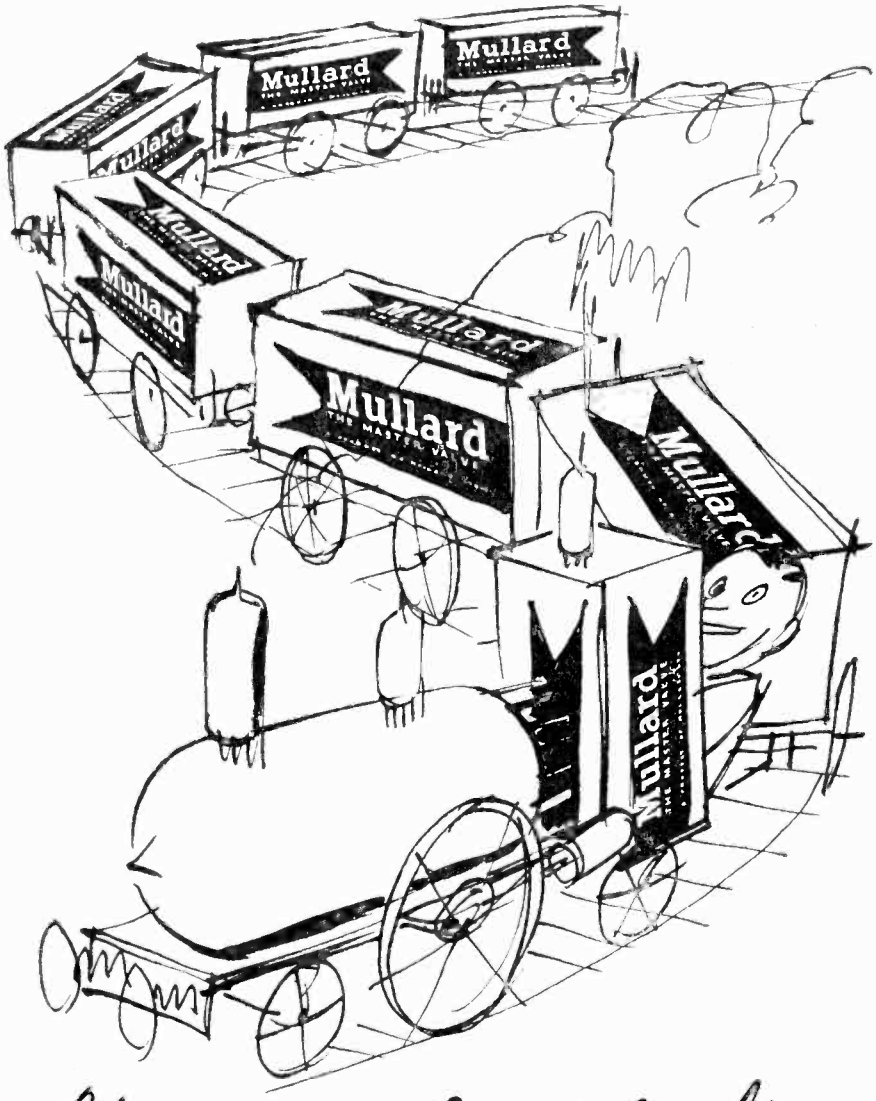
PRACTICAL WIRELESS

Vol. 29. No. 564
OCTOBER, 1953
EDITOR
F.J. CAMM



FREE INSIDE!

BLUEPRINT OF F.J. CAMM'S "CORONET FOUR"



You're on the right lines if you choose

Mullard

VALVES

MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, W.C.2

MVM 237

Tracking 2000g at 10 grammes maximum stylus pressure

Pick-up tracking capabilities now have to be of a substantially higher order than those for 78 r.p.m. records, and are likely to become even more critical. This sets a difficult problem for pick-up manufacturers.

Cosmocord, with the very helpful co-operation of the Decca Record Company, have recently made a detailed examination into the optimum tracking requirements that *could* arise in modern types of microgroove records. This was done in order to establish a basis for the design of pick-ups that would not only satisfy the requirements of all records at present available to the public, but if possible anticipate future developments within the limits as set out in the recently published British Standard Specification (B.S.1928 : 1953).

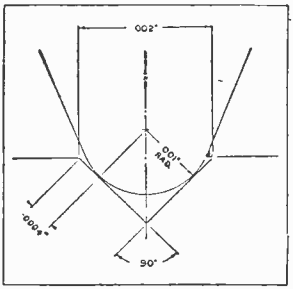


Fig. 1

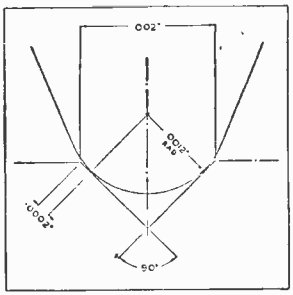


Fig. 2

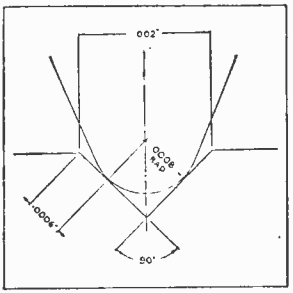


Fig. 3

THREE FACTORS

The three important factors that had to be considered by Cosmocord in designing such a pick-up were minimum groove width, maximum lateral displacement and maximum stylus tip acceleration.

The minimum groove width as laid down by the British Standard Specification is .002in. The conditions existing in a record giving up to 30 minutes playing time per 12in. side are well demonstrated in the accompanying scale drawings. For simplicity's sake, the groove angle has been shown as 90° and the radius at the bottom of the groove has been left out, as at .0003in. maximum it has no effect. Three pick-up stylus radii are shown, the nominal .001in. radius (Fig. 1) and its upper and lower limits of .0012in. and .0008in. (Figs. 2 and 3 respectively) according to British Standard Specification. It can be seen that the .001in. radius has .0004in. wall above its point of contact, whilst the .0012in. radius has no more than .0002in. This does not take into account the pinch effect which can reduce the margin by .0002in. at 5,000 c/s.

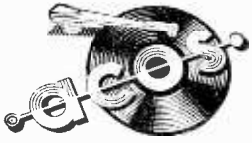
PRACTICAL CONSIDERATIONS

In order to arrive at maximum possible displacement, some assumptions have to be made that are dictated by practical considerations. Working on the basis of 200 grooves per inch the maximum possible displacement (d) is .003in. At a frequency of 40 c/s. this displacement corresponds approximately to a maximum velocity of 2 cm/sec. ($v=2\pi fd$).

Accepting the recording characteristics of the Decca Long Playing test record No. LXT 2695 as typical for commercially produced long playing records, the maximum velocity and corresponding acceleration at 10,000 c/s. can be calculated. According to the record specification the recording pre-emphasis at 10,000 c/s. relative to 40 c/s. is +24.4 dbs. and this gives a velocity of 31.6 cm/sec. and a corresponding displacement of .0002in. $\left(e=\frac{v}{2\pi f}\right)$. It further follows that expressed in gravitational units the acceleration at 10,000 c/s. may be as high as 2,000g $\left(g=\frac{ef^2}{10}\right)$, where e=displacement=.0002in. and f=10,000 c/s.).

WHAT OF THE FUTURE ?

It may be only a question of time before these conditions appear on commercially produced records, but Acos "Hi-g" series of pick-up cartridges already meet, here and now, any likely future development of gramophone records within the B.S. 1928 : 1953 specification.



always well ahead

COSMOCORD LTD., ENFIELD, MIDDX.

"P.W." COMES OF AGE!

By THE EDITOR

THIS issue, specially enlarged to signalise the occasion, celebrates our twenty-first birthday. Since September 24th, 1932, when the first issue saw the light of day, this journal has appeared continuously, first as a weekly until July 27th, 1940, and then as a monthly. The intense paper shortage of the war years caused us, in common with all other newspapers and periodicals, to shrink in size. But notwithstanding the production and paper difficulties of the war years we appeared promptly each month and, for the duration of the war, our issues contained features which helped to train the radio and radar personnel for the Services.

The history of this journal is told in other pages, but it is fitting in this place to acknowledge with gratitude the large number of congratulatory messages we have received from readers and from the trade. The coming of age of "P.W." is a tribute to the soundness of its editorial policy.

It fought the keenest possible competition when it was launched, but readers as well as advertisers soon realised that here was a journal which differed from most of the others. Only those parts used in the prototype were nominated in the parts list. These components were recommended whether the manufacturers of the particular components advertised or not, and in the long run this has proved to be a sound policy. We took particular care to see that only straightforward advertisers' announcements appeared in our pages. We guaranteed our receivers as well as the integrity of our advertisers. That initial policy remains to-day, and we see no reason to depart from it.

In the course of these twenty-one years this journal has sponsored many innovations and been responsible for improving the design of receivers. We introduced the chassis-type of receiver in which the bulk of the components could be tucked away out of sight. We sponsored the guaranteed circuit; transfer prints; data sheets; free booklets for beginners; the pocket radio tool kit, to mention but a few of the steps we took to provide constructors with a reliable periodical.

Its birthday coincides with the Radio Show and this issue, therefore, has been greatly enlarged to accommodate our many special **Birthday** features, without reducing the space devoted to our Show Report.

We acknowledge with sincerity the great services rendered to this journal by the staff (most of whom have served it from the start) and by its contributors. Most of those, too, have regularly contributed from the first issue.

Radio has undergone a momentous metamorphosis since 1932. Radar, television and the many allied branches of electronics now comprise an industry of great national importance.

This journal, therefore, has a greater mission to fulfil than ever before and with this twenty-first Birthday number it dedicates itself anew to its readers and the trade.—F. J. C.

ROUND THE WORLD OF WIRELESS

V.H.F. System in Oil Tankers

PROVIDING facilities for direct speech communication from ship to shore up to a distance of twenty-five miles, very high frequency radio-telephone equipment, supplied by the Marconi International Marine Communication Co., Ltd., is to be installed in nine oil tankers of the Shell fleet, and in two shore stations. The system, when installed, will not only enable berthing arrangements to be discussed while a vessel is still at sea, but will also provide "telephonic" communication with the shore when the ship is lying off the end of a long jetty.

The two shore stations will be at Shellhaven, on the Thames, and Pernis, Rotterdam.

Daventry Transmitter

THE BBC regrets that the development of an unusual fault in the aerial system of the transmitter at Daventry carrying the Third Programme on 464 metres made it necessary to bring the reserve aerial into operation and to reduce the power to approximately 60 kW.

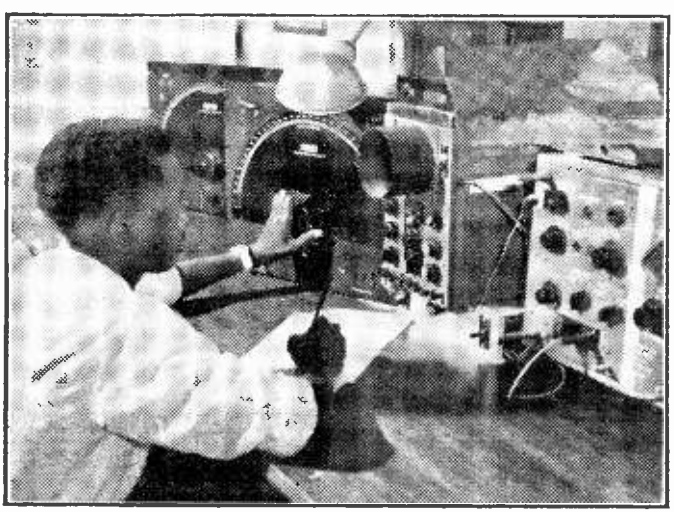
The consequent reduction in signal strength is not likely seriously to affect listeners who receive the Third Programme from this transmitter unless they live at considerable distances from it. At such distances there may also be some fading after nightfall because the reserve aerial is not of advanced anti-fading design as is the main one.

Mullard Research Laboratories

MR. P. E. TRIER, M.A., and Mr. G. Knott, M.A., A.M.I.E.E., have been appointed joint managers of the Mullard Research Laboratories.

In his appointment, Mr. Trier will direct the electronics laboratory and be responsible for work in the fields of communications, radar, special circuit techniques, particle accelerators, special components and materials, valve applications, ultrasonics, and metal physics. He will also act in the capacity of plant head.

Mr. Knott was placed in charge of the Mullard Vacuum Physics Laboratory when it was formed in 1946. He will continue to direct the work of this laboratory in his new appointment, and will be responsible for V.H.F. valves, gas discharge tubes, and photo-electric devices.



Receiving, measuring and plotting the signals from the radio-sonde transmitter at the Sudan Meteorological station in Khartoum.

Weather Station

THE Sudan Meteorological Service established the first radio-sonde and radar wind station in Khartoum earlier this year. Since March 1st, the Sudanese operators have been producing a daily sounding of upper air temperatures and winds. British-type ground equipment and radio-sondes being used.

Broadcast Receiving Licences

THE following statement shows the approximate number of sound receiving licences issued during the year ended June, 1953. The grand total of sound and television licences was 12,964,065.

Region	Number
London Postal ...	1,719,179
Home Counties ...	1,457,880
Midland	1,310,622
North Eastern ...	1,704,619
North Western ...	1,339,661
South Western ...	1,025,634
Wales and Border ...	666,496
Total England and Wales	9,224,091
Scotland	1,111,098
Northern Ireland ...	213,571
Grand Total ...	10,548,760

Agricultural Repair Scheme

A FIRM of agricultural machinery agents, at Evesham, have fitted their repair service vans with two-way radio, enabling mechanics to keep in touch with headquarters while engaged on jobs in distant farms.

As the firm operates over an expansive and highly mechanised area, the scheme saves a great deal of time; the vans can be directed from one breakdown to another.

Channel Swimmers Broadcast

WHILE actually swimming in mid-channel the competitors in the Butlin's mass swimming competition spoke personally to the control centre situated on board the "John McLeod"—a 160-ton motor vessel which carried Mr. Billy Butlin and other officials.

This entirely new innovation in cross-channel swimming was made possible by the use of Pye "Reporters"—radio-telephones which are equipped with the normal hand-set—one of which will accompany each of the swimmers.

Obituary

IT is with regret that The Marconi International Marine Communication Co., Ltd., announces the sudden death of Commander Quinton H. Bullard, until a month ago managing director of its associated company Marconi (South Africa), Ltd. He had recently been in ill health, and was travelling by train on Tuesday July 28th, when he died of a heart attack as the train, the Orange Express, was approaching Wellington.

Commander Bullard began his career in communications with the South African Post Office and later joined Cable and Wireless, Ltd.

Commander Bullard, who was 51 at the time of his death, leaves a widow, three sons and a daughter. Their home is at Ocean View, Bantry Steps, Bantry Bay, Cape Town.

B.I.R.E.

THE following institution meeting will be held during September, 1953:

London Section. — Wednesday, September 30th, at 6.30 p.m. London School of Hygiene and Tropical Medicine, Keppel Street, (Gower Street), London, W.C.1. "The Impact of Communication Theory on Television." D. A. Bell, M.A., B.Sc., Ph.D.

A programme booklet giving details of the meetings of all sections of the institution will be published during October. Copies may be obtained from the Publications Officer, Brit.I.R.E., 9, Bedford Square, London, W.C.1. price 4d., post free.

I.P.R.E.

A NORTH-WEST section of the Institute of Practical Radio Engineers was inaugurated at the Grand Hotel, Manchester, on July 29th, with an initial membership of 82.

Officers elected were D. Medwell, chairman; H. Budworth secretary; with a supporting committee consisting of Messrs. A. Davies, J. Miller, H. Price, and D. E. Richardson. The address of the secretary is 466, Holden Road, Leigh, Lancs.

New Radio-Telephone Services

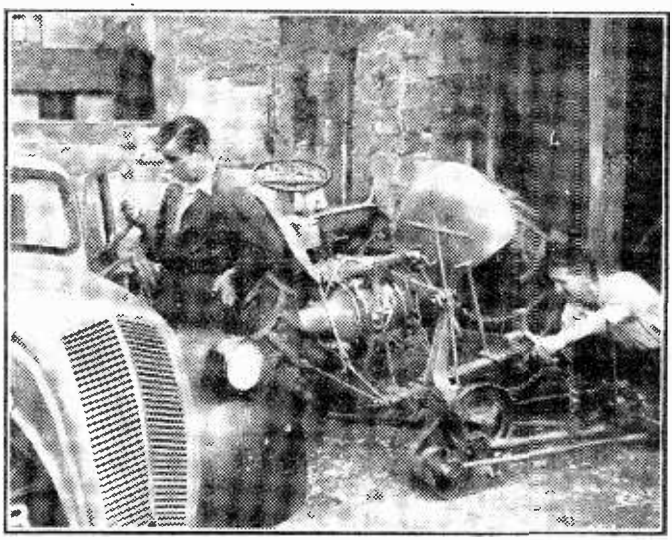
ADDITIONAL radio-telephone services are now available in the Middle East and Pacific areas. In the Middle East, a new service is now open for public use between Amman and Cairo, operated by Cable & Wireless, Ltd., in Amman and by the Egyptian Marconi Company in Cairo.

In the Pacific, a new service links Suva, Fiji, with Sydney, Australia. It is being operated at Suva by Cable & Wireless, Ltd., and at Sydney by the Overseas Telecommunications Commission (Australia). These new services are linked at each end to the respective local telephone systems.

Expenses Higher

IT is expected that the BBC will find their Radio Show expenses rather higher than at first calculated.

In the large Earls Court television studio, which can accommodate a thousand people, continuous all-day rehearsals and broadcasts will be seen by visitors to the show. Because of this, radio and television musicians have demanded that the rehearsals be treated in the same way as actual performances and that full rates be paid for both.



While engaged on a tractor repair at a farm near Cheltenham, mechanic G. James receives instructions for another job by two-way radio.

Third Programme

STARTING on Sunday, September 27th, and continuing throughout the winter months, the Third Programme is to open on Sunday afternoons at 3 p.m. To meet the additional cost the service will close daily at 11.30 p.m.

A full-length play or opera will normally fill the greater part of this extra three hours of programme time each Sunday.

On the first four afternoons the complete cycle of "The Ring" will be given from new recordings made at this year's Wagner Festival at Bayreuth, beginning on September 27th with "Das Rheingold."

Twenty-one Today

A SELECTION OF MESSAGES OF CONGRATULATION FROM LEADING MEMBERS OF THE RADIO INDUSTRY

From Mr. A. H. Whiteley (Director of Whiteley Electrical Radio Co. Ltd.).

"CONGRATULATIONS upon the 21st birthday of PRACTICAL WIRELESS.

MR. A. H. WHITELEY

"I well remember your first issue at a time when there were many other similar journals, but with your practical and unique way of editing PRACTICAL WIRELESS you have gone from strength to strength, and in a way it is the only radio journal which does appeal to all sections of the community.

Long may your success continue.

From Mr. H. Freeman (The National Publicity Co. Ltd.).

"AS one who has for over 30 years been associated with the advertising side of radio it is a very great pleasure to send to you and the publishers of PRACTICAL WIRELESS my heartiest congratulations upon your journal attaining its 21st birthday.

MR. H. FREEMAN

"Your consistent policy of fostering the growth of home-construction of radio sets ranging from the humble crystal receiver to the ultra short-waver and transmitters for the amateur is, I am sure, responsible in a great degree for the ever-increasing popularity of PRACTICAL WIRELESS.

"All associated with its production have every reason to be proud of the wonderful growth of your widely-read journal."

From Mr. G. J. Freshwater (Controller of Advertising for Electrical & Musical Industries, Ltd.).

"MAY I add my congratulations to the thousands you will receive on the occasion of the 21st birthday of PRACTICAL WIRELESS.

MR. G. J. FRESHWATER

"The great British radio industry as we all know it to-day was founded upon the fine work done by the few pioneer publications such as PRACTICAL WIRELESS.

"'Tall Oaks from little Acorns Grow' . . . you were certainly one of the acorns from which our present industry grew. It has been good to see you prosper with it. I wish you a fine future."

From Mr. C. Barwell (Publicity Manager, Mullard Ltd.).

"IN an age of mass-produced technical products, the amateur constructor is often regarded as a phenomenon. How far this is from the truth can be judged by the ever-increasing popularity of PRACTICAL WIRELESS.

There is a great need to-day for the encouragement of individual crafts and skills, not only because self-expression is a good thing in itself, but also because the very character of British industry and enterprise is dependent upon a plentiful supply of practical and inventive minds.

MR. C. BARWELL

For 21 years PRACTICAL WIRELESS has been a source of interest and inspiration for thousands of radio enthusiasts, and it has influenced many a young man in his choice of a career.

As one who has known PRACTICAL WIRELESS all its life, I offer my congratulations on an outstanding journalistic achievement, and sincere wishes for its continued success."

From Mr. R. Arbib (Director of Multicore Solders Ltd.).

"I REMEMBER distinctly the issue of the first number of PRACTICAL WIRELESS at a time when the 'constructor' market was generally considered to be coming to an end, and the foreboding that another journal devoted to home constructors could not possibly be a success. The passage of a very few years, and the absorption by your journal of the other papers one after another, showed how conclusively your editorial policy was justified.

"I have always held the opinion that PRACTICAL WIRELESS has undertaken a great service to the radio industry as a whole. Besides keeping home-constructors up to date with new developments, I am certain that it is the radio enthusiasts who are often responsible for recommending to non-technical friends the complete domestic type television and radio receivers which are made by the leading manufacturing firms in the industry.

MR. RICHARD ARBIB

"It scarcely seems possible that 21 years have elapsed since the Number One issue, and on behalf of all the members of my company I send you very sincere congratulations and all good wishes for the future."

Long may you continue your good work, in your progress towards what you undoubtedly will achieve—your centenary.

From Mr. F. H. Barnes (Publicity Manager of The Telegraph Condenser Co. Ltd.).

"FOR a journal to have covered 21 years of continuous publication is in itself an achievement of no small order; when for the whole of that period it has been under the direction of its founder, the achievement is two-fold. I congratulate both the paper and its editor."

MR. F. H. BARNES

From Mr. H. W. Read (Whiteley Electrical Radio Co. Ltd.).

"HEARTIEST congratulations on achieving 21 years of continuous publication.

MR. H. W. READ

"I have always admired the wealth of information to be regularly found in your journal, and the instructive articles which have been responsible for creating and maintaining the interest of the amateur constructor."

From Mr. A. Schumann (Director of Cosmocord, Ltd.).

"THOSE of us who have been brought up with radio—who have known it since the days of "Writtle" and "cat whiskers"—have a special affection and respect for PRACTICAL WIRELESS. Then—and even now—it was more than a publication: it was our private mentor and personal guide to the unfolding mysteries of an exciting new discovery. We were much younger then, and I feel that many who essayed their first hook-up with the help of "P.W." are now among the leading minds of what we now call "electronics."

All of us at Cosmocord congratulate the publishers most sincerely on maintaining that high standard and early enthusiasm which, I feel sure, will continue in the future."

MR. A. SCHUMANN

From Mr. J. Bull (Managing Director of Electronic Precision Equipment, Ltd.).

"ON the occasion of the 21st birthday of PRACTICAL WIRELESS, may I compliment and congratulate you on doing so much to promote interest in electronics. As founder editor you must undoubtedly have done more than most to keep Britain ahead in the field of Radar, on the Services side, as well as in domestic radio and television.

"I personally hope you continue for another 21 years."

From Mr. A. W. Allwright (Managing Director of Denco (Clacton) Ltd.).

"IN offering my sincere congratulations on this great event, "Your 21st Birthday," I also extend on behalf of my staff my equally sincere thanks to your technical and advertising staff who have done so much in fostering the growth of the amateur radio industry."

MR. A. W. ALLWRIGHT

From Mr. P. Moseley (Managing Director of Osmor Radio Products Ltd.).

MR. P. MOSELEY.

"WE extend our greetings to the Editor and Staff of PRACTICAL WIRELESS, and congratulate all concerned on maintaining such a successful policy for 21 years."

From Mr. E. Lasky (Director of Lasky's Radio).

"CONGRATULATIONS to Mr. F. J. Camm and PRACTICAL WIRELESS. Keep up the good work. "Re-

MR. E. LASKY

member, you fulfil a great need in the amateur world."

From John Clarricoats (General Secretary of the Radio Society of Great Britain).

"I CANNOT allow the occasion of the coming of age of PRACTICAL WIRELESS to pass into history without offering to you and those who are, or have been, associated with you, my most warm congratulations and best wishes for the future.

MR. J. CLARRICOATS

"Many members of the R.S.G.B. owe a great deal to PRACTICAL WIRELESS for having opened wide the door of scientific knowledge at a time when they were first showing an interest in radio as a hobby. They, in company with countless thousands of others, have helped to build up for PRACTICAL WIRELESS a tradition. New generations of readers will assuredly not fail to recognise the part you personally played in creating that tradition.

May PRACTICAL WIRELESS go from strength to strength.

From Vice-Admiral J. W. S. Dorling, C.B., M.I.E.E. (Director, The Radio Industry Council.)

"MAY I add my own personal good wishes to your journal which is always very close to my heart because I myself started wireless as an amateur more years ago than I care to remember."

VICE-ADMIRAL J. W. S. DORLING

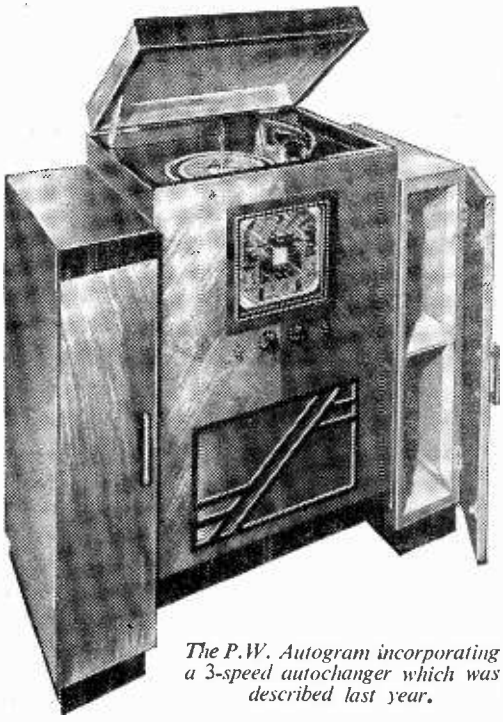
From Ernest R. Gilbert (Managing Director, Gilbert Advertising Ltd.).

"CONGRATULATIONS on attaining your 21st birthday, and I offer them with great sincerity. I have watched your progress from the start and admired your forthright policy. I would also like to pay tribute to the boundless energy and enthusiasm of Mr. F. J. Camm, which is quite undimmed as the years roll by."

Famous PW Practical Wireless GUARANTEED RECEIVER RECEIVERS

THE very first receiver described in this journal was the Long Range Express Three, and it was the subject of our first blueprint. It was built in its thousands and we still receive queries concerning modifications to bring the receiver up to date. At that time most constructors' sets had all the components mounted in one plane on a baseboard. We made the bold move of introducing for it a metal chassis with sub-chassis wiring so that when finished the receiver had a professional appearance.

In all of our receivers we incorporated the very latest components and circuitry, and in most cases we were the first to do so. Older readers of the paper will recollect some of the boom sets we produced. In our very first issue there was the Dolphin Straight Three—a detector and 2 L.F. battery set. Apart from a very large number of simpler receivers in the course of 21 years we have published details of over 120 sets—an average of five a year. Of course, during the war years when components were not readily available the number of designs dropped. How many readers are still operating the Sonotone? The Bijou? The Argus Three? The Empire Short-wave Three? The Soloknob Three? The Midget Two? The Selectone? All of these receivers were described in our first year of issue.



The P.W. Autogram incorporating a 3-speed autochanger which was described last year.

1933

In January, 1933 the Editor launched his famous "Fury Four," and it was a phenomenal success. It was produced in two versions—battery and mains—and for the first time in the history of radio journalism the whole of the front page of the *Daily Mail* was taken to advertise it. Similar advertisements appeared in most national and provincial newspapers. In 1933 iron-cored coils were introduced, and P.W. was one of the first in the field with the Ferrocart Q.P.P. Hi-mag Three. This was followed in the same year by the Supersonic Six, the A.C. Twin, the Beta Universal Four, the Featherweight Portable Four, the Radiopax Class B Four, the Pyramid Portable Two, the Three Star Nicore, the Arcady Portable Three, the Superset, the A.C. Three and the Orbit Three.

1934

In 1934 we produced the Leader Three, the Prima Mains Three, the Master Midget Two, the Atom Lightweight Portable, the Ubique, the Midget Short-wave Two, the All-Pentode Three, the first Three-valve Superhet, the £5 Battery Superhet, and the Hallmark Three.

1935

This was followed in 1935 by the Universal All-Mark Four, the Guinea Two-valver, the All-wave Silver Souvenir, the Cameo Midget Portable, the very first Two-valve Superhet, the Superformer Four, and the Four Pound Superhet Four.

1936

The year 1936 saw the production of the Monitor Three, the Prefect Short-wave Three, the Tutor Three, the Elf Midget Portable, the Midge Portable, the Limit All-wave Four, the Record and the Colt Battery Three.

1937

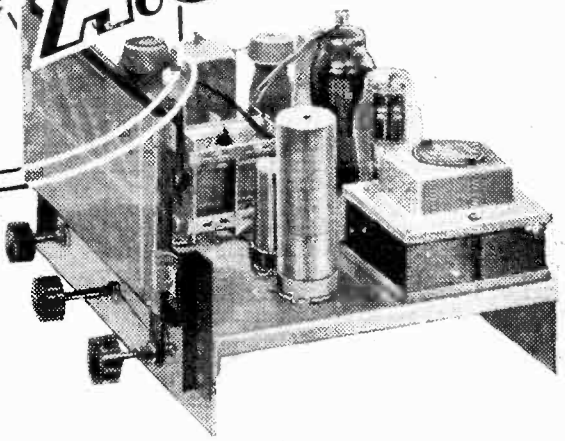
In 1937 the Qualitone Universal Four, the Beginner's Telecent Three, the Vitesse All-valver, the Parvo Flyweight Midget Portable, and the All-wave Corona Four.

1938

In 1938 there followed the 1938 Triband Three, the Acme All-wave Four, the Imp Four-valve Portable, the Sprite Three, the Hurricane All-wave Three, the Compass Portable Four, the Push-button Three, and the Push-button Four, the Trio-Pen Short-wave Two, and the Air Hawk Nine.

(*Continued on page* 614).

F. J. CAMM'S Coronet A.C. Four



FULL DETAILS OF OUR SPECIAL BIRTHDAY SOUVENIR RECEIVER

THERE has been considerable controversy in the past as to the best type of circuit for amateur construction. Many favour the straight or T.R.F. arrangement, whilst others claim that only a superhet can be considered suitable for modern conditions. Various reasons are given by the adherents of both arrangements, but it is found that the main argument which is put forward is that a T.R.F. circuit can be aligned without costly instruments, whereas to get the maximum performance from a superhet a signal generator or some similar instrument is necessary. Whilst this may have been true some years ago, it no longer applies, as manufacturers have been able to improve manufacturing tolerances, etc., and can supply coil units in which very close alignment may be made at the factory. For the benefit of newcomers it may be mentioned that in a superhet the frequency or wavelength of every station which is tuned in is converted into a new frequency. This new frequency is constant for any station, and thus the subsequent amplifiers may be "fixed tuned" to that frequency, and this means that additional amplification at the best frequency may be given to any station. When a receiver is designed to cover short, medium and long-waves a compromise has to be made between maximum gain and selectivity and, strictly speaking, the requirements at, say, the low end of the short-wave band are quite different from those in the middle of the medium-waves. If, however, we can find a frequency at which maximum gain can be obtained with a certain type of coil, then obviously if we could change the frequency of every station we tune to that frequency we shall obtain maximum performance. This is what the superhet does. Only two tuning coils, therefore, become necessary for each waveband, one on which the station is tuned on its correct frequency, and the other to tune a local oscillator to a slightly different frequency. The two are mixed and the resultant difference is passed through two transformers tuned to that frequency. The result is a very selective circuit and high gain. It is essential, however, that the two tuning circuits are adjusted so that the correct difference is obtained on all parts of the tuning scale, no matter whether switched to short, medium or long waves, and this is where the main snag arises. However, Messrs. Roding Laboratories have arranged to produce a set of coils and the associated I.F. transformers which are pre-aligned at their works and are thus sufficiently well matched that no additional work is required for all normal purposes.

A Full-size Blueprint of this Fine Receiver is given Free with every copy of this Issue.

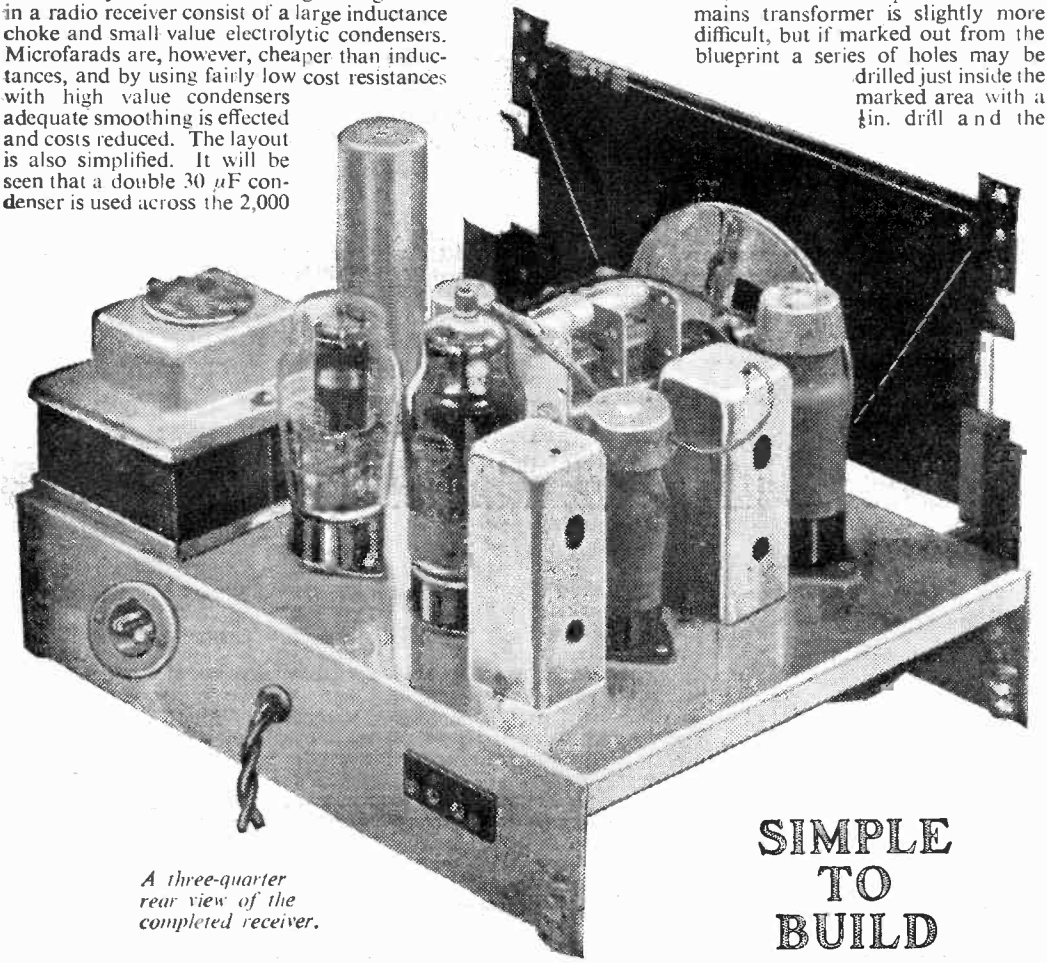
The Circuit

We used a set of these components just as received and found the claims substantiated, and therefore decided that we could confidently produce a superhet design which would not have the drawbacks usually mentioned. In designing a receiver for home-construction there are two points which have to be considered—the receiver must be fairly simple to construct and must have a reasonably good appearance. In the Coronet receiver four valves have been used, the first a triode-hexode which is the frequency changer; the second an H.F. pentode which is the I.F. stage; the next a double-diode pentode which is the second detector and output stage, and the fourth the mains rectifier. It will be noted that this arrangement differs from the usual superhet in that the second detector and A.V.C. diodes are enclosed in the output valve, whereas they are usually found in the I.F. valve or a first L.F. stage where two such stages are employed. To bring the receiver within the reach of the newcomer the various components have been very carefully selected and reduced to a

minimum, with the result that the actual wiring up of this receiver should be no more than one evening's work. The Free Blueprint which is enclosed in this issue gives the theoretical circuit, a list of the parts which were used in the original, a drilling plan for the chassis, and a wiring diagram. From the illustrations on these pages it will be seen that a full-vision dial has been specified and this is a J.B. product of the fly-wheel or spin-wheel tuning type. It is accurately matched to the coils specified and thus station names may be followed in locating stations or the wavelength markings adopted when searching. It must be emphasised, however, that this dial will only hold good if the condenser and coils which we specify are used, and the wiring is carried out exactly as shown on the Blueprint. It must be remembered that stray capacities can affect results and only by using matched components can one be sure of correct lining-up. Messrs. Roding Laboratories can supply the coils, I.F. transformer and condenser and dial as a complete kit which will simplify your shopping difficulties. The mains transformer delivers an H.T. line of 250 volts which is smoothed by resistors instead of a choke. Experienced readers will know that usually the H.T. smoothing arrangements in a radio receiver consist of a large inductance choke and small value electrolytic condensers. Microfarads are, however, cheaper than inductances, and by using fairly low cost resistances with high value condensers adequate smoothing is effected and costs reduced. The layout is also simplified. It will be seen that a double 30 μF condenser is used across the 2,000 ohms resistor feeding the maximum H.T. points, and that a further 33,000 ohms resistor in conjunction with a 16 μF condenser is used to feed the screens of the first two stages. The decoupling thus provided, together with the smoothing and voltage dropping which result, ensures that the receiver is perfectly stable and hum-free.

Construction

The chassis, which measures 12in. by 9in. with 2½in. runners is a Denco product and is provided with special recesses on the runners by means of which the chassis may be fixed to the cabinet if desired. If an undrilled chassis is obtained the holes as shown on the blueprint should be cut. For the circular holes one of the special chassis-cutters such as the Osmor or Q-max will be found most suitable. These cut a clean hole without difficulty and it should be noted that similar large holes are recommended for the electrolytics. Some constructors simply drill small holes to clear the soldering lugs on these components, but it is better to leave ample clearance to avoid the risk of short-circuit, and if a chassis cutter is available it is not difficult to make these holes. The aperture for the mains transformer is slightly more difficult, but if marked out from the blueprint a series of holes may be drilled just inside the marked area with a ⅛in. drill and the



A three-quarter rear view of the completed receiver.

SIMPLE TO BUILD

centre piece then knocked out. The ragged edges should afterwards be cleaned up with a file. Alternatively, a ¼in. hole may be drilled at each corner, and the rectangle cut out with an abrasive hack-saw blade. When the holes have all been drilled the work of assembly may commence. Valveholders should be fitted first, then the mains socket, aerial-earth socket and volume control, after which the I.F. transformers and mains transformer may be bolted down. The variable condenser should now be placed in its position and the dial held in its position to make certain that your fixing holes for these items are correct. The dial drive is provided with a self-aligning coupling which will compensate for slight inaccuracies but you may find it necessary to put a nut between the feet of the condenser and the chassis to lift it so that the spindle is truly horizontal and this will remove undue strain on the drive. The electrolytic condensers should be mounted and then some of the wiring may be carried out—leaving the coil pack until last so that there will be no risk of damage due to movement of cores, trimmers, etc.

Wiring

Commence wiring by linking up the heater connections and other direct wiring as shown on the wiring plan. Note that an earthing bus-bar has been employed in this model instead of taking earth connections to the nearest earthing bolt. This arrangement produces a single earth point and avoids linkage of currents through the chassis which may lead to instability and impaired performance. It will be noted that the bus-bar is taken from the negative lug on the electrolytic condenser (which is not in direct contact with the case) to a soldering tag on the bolt holding down one of the I.F. transformers, and from here another wire is taken to the earth socket. The length of screened sleeving should be prepared by removing the insulation and sleeving from one end and wrapping this with cellulose tape or ordinary insulation tape so that the metal braid cannot come into contact with the inner lead. A top-cap connector should be attached to this end and the other end threaded down through the grommetted hole as shown and taken towards the volume control centre lug. A .02 μF condenser has to be the linking medium between this lug and the lead and to make certain that the correct amount of lead is cut off, the EBL31 valve should be inserted in the V3 holder, the cap placed on the valve and then the chassis turned over carefully. The lead should now be cut so that it just reaches to the wire at the end of the .02 μF condenser and the two soldered together with one end of the 470 kΩ lead joined on at the same time. The other end of this resistor should be joined to the sleeving and a short length of bare wire attached at the same time. In the plan these are shown as two separate points for clarity, but the two may be joined at one point to avoid unduly heating up the lead. The short lead is then taken to the heater socket of V1 as shown, and this acts as an anchoring point to prevent the screened lead from moving about. Finally, the coil unit should be placed

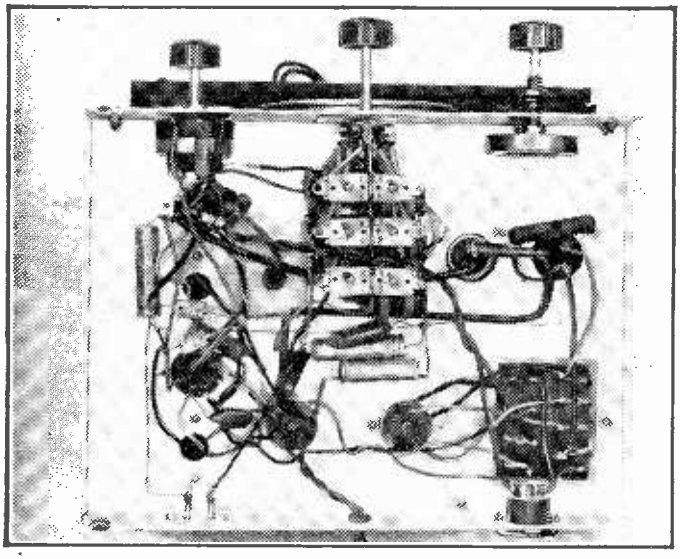
EASY TO WIRE

Another view of the receiver ready for plugging in.

in position and the locking nut tightened, taking great care not to use undue force but at the same time making certain that it cannot turn and develop an unwanted short-circuit. The wiring should now be completed, leaving the coloured leads on the coil unit exactly as they are. Do not cut them down to fit as this may upset the alignment slightly.

On the top of the chassis a short length of wire should be attached to the lug on the condenser farthest from the dial and the other end of this should be fitted with a screened top-cap connector. A similar connector should be attached to the green lead projecting from the top of IFT1. If panel lights are required a further hole should be drilled in the top of the chassis and a length of twin flex brought through this and attached to suitable bulb-holders clipped on to the dial framework at the points provided. The other ends of the flex should be taken to the nearest valveholder, preferably V1 and joined to pins 2 and 7.

When the wiring has been completed go over it to make certain that nothing has been omitted, no wrong connections made, and that there are no dry joints. It is always advisable, especially for the beginner, to scratch through the wiring on a blueprint as a wire is placed in position and this serves as a check for correctness and ensures that there are no omissions.



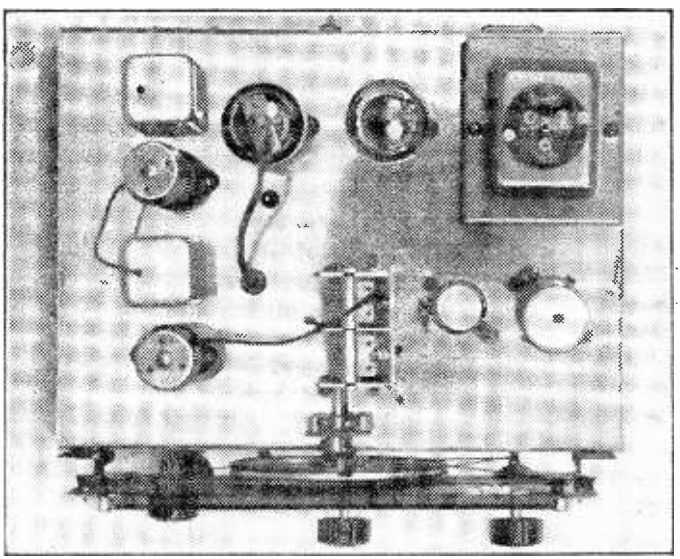
An underside view of the receiver.

Testing

When quite certain that the wiring is correct, connect the loudspeaker to the two lengths of flexible lead taken through the grommet in the rear of the chassis and plug in a lead to the mains socket. Screw the terminal which comes with the mains transformer into the hole on the paxolin disc on the top which corresponds to your mains voltage. If your particular voltage is not marked, use the socket with the nearest marking above. That is to say, if your mains are 240, use the 250 volt socket, not the 230 volt one. Attach an aerial and earth lead, plug in the valves, and turn the waveband switch to medium waves (the centre position). Set the dial to approximately your local station, and then switch on. Note that the combined volume control and switch should only be turned so that a click is heard and you should then wait for the valves to heat up. After a few moments a slight rushing should be heard from the speaker, but if a hum is heard switch off and check your wiring again. If there is no hum, but just the gentle rushing gradually turn up the volume control, at the same time turning the tuning control.

Results

The local should soon be heard and the volume control adjusted for best results. You can now tune to the short or long-wavebands and explore the various stations which may be heard in your locality, but do not be disappointed if you cannot at the first try hear dozens of short-wave stations. Climatic conditions have a great effect on short-waves, and it is possible to tune in some evening and not be able to hear a single station with the most powerful receiver.



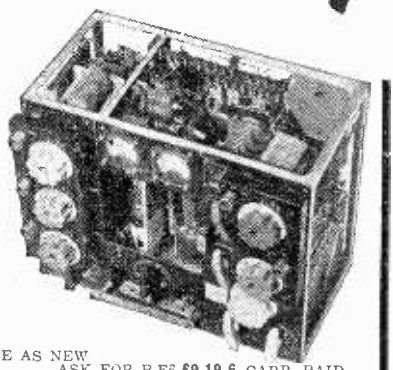
A plan showing the only wiring above chassis.

CLYDESDALE prices Slashed

T1154B TRANSMITTER UNIT

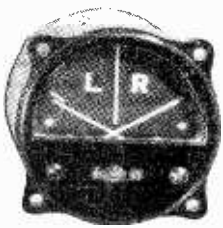
Medium High powered for C.W.-M.C.W.-R/T. 3 Ranges 10-5.5 Mc s, 5.5-3 Mc s, 500-200 kc/s. Complete with 4 valves, etc., in metal case 14 x 16½ x 8½in. External Power Supply required.

ASK FOR P/E5A **39/6** Each CARRIAGE 7 6 EXTRA
Circuit 2 3



R1155 RECEIVER UNIT

Communications. D.F. and " Ham " 20. 40, 80, 5 ranges 18-7.5 Mc s, 7.5-3 Mc s, 1.500-600 kc s, 500-200 kc s and 200-75 kc s. Complete with 10 valves, SM drive, ME tuning, BFO, etc., in metal case 16½ x 9 x 9in. External Power Supply required.



APPEARANCE AS NEW
ASK FOR P E6 **£9.19.6** CARR. PAID
APPEARANCE GOOD
ASK FOR P.H916 **£8.19.6** CARR. PAID
APPEARANCE ROUGH
ASK FOR P H898 **£5.19.6** CARR. 7 6 EXTRA
Circuit 1/3.

VISUAL INDICATOR TYPE 1. Ref. 10Q/2.

Dual reading Left Right DF meter for R1155. 2½in. Scale. Overall dim. : 3¼ x 2¼in. In used condition.

ASK FOR P.H862A **12/6** Each POST PAID

LOOP AERIAL TYPE 17 10D 16950.

NOT designed for R1155, but could be used. NO Housing, scaled 0-350 degrees. Wgt. 2½lb.

ASK FOR P/H938 **21/-** Each POST PAID

POWER UNITS for T1154/R1155 UNITS

Types 33 or 33B. Input 24v. D.C. 16 a. Output 1,200v. D.C. 200 mA.
ASK FOR P E7A.

Types 35 or 35A. Input 18 v. D.C. 12 a. Outputs 7.2 v. D.V. 13 a. and 225 v. D.C. 110 mA.
ASK FOR P.E8A.

Each a Motor Generator Unit, smoothed, etc., in metal case 16 x 7½ x 6in.

LOOSE STORED

ANY UNIT **42/6** Each CARRIAGE PAID

DINGHY TELESCOPIC MAST.

Aluminium Telescopes from 14¼in. to 7½ft. Seven sections, base dia. 1¼in., top dia. 7/16in. Wgt. 4 oz.

ASK FOR P/H489 **4/6** Each POST 6d. EXTRA

MONITOR CRYSTAL TYPE 2 10F/11390.

As used with R1116 or R1082. Less valves and Crystals, but otherwise complete ; dim. : 7½ x 5¼ x 3¼in. Plastic construction, in Transit Case.

ASK FOR P H872 **5/-** Each POST 1 - EXTRA

FLUXMETER TYPE 1. WY 0023.

Designed to determine the polarity of Magnets. Complete with probe. 3 ranges 500 1,000 gauss, 1,000 2,000 gauss, 2,000 4,000 gauss. M.C Meter and instruction leaflet. Less batt. (1.5 v.) in wood case with hinged lid and handle. Dim. : 12½ x 9 x 6in.

ASK FOR P H361 **55/-** Each CARRIAGE PAID

JEFFERSON-TRAVIS UF 2

Transceiver Chassis. (U.S.A. made) Less valves, partly stripped by the M.O.S., also less inductances, OSC connections. Original frequencies 60-75 Mc s. In black crackle cabinet 15¾ x 18¾ x 8¾in.

ASK FOR P/H518 **17/6** Each CARRIAGE PAID
Circuit 2 6.

BC-456 SPEECH MODULATOR UNITS.

Part of SCR-274-N " Command " Equipment (U.S.A. made.)

Complete with valves 1625, 1215 and VR150 30 Transformers, Relays, etc., less Dynamotor. Overall dim. : 10¼ x 7¼ x 4¼in. Loose stored.

ASK FOR P/E42 **27/6** Each CARRIAGE PAID
Circuit 1/3.

MODULATOR 169.

BRAND NEW. In original wood case. Contains :—CV7 Klystron and valves CV85, 5U4G, EF50, Metal Rectifiers, plus H.V. chokes and condensers. 80 v. 400 c s Trans. Dim. :—18 x 8½ x 7½in. Finish black.

ASK FOR P/H713 **21/-** Each CARRIAGE PAID

WS-18 RECEIVER CHASSIS

Complete with valves 3 ARP12 (VP23), AR8 (HL23DA), IF 465 kc s. Range 6-9 Mc s. (Battery operated). Chassis 8¼ x 5 x 1in. Front panel 9¼ x 5¼in.

ASK FOR P/H22 **25/-** Each POST PAID

WS-18 TRANSMITTER-RECEIVER CHASSIS.

With Carrying Case.

Comprises Receiver as above plus Transmitter Chassis, less valves, partly stripped by M.O.S., also less meter and inductances. Contained in metal carrying case dim. : 11 x 10 x 17in.

ASK FOR P H349 **33/6** Each CARRIAGE PAID

ELECTROSTATIC KILOVOLTMETER.

Range 0 2 kV. 2½in. round mld. case, drilled flange.

ASK FOR P/E333 **27/6** Each POST PAID

S-440-B VHF TRANSMITTER CHASSIS.

Part of the Stratton P40 Equipment.

Less valves, partly stripped by the M.O.S., also less Inductances and Crystal, but otherwise a good basis for reconstruction, compact size 14 x 8 x 7in. Original frequencies 85-95 Mc/s.

ASK FOR P/H517 **15/-** Each CARRIAGE PAID
Circuit 1/3.

AERIAL SYSTEM TYPE 62.

U.H.F. Antenna on streamlined moulding with VR92 (EA50) untuned detector stage. Overall dim. : 13½ x 4¼ x 2¼ Antenna 22.5 cm.

ASK FOR P/H496 **3/6** Each POST 9d. EXTRA
Circuit 1 3.

AERIAL ROD

15in. lengths, copper plated steel tube, ferruled to interlock and an Aerial of desired length.

⅜in. dia. : Ask for P/H709.
¼in. dia. : Ask for P/H710.

EITHER SIZE **5/6** Doz. Lengths POST 6d. EXTRA

REBECCA ANTENNA AN-148-N.

Also 110BB/36. (U.S.A. made.)

240 Mc/s dipole and Director with mtg. plate and support, Stand. Dakota Aircraft fitting.

ASK FOR P/H53 **3/6** Each POST 9d. EXTRA

STAINLESS STEEL AERIAL WIRE

7.015 in reels of approx. 1,600ft. made by Temco.

ASK FOR P.E143 **25/-** Per Reel CARRIAGE PAID

GYRO ANGLING POWER UNIT 9 2201.

Torpedo directional control gear unit 360 degree rotation 7 times per minute. 24 v. D.C. Electric Motor, worm drive, ball-race bearings, weather proof casing.

Could be adapted as rotating head for 2 metre and other lightweight beams. Dim. : 5 x 5 x 2½in. Wgt. 5½lb.

ASK FOR P.E874 **12/6** Each POST PAID

CALIBRATOR UNIT R.D.F. No. 1 ZA.14401.

In Original Wood Case.

Complete with valves 2/VR65 (SP61). 2/VR66 (P61), 2/VR92 (EA50) 5Z4G and VGT129 (GTK). 80 v. 400 c s Power Supply, condensers, resistors, etc. Dim. : 13 x 7½ x 9½in.

ASK FOR P/H829 **30/-** Each CARRIAGE PAID

TEST KIT TYPE 6 108/720.

British version of APN-1 Radio Altimeter Tester. Comprises FM Osc. operating on approx. 420 Mc s (using 2 955 Acorns) plus associated circuits and utilising mostly American Components, with 24 v. D.C. Dynamotor, in enclosed metal box with carrying handles and hinged lid, dim. 18 x 15 x 10½in. Less Cable, connectors and Tools.

ASK FOR P/E789A **79/6** Each CARRIAGE PAID

TEST OSCILLATOR TS-24 ARR-2.

(U.S.A. made.)

For alignment of TBX Aircraft Receivers. H.F. Osc. signal of 245 Mc s. L.F. Osc. tuned 540-830 kc s. 2 955 acorns, safety time switch, calibrated dial, etc. Complete less batteries. In metal box 9¼ x 7¼ x 7in.

ASK FOR P/H364 **49/6** Each CARRIAGE PAID

TEST OSCILLATOR TS-24A ARR-2.

(U.S.A. made)

As TS-24/ARR-2 but having additional tone modulation section, with further 955 acorn, this provides optional Audio Signal Switch controlled.

ASK FOR P/H364A **59/6** Each CARRIAGE PAID

TEST SET TYPE 102.

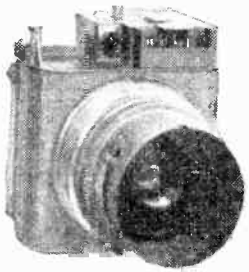
A 250 v. A.C. 50 c s Test Set emitting 25 c's and 50 c s synchronising pulses. Amplitude calibrated 0/2 a. and 1.4 watts for output lamp. Complete with valves. 6J5 and CV18 (double triode) photometer type comparator, spare lamps, output cable, etc., in steel box 11 x 9 x 10in., with carrying handle.

ASK FOR P.H561 **59/6** Each CARRIAGE PAID

F24 AIRCRAFT CAMERA, in Transit Case.

With f/4.5in. lens, focal plane shutter. Adjustable from 1/60th to 1/1,000th of a second, and time, and suitable for hand or electric use. Takes 5½in. film.

ASK FOR P/H302 **£4.19.6.** Each CARRIAGE PAID



RECORDER MK. II 24 VOLTS.

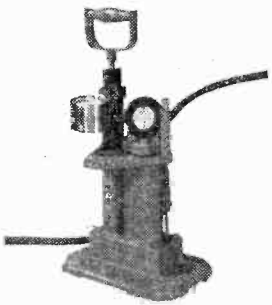
An Auto camera for 16 mm. film, operated by a 24 v. D.C. Motor 0.5 a., shutter can be set for single shot or one frame per 1 second continuously. f/4.5 lens with prism system for R/A operation through case side, Iris control and film footage Indicator, contained in Transit Case 4½ x 4 x 1 ft. Requires Cassette (not supplied) 25ft. capacity.

ASK FOR P/H883 **27/-** Each POST PAID

GUN SIGHT PROJECTOR UNIT TYPE 30.

With spiral-slide focussing. Contains 24 v. D.C. 12 w. lamp, which projects images on to an Opaque Glass screen and then on to a 45 deg. Reflector Mirror, viewed at right angles through Rubber eyepiece provided. New condition.

ASK FOR P/H882 **19/11** Each POST PAID



PUMP, DESSICATOR, for Telescopes and Binoculars.

Adm. Patt. No. 12128 made by Geo. Adlam & Sons, Bristol. A hand operated Pump, complete with spare GEL Cell, washers and two 3ft. connecting tubes. Stroke capacity 480 ccs. Humidity gauge reading from 10-100 per cent. and Vacuum gauge reading up to 30in. of vacuum. Contained in wooden transit case 19½ x 12 x 9in.

ASK FOR S/H358 **£3.10.0** Each CARRIAGE PAID

PLOTTER FIELD Mk. IV, Ref. OS.739A.

A precision-made Protractor Unit, first-class condition. With 2 scales 0-180 deg., moving crossarms, scaled 21·65 each 12½in. long. Straight edge base scaled 0-3500 length 25in. fully extended. Insoiled leather case 16 x 5½ x 2in.

ASK FOR P/H861 **9/11** Each POST PAID

BRAND NEW CANADIAN R.E.L. BINOCULARS.

Guaranteed optically perfect, having individual eye-piece focussing (dioptar setting) and variable inter-ocular setting. Magnification 6X30, with leather carrying (neck) strap.

IN ORIGINAL CARTONS.

ASK FOR P/H920 **£8.19.6** Each POST PAID

MAGNETIC MARCHING COMPASS Mk. 1.

Small hand compass. Can be used day or night. Complete with instructions in plastic case, size 3in. x 2½in. x 1in.

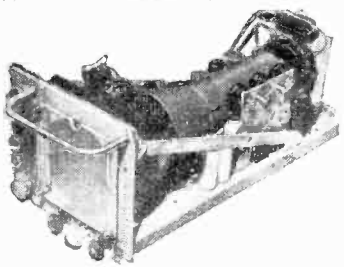
ASK FOR P/H406 **12/6** Each POST PAID

FOR INEXPENSIVE TELEVISION

INDICATOR UNIT TYPE 6H.
In Original Wood Case.

Containing VCR.97 tube and valves, etc., in metal case 18in. x 8½in. x 7½in. New condition.

ASK FOR P/E777 **89/6** Each CARRIAGE PAID



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Beginner's T.V.—

Mains Transformer...	35 - each
Smoothing Choke	15 6 each
Output Transformer	9 9 each
Crystal Diodes	5 3 each

Electrostatic Visual Section.

Mains Transformer...	27 6 each
E.H.T. Transformers... 50 - and	45 - each
Smoothing Choke	15 6 each

INDICATOR UNIT TYPE 6.
In original wood case.

Containing VCR.97 tube and valves, etc., in metal case 18in. x 8½in. x 7½in. New condition.

ASK FOR P/H521 **89/6** Each CARRIAGE PAID

INDICATOR UNIT TYPE 62.

Containing VCR.97 tube and valves, etc., in metal case 18 x 18½ x 11½ in. Used good condition.

ASK FOR P/E774 **49/6** Each CARRIAGE PAID

Receiver Unit R3601. Ref. 10DB6037. 15 valve Radar Unit, complete with all valves, etc., separate R.F. and Power sections 80 v. 400 c.s. In metal case : 18in. x 9in. x 8in.

ASK FOR P/H193 **39/6** Each CARRIAGE PAID

Argus T.V.

Mains Transformers	67 6 and 66 - each
E.H.T. Transformers	50 - and 45 - each
Smoothing Choke	15 6 each
Set of Chassis drilled for principal parts	45 - set

Economy T.V.

Mains Transformer...	60 - and 55 - each
E.H.T. Transformer	49 6 and 27 6 each
Smoothing Choke	7 6 each

Ion Trap Magnet Assembly. Mfg. Surplus. Type IT.6 by Elac for 35 mm. tube neck.

ASK FOR P/H919 **2/6** Each POST 3d. EXTRA

5CP1 CATHODE RAY TUBE
In Original Carton.

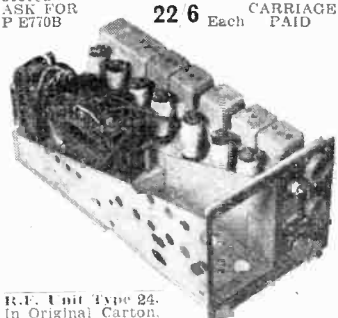
6in. Electrostatic type. Heaters 6.3 v. 0.6 a.

ASK FOR P/H529 **19/6** Each POST PAID

IF/AF AMPLIFIER UNIT R1355.

With valves. I.F. frequency 7·5 Mc/s. Dim. : 18 x 8½ x 7½in. Used, good condition (loose stored).

ASK FOR P/E770B **22/6** Each CARRIAGE PAID



R.F. Unit Type 24.
In Original Carton.
Switched tuning 20-30 Mc/s with valves, etc., in metal case, dim. : 9½ x 7½ x 4½in.

ASK FOR P/H850 **22/6** Each POST PAID

R.F. Unit type 25. In Original Carton. Switched tuning 40-50 Mc/s with valves, etc., in metal case, dim. : 9½ x 7½ x 4½in.

ASK FOR P/H847 **22/6** Each POST PAID

R.F. Unit Type 27. With broken dial. Variable Tuning 65-85 Mc/s with valves, etc., in metal case, dim. : 9½ x 7½ x 4½in. Used, good condition.

ASK FOR P/E771 **39/6** Each POST PAID

CLYDESDALE SUPPLY CO. LTD.

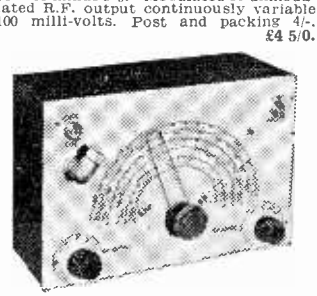
2, BRIDGE STREET - GLASGOW, C.5.

Telephone : SOUTH 2706/9

Branches in SCOTLAND, ENGLAND & NORTHERN IRELAND

CABINET as illustrated in walnut or cream, complete with T.R.F. chassis, 2 waveband scale, station names, new waveband back-plate, drum, pointer, spring, drive spindle, 3 knobs, and back. **22/6.** P. & P., 3/6.
As above, but complete with 5in. Speaker and O.P. trans. (These speakers have been used but tested O.K.) P. & P. 3/6. **30/-**
Gang with trimmers to suit above, **7/6.** Medium and long T.R.F. coils to suit, **5/6.** Three ex-Govt. valves, 3 v/h and circuit. A.C. mains, 3 valve plus rec., T.R.F. (built for approx. £4). **8/6.** Heater trans., **6/-.** Volume-control with switch, **3/6.** Wavechange switch, **2/-.** 32+32 mfd. condenser, **4/-.** Bias condenser, **1/-.** Resistor kit, **2/-.** Condenser kit, **4/-.** Metal rectifier, 250v. 100 mA., **7/6.**

COMPLETELY BUILT SIGNAL GENERATOR. Coverage 110 Kc/s-320 Kc/s., 300 Kc/s-900 Kc/s., 900 Kc/s-2.75 Mc/s., 2.75 Mc/s-8.5 Mc/s., 8.5 Mc/s.-25 Mc/s., 17 Mc/s.-50 Mc/s., 25.5 Mc/s.-75 Mc/s. Metal case 10 x 6½ x 4½in., size of scale 6½ x 3½in., 2 valves and rectifier, A.C. mains 230 250 v. Internal modulation 400 c.p.s. to a depth of 30%. Frequency calibration accuracy plus or minus 1%. Modulated or unmodulated R.F. output continuously variable 100 milli-volts. Post and packing 4/-. **£4 5/0.**



MAINS TRANSFORMERS

Primary, 200-250 v. P. & P. 2/-.
400-0-400 250 mA., 4 v. C.T., 3 a., 4 times. Unclamped, **32/6.**
300-0-300, 100 mA., 6 volt 3 amp., 5 volt 2 amp., **22/6.**
Drop thro' 350-0-350 v. 70 mA., 6 v. 2.5 amp., 5 v. 2 amp., **14/6.**
Drop thro' 250-0-250 v. 80 mA., 6 v. 3 amp., 5 v. 2 amp., **14/6.**
Drop thro' 110-110 60 mA., 6 v. 0.5 amp., **8/6.**
280-0-280, drop-through, 80 mA., 6 v. 3 amp., 5 v. 2 amp., **14/6.**
Auto-wound, H.T. 280 volts at 360 mA., 4 v. 3 amp., 2 v. 3 amp., or 6 v., 3 amp. Separate 4 v. 3 amp., **10/6.**
Auto-transformer, 110 v. 70 watts, **10/6.**
250-0-250 80 mA. 6 v. 4 amp., **14/-.** Pri. 230 v. Sec. 200-0-200 35 mA., 6 v. 1 amp., **8/6.**
Pri. 200/250 v., secondary 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volt at 2 amps., **13/-.**
Semi-shrouded drop-thro' 280-0-280, 200 mA., 6 v. 5 amps., 5 v. 3 amps., **27/6.**
Semi-shrouded drop thro', 270-0-270, 80 mA., 6 v. 3 amp., 4 v. 1.5 amp., **13/6.**
Semi-shrouded drop thro', 270-0-270 60 mA., 6 v. 3 amp., **11/6.**
Heater Transformer. Pri. 230-250 v. 6 v. 1½ amp., **6/-** ; 2 v. 2½ amp., 5/-. 2 4 or 6 v. at 2 amps., **7/6** ; 2 v. 2½ amp. and 6 v. 0.6 amp. E.H.T. insulated, **8/6.** P. & P. each 1/-.
800-0-800 250 mA., 4 v. 2 amp., **27/6.** P. & P. 5/-.
R.I. MAINS TRANSFORMERS, chassis mounting, feet and voltage panel. Primaries 200/250.
300-0-300 60 mA. 6.3 v. 1 a., tapped at 4 v. 6.3 v. 2 a. tap 4 v., **13/6.**
350-0-350 75 mA. 6.3 v. 3 a. tap 4 v. 6.3 v. 1 a., **13/6.**
350-0-350 120 mA. 6.3 v. 3 a. tap 4 v., 5 v. 2 a. tap 4 v., **25/-.**
350-0-350 70 mA. 4 v. 5 a. 4 v. 2.5 a., C.T., **18/6.** P. & P. on the above transformers 2/-.
500-0-500 125 mA. 6.3 v. C.T. 4 a. 6.3 v. C.T. 2 a. 5 v. C.T. 2 a., **27/6.**
500-0-500 120 mA. 4 v. C.T. 4 a., 4 v. C.T. 4 a. 4 v. C.T. 2.5 a., **27/6.**
500-0-500 250 mA. 4 v. C.T. 5 a. 4 v. C.T. 5 a. 4 v. C.T. 4 a., **39/6.**
500-0-500 250 mA. 6.3 v. C.T. 4 a. 6.3 v. C.T. 3 a. 5 v. C.T. 3 a., **39/6.** P. & P. on the above transformers 3/-.

32 mfd., 350 wkg.	2/-
16 x 24 350 wkg.	4/-
4 mfd., 200 wkg.	1/3
40 mfd., 450 wkg.	3/6
16 x 8 mfd., 500 wkg.	4/6
16 x 16 mfd., 500 wkg.	5/9
8 x 16 mfd., 450 wkg.	3/9
32 x 32 mfd., 350 wkg.	4/-
32 x 32 mfd., 350 wkg. and 25 mfd., 25 wkg.	6/6
25 mfd., 25 wkg.	11d.
250 mfd., 12 v. wkg.	1/-
16 mfd., 500 wkg., wire ends	3/3
8 mfd., 500 v. wkg., wire ends	2/6
8 mfd., 350 v. wkg., tag ends	1/6
50 mfd., 25 v. wkg., wire ends	1/9
100 mfd. 350 wkg.	4/-
100+200 mfd., 350 wkg.	9/6
16+16 mfd. 350 wkg.	3/3
Ex-Govt. 8 mfd. 500 v. wkg., size 3½ x 1½, 2 for	2/6
60+100 mfd., 280 v. wkg.	7/-
16 x 32 mfd., 350 wkg.	6/-
50 mfd., 180 wkg.	1/9
65 mfd., 220 wkg.	1/6
8 mfd., 150 wkg.	1/6
60+100 mfd., 280 wkg.	8/6
50 mfd., 12 wkg.	11d.
32+32 mfd., min., 275 wkg.	4/-
50 mfd., 50 wkg. 8 mfd., wkg., wire ends	1/9
Miniature wire ends moulded 100 pf., 500 pf., and .001 ea.	7d.

CONSTRUCTOR'S PARCEL, comprising chassis 12½ x 8 x 2in., cad. plated 18 gauge, v/h., IF and trans. cut-outs, back-plate, 2 supporting brackets, 3 waveband scale, new wavelength station names. Size of scale 11½ x 4½in., drive spindle, drum, 2 pulleys, pointer, 2 bulb holders, 5 paxolin international octal valve holders, 4 knobs, and pair of 465 IFs, **16/6.** P. & P. 1/9.
AS ABOVE, but complete with 16+16 mfd. 350 wkg. and semi-shrouded drop thro' 250-0-250 60 m/a. 6 v. 3 amp. Pri. 200-250, and twin-gang, **31/6.** P. & P. 3/-.
EX-GOVT. RECEIVER TYPE B28. Complete coil unit, 6 bands, 60 kc/s., 420 kc/s. 500 kc/s.-30 Mc/s., **21/-.** Plus 2/- P. & P. Circuit for above, **4/-.**
Variable selectivity IF Switch to suit above, **7/6. 465 Kc. I.F.'s** to suit above, type 3, 4 and 5, 5/- ea. **IF12** incorporating 465 Kc/s Xtal, **19/6. BFO, 7/6. Special 4-gang,** to suit, **15/-.**
R. & A. 8in. M.E. Speaker field coil, 1,600 ohms O.P. trans. 5,000 ohms, imp. **18/6.** P. and P. 2/-.
5in. M.E. field coil 750 ohms with O.P. trans., **17/6.** P. and P. 1/-.
Constructor's Parcel, comprising chassis 8in. x 4in. x 1½in., with speaker and valveholder cut-outs. 5in. P.M. speaker with transformer, twin gang with trimmers, pair T.R.F. coils long and medium, iron cored, four valveholders, 20 K. volume control and wave-change switch, **23/-.** Post and packing, 1/6.
Germanium crystal diode, 2/3, post paid.

PERSONAL PORTABLE CABINET in cream-coloured plastic, size 7 x 4½ x 3in. Complete 4-valve chassis. Scale and 3 knobs. Takes miniature 90 v. and 7½ v. batteries. **9/-.** P. & P. 1/6.
3in. P.M. SPEAKER to fit above, **10/-.** Miniature output transformer, **5/-.** Miniature wavechange switch, **1/6.** Miniature 1-pole 4-way used as Volume and Off, **1/6.** 4 B7G valveholders, **2/4.** Midget twin gang 4in. dia., 2in. long and pair medium and long-wave T.R.F. coils 2in. long x 2in. wide ; complete with 4-valve all-dry mains and battery circuit, **8/6.** Condenser Kit, comprising 11 miniature condensers, **3/6.** Resistor Kit, comprising 15 miniature resistors, **10/-.** The above receiver (less valves and batteries) could be built for approximately **51/-.** P. and P. 2/6. Valves to suit above **10/-** ea. Point to Point Wiring Diagram, **1/-.**

View of chassis as it would look when assembled with valves inserted.

Extension speaker cabinet, in contrasting walnut veneers, size 15 x 10½in. Will take 6½ or 8in. speaker. **17/6.** P. and P. 2/-.
Volume Controls. Long spindle less switch, 50K, 500K, 1 meg., **2/6** each. P. and P. 3d. each.
Expanded aluminium speaker fret, 13½ x 9in., **2/-.**
Volume Controls. Long spindle and switch, ¼, ½, 1 and 2 meg., **4/-** each ; 10 K. and 50 K., **3/6** each. ¼ and 1 meg., long spindle double pole switch, miniature, **5/-.** P. and P. 3d. each.
Standard Wave-change Switches, 6-pole 3-way, **2/-** ; 4-pole 3-way, **1/9**; 5-pole 3-way, **1/9.** Miniature 3-pole 4-way, 2-pole 5-way, 4-pole 3-way, **2/6.**
Valveholders. Paxolin octal, **4d.** Moulded octal, **7d.** EF50 ceramic, **7d.** Moulded B7G **7d.** Loctal amphenol, **7d.** Loctal pax., **4d.** Mazda Amph., **7d.** Mazda pax., **4d.** B8A, B9A amphenol, **7d.** B7G with screening can, **1/6.**
Trimmers, 5-40 pf., **5d.** ; 10-110, 10-250, 10-450 pf., **10d.**
Twin-gang .0005 Tuning Condensers, 5/-. With trimmers, **7/6.**
Midget .00037 dust cover and trimmers, **8/6.**

P.M. SPEAKERS	with trans.	less trans.
2½in.		15/6
3½in.		13/6
5in.	16/6	12/6
6½in.	16/6	12/6
8in.	18/6	15/-
10in.		19/6

Post and packing on each of the above, 1/6 extra.
Crystal pick-up with Sapphire Trailer Needle, with volume control, **23/-.** P. and P. 1/-.

Terms of business : Cash with order. Dispatch of goods within three days from receipt of order. Where post and packing charge is not stated, please add 1/- up to 10/-, 1/6 up to £1 and 2/- up to £2. All enquiries and list, stamped addressed envelope.

My 21 Years as Editor

1932 By F. J. Camm 1953

AS in the case of human beings, so with a periodical, the completion of 21 years of existence is considered an occasion for celebration. It "comes of age." It provides me with an opportunity of dispensing with the editorial "we" and adopting the style of personal narrative—also with an opportunity for retrospection.

The years slip past unnoticed, and it scarcely seems possible that 21 years have elapsed since I passed the proofs of the first issue, which was published on September 24th, 1932. During those 21 years I have had little time for reflection or retrospection, but now that I can relax for a moment I can look back with justifiable pride on 21 years of successful achievement.

A glance at the bookshelves in my office provides reminders of my output during that time. I recall a comment made by the editor of a well-known encyclopaedia when the first bound copies of his work were placed on his desk: "Did I *really* produce all that?" For in those 21 years I have written over 21,000,000 words, and probably far more, in the form of articles and books. This represents an output of over 20,000 words a week, apart from the work of make-up, proof-reading, arranging exhibitions, lectures, and the other general work associated with the work of an editor.

It is evident, therefore, that I have "shunned delight and lived laborious days," but they have been pleasant days. I have made a hobby of work. I believe in it, and I do not like holidays. I believe that "the best of all ways to lengthen your days is to steal a few hours from the night." I have devoted all of those 21 years with energy and enthusiasm to this and our associated journals, and I have not spared myself. The task has been enjoyable, and an unquenchable enthusiasm has provided the driving force. Work does not kill!

There has been no five-day week for me. I believe in work in large doses, undeterred by the brake which to-day is placed upon individual effort by our present system of crushing taxation. Money to me is not a prime reward. The success which has attended my efforts and the knowledge that the work has been appreciated by tens of thousands of readers all over the world has acted as a spur and provided a reward in itself.

I mentally visualise from my office the hundreds of thousands of readers depending upon my journals for help and guidance, and a strong sense of duty is within me to serve them. Fortunately I have been able to meet many thousands of them at exhibitions, at my lectures, and when visiting local clubs. I have found discussions with readers of great value in deciding what material to publish.

I mention these facts because in the hundreds of congratulatory letters I receive from readers and from leading members of the trade many have expressed astonishment that so much could have emanated from one man. I do not employ ghosts. Work bearing my signature is my own.

Many also have expressed surprise that one man could write on so many subjects. I suffer the penalty of versatility. My interests have always been wide; I have been associated with so many developments behind the scenes and with most of the famous names in radio, television, engineering and aviation all my life. As an engineer by education and training, I have been in the fortunate position of being asked to witness highly technical demonstrations which would not be comprehended by the usual non-technical journalist.

It has been part of my job to write for the man who does not know, and to convert highly technical matters into simple language. I am told by readers that the success of my journals is due in the main to that gift.

In the space of 21 years I have founded not only PRACTICAL WIRELESS, but several journals in other technical fields—the *Practical Motorist*, *The Cyclist*, *Practical Mechanics*, *Practical Television* and *Practical Engineering*. During the same span of time I have produced over 80 books, most of which have run through several editions, and are still in print, many having been translated into many other languages.

My large output could not be achieved by handwriting alone. Most of it is dictated and is typed as I talk; some is taken down in shorthand, some recorded on tape or wire, and only a small proportion written by hand. The latter is mathematical matter which defies the grammalogues of Mr. Pitman and even the skill of my expert stenographers.

Elsewhere in this issue I have summarised the history of PRACTICAL WIRELESS and the large number

Mr. W. J. DELANEY, Assistant Editor from the first issue.

of developments and innovations for which it has been responsible. It is quite a formidable catalogue ; we set a very high standard in radio journalism.

In 1932 there were a large number of weekly and monthly periodicals with a 10 years' start. It was a plucky enterprise for the publishers to embark on yet another and to storm the citadel which its competitors had so well fortified—especially at a time when it was considered that the constructors' market was waning.

Having been associated with the very first radio journal I was certain that the market was there but that it needed revivifying. I considered that if the market was to be kept alive and this vast national interest sustained an entirely new editorial policy was necessary. The trade at that time was not too happy about some editorial policies, and before publication I went to some trouble to see what the grievances were among the amateurs and manufacturers. As a result, the solus specification, one of the main planks in this journal's platform, was born, and it has been wholeheartedly supported by constructors and the trade. The journal was launched with a free blueprint—the "Long Range Express Three"—which set a new standard in set construction. The usual baseboard was replaced with a metal chassis so that the finished receiver had a professional appearance.

The journal in those days had yet to prove itself, but the first issue listed only one manufacturer for each item in the specification—a policy which has been adhered to ever since. Manufacturers as well as readers rallied round the PRACTICAL WIRELESS banner until finally, as everyone now knows, most of our competitors ceased publication. We backed our receivers by a free advice guarantee, and instituted also a Free Advisory Service.

In the early days of this journal there were some firms whose goods and methods had given cause for complaint. Some misrepresented them, others were slow in delivery, and a few were positively dishonest. This journal, therefore, embarked upon a cleaning up campaign. We assured ourselves that the firms advertising in this journal were not only firms of integrity but that the goods they offered were immediately available. We are behind our readers and on the odd occasion when a mild complaint is received we have always been able to obtain satisfaction for the readers concerned.

I made it a rigid condition that no components would be specified nor receiver described until each had been thoroughly tested in our own laboratory. That is why all PRACTICAL WIRELESS receivers have given so many years of faithful service. Dozens of our early receivers, such as the "Fury Four" are still in use, as I know from correspondence.

I have always believed in a forthright style of editorial comment. Where criticism was necessary I made it, without obscuring the comment in tangled verbiage or honeyed words. I successfully campaigned on a number of important issues on behalf of our readers, and brought about changes in design and the production of new components more in keeping with the times and the trends.

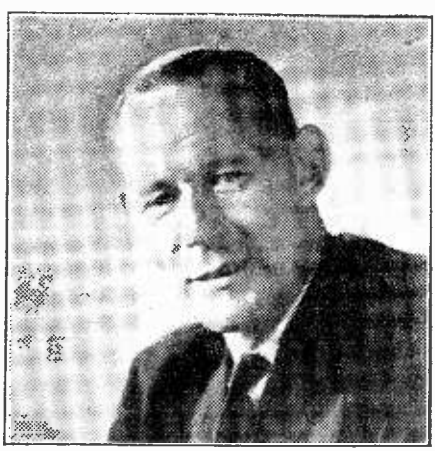
It has not been given to many editors to be backed by a firm such as George Newnes Limited, who share and back my enthusiasm, nor to be served by such a loyal staff who have always been prepared to work such hours as the exigencies of the job demand. A special word of praise for my assistant, Mr. W. J. Delaney, who has worked with me from the very foundation of the journal ; and to my Advertisement Manager, Mr. R. D. Young, and his assistant, Mr. Ashley W. Clarke, for the production of a journal is a co-operative effort—it cannot succeed on the work of one man alone.

Radio has given birth to a number of allied sciences such as electronic musical instruments, wire and tape recording, and radar. Readers will have noticed that these new applications have been dealt with promptly in this journal.

Formerly television was dealt with in a four-page supplement, but it was found impossible to deal adequately with the subject in such a confined space. Therefore, in 1950 I started our sister journal, *Practical Television*, the only journal entirely devoted to the technical side of television.

It is pleasant to be able to record that PRACTICAL WIRELESS is in a stronger position than ever before, and that its readership continues to expand.

And now back to my desk ! F. J. C.



Mr. R. D. YOUNG, Advertisement Manager.

The MINI AMP

By R. Hindle

A VERSATILE MINIATURE AMPLIFIER AND ITS USE AS A BABY ALARM OR INTERCOM. SET

THE present design began as an experiment in audio amplifier miniaturisation to test the high gains theoretically practicable using modern small valves in a compact layout, and finished up as a baby alarm permitting transmission in either direction. The practicability of high gains in a small space has been proved beyond doubt, and the basic amplifier to be described will be found of value in many applications in addition to that to which the prototype was turned. As an amplifier for a portable gramophone player, for instance, it is very suitable.

A glance through the current valve lists shows that the Brimar 6BR7, a pentode on a B9A (noval) base, will give a voltage gain of 185 times with suitable circuit constants. This valve is designed especially for audio amplification where a minimum of noise, hum and microphony is required in a high gain circuit intended to handle small inputs. This is all very good, but attention then strayed to the characteristics of the 6AU6 valve which, according to the Brimar lists, can give an amplification of 320 times in a suitable circuit. This valve is designed for R.F. rather than audio amplification and so it seemed possible that it would be more prone to microphony or noise than the 6BR7, but in view of the aim of high gain in the work being undertaken the 6AU6 was adopted. The finished amplifier proved entirely satisfactory and gave no sign of trouble in spite of the closeness of the speaker to the amplifier and in spite also of deliberate attempts to induce microphony. There was the possibility that a particularly good specimen of valve was being used, of course, and to see if this was so three different specimens of the 6AU6 were tried and all found to be above reproach. No difficulty should be experienced, therefore, by any constructor of this amplifier who keeps to the recommended circuit and layout.

Basic Amplifier

The basic circuit of the amplifier is given in Fig. 1. It is a quite orthodox two-valve circuit, resistance capacity coupled and using a pentode and output tetrode. The first valve, as stated above, is a 6AU6 in a high-gain circuit. The second valve is also a miniature, actually a 6AQ5 output tetrode. Both valves have the small B7G base, but in spite of its small size the 6AQ5 has characteristics similar to the well-known octal 6V6 and is capable of giving 4.5 watts for 250 volts H.T., its maximum rating.

A secondary, but important, aim when designing the amplifier was cheapness, an aim that will be appreciated by most readers as much as by the designer, and this was very much in mind when considering the power supply. For greatest versatility it was decided that the amplifier should be built on a chassis separate from the power supply. It is much easier to tuck away two small chassis in a small cabinet than one larger one and it confers the additional advantage that the amplifier design can be followed by the reader who can then proceed to work it from any type of power pack that he has a mind to put together. A special power pack was designed, however, to fit on a chassis no larger than the miniature amplifier so as to take the minimum of space.

A.C. operation only was contemplated for the power-pack design and, therefore, in order to avoid the need for voltage droppers, the amplifier valve heaters were connected in parallel and supplied from a transformer. No doubt if any reader wishing to build the amplifier has to work on D.C. he will be inclined to connect the heaters in series (with a resistor across the heater of V1) and use a voltage dropper instead of the transformer. However, having decided on a transformer in the present case for heaters, two possibilities for H.T. presented themselves. Either the transformer used could have an H.T. winding and ordinary A.C. technique could be employed or alternatively a heater transformer could be used and universal technique applied. A heater transformer can be obtained very cheaply capable of giving the .75 amps required and moreover such a component is generally very small in size, which is satisfactory in view of the aim towards miniaturisation, whereas a component with a high

LIST OF COMPONENTS

C1, 5, 6—8 μF electrolytic, 450 volts wkg. Dubilier type BR850
C2, 4—25 μF electrolytic, 25 volts wkg. Dubilier type BR252A.
C3—.01 μF 250 volts. Dubilier type 410
Cin—.05 μF 500 volts. Dubilier type 460.
R1—1 MΩ
R2—470 KΩ
R3—1,500 Ω
R4—½ MΩ
R5—270 Ω
} all ½ watt. Dubilier type BTS.
R6, 7—20 Ω ½ watt. Dubilier type BWF2 wire wound.
Sw. 1—Bulgin type S246 2-pole on/off rotary.
Sw. 2—Wafer type 4-pole 2-way rotary.
T1—Miniature output. Tfmr. type for 3S4 valve.
T2—Miniature output. Tfmr. ratio 42 : 1 for 50 mA.
T3—Miniature heater. Tfmr., giving 6.3 volts at 1 amp.
Ch.—Miniature smoothing choke for 50 mA.
V1—Brimar 6AU6.
V2—Brimar 6AQ5.
MR—Brimar DRM1B.

tension winding is more expensive and is generally much more bulky. For this reason, therefore, the universal technique was employed. The primary of the heater transformer is employed as a step-up auto transformer in locations where low A.C. voltages are in use by connecting the H.T. rectifier to one of the extreme ends of the winding, the other end going to earth as usual and the mains input going to the tags appropriate to the voltage of the power supply. For instance, the component used in the prototype had primary connections marked "common," "200V," "220V" and "240V." The "common" lead was connected to earth and to one side of the mains whilst the rectifier was connected to the "240V" lead. The power supply available was at 200 volts only and so the other side of the mains was connected to the "200V" lead, thus stepping it up to 240 volts for the H.T. circuit. Some miniature heater transformers have no primary tappings, being specially wound for the most common range of mains voltages (230/250 volts) and in these cases no step-up is practicable.

valve of reasonable size is used, voltage drop is avoided by using a miniature smoothing choke together with two 8 μF electrolytic condensers. No difficulty was experienced in fitting this in the space allotted on the small chassis. There is an advantage in using a half-wave rectifier for a circuit such as this, quite apart from the question of convenience from which aspect its use has been justified above. It results in the hum content in the H.T. supply, which is inevitable in spite of the smoothing, having a frequency of 50 cycles. Admittedly, this is less effectively smoothed by components of a given size, but the miniature speaker and cabinet used for this equipment is a far less efficient reproducer of such a frequency than of the full-wave hum frequency of 100 cycles and this factor helps the smoothing. It is possible, also, to reduce still further the hum, where such a move is found desirable, by introducing deliberately a hum potential of similar amplitude but of opposite phase and when the hum content of the output is at the mains frequency all that is necessary is to pick up a voltage direct from the

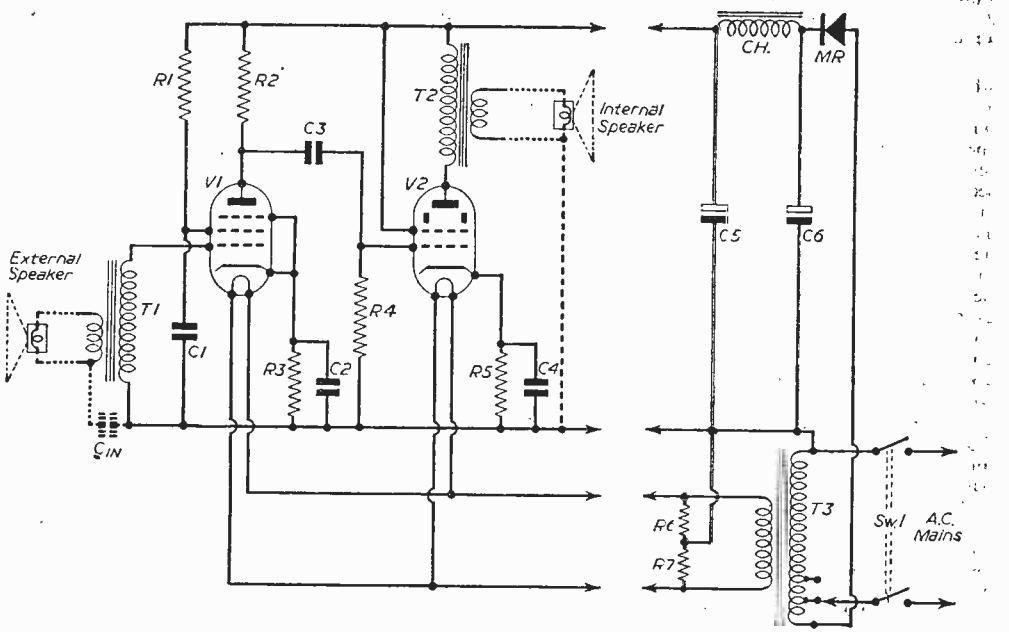


Fig. 1.—The basic amplifier circuit. Dotted lines show additions required to complete the baby alarm.

Having decided not to use a transformer with an H.T. winding half-wave rectification is essential. A valve could be used, and very suitable miniatures are available. In fact, probably a valve on a miniature base is the most economical of space and the modern types can be used from the same heater winding as the other valves. The selenium type of rectifier is very convenient for this type of circuit, however, and quite reasonably small so it was adopted for the present design. It fits in quite well with the secondary requirement of cheapness, too. The Brimar model DRM1B was used and its rated 60 mA output is adequate for the two valves used.

Smoothing in simple circuits is often done by means of a series resistor in conjunction with the usual capacitors, but in the present case, as an output

mains source. There is the complication of phase-shifting which prevents this measure from being 100 per cent. effective and more will be said about this later. In the first prototype, however, the hum level, though apparent to the ear when no signals were being conveyed, was not annoying, and no such measures were introduced. The precaution was taken, as will be seen from Fig. 1, of earthing a centre-point instead of one side of the heater supply. If a tap is provided on the heater transformer to be used this should be connected to earth and the resistors R6, R7 will not then be required. The transformer used for the prototype had no such tapping, however, and the two equal resistors, R6, R7 provide an artificial tap. This method of connection is of use also if the exceptional measure of deliberately

introducing an out-phased hum potential mentioned above is employed, because, as shown later, it permits the selection of the correct phase of input hum.

The output transformer, T2, must be small if the completed amplifier is to be no bigger than the prototype but, of course, it has to carry the full H.T. current of a mains output valve, the 6AQ5 taking 45 mA. at 250 volts. One is apt to forget this when first working with mains miniatures. Consequently the very tiny output transformers made for battery working are unsuitable. Suitable components are quite easily obtainable, however. A fixed ratio component, or one without a tagboard, is preferable both from the point of view of space and, in the case of the circuit for two-way communication shortly to be described, to avoid undesirable coupling to the input, but actually a transformer with a tagboard and with alternative ratios was used for one of the two models that have been built and no difficulty was experienced in setting it up. The ratio is fairly critical for best results; the optimum load is 5,000 ohms so for the usual type of speaker (a 3½in. P.M. type is used) with 3 ohm speech coil a ratio of 40 or 42 : 1 is required.

The input circuit will depend on the purpose to which the amplifier is to be put. The prototype, used as an intercom. set, required a microphone input, but the microphone had to be suitable to act as a speaker when switched for communication in the reverse direction. The obvious choice was for a second P.M. speaker and in fact another 3½in. unit in a small plastic case was used. The reader could avoid the provision of the second speaker if he so desired and if a suitable speaker was already installed in the room with which communication was required, perhaps in a receiver at that point or perhaps an extension speaker already in use there. A separate speaker is a convenience, however, because the communications equipment can then be moved about at will and many uses in different situations will be found.

A transformer is required to step up the input from the microphone to V1, and here one of the miniature output transformers made to match the battery valve type 3S4 to 3 ohms was found ideal.

Precautions have to be taken, in view of the connection of one side of the mains supply to the chassis, to avoid the connection of any component external to the amplifier cabinet direct to the earth line. The dotted line circuit addition to Fig. 1 will illustrate the simplest way to make the amplifier into a baby alarm at the same time as showing how the precautions should be taken. The internal speaker is inside the cabinet and it was found desirable to earth one side as shown, but it is well out of harm's way. Probably, if this speaker was away from the amplifier chassis, no earth connection would be found necessary. On the input side the external speaker, which acts as a microphone, is also isolated by means of a transformer, though it was found desirable to tie one side to earth. To avoid a direct connection, however, a condenser Cin was used. This should not exceed .05μF and actually .01μF was used. This component should be of at least 450 volts working and if there is any doubt as to the insulation of the components to hand it will be better to use two condensers, each of .02 μF, in series. The extension lead is at low impedance and if it is to be long a type of cable with a reasonably low resistance should be employed. The virtue of a low impedance feed is, of course, that it is far less prone to hum or interference pick-up. A lightweight twin mains flex with PVC transparent insulation was used here and the 12 yards required had no undesirable effect; no doubt it could be much longer if necessary.

Two-way Communication

Fig. 2 gives the addition to the basic circuit of Fig. 1 actually used in the prototype amplifiers to give two-way communication. Duplex working, i.e., both ends talking at once, is not provided; the control switch in the master cabinet housing the amplifier determines the direction in which speech will be transmitted. This is very desirable, of course, because the instrument is still to be used as a baby alarm amongst its other duties and it is obviously undesirable to have the baby listening-in to all the noises and conversation at the other end! But if the baby should awaken the instrument can be switched over and words of condolence can be spoken whilst someone hastens to the offspring's aid.

It will be seen that a four-pole two-way switch is used. A wafer type is employed because low capacity is essential to prevent feedback. Not so much trouble as might be expected when bringing output so near to input is experienced because the switching is done at the low impedance side of the transformers. All the leads to the switch, including the connections between switch contacts, were of fine screened cable as used for pick-up connections and the amplifier was rock stable. The input and

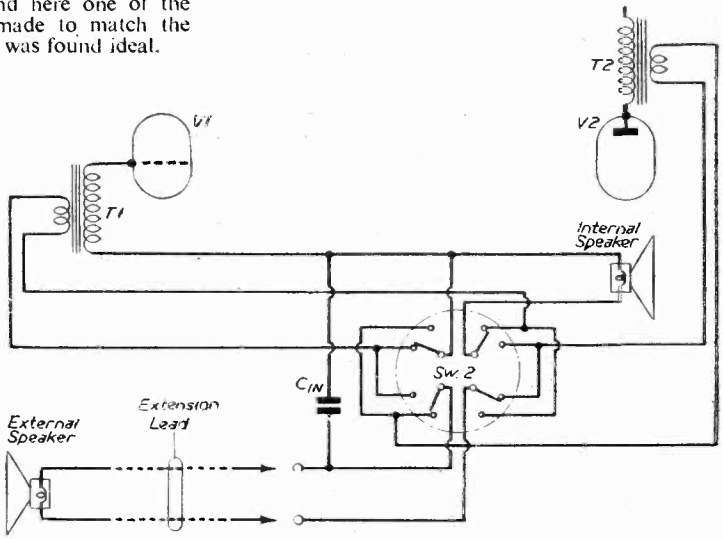


Fig. 2.—Additional wiring required for a two-way intercom. system.

output earthing no longer goes to the transformers but instead is to the side of the switch nearest to the speaker units as shown so that the internal speaker is always earthed direct whether it is used for reproduction or as a microphone, whilst the external wiring is always earthed via Cin. Both sides of each speaker are switched so that twin screened leads can be used, still further reducing the risk of feedback. Actually, a switch with the necessary 4-pole 2-way contacts was not available so a 4-pole 3-way switch, such as is easily obtained, was used and the switch arm was prevented from moving to the third and unused position by adding a stop to the switch baseplate.

If a pick-up is to be used with the amplifier the constructor will have to be guided by the maker of the particular pick-up to be used. A transformer may still be required, but if the pick-up is suitable for direct connection to the grid Fig. 3 shows the precautions necessary. C7, C8 isolate the pick-up from the mains and could be .02 to .05 μF each. Across the pick-up itself should be any resistance that may be recommended by the pick-up maker and

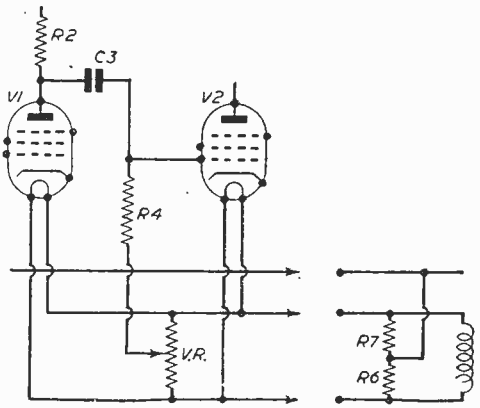


Fig. 4.—Method of cancelling hum.

R8 has to be introduced to complete the D.C. path of the grid of V1. In this case a volume control will probably be required and had been introduced in Fig. 3 in place of the fixed resistor R4 of Fig. 1.

It may be as well to point out here that no volume control has been introduced into the circuit of Fig. 1 because for the purpose for which it is used full gain is always required and, when speaking into the unit in use as a microphone, there was found to be a remarkable tolerance in the volume of sound into the microphone for satisfactory reproduction. With the microphone at one corner of a room of rather more than average size, conversation carried out in a quiet voice at the furthest corner of the room was clearly transmitted, and even the conversation of pedestrians passing outside was picked up, though one could speak in a moderate voice quite near to the unit without blasting. If a volume control is desired for any purpose that in Fig. 3 could be adopted.

Construction

The prototypes, two have been built already to this design with success, were designed to fit, power pack, amplifier and speaker, into one of the cabinets produced by Tallons originally to house the Mini-four receiver. This is a very convenient size and type of cabinet which is easily available still but which called for a very compact design. The photo-

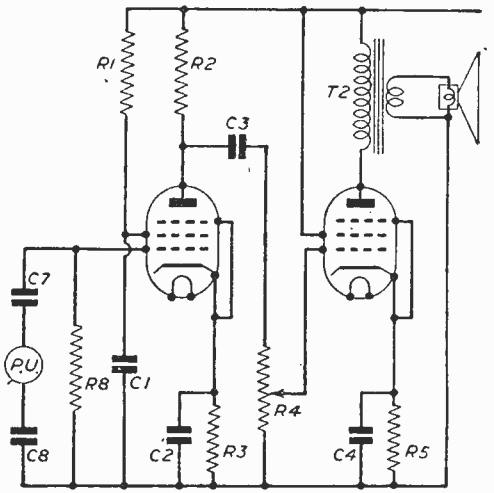


Fig. 3.—Amplifier modification required for use as record-player.

graphs and drawings will show how this was achieved. The circuit used, as previously mentioned was that of Fig. 1, without volume control, but with the addition of the switching given in Fig. 2 to allow two-way communication.

A double-decker chassis was made up from sheet aluminium in the form indicated in Fig. 5.

(To be Continued).

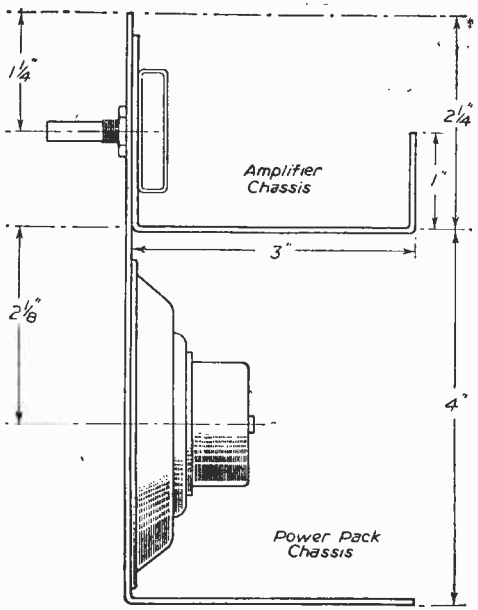


Fig. 5.—Method of constructing the chassis.

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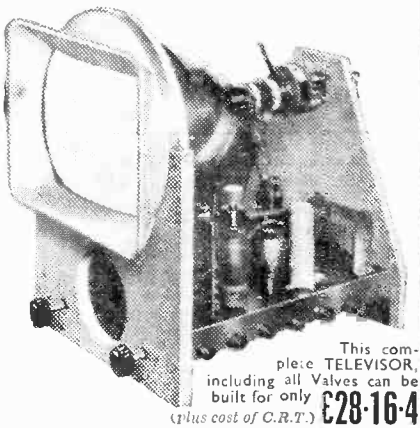

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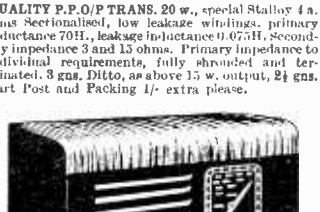

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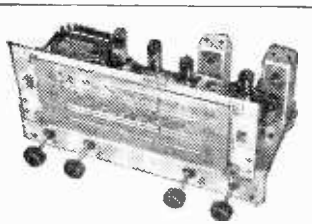

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6G6	6/6	12AX7	10.6	EC91	7/6	VR116	6/6
6H6	3/6	12K7	10/6	EF36	7/6	ECL80	12/6
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50/50 v T.C.C,	2/-	in same can B.E.C.,	6/6

SENTERCEL RECTIFIERS.
E.H.T. TYPE.—K3/25 2Kv.. 4/3 ; K3/40 3.2Kv. 6/- ; K3/45 3.6Kv., 6/6 ; K3/50 4Kv. 7/3 ; K3/100 8Kv., 12/6 ; K3/160, 18/-.

MAINS TYPE.—RM1. 125 v.. 60 ma.. 4/- ; RM2 100 ma., 4.9 ; RM3, 120 ma., 5/9 ; RM4 250 v. 275 ma., 16/-.

KNOBS, GOLD ENGRAVED.—Walnut or Ivory 1¼in. diam., 1.6 each. "Focus," "Contrast," "Brilliance," "Brilliance—On-Off." "On-Off." "Volume," "Vol.—On-off," "Tone," "Tuning," "Treble," "Bass" "Wavechange," "Radio-Gram," "S., M., L., Gram.," "Record-Play," "Brightness," Ditto not engraved. 1/- each.

COILS.—Wearite "P" type, 2 6 each. Midget "Q" type, adjustable dust core, 3,6 each. All ranges.

REACTION COND.—.0001, .0005, .0005 m.d., 3/6 ea.

AIR SPACED VARIABLE COND.—High quality 10pf, 1/9. 20pf. 2/3. 30pf. 2/9.

SURPLUS MAINS TRANS.—Prim. 0-200/250 v Sec. 275-0-275 v., 60 ma. 6.3 v. 3 a., 6.3 v 1 a., 10/6 ; ditto, 260-0-260 v. 80 ma., 6.3 v. 3 a., 6.3 v. 1 a., 12.6. Oscilloscope Transf. Prim. 0-230 v. Sec. 800 v. 15 ma., 5 v 2a., 5 v. 2 a., 4 v. 1 a., 17.6 P.P. all Transf. 1/-.

BATTERY CHARGER.—200/250 v. Output 6 v. and 12 v. 1½ amps., in steel case complete with fuse and leads, ready for use. OUR OWN MAKE FULLY GUARANTEED, 35/-, P. & P. 1/-.

CHARGER TRANSFORMER.—0-200/250 prim sec. 0,9, 15 v. 1½ amp., 13/6.

G.E.C. FULL WAVE BRIDGE TYPE RECTIFIER —6 or 12 v. D.C. 1½ amp , 8/9. S T.C. ditto 4 amp. 13/6.

C.R.T. HEATER ISOLATION TRANSFORMER.—Low leakage windings with 15% sec. boost, 2 v., 9/6 ; 4 v., 10/- ; 6.3 v., 10/6 ; 13 v., 11/-. .3a series type for 6.3v. .3a. tubes 10/6.

FUSES.—1¼in. all values 60 ma. to 15 a., 6d.

H.F. MIDGET CHOKES.—14 M H. 2.6 each.

BRIMISTORS.—CZ1 for .3 a. heater chains, 3/6 CZ2 .or .15 a. or .2 a. 2/6.

COPPER ENAMEL WIRE.—1lb. reels 16 to 20 s.w.g., 2/- ; 22 to 28 s.w.g., 2/6 ; 30 to 40 s.w.g., 3/6.

WIDE ANGLE SCANNING.—Full range Allen, Teleking, and Viewmaster. Components in stock.

TWIN GANG STANDARD SIZE.—With feet. .0005 mfd., 8/6; Ditto midget. 7/6. 375 pf. midget twin gang, 6.6 : **BARGAIN** .0005 mfd. twin gang, slightly soiled, 5/6.

ALADDIN FORMERS and cores 1in., 8d. ; ½ in., 10d.

SLOW MOTION DRIVES.—Epicyclic ratio 4 : 1, 2/3.

LOUDSPEAKERS P.M., 3 OHM.
8in. Plessey, 12/6. 5in. Plessey, 13/6. 6½in. Truvox 14/6. 8in. Lectrona. 15/6. 10in. Lectrona, 25/-. 5in. G.E.C. Energised 700 Ω field with trans, 19/6.,

WAVECHANGE SW'TCHES.—All at 3/6. 2 p. 2 way, 2 p. 3 way, 4 p. 2 way, 4 p. 3 way, etc.

CRYSTAL DIODE.—Very sensitive. G.E.C., 3/6 B.T.H., 2/6. **H.R. PHONES** (S.G. Brown), 15/6 a pair.

OUTSTANDING BARGAINS UNREPEATABLE VALUE

I.F. TRANSFORMER 465 Kc/s Slug tuning Min. Circular Can, 2½in and 1¼in. diam. Fits octal V-holder cut out Very high Q., ex Pye Brand New **6/9** pr.

MIKE INSERT Ex U.S. Govt. Min. Moving Coil, 1in. diam. x ½in. Hermetically sealed and precision engineered. **A Real High Quality Job.** DON'T MISS THIS—ONLY **3/9** ea. Matching Trans., 3/9

On Your Wavelength

By Thermion

Thirty-one Years of Service !

THIS issue celebrates 21 years of continuous publication under one editor, Mr. F. J. Camm. I cannot claim to have served PRACTICAL WIRELESS for that period. I have sailed under two flags—*Amateur Wireless* from November 18th, 1922, until it succumbed to the fierce opposition of P.W., which absorbed it with its issue, dated January 26th, 1935. Mine was one of the few features which was carried on in the combined journal which, for a time, appeared under the title of *Practical and Amateur Wireless*. I well remember the sadness of the parting with my old love and the regret with which I received the news that a new journal, after a short space of three years, had knocked out the older of the two first radio journals. I remember, too, the smirks which took place in the editorial office of *Amateur Wireless* when it was first announced in *World's Press News* and other trade journals that George Newnes, Ltd., had decided to enter the highly competitive field of radio : we all gave it about three months, in view of the fact that in 1932, when "P.W." was launched, a large number of weekly and monthly competitors had had a ten-year start. I do not think that the editors of contemporaries enjoyed the same nonchalance and also *sang-froid*, because they planned boom issues to coincide with the first issue of P.W. The daily newspapers carried announcements singing not only the virtues of the new, but the praises of the old.

To have been first in many cases proves nothing but antiquity. To have become first and to have slain in honest combat most of the old established rivals is an achievement as far as I know without parallel in the history of periodical journalism.

The first issue of *Amateur Wireless* was dated June 10th, 1922, but I was not invited to contribute my weekly critique until the issue dated November 18th, 1922. Under the rules which then applied, a restraining hand was placed upon my comments and quite often my remarks were considered hypercritical and watered down by the time they appeared in print. The merging of the two journals did not occasion any hiatus. *Amateur Wireless* was suitably interred on January 19th, 1935, and combined with P.W. the following week, which carried the first of my contributions under the new editorship.

When I was called to the editorial sanctum sanctorum of PRACTICAL WIRELESS, I was pleasantly surprised to find that only the mildest of editorial restraint would be placed upon my writings, no doubt with a lively eye to the law of libel. I must say I found it refreshing to meet an editor whose only interest was his readers and who believed not in the write-up and trade puff adopted by so many journals, and in which things which quite rightly ought to be severely criticised are praised, but in honest criticism without punches being pulled.

In carrying out this policy, I must say that brickbats and bouquets quite often have been deposited on my desk. Some readers have not seen eye to eye with me, whilst others have enjoined me to be even more critical. No critic worthy of his salt can expect to write that with which every one of his readers will agree. If he does he is only expressing the obvious and his writings are merely space-filling froth. How often does it occur that contributors have to serve under nervous editors who will hint at a fault and hesitate dislike—being willing to wound and yet afraid to strike ! Such journals can never be taken seriously and, in the long run, their opinions will be accepted *cum grano salis*.

It was in such an atmosphere of keen competitive journalism that I witnessed one by one the old established journals fall by the wayside, until to-day only one esteemed competitor of long standing remains. It is not given to many contributors to write one feature continuously for 31 years and by this time, I think, I can fairly claim to be the doyen of radio journalists, for I was writing about radio long before the foundation of any of the popular radio journals. This issue, therefore, provides me with the occasion for a double celebration, and over my glass of sarsaparilla I shall toast not only my editor and colleagues, but my fellow contributors and the thousands of friends and friendly enemies who continue to write to me—yes even those whom, from time to time, ask the editor to sack me.

I am touched by the esteem, almost amounting to reverence, in which I am held by some readers ; and by the belief in the omniscience with which some think I can solve their troubles. It is true that, in the course of years I have acted as intermediary for readers who have felt, perhaps, that some advertiser has not dealt fairly with them. Those have been rare occasions, but in every case I have found the advertiser has an adequate answer and satisfaction has always been obtained. All technical journals to-day run a light feature as a sort of comic relief to the technicalities of other pages. My feature is intended to provide a source of gentle bandinage and persiflage on this, that and the other and to criticise, choosing fair words. If I have not succeeded in the passage of 31 years in pleasing all of my readers all of the time I can at least claim to have pleased most of them most of the time.

I must say that I have loved writing this feature above all of my other journalistic work and I hope I shall be allowed to continue to do so.

My gratitude to all those readers who have written congratulatory messages.

Also to the many hundreds of beginners who have written to me on the subject of pictorial v. theoretical circuits : the general concensus of opinion is that we should give both, and steps are being taken in that direction. A selection of readers' opinions is to be published.

The PW FULL-COMPASS Electronic ORGAN

Introductory Details of Our New 6-octave Polyphonic Instrument Which Can Form the Basis of Various More Elaborate Designs. It Produces a Really Good Pipe Tone.

By W. J. Delaney (G2FMY)

EVER since the publication, last year, of our simple electronic keyboard instrument, we have received numerous requests for a polyphonic instrument, the requests ranging from a simple three- or four-octave instrument to a complete three manual plus pedals design of the cinema type. Many readers do not seem to realise the expense of building a proper organ design, and although novelty type instruments may be built quite cheaply, it is felt that if time and money are to be spent on constructing an instrument it might just as well be one that can be called a musical instrument. Accordingly, all the known methods were carefully studied with a view to finding some design which could be built by the average radio constructor; would not call for specialised parts which could not easily be fabricated (printed circuit arrangements, for instance); and which would be of such a type that it would lend itself easily to modification to suit individual preferences. A further refinement was finally added to the above—namely, portability.

The design now presented and shown in the illustration above, a rear view of which may be seen on page 599, is a single manual of the 60-note type, plus one octave of pedals, delivering a good pipe tone as distinct from the "electric organ" type. A foot-operated swell pedal is fitted, and the instrument is so arranged that it may be dismantled merely by removing a number of plugs, and in its dismantled condition it may be carried in a standard 8 h.p. car. Assembly of the sections after transportation takes only two or three minutes, but there is no reason why, if required, it should not be built as a complete self-contained arrangement for use in a church hall, etc. Forty-six valves are employed, of which 39 are double triodes.

Specification

In order that an idea of the design may be gained by would-be constructors the following is a description, omitting the cabinet or containing case which may, of course, be built to any desired idea. The original is finished in black and silver, not only for simplicity, but also from the photographic point of view. The basis of the design is shown in Fig. 1, from which it will be seen that note generators are connected to a suitable amplifier feeding the loudspeaker, and that the keys and tone shapers are in shunt between these two main elements. This is a different arrangement from practically all other similar instruments wherein the switching, etc., is in series. After experimenting with the various known schemes it was found that unwanted resistance effects, poor contacts and erratic action, which is likely to arise in home-made equipment, plays a greater effect in series schemes than in this shunt arrangement. Explained briefly, in this design everything is "earthed," and to sound a note or add a tone, the key or switch which is operated merely removes the earth connection from that part of the circuit and permits the desired note or tone to go to the amplifier.

The notes are generated by an oscillator, twelve of which are used to generate the notes of the top octave of the keyboard, and frequency dividers then produce the required additional four octaves of each note. Each oscillator is provided with a simple tuning control by means of which the note produced may be varied over two or three semi-tones. It is only necessary, therefore, when once set up, to adjust the pitch of the required note in the top octave to

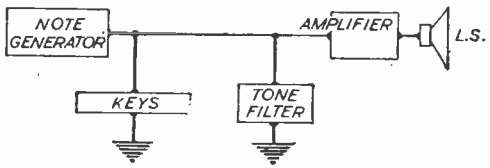


Fig. 1.—Basic arrangement of the organ.

produce automatically and correctly the remaining four octaves of that note. The entire keyboard is thus tuned with only 12 adjustments. The H.T. to the generators is stabilised.

Split Keyboards

Experiments were conducted with split and graduated keyboards but a successful design was not easy to find. Accordingly, no device of this nature is at present fitted, although experiments are continuing with an arrangement which shows promise. Rather than wait until the experiments are concluded, however, the original design is given now, and if at a later date the arrangement is found successful, details will be given and should not entail much modification. The notes produced from the generator stages are fed to a distribution strip in which a three leg filter takes the note not only to the appropriate key switch, but also to the octave above and below. For those new to music it should be mentioned that a fundamental note on the organ is referred to as the 8ft., the octave above as the 4ft., and the octave below as the 16ft. Switches permit the player to sound either a single note, an octave or two octaves merely by pressing one key. The small pedal clavier which is fitted is actually a 16ft. of the bottom octave of the keyboard, or in other words may be regarded as an octave extension at the end of the keyboard, but as explained later, the standard organ pedal clavier may be fitted with this 16ft. as its usual correct feature.

Tone Modifications

A separate valve stage is employed to modify the tone produced by the instrument, and this has the usual grid-circuit filters by means of which the tone may be "shaped." Switches as in the original design enable the desired filter to be included in circuit, and to function on any desired selected tone a vibrato stage is included. As described, there are seven tone switches, but the builder may use less or more as he desires, according to the uses to which the organ is to be put. The vibrator stage is provided with a control so that the *strength* of the oscillation (not its pitch) may be modified as required. It was not found necessary to have a pitch control as a separate device, but again, the design is such that if desired a two- or three-position switch may be fitted so that slow, medium and fast vibrato can be used as required.

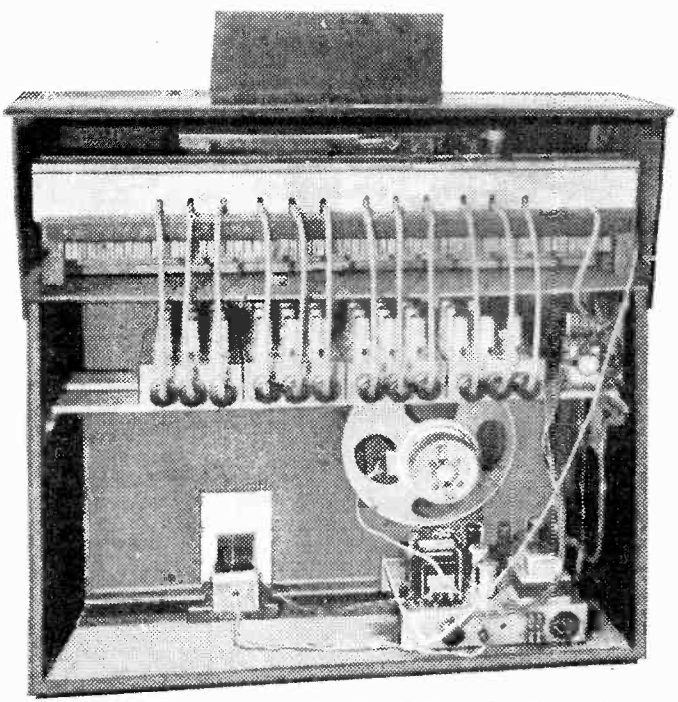
Swell Control

A standard volume control is mounted in a foot pedal device and is included early in the L.F. circuits, and this has been found to function quite satisfactorily without noise, and a special device is not necessary here. A further point which is of great importance in all electronic organs is the suppression of key clicks. When an oscillator is switched into circuit it is not a simple matter to guarantee that the switching will take place exactly at the beginning or end of an oscillation, and as a result a click will undoubtedly be heard. Usually, quite elaborate arrangements have to be adopted to eliminate the click, but in this design a quite simple arrangement is employed which, whilst it does not completely eliminate it, reduces it to such proportions that it can only be noticed by anyone who is listening critically for it. Under all normal playing conditions it will pass unnoticed, and the majority of those who have heard the organ have been unaware of the click until their attention has been drawn to it.

The construction, whilst it has been reduced to a fairly simple arrangement, does, of course, call for some careful and tedious work and will occupy many hours. No lathe or other similar apparatus is required beyond a simple hand-drill and the tools ordinarily met with in normal radio construction, but it is essential that the constructor should be able to solder really well. On the actual keyboard alone, for instance, there are over 500 soldered connections to be made, and to ensure that the organ is really reliable, especially if built in the portable fashion, these connections must be perfect.

Output Required

Two final points may be mentioned before commencing the actual circuit description. Firstly, the instrument may be needed for private use in the home, or for use in a church, hall or other public building. The output required under these conditions will vary considerably, but fortunately it is a simple matter and will not affect the design of the musical part of the organ in any way. As shown, the instrument delivers an output of about 15 watts "all out" which, when playing eight-note chords on the "full-



A rear view of the completed instrument. Any individual part may be instantly removed for test or servicing.

Organ" stop, is more than sufficient for the home, especially when using the pedals or playing in a lower register. Under these conditions the low notes will set in vibration windows, ornaments and all sorts of things which are not normally heard and one almost needs a special room in which to develop full output including the pedals. Incidentally, the lowest frequency on the pedals, the low C, is 32 c.p.s. and at 15 watts a really good speaker is essential. Preferably, this should be one designed specially for the purpose, but the specified model has been found to stand up well to this output, and the cabinet portion of the organ has not been specially modified to permit of this. If maximum performance is desired at low frequencies, the cabinet must be built in the form of an acoustic labyrinth to load the cone properly, or, alternatively, the arrangement needed for larger outputs adopted. This is, to use two speakers in parallel, one mounted on each side of the swell pedal, with a vertical partition between them to take care of phase shift. For permanent use in a church hall, etc., the cabinet containing the speaker should be large and of the acoustic labyrinth type placed in a suitable position in the hall remote from the organ itself. The amplifier may then be designed to deliver 30 watts or more, as will be described.

Finally, the instrument described has been played by well-known organists of the church as well as the cinema type, and all have remarked on the tonal quality which is truly pipe-like and nothing of the squeaky form usually associated with electronic instruments. Such an instrument is obviously expensive to build, and it will be found that the cost will be of the order of £100.

(To be continued).

Radio Show Control

BEHIND the showmanship of radio manufacturers vying with one another to attract the public at the annual National Radio Show there is a technical network unique in any exhibition. This technical set-up is itself of considerable interest to ordinary visitors, because of the "peep behind the scenes" which it provides, and more so to anyone technically interested in broadcasting—especially to visitors from countries overseas which are developing or contemplating having a television service. In this year's Show there are some innovations designed to increase the practical efficiency of the control and to give a better public demonstration.

The co-operation which has always existed between the Radio Industry Council and the BBC is being further cemented by a closer degree of working and is centred around this control room. In it will be found all the technical apparatus responsible for the distribution of the television pictures which can be seen on the various stands throughout the Exhibition and in "Television Avenue."

Previously the control room has produced a closed circuit programme to enable the demonstration of television receivers to take place throughout the hours of the exhibition every day. This year, for the first time, the BBC are arranging to stage twice-daily small programmes which may be transmitted from their national television network. It will be appreciated that to undertake this the quality of the pictures generated within the control room and its associated studio must be of the highest order. The requirements, therefore, fall into two distinct categories, the first to enable the BBC to obtain its excerpts for the television programme with the help of the R.I.C. studio and cameras, and the second to distribute programmes throughout the exhibition which may be obtained from a number of sources. These are as follows:

(1) The normal BBC service as received over the air from Alexandra Palace.
(2) Films which can be transmitted by means of the film scanning equipment in the R.I.C. control room.
(3) The output from two television cameras located within the glass-walled studio associated with the control room.
(4) The television camera which covers the dais on which from time to time various radio, television and other celebrities will appear.
(5) Pictures taken from the BBC studio located in the exhibition which are fed through the control gear in the R.I.C. control room and subsequently to the receivers in the show.

Monitoring

The following details of the apparatus may be of interest: The programme officer has complete operational control of the equipment from his position in the control room and may choose at will any one of the five programme sources previously mentioned. The programme is monitored, passed through faders and then fed to the main amplifiers for distribution by cable and thence to the receivers. From previous experience it is known that the internal television circuit can suffer from direct pick-up of the Alexandra Palace signal, resulting in interference. For this reason the sets in use are those for Channel 4 (Birmingham) using 61.75 megacycles for vision and 58.25 megacycles for sound.

The waveform conforms to standard BBC practice and each outlet in the Show feeds only one receiver at a signal level of 1 Mv—3 db into 70 ohm unbalanced.

A comprehensive range of test equipment in the control room ensures that the standard and level of signal is maintained and continuous monitoring of the programme is carried out by the duty engineer.

The public address equipment is also regulated from the control room, and while the input amplifiers can be seen, the main amplifiers are located up in the roof and feed a large number of loudspeakers throughout the exhibition. Facilities are provided for playing both 78 r.p.m. and microgroove records.

The film scanner is of the latest type in which the film moves continuously through the gate, interlacing being provided by a lens system in the scanner.

The Beginner's Guide to RADIO

The Sixth of a Series of Articles Specially Written for Those Who Have Become Interested in Radio for the First Time Explaining the Principles of Radio Transmission and Reception

By F. J. CAMM

As many readers may have already noticed, the printers omitted the final line of the formula which closed my article last month. It will be remembered that in dealing with resistances in parallel it was shown that the formula is

$$\frac{1}{R} = \frac{1}{5} + \frac{1}{3} + \frac{1}{2}$$

This, expressed in words, is "The reciprocal of the total resistance is equal to the sum of the reciprocals of the individual resistances." Working out the example, therefore, the answer would be

$$= \frac{6 + 10 + 15}{30} = \frac{31}{30}$$

$$\therefore \frac{1}{R} = \frac{31}{30}$$

$$\text{and } R = \frac{30}{31} \text{ of an ohm.}$$

Fig. 27 shows how the meter is used for measuring voltage and current. It will be seen that the voltmeter is connected in parallel whilst the ammeter is connected in series. Fig. 28 shows how to measure the voltage of a battery and how the current flowing from a battery through a resistor is measured with an ammeter. It sometimes becomes necessary to increase the range of a voltmeter when taking measurements which are outside the scope of the scale when the needle is in the fully deflected position. In such a case the excess current passing through the meter is by-passed by connecting a resistance across the meter. To increase the range of an ammeter a resistance is included in series with it to limit the current. This is shown in Fig. 29.

Of course, the meter itself has a resistance and this needs to be taken into account in calculations resulting from the meter readings. All voltmeters should have a resistance of at least 1,000 ohms per volt, whilst high class meters have a resistance of the order of 20,000 ohms per volt. This is to ensure that the meter does not itself take so much current that it produces false readings.

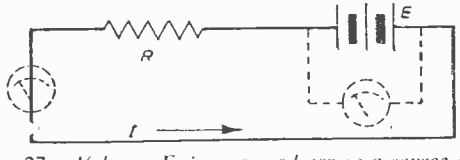


Fig. 27.—Voltage, E, is measured across a source and current, I, in series.

It is obvious that a circuit may be checked in two ways, either by measuring the current which it is passing, or by measuring the voltage on the anode of the valve. The *wattage rating* of a resistance is of importance, since it must safely carry without overheating the current it is designed for.

If resistance and current values are known,

$$W = I^2R \text{ when I is expressed in amps}$$

$$\text{or } W = \frac{\text{Milliamps}^2}{1{,}000{,}000} \times R$$

If wattage rating and value of resistance are known, the safe current for the resistor can be calculated from

$$\text{Milliamps} = 1{,}000 \times \sqrt{\frac{\text{Watts}}{\text{Ohms}}}$$

For automatic bias circuits, the value of the bias resistor can be determined by

$$R = \frac{E}{I} \cdot 1{,}000$$

when R equals the value of the bias resistor in ohms; E the value of grid-bias required and I the anode current in milliamps of the valve, or the total H.T. current of the circuit according to the system in use.

Increasing Range

In increasing the range of a meter the resistance employed must, of course, be of a pre-determined value.

If R_m is the resistance of the meter; R_s the value of the shunt (parallel-connected) resistance and n the number of times it is wished to multiply the scale reading, then:

$$R_s = \frac{R_m}{(n-1)}$$

As already stated the voltage range of ammeter can be increased by connecting a resistance in series with it. If this series resistance is R_s and R_m and n as before, then

$$R_s = R_m \cdot (n-1)$$

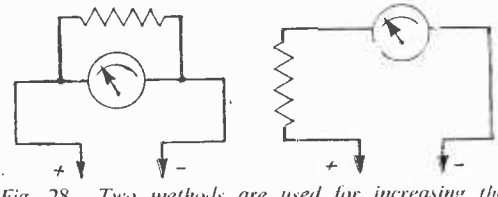


Fig. 28.—Two methods are used for increasing the range of an ammeter.

Colour Codes

All resistances, condensers, transformers, fuses and battery leads today are marked according to the colour code which enables their values to be read off and it is necessary to memorise this code. Here it is :

Resistances and Condensers

The colour codes for fixed condensers and fixed resistors are identical, the standard for resistors being ohms and for fixed condensers $\mu\mu$F (Picafarads or micro-microfarads).

Colour	*Fig.*	*No. of noughts*
Black	0	None
Brown	1	0
Red	2	00
Orange	3	000
Yellow	4	0000
Green	5	00000
Blue	6	000000
Violet	7	
Grey	8	
White	9	

The order of reading these colours is : Body, Tip, Dot.

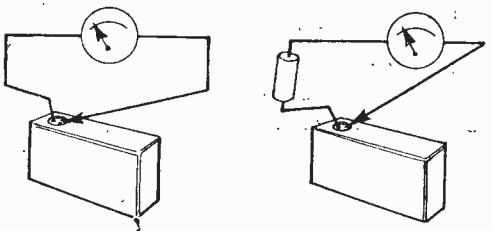


Fig. 29.—Pictorial illustrations of methods of measuring voltage and current.

Example. Resistance with red body, black tip and orange spot will have value of 20,000 ohms. If there is no dot on the body it indicates that it is of the same colour as the body.

		Fuses	
60 mA.	Black	1 amp	Dark blue
100 mA.	Grey	1½ amp	Light blue
150 mA.	Red	2 amp	Purple
250 mA.	Brown	3 amp	White
500 mA.	Yellow	5 amp	Black and white
750 mA.	Green		

Choosing Meters

The greatest care must be taken in choosing measuring instruments for some of the cheaper grades require more watts to deflect the needle over the dial than the whole current consumption of the set. The most expensive meters take the least current to operate them ; it is for this reason, therefore, that a good voltmeter must have a very high resistance—it may be as much as 1,000 ohms per volt and the current taken would be only 1 milliampere, the best type being the moving-coil pattern. This operates on the principle of a coil moving in the field of a permanent magnet. It is only suitable for use on direct-current circuits and being of the polarised type the leads must be connected up in the correct manner to deflect the needle of the instrument across the dial in the right direction. If the leads are changed and connected the wrong way round then the needle swings over in the opposite direction ; although a meter will often stand current in the reverse direction, it may possibly damage the needle by causing it to hit the reverse stop very hard, thus putting a strain on some of the mechanism. Accurate meters are generally fitted with an adjustment which will return the needle to zero, thus enabling it to be brought to exactly O on the scale before the instrument is used.

Voltmeters can be obtained in various voltage ranges and also there are those on the market which cover several readings, enabling voltages to be taken of, say, 0 to 10 volts L.T. and 0 to 200 volts H.T. The lower readings are suitable for testing filament voltages and low-tension battery voltages when the set is working.

Milliammeters. The anode current taken by the valves in a set so small that it is very seldom that an ammeter is used. To measure these minute currents a milliammeter is used, which is so arranged that its pointer moves for thousandths of an ampere, or as it is known, milliamperes.

When a milliammeter is joined in the anode circuit of the power valve, it is possible and very interesting to test for correct values of H.T. and grid bias, also to see the movement of the needle when the latter is incorrect. The grid bias should be adjusted to that stated by the makers of the valve and the set switched on, it being tuned to a station giving a medium amount of volume. If the biasing is correct the needle will remain steady and the reading on the dial should be noted. Switch off the set and reduce the bias a little. Switch on again and it will be observed that not only will the needle no longer be steady, but the current from the H.T. battery will have increased, thus indicating that distortion is occurring and, as before stated, H.T. current is being used wastefully.

If the same operation is gone through, but this time increasing the bias on the valve, it will be seen that the needle of the meter tends to kick upwards on strong signals, at the same time the anode current from the battery will decrease, coupled, of course, with distortion. When the needle of the milliammeter kicks both up and down the dial and no alteration of the grid bias will correct it, it can be assumed that the valve is overloaded, that is to say, that the input to the set is rather greater than the valve can handle. If the power valve is overloaded a more suitable valve must be used in the last stage or the input to the receiver reduced. All that is necessary is to reduce the signal input slightly to that point where it does not result in overloading the last valve.

(To be continued.)

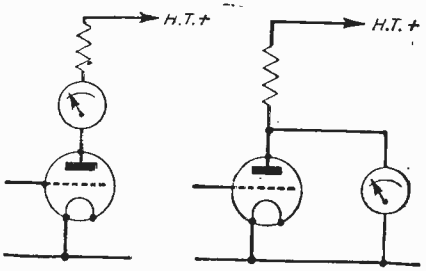
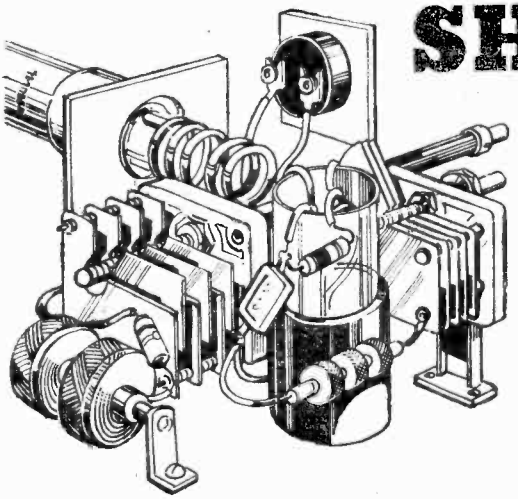


Fig. 30.—The working of a valve stage may be checked in two different ways as shown here.



SHORT-WAVE SECTION

OUR SHORT-WAVE CONTRIBUTOR, A. W. MANN, LOOKS BACK OVER THE PAST 21 YEARS

WITH the September 24th, 1932, issue PRACTICAL WIRELESS made its debut. Backed by a sound policy and guided by a far-seeing editor it has successfully stood the test of time and the many difficulties associated with wartime production and distribution.

As one of the earliest of outside contributors and a reader from No. 1 I have followed the progress of this journal with interest, and I propose to discuss in this article some of the changes and developments which have taken place in the sphere of short-wave radio during the past 21 years.

Home Construction

Time was when the construction of the most simple types of short-wave receiver called for cut and try methods, and the modification of broadcast receiver components. While the more experienced home constructors obtained some measure of satisfaction there is no doubt that many would-be listeners and experimenters were scared away and regarded this branch of radio as one fraught with difficulty. Looking back, one feels that there was some justification in thinking that way.

Credit is due to those among British manufacturers who decided to cater for the short-wave constructors who, after all, were but a comparatively small minority.

The same applies to the second issue, which saw the introduction of the short-wave section, in which receiver design and other matters were discussed, subsequent issues containing, in addition, short-wave receivers of sponsored design, thus catering for the listener and experimenter.

A few hours spent looking through the pre-war weekly and the later monthly issues brings to light the fact that, in addition to the space devoted to broadcast receivers, the release of a new short-wave component, including plug-in, dual-range, triple-range, four-range and rotary coil units was followed by sponsored designs in which they were incorporated.

In addition, contributors to the short-wave section, including the author of this article, discussed and described their application in experimental design, and a wide range of circuits, apparatus, test gear, aerials, valve applications and the design and construction of experimental receivers.

In a recent article I remarked that much had been written concerning short waves and short-wave receivers. While this was meant to be regarded in the general sense, a study of personal records denotes that the completion of this article brings the writer's quota to 158,200 words. Add to this the contributions of my fellow writers and the claim that PRACTICAL WIRELESS has and does cater for the short-wave listener and experimenter is beyond dispute.

Meanwhile the past 21 years has witnessed many far-reaching developments in the respective fields of short-wave broadcasting, listening, amateur radio and receiver design and construction.

Valves

Many are apt to regard America as the home of valve development. Let us not forget, however, that while the U.S.A. have made several valuable contributions, the L.F. pentode was first developed, manufactured and used in this country. Other facts worthy of mention are that American amateurs and others swear by one particular specialised valve of British manufacture, the efficiency of which is acknowledged by radio engineers in the United States. British manufacturers have contributed considerably to the development and application of modern receiving and transmitting valves.

Short-wave Receivers

Communication receivers are nowadays of smaller overall dimensions than in pre-war days, due to the development of miniature valves. Receivers are thus more compact, modern coil packs and other components, as in the case of valves, all contributing to a reduction in space requirements.

Not so many years ago the short-wave superhet was a cumbersome affair and multi-valve in the true sense. During the years considerable improvement has taken place in this respect. The smallest superhet in terms of valves was the two-valve superhet described in this journal before the war.

Double Superheterodynes

The double superheterodyne principle as applied to communication receiver design is now a feature of American design. I have before me at the moment an old catalogue dating back to the earlier days of PRACTICAL WIRELESS in which the specification and an illustration of a double superhet, which also includes bandspread, is shown: an R.F. stage is also included. This receiver, which was a British product and of British design, was an all-wave type broadcast

model capable of meeting the communication requirements of the time. I refer to the A52 Murphy. Add to this the fact that the R.A.F. during the war used R1116 type double superhets, and that there are at least two very efficient British communication receivers of modern design available. Britain is not behind in this field of design and construction. It is also worthy of mention that the first British-designed communication receiver was the Eddystone E.C.R.

Communication receivers of British and American design were an expensive item from the short-wave listeners' point of view, and it is interesting to recall that this journal filled the gap by producing a design and full constructional details for a nine-valve A.C. type communications receiver, thus catering for the more advanced constructor.

U.S.W.

The allocation of the 5-metre band for the use of transmitting amateurs created a new sphere of interest. This called for a new approach to the problems associated with the design and construction of suitable transmitter and receiving equipment.

Within a short period amateurs were making and breaking records, among them and very much to the fore being G5BY, the outstanding V.H.F. operator and experimenter of today. 5-metre activity, however, was not universal throughout the British Isles. Consequently, lack of local interest did not foster the building of suitable receivers by the listener fraternity. This magazine, however, produced a design suitable for the purpose, while the writer and others described experimental equipment.

Amateur Radio

During the lifetime of this journal amateur radio has progressed to an amazing degree. V.H.F. developments and activities being most encouraging. This field offers ample scope for the aerial designer and experimenter, stacked arrays and other forms of beam aerial systems being extensively used. The transmitting section keeps readers informed with respect to new developments and technique in this field.

Surplus Radio

Owing to the availability of government surplus radio apparatus, amateur radio enthusiasts are better equipped generally than in pre-war days, receivers of the H.R.O. and CR. 100 types along with others being in common use. In addition, the conversion of surplus apparatus to suit amateur radio requirements denotes much painstaking work, and at times considerable ingenuity and skill.

Short-wave Broadcasting

In this field, and especially during the war years, far-reaching developments have taken place. This applies to the BBC and overseas services of several other countries.

The design and development of high-power short-wave transmitters together with that of rotary and switched beam arrays, console control of all operations by a single operator, etc., has now taken the place of the uncertain hit-and-miss methods of earlier times. Canada, America, Australia among others providing a round the clock service to most parts of the world.

Ship To Shore

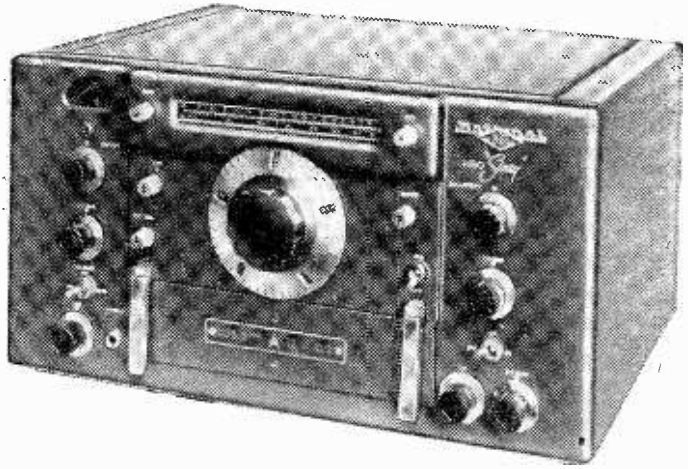
The ship-to-shore telephone services have also been further developed, extended and improved, and the same applies to the American and other overseas radio communications services, as a future article will prove. In plane to ground services research has brought about considerable improvement. The further development of Radar and navigational aids for use at sea and in the air still continues. Let us not forget, or for that matter allow anyone else to do so, that Radar was a British invention.

The Future

This is an age of discovery, the electronic age. The next 21 years will no doubt see many changes. PRACTICAL WIRELESS, however, will keep pace with all new developments in the sphere of radio and its readers fully informed.

Communication type receivers will continue to be developed to a higher state of efficiency and in even more compact form, and the personal portable short-wave receiver using miniature valves and coil pack will, I think, become commonplace. The possibilities of valveless receivers also comes to mind. The valve as we know it today being superseded. One thing is sure, however, and it is that designers will continue to improve communication type receivers from the signal-to-noise ratio point of view.

It is never safe to prophesy and this applies especially to radio, but the recent claims which have been made in America for the transistor, coupled with the printed circuit technique, can perhaps lead to the design of a "valveless" communication receiver, capable of being carried in the pocket—or is this too much to expect?



A typical S.W. receiver mentioned by our contributor. This is the American H.R.O. "Sixty" and uses plug-in coil units.

Twenty-one Years of "P.W." Progress

A BRIEF HISTORY OF ITS INCEPTION AND DEVELOPMENT

By The Editor

THE first issue of PRACTICAL WIRELESS appeared on September 24th, 1932. The first public broadcasting service took place in 1922 under the auspices of the British Broadcasting Company (call sign 2LO), which later became the British Broadcasting Corporation. Thus, when this journal was launched, radio had been in existence for 10 years, and the industry was only just getting into its stride. Long before 1922, however, the amateur movement in this country had developed and gained a strong footing. The experimental station at Writtle (call sign 2MT) had been broadcasting a half an hour's programme once a week for some time previously. It was a programme keenly looked forward to by amateur set builders who only had this brief period once a week to test new receivers or check alterations to old ones.

Captain P. P. Eckersley was the chief engineer of Writtle and he later, of course, became chief engineer of the British Broadcasting Company. In those days he was very much a general factotum, for apart from the problems associated with that early transmitter, he had to arrange programmes and often act as announcer.

Prior to the installation of Writtle the amateur movement in this country, carefully fostered by the Radio Society of Great Britain, was entirely confined to amateur transmitters, and a tribute must be paid to this society for the pioneer work it did and still continues to do. For it was from the pool of amateurs that the industry drew its personnel. Many of these pioneer amateurs founded businesses of their own.

The first "Practical Wireless," dated September 24th, 1932.

It will be seen that amateur set constructors have been the basis upon which the radio industry was founded. In 1922 when the first daily service was introduced a wave of enthusiasm for the new hobby spread over the country. In the remotest village lone experimenters built crystal sets and, if they were a little more ambitious, one- and two-valve sets, and made a profitable hobby out of building for their friends.

In those days literature which could be read and understood by amateurs was scant. There was only one regular periodical whilst a few of the journals dealing with technical subjects for amateurs devoted a page or so a week to the new national hobby. Firms in their hundreds started up to supply components for this new market, and it was not long before publishers saw that radio, quite apart from being the flash in the pan which hitherto they thought it would be, was here to stay and develop, and that it would become eventually an inseparable part of our national life, like boots, bedsteads and bicycles.

It was not many months after 2LO started that two popular journals appeared, and within the short space of two years there was a large number of weekly and monthly radio journals. Each had large circulations and performed a good service in fostering interest in the new hobby and in reporting on the latest technical developments.

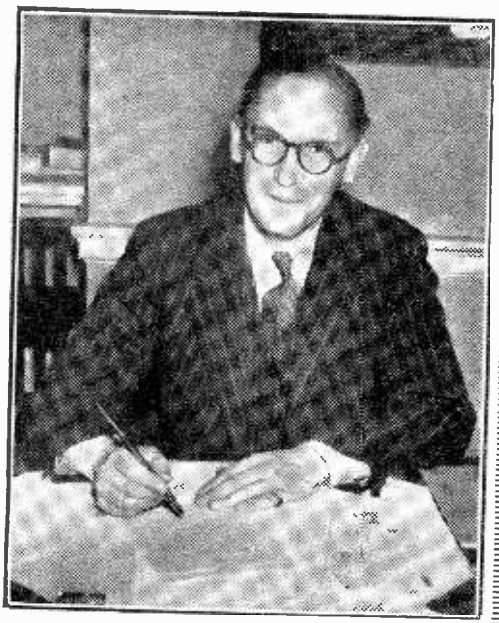
It was not long before complete sets appeared on the market and it was thought at that time that this would spell the doom of home construction. Instead of that it acted as a fillip; for the complete receivers were sold only to those who were unable to build receivers through lack of elementary technical skill. The ranks of constructors continued to grow during the 10 years which

GREETINGS FROM LORD BURGHLEY

(*President, Radio Industry Council.*)

Congratulations to PRACTICAL WIRELESS *on attaining its 21st birthday and good wishes for continued success in stimulating and maintaining wide interest among its readers. In 21 years there has grown up a vital radio industry. Although technical progress has been almost overwhelming to the layman, the subject of wireless somehow retains its early romantic interest and it is easy to see why it remains a fascinating and satisfying hobby for so many.*

GREETINGS FROM Sir Ian Jacob



Sir Ian Jacob, K.B.E., C.B. (Director General of the B.B.C.).

I should like to congratulate PRACTICAL WIRELESS *on its 21st birthday. As its name implies, it is essentially a magazine for the practical wireless man—particularly the amateur transmitter and the home constructor. Since the early days of the "cat's whisker," the development of all branches of radio has owed much to the work of the amateur. The fact that the Atlantic City Conference of 1947 set aside several wave-bands in the crowded radio spectrum for the exclusive use of amateurs is evidence of the value set upon their efforts by the Governments of the world.*

Technical journals have done much to foster interest in the technical side of radio and to spread a sound knowledge of it among its devotees. Many readers must have found opportunities to put this knowledge to good use, either in the Services or in Broadcasting, or in one of the many other applications of radio techniques. They will join me in wishing every success to PRACTICAL WIRELESS *and its contemporaries in the years to come.*

preceded the publication of this journal. They all thrived and each produced during each year a number of "boom" sets supported by a free blueprint.

In those days any man who built a crystal set became an acknowledged expert. Books poured from the presses and the periodicals issue by issue described some new receiver or improvements to old ones.

"Practical Wireless" is Born

It was in such an atmosphere that PRACTICAL WIRELESS was born, but it is necessary to go back before the date of its first issue to trace the seed from which it germinated.

I was the founder Editor of PRACTICAL WIRELESS, but prior to that I was also the Editor of *Hobbies*, a weekly journal appealing to handymen. The readers of that journal made it quite clear to me that whilst they were interested in woodwork, model boats, model aeroplanes and locomotives, and the other practical hobbies, they would welcome a weekly feature devoted to radio. Accordingly, in the issue of that journal dated February 13th, 1932, I commenced a weekly radio feature under the title of "The Practical Wireless Supplement." In it was described a number of simple circuits mostly of the detector and 2 L.F. type, which were built in large numbers. From the volume of correspondence which accrued it soon became evident that the part could not contain the whole, and that it would be necessary to start a separate weekly publication. This was a bold venture when it is remembered that there were 11 weeklies and eight monthly competitors with a 10 years' start. It had become apparent, however, that the trade would support a new weekly running on different lines, and it was as a result of discussions with members of the trade after a very careful survey of the publishing possibilities that the decision was taken in July, 1932, to produce PRACTICAL WIRELESS.

PRACTICAL WIRELESS was the last journal in the field, but it is an obvious tribute to the soundness of its policy, which does not need stressing, that most of its competitors fell by the wayside within a few years, until to-day only one remains and that the first and oldest.

Our Policy

The policy of the paper is well known to all older readers and to the trade. We decided to produce designs for receivers which readers could build with absolute confidence that they would perform in accord with the stated claims. We would specify only the actual parts to be used in our receivers without any eye to advertising revenue, and irrespective of whether the manufacturers of the components advertised or not.

The solus specification has remained part of our editorial policy ever since and we do not propose to depart from it. We introduced, to back up that policy, our Free Advice Bureau, in the belief that every reader who built a set from our pages was entitled to the same free advisory service that he would obtain had he bought a commercial receiver.

Naturally there was fluttering in the dovecotes of our contemporaries when the news was announced in the trade press that yet another constructor's journal was to appear. Members of the trade were

informed that it could not last, and we met with the fiercest opposition when the first issue in a red and blue cover appeared on that day 21 years ago when the first issue of this journal was launched, with a free gift blueprint of our very first receiver—The Long Range Express Three. Up to that time most amateur sets were designed for baseboard construction. Such sets looked amateurish, and because all of the components were located on one plane they were large in size. The Long Range Express was one of the first, if not the first, of the amateur sets to make use of a metal chassis, thus reducing its bulk and enabling unsightly components to be tucked away out of sight in the sub-chassis.

Each of our designs was well tried and tested before it saw the light of print. In many cases we led design and encouraged manufacturers to produce components of newer types and improved performance.

Thus, on September 24th, 1932, every radio-minded enthusiast in this country was appraised, by means of large advertisements in most of the national and provincial newspapers and by means of posters in the newsagents' shops, that the first issue of a new and improved constructor's journal had been launched.

Gift Offers

The first issue of PRACTICAL WIRELESS also contained a remarkable book offer. Every reader who took the paper regularly could obtain a copy, upon payment of a very small sum, of the *Wireless Constructor's Encyclopædia* (now the *Practical Wireless Encyclopædia*). Over 60,000 readers availed themselves of that offer, which was later repeated by the *News Chronicle*, whose readers absorbed a further 50,000 copies. To-day that book is in its 12th edition and over 300,000 copies have been sold throughout the world. This does not take into account editions printed in other languages such as Spanish.

To make good an obvious omission in the technical literature of radio we also undertook the preparation of a whole series of handbooks which would appeal to the amateur, and to date over 40 of them have appeared—each having run through many editions.

The pages of PRACTICAL WIRELESS have promptly recorded each new development in radio, often long ahead of its competitors. It went from strength to strength, its circulation steadily increasing and gaining prestige issue by issue. Within three years it was firmly established and the first sign of a crack in the front of its competitors appeared in the announcement in the daily press which was headed "Two Famous Journals Combine." This preceded the statement that as from issue dated January 26th, 1935, *Amateur Wireless* would be merged with PRACTICAL WIRELESS. The second oldest of the popular weeklies had collapsed, and for a time this journal appeared as *Practical and Amateur Wireless* That journal had grown, like PRACTICAL WIRELESS, out of a supplement to another journal—*Everyday Science*, of which I was also the Editor. *Amateur Wireless* was published by Cassell & Company. The departure of our competitors, however, was not the signal

(*Continued on page* 622.)

1932.

No. 1 P.W. published Sept. 24th. Wireless Constructor's Encyclopaedia (now Practical Wireless Encyclopaedia). Free Blueprint of Long Range Express Three. Free Blueprint of the Sonotone Four. Special Supplement for Beginners Incorporated. Free Data Sheets. Free Reader Service instituted. Solus Specification of Components.

1933.

Free Blueprint of F. J. Camm's Fury Four and Featherweight Class B Four. Pictorial Circuits introduced. P.W. attains largest circulation. Chassis system of construction introduced. Blueprint Service introduced. P.W. Pocket Tool Kit offered. Set of Spanners given free. Transfer Print system introduced. Every P.W. Circuit guaranteed. Orbit Receiver introduced. Encyclopaedia of Popular Mechanics offer.

1934.

Everyman's Wireless Book offered to readers. The Leader Three (cost less than £3) introduced. Designs for Car Radio Receivers. Blueprint of Atom Lightweight Portable. Free Blueprint of F. J. Camm's All-Pentode Three. Television and Short-wave Manual offered to readers. Free Blueprint of F. J. Camm's £5 Three Valve Superhet—the first ever, followed by D.C. Three Valve Superhet. Free Blueprint of Hall Mark Three. "Practical Television" launched.

1935.

PRACTICAL WIRELESS *absorbs "Amateur Wireless" (Jan. 26th, 1935). Title of journal changed to "Practical and Amateur Wireless." Free Blueprint of F. J. Camm's All-wave Silver Souvenir. Cameo Midget Portable introduced. Two-valve Superhet introduced. Service Data Sheets introduced. Free Short-wave Handbook. Blueprint of Super-former Four, and many other Blueprints, including £4 Superhet.*

1936.

Blueprint of the Monitor Three. "Practical Television" included in title. Blueprint of the Tutor Three, and Elf Midget Portable. First Television Receivers Reviewed. Television Service introduced. Blueprint of the Limit All-wave Four, and Record All-wave Three.

1937.

The Vitesse. Parvo Flyweight Portable and Oracl All-wave Three published. The Corona All-wav Four.

MORE MILESTONES (*continued from page 609*).

1938

P.W.'s only remaining competitor ceases publication. Push-button Tuning introduced. The Triband, Acme and Hurrican Designs published. New Series for Beginners. The Compass Portable Four. Automatic Tuning described. Push-button Three. New Series for Amateur Transmitters. Air Hawk Nine described. Component Construction for Amateurs.

1939

50/- All-wave Three. Aeronautical Radio Receivers. Contrast Expander introduced. New Series on Amplifiers. Four-band Short-wave Receiver. All-wave Superhet. Variable Selectivity introduced. Kestral Short-wave Four. New Cover Design—title reverts to PRACTICAL WIRELESS. *New Series for Service Engineers. War declared Sunday, September 3rd. Radio Show closes as a result. Television Service discontinued, and Amateur Transmitting suspended.*

1940

Ideal Radiogram introduced. Radio in the Services feature commences. Radio Training Manual offered. Gas-mask Receiver described. Frequency Modulation Service. Remote Control System. Construction of Test Equipment. Radio in Air Raid Shelters. Battery Economisers. Last weekly issue July 27th, 1940. First monthly issue dated September, 1940.

1941

First All-dry Four-valve Superhet. Radiolocation (Radar) described. Wartime Hook-ups. Present size of journal introduced December, 1941. Aircraft Direction Finding. Emergency Receivers and Midget A.C./D.C. Receivers.

1942

German Radio Receivers described. Many Wartime Economy Receivers. Direction Finding Explained.

1943

Further Wartime Receivers. Baird introduces Colour Television. Directive Aerial Systems. Pocket Regenerative Receivers. Frequency Modulation. Valve Data Sheets introduced. Communication Receivers.

1944

New Series for Service Readers. New Series on Test Equipment. Disc-Recording explained. Radiogram designs.

1945

Series on All-wave Receivers. Deaf-aids. Television Advisory Committee Report published. R.S.G.V. publishes list of required radio components. Amateur Transmitting Licences Re-introduced. Frequency Meters described. New Series on Communication Receivers. Death of Sir Ambrose Fleming (inventor of the valve). Publication of Radio Valve Data Book. Design of Post-war Receivers described. Beam Radio.

1946

Campaign for More Components. Television Service re-commences. Third Programme introduced (September, 1946). John Logie Baird dies. Radar Association formed (F. J. C. appointed Life Member). R.M.A. changes title to Radio Industry Council.

1947

Construction of Electronic Organ and Musical Instruments. Fuel Crisis Causes two issues (May-June) to be Combined. Fiftieth Anniversary of First Marconi Demonstration. First Post-war Radio Show. Many Television Features introduced, and Expansion of Short-wave section.

1948

Test Instrument Design. The Shoulder Strap Five. Experimental V.H.F. Receiver. High Fidelity Radiogram. Using the Oscilloscope. Recording Technique.

1949

French Television Service Starts. Three-valve Receiver Generator. Interference Suppression. Building a Television Receiver. New Developments in Broadcasting. Agreement on Television Standards. Remote Receiver Control Described. Building a Cathode Ray Comparator. A 12-Watt Amplifier. "Practical Television" Supplement Introduced. An All-wave Six-valve Superhet. Building a Small Oscilloscope. Transformer and Choke Construction. Making a Record Changer.

1950

The PRACTICAL WIRELESS *Television Receiver. London-Birmingham Television Radio-Relay Link. Television Aerial Construction. Electro-magnetic Tone Generator. Our new companion journal "Practical Television" published. Nine-valve All-wave Superhet. September and October issues combined Owing to Printers' Strike. Details of the New Wavelength. Radio Valves Reviewed. Installing Car Radio. Magnetic Recording.*

1951

Quality Amplifier for Record Reproduction. Making a Compact Car Radio. Resonance Indicating Signal Generator. Transportable All-mains Four. Compact Car Radio. Making an Absorption Wavemeter. Modern Superhet Tuning Unit. P.A. for the Amateur. An All-Dry Portable. An A.C. Mains Midget. A General Purpose Amplifier.

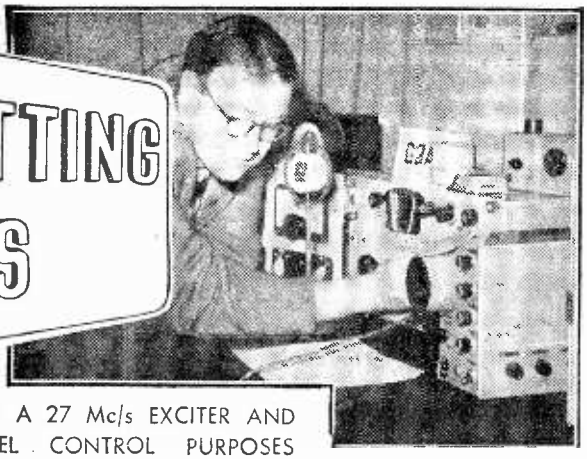
1952

Making a Low Power High Fidelity Amplifier. Free Blueprint for Building a 4-valve Midget Portable. A T.R.F. Communications Receiver. Building the 3-speed Autogram. A Tape-Deck Amplifier. Building an Electronic Organ. Making a High-speed Fault-finder. Facts About Crystal Diodes. The A.C. Band-pass Three.

1953

Printed Metallic Circuits Described. Transistors Introduced. Portable Electronic Organ Described. Radio-controlled Transmitter. Beginner's Guide to Radio Introduced. Purchase Tax Reduced. Crystal Diode Receivers.

TRANSMITTING TOPICS



THIS MONTH WE DESCRIBE A 27 Mc/s EXCITER AND TRANSMITTER FOR MODEL CONTROL PURPOSES

By F. G. Rayer

NO special licence is required to operate model-control transmitters, but it is essential that the equipment be kept within the prescribed bands. This can be assured by using an accurately calibrated monitor, with the usual type of self-excited, tunable transmitter, or by using a crystal-controlled exciter or transmitter. In some respects the latter possibility is more convenient for the constructor. If a monitor is made, some means of calibrating it is required, while commercially-manufactured calibrated monitors are fairly expensive. If, however, the transmitter is crystal-controlled, then operation within the specified band is assured.

The transmitter described here is of this type. If correctly made no danger of operating outside the specified band arises, and this is very important indeed. A model-control transmitter operating on incorrect frequencies can cause interference to television receivers over a wide area, especially when a powerful harmonic chances to fall upon a frequency used by television receivers. With crystal-control, this danger does not arise.

Provision is also made for modulating the transmitter, so that tonally-modulated control is possible. A great deal of experience can be obtained from such equipment, and various forms of modulation, tuning, etc., can readily be tried to determine how results are influenced.

The equipment is battery-operated, since portability is usually an important point with model-control transmitters. This means that it is safe to handle at all times, which is not necessarily so with mains-operated equipment, and it should commend itself to the less experienced constructor. Needless to say, even battery-operated equipment can deliver quite a strong shock, so care should be taken not to touch tuning coils or other H.T. positive connections unless the battery is disconnected.

Due to the reduced power obtained with crystal-controlled circuits, as compared with self-excited oscillators, the unit will not deliver the full permitted output of 5 watts. The output is ample, however, for short-range working, or the transmitter may be used as an exciter, driving a final stage delivering the full 5 watts into the aerial.

R.F. Section

This is shown in Fig. 1, and may be employed by itself to produce an unmodulated carrier-wave. This can be used to control any crystal-diode, 1-valve, or other "carrier only" receiver. With a 90-volt H.T. supply and 9in. aerials, the rectified output of a crystal-diode monitor in the vicinity of the transmitter was about 250 micro-amperes. This increases to some extent when modulation is applied. A range of ½ mile should normally be obtained with an efficient single-valve receiver.

Since crystals are not usually available for very high frequencies a 9 Mc/s crystal is used, and this forms the resonant grid load of the first valve in Fig. 1. A path for D.C. is provided by the 0.1 megohm leak and H.F. choke, the latter helping to maintain

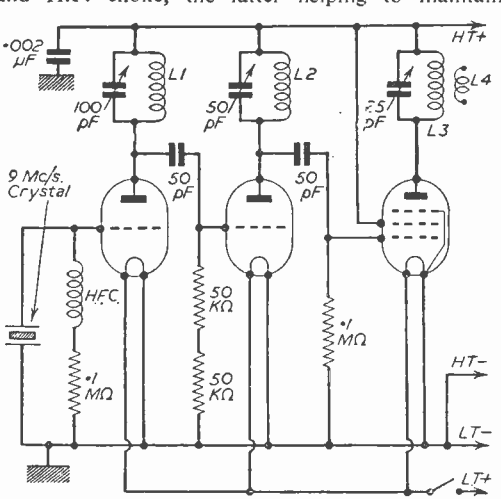


Fig. 1.—R.F. section of the transmitter.

oscillation by reducing the grid-to-earth stray capacity presented by the leak alone. Here, a pile-wound, short-wave H.F. choke is required. With H.T. voltages in excess of 90 volts the stage should oscillate without this choke, unless the crystal is a poor one of low activity.

L1 is tuned to the crystal frequency, and consists of 12 turns of 20 s.w.g. wire, on a 1¼in. dia. ribbed

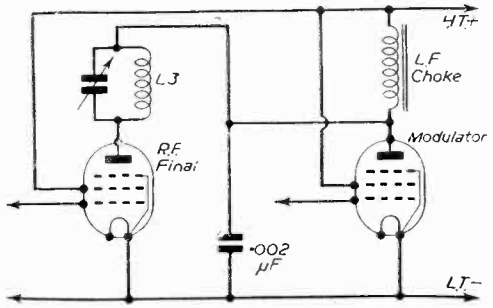


Fig. 3.—Coupling R.F. and the modulator.

former, with turns spaced to occupy 1⅛in. Reliable oscillation could not be obtained with the anode load of this valve operating upon a harmonic of the crystal frequency, but this is a limitation imposed by battery-type valves and low anode voltages. The required frequency-multiplication therefore takes place in the second stage, which operates with an anode coil tuned to 27 Mc/s. This coil is self-supporting, consisting of ten turns, ¾in. in diameter, approximately 1⅜in. long.

For simplicity, capacity coupling is used between all stages. L3 consists of seven turns of 20 s.w.g. wire, 1in. in diameter and 1in. long. Here, aerial loading will influence the number of turns as well as the spacing between turns.

Short direct connections are essential, and the layout shown in Fig. 5 may be followed. The variable condensers are mounted on an insulated panel and operated by means of insulated couplings, since their spindles are at H.T. potential. *All* wiring should be short, including that to valve filaments and 0.002 μF fixed condenser.

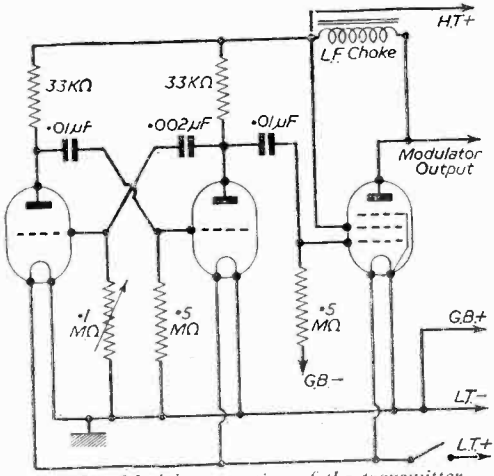


Fig. 2.—Modulator section of the transmitter.

Adjusting the R.F. Section

A meter should be included in the H.T. positive lead, and set to a range giving 5 or 10 mA full-scale deflection. The first valve should be inserted, and the equipment switched on. The condenser tuning L1 should then be opened slowly from maximum capacity until the anode current dips sharply, showing that L1 is tuned to the crystal frequency and the valve has gone into oscillation.

The second valve should then be inserted, and the first tuning condenser carefully adjusted again to make up for the stray capacity thus introduced. L2 is then tuned for resonance at 27 Mc/s. The meter is then set to a range of 20 to 25 mA or so and the output stage treated in the same way.

It is of great advantage to have a simple monitor, so that the strength of the actual signal radiated may be noted. Very exact tuning of the stages can then be undertaken easily. A slight error in tuning can severely reduce output. Finally, it will be found that output increases when each circuit has the maximum inductance and minimum capacity. This

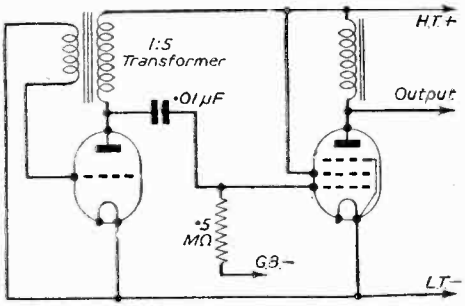


Fig. 4.—A two-valve modulator circuit.

state of affairs may be achieved by carefully compressing the self-supporting coils, meanwhile opening the tuning condensers to maintain maximum output. When the aerial is changed, retuning of L3 is required. With a monitor to hand, final tuning adjustments can readily be made at any time.

The Modulator

This is shown in Fig. 2, and operation of the 0.1 megohm control enables an audio-tone of any desired frequency to be obtained. If more than one tone is required, a separate potentiometer or variable resistor should be employed for each tone and brought into circuit by means of a rotary switch.

The second valve drives a power pentode, the audio output of this being developed across a low-frequency choke. The strength of the modulation may be measured by wiring an A.C. meter in parallel with this choke, with a 0.5 μF. condenser in one lead to block D.C. A modulation voltage of 50 was obtained with the 0.1 megohm control at its optimum setting. With other settings (e.g., extremely low and very high tones) the output was found to fall off to some extent.

The output valve, or final, of the R.F. stage was anode-modulated as shown in Fig. 3. The 0.002 μF condenser must be wired directly from the condenser tuning L3 to the chassis. Other forms of modulation may readily be tried—for example, screen-grid modulation. In general, however, anode modulation

was found most suitable here. The L.F. choke must be capable of carrying the combined anode currents of both valves, and care should be taken not to touch the valve anode connections since high-voltage peaks arise.

Fig. 5 shows the layout which was adopted, the chassis for the completed transmitter being 8in. by 12in. In this diagram the 50 pF condensers and dotted connections are under the chassis.

If a fully-variable tone is not required, one valve may be saved by using the modulator circuit shown in Fig. 4. The drive obtained from this is similar to that obtained from the three-valve circuit. The tone may be modified to some extent by using different transformers, or by wiring condensers or resistors in parallel with the windings. If no oscillation is produced, connections to one winding should be reversed. The primary is connected to the valve anode, while the secondary forms the valve grid load.

Oscillation may be tested for by connecting one tag of headphones to the output valve anode, the second tag being taken to H.T. positive through a resistor of about 0.25 to 1 megohm.

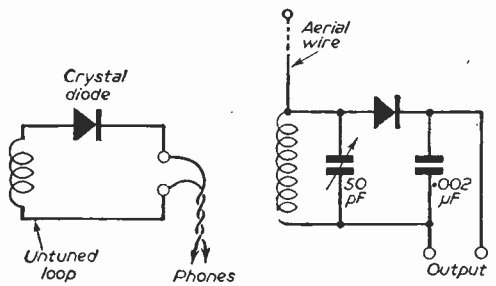


Fig. 6.—Details of the monitor circuits.

Monitor Circuits

Two suitable circuits are given in Fig. 6, and the first is very simple indeed. The untuned loop can consist of three or four turns an inch or so in diameter and slightly spaced. When this loop is near the transmitter the audio tone will be heard in the phones. This provides a simple means of assuring that the transmitter is actually radiating. The loop should not be brought too near L3.

A tuned monitor is also shown in Fig, 6, and the coil may consist of 12 turns of 20 s.w.g. wire, 1in. in diameter and 1¼in. long overall. For the aerial, 9in. to 12in. of stiff wire can be used. With longer aerials it will be necessary to stretch out the coil, or reduce the number of turns, to reach the required frequency. With phones, the signal should be clearly audible up to 10 to 15 yards from the transmitter, with a small aerial on the latter.

Signal strength may be ascertained by taking the "Output" terminals to a suitable meter. A 500-micro-amp. meter can be used near the transmitter. For increased range a 50 or 100 micro-amp. meter is desirable. There is no need for the exact deflection of the meter to be known, and various ex-service units are suitable. With such an arrangement a very exact indication of output can be obtained,

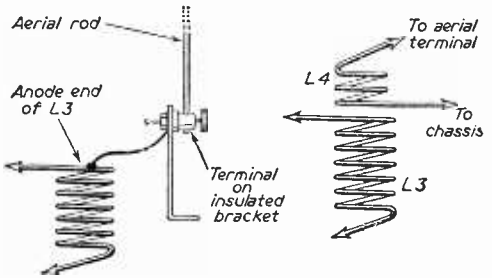


Fig. 7.—Suitable transmitting aerials.

and it will become immediately apparent whether any modification of tuning in the transmitter, or other changes, brings about an increase in the power radiated.

A meter is essential when the transmitter is of the "carrier only" type, since this kind of signal does not produce any audible note with headphones. In all cases the monitor should be carefully tuned to the correct transmitter frequency, as shown by maximum meter deflection or maximum volume in the phones.

Aerial Couplings

For short-range operation, a short aerial consisting of a vertical rod or wire connected to the anode and of the final coil, as illustrated in Fig. 7, is suitable. This aerial may conveniently be 9in. to 18in. long.

Increased range will be obtained with longer aerials, and these are best coupled as shown, with a further winding (L4). Or, if the aerial is only of moderate length, it can be taken to a tapping on L3.

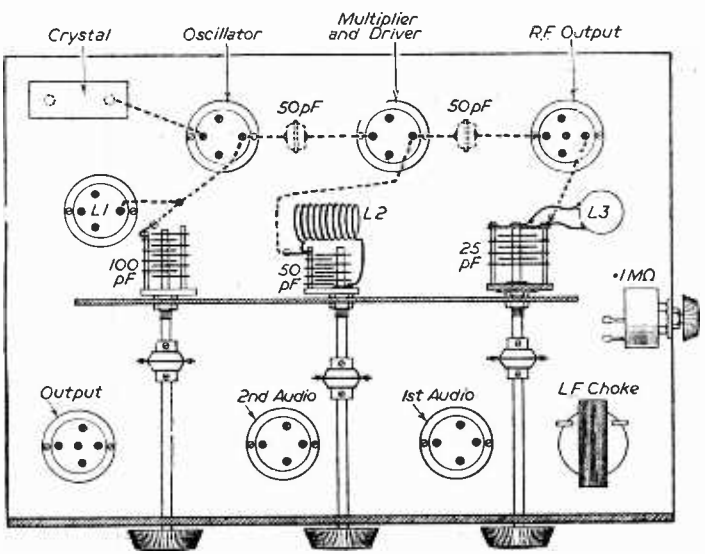


Fig. 5.—Layout of the transmitter.

Valves

In all cases the final tuning condenser should be operated to obtain maximum output. With long aerials, which impose more damping on the coil, it may be found that the condenser needs to be fully opened. If this is so, the coil should be pulled out a little, or a turn removed, to assure that correct tuning is possible. For all ordinary purposes there is little point in increasing the transmitter aerial beyond 8ft. in length. If desired, an exact quarter- or half-wave aerial may be made, though the slightly increased efficiency obtained with such an aerial is not really required for average purposes.

A wide range of valves may be used in both R.F. and modulator sections. Small power valves are best, though detector type valves can be used in the first and second A.F. stages and in the second R.F. stage. For maximum output, power pentodes should be used in both output stages. Triodes are not suitable here, since grid and anode frequencies are the same in the R.F. section, and self-oscillation would arise. A detector type triode would not oscillate in the crystal-controlled stage (first R.F.), but a small power valve oscillated readily. Valves of suitable type are readily obtainable at low cost from ex-service stockists. If a valve in the R.F. section is changed, retuning is essential. A suitable receiver will be described in the next issue.

Geiger Counter Tubes

By E. G. Bulley

THESE tubes are for the purpose of detecting the radiation of alpha; beta and gamma rays, and are to-day used in atomic research as well as medical and industrial fields. Various types of these counters have been developed, each for a specific purpose, and they can be best described as a special type of gas discharge device. The ordinary type of counter comprises a fine wire anode, usually tungsten, surrounded by a cylindrical metal cathode. These electrodes are sealed into a glass envelope which in turn is evacuated and gas filled at a low pressure.

The gas filling is important, because tubes that are filled with organic vapours, such as alcohol or ethyl acetate, produce their own quenching effect. That is to say, the characteristic of the gas produces a discharge which is self extinguishing.

However, such geiger counters are known as self-quenching types and have the disadvantage that the counting characteristic does not remain constant over a long period of time. This is due to the fact that the quenching vapour changes in its characteristic.

Non-quench Types

Other methods of quenching are used when the tube is of the non-quench type. The discharge is extinguished in this case by electronic means.

The tube, like the radio valve, must be connected into a suitable circuit, so that a fairly high potential exists between the cathode and the anode. Now, when radiation from an external source enters the counter cumulative ionisation takes place. This is so rapid that a pulse current passes between the anode and the cathode. To prevent a continuous gas discharge taking place, the quenching is necessary so that each ionising particle entering the discharge area of the tube produces one current pulse. This pulse is then passed on to the various electronic circuits, by means of which it can be made to operate a relay or mechanical counter.

These tubes have tremendous amplification and the presence of one electron will set off the counter mechanism without further amplification.

It can be seen, therefore, that the tubes will have applications found for them in many fields where radioactive substances occur, whether they are produced artificially or found naturally.

FAMOUS P.W. RECEIVERS

(*Continued from page* 578)

1939

The year 1939 saw the All-wave All-Stage Two Superhet, the Request Straight Six, the low-priced All-wave Three, the A.C. Spare Parts Three, the 1939 All-wave Superhet, the Kestral Short-wave Four, the 1940 Air-Hawk Nine, the 1940 All-wave Three, the Mite Two and the Pocket Two.

1940

The year 1940 saw the Student's Three, the All-dry Four-valve Superhet, and one or two emergency receivers. That was the first year of the war, and it was impossible for firms to devote much time to components for the constructor market. During the war years we were tied to one or two boom receivers a year. Thus in 1941 there was the A.C. Four-valve Three, in 1942 the Three-valve Emergency Receiver, in 1943 the Midget Universal Receiver the Odd-moment Portable, and the All-mains Midget Three.

1944

In 1944 appeared the Portable Three ; in 1945 the Midget Battery Three ; in 1946 the Ultra-short-wave Three, and the Four-valve Portable, as well as a two-valve All-dry Portable ; in 1947 a Short-wave Four, a Push-button All-wave Three, a Short-wave Battery Three and the Shoulder Strap Five.

1948

In 1948 there was the Bedside Portable Two, and in 1950 a Nine-valve All-wave Superhet. The Summer All-dry Portable appeared in 1951, together with the A.C. Pre-set Two. In 1952 the restrictions on paper were withdrawn and we issued our first post-war blueprint for the Mini-Four Portable—a Midget which is still being built in its thousands. This was followed by the P.W. Three-speed Autogram (illustrated on page 578), a quality job and one of our most ambitious receivers. We have devoted much space to electrical musical instruments and tape recorders. Last year we described the P.W. Electronic Organ and in this issue are details of the Coronet Four, and our latest Electronic Organ.

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Goodsell M.A.5	13	10	0
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Leak Radio Tuner	35	0	0
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B.S.R. Monarch Auto-change ...	16	10	0
Decca X.M.S. Pick-up, with two heads (all values)	6	13	3
Ditto, with diamonds	14	8	0
Cosmocord G.P. 20	3	6	1
Cosmocord G.P.19 L.P. Head ...	2	0	0
Leak Moving-Coil (78 or L.P.) ...	11	11	0
Ditto with diamond	17	10	0
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The Reproduction of Disc Recording

INTERESTING DETAILS AND CIRCUITS FOR THE GRAMOPHONE ENTHUSIAST

By J. B. and R. E. Gregory

(*Concluded from page* 527, *September issue*)

SINCE the crystal contains no coils it has the lowest hum level, but its stability against changes in temperature and humidity is not very good ; in addition, it is usually more fragile than its magnetic counterparts.

Final choice of pick-up depends largely upon the amplifier it is to serve. When a high output is required (when feeding straight into a commercial radio, for example) a crystal is generally preferred. Sometimes, however, its output may be *too* high, resulting in overloading ; correction of this is a simple matter, and may be effected by a circuit such as that shown in Fig. 5.

Pick-ups incorporating dual styli for standard and L.P. can only give good quality where the problem of the large moving mass involved in vibrating two styli instead of one has been overcome without recourse to heavy downward pressure.

While the highest quality can be obtained from moving coils, they are generally expensive, and for practical purposes a good quality lightweight moving iron gives a wide frequency response with scarcely perceptible distortion.

(3) *The Stylus*

The stylus provides the connection between the pick-up and the rotating disc. The requirements of this small link in the reproducing chain are considerable ; it must track the groove perfectly, while introducing little noise and producing a minimum of wear on both the disc and itself. When one

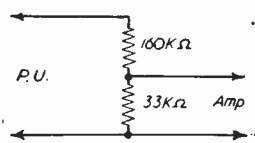

Fig. 5.—A simple attenuating circuit for use when the output is too great.

considers that the " length " of the groove on a 12in. standard recording may be a furlong, and on a long-player well over a quarter of a mile, it will be seen that a great deal is asked of this simple little needle.

Experiments have shown that the optimum position for the stylus to ride is about halfway up the groove walls ; if it rides lower the noise is increased ; if higher, it will tend to move about in the groove, causing rapid wear ; if higher still, it will tend to leave the groove altogether and skate across the surface of the disc.

To minimise wear, the downward pressure of the pick-up assembly should be as little as possible, but a certain " weight " is needed to keep the needle in the groove ; for where high frequencies or loud notes are involved the accelerations are high indeed, and there is a great tendency for the needle to leave the groove. Careful mounting of the stylus, giving a very free movement, has enabled pick-ups to track shellac discs perfectly with a needle pressure of 7 gms. and vinylite discs with a pressure as low as 3 gms., producing negligible disc or stylus wear. Variable surfaces, however, mean that for practical purposes 10 and 6 gms. are the respective minimums, and the pick-up arm must be carefully pivoted even then. It should be noted that certain pick-ups are on the market with a downward pressure insufficient to offset a stiff lateral movement ; these should be avoided !

Several materials have been employed in the manufacture of styli, ranging from soft thorns, through steel, to sapphire, ruby and even diamond. Given efficient lightweight pick-ups, the harder the material the better, for it will retain the correct shape longer and thus will both minimise wear and maximise fidelity of reproduction. In the case of more flexible materials, such as fibre and thorn, higher frequencies tend to be absorbed by the stylus before they reach the actual " E.M.F. generator " ; while this is normally to be deprecated, it may be a useful way of eliminating surface noise from worn discs.

Again, the resonant frequency is higher for the harder material, and distortion is therefore less. It was found, for example, that whereas the resonant frequency of a moving coil pick-up fitted with a sapphire was 20 kc/s, with a fibre it was about 11 kc/s—well within the audible range. The diamond needle will, therefore, produce the best frequency characteristic with the least wear. The difficulty of shaping and polishing such needles, though, means a high price, so sapphire (giving high quality with fairly good wearing qualities) provides the best solution for the modest purse.

(4) *The Motor-turntable Unit and the Pick-up Arm*

The turntable must revolve at a constant speed, while the driving mechanism must produce as little noise and vibration as possible. The motor is usually an A.C. induction type ; speed is easily held constant,

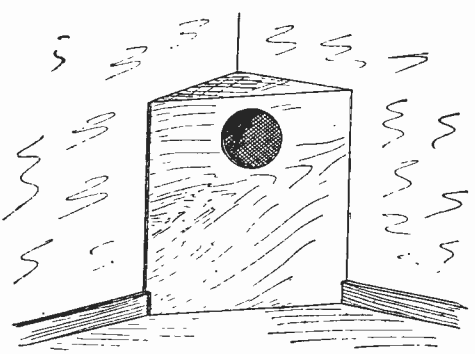

Fig. 6.—A typical corner cabinet of modern design.

and the absence of brushes and commutator results in a minimum of mechanical or electrical noise. In the case of "rim-drive," the motor drives (either directly or through an idler pulley) on the edge of the turntable; "centre-drive" sees the central bearing of the turntable acting as the drive. The former method is cheaper owing to the elimination of the necessity for gearing: however, most manufacturers prefer to drive the turntable on its inner edge (why?), and the resultant hollow turntable provides a perfect echo chamber wherein mechanical noise is amplified. Also, vibration is greater and speed is more variable, for the "flywheel" effect is not so great with rim-drive types. The noise is usually at its maximum between 50 and 100 c/s, and may be radiated directly or induced into the pick-up or amplifier. Little can be done to cure the direct acoustic noise save mounting the motor on rubber bushes (carefully done this can result in a considerable improvement), but electrical noise may often be removed by screening the motor, pick-up and leads.

Vibration will occur at the same frequency and, if too severe, rapid wear of record and needle may result. In addition, a loud hum will be produced in the output if the pick-up has a good bass response.

In order to allow good tracking, the pick-up arm must be very free of movement and must be positioned correctly in relation to the record. The first condition is best fulfilled by ball-bearing or gimbal mounting in both vertical and horizontal directions, and although this is expensive it is essential for the best quality to be obtained from a lightweight microgroove pick-up. Simpler mountings may, however, prove satisfactory; in this connection it is worth remembering that counterbalancing by weight rather than by a spring will normally give greater vertical freedom of movement.

If the pick-up is to trace the modulation of the groove correctly, a line drawn at right-angles to the side-to-side movement of the stylus tip should form a tangent with the groove throughout the length of the disc. In the commercial type of pick-up this would only be possible with an arm of infinite length; however, if the pick-up arm is bent at a suitable angle the error can be reduced to a maximum of 2 deg. with a 12in. arm, which provides a most acceptable standard.

If the mounting of the arm is poor the whole structure may resonate about the vertical pivot, and while there is no excuse for this, pick-ups do sometimes reach the market with this fault. The resultant peak in the output curve greatly increases wear, and the stylus may even be thrown out of the groove. But with free pivoting the lower resonant frequency can be kept down to about 20 c/s, where no trouble will occur.

(5) *The Amplifier*

The design of a distortionless amplifier for the reproduction of discs differs little from standard practice. There are, however, a few special requirements which warrant particular attention.

The amplifier is usually best built in two units: The main amplification stages (having a flat frequency response), and the pre-amplifier and "tone-control" stages (where any frequency correction required is carried out).

Ideally, the main amplifier has a response that is flat between 20 c/s and 20 kc/s. Phase-shift should be minimised within this range, for when transients occur the quality may be appreciably altered by the disturbance of phase relationships between the component frequencies.

Probably the most important component is the output transformer, for an unsuitable one can introduce frequency, harmonic and intermodulation distortion as well as phase-shift.

The initial stages provide all the control, and the first stage should normally give a fixed amount of bass boost, for all recording characteristics fall from about 300 c/s to 10 c/s at about 1 db an octave. The next two stages should provide the frequency controls so that recording characteristics can be corrected according to listening conditions and personal tastes. It is also advisable to have a "top-cut" control that enables the successive elimination of the higher frequencies in half-octave steps between 20 and 4 kc/s.

(6) *The Loudspeaker*

The loudspeaker system provides one of the main problems, for it is extremely difficult to produce in a comparatively small room the varied effects of symphony, opera or chamber music. No single speaker reproduces the entire audible spectrum, and the best answer seems to lie in the use of several speakers.

Admirable results are obtained with the output of the amplifier feeding into a cross-over network which distributes the output between three speakers. The bass unit should reproduce from about 800 c/s downwards. For this purpose, the bigger the speaker the better. A 12in. unit mounted in a bass reflex cabinet in order to lower the resonant frequency gives excellent results. If the cabinet is placed in the corner of the room, the reflections from the walls overcome the "point-source" effect of a normal baffle-mounted speaker, giving a better illusion of space. The middle-range speaker (of, say, 8in. diameter) should deal with frequencies up to 5,000 c/s, and should be mounted similarly or on a fairly large baffle. The high-frequency speaker is ideally a small metal cone type, or a horn-loaded ribbon (the latter rather expensive).

For those with less cash to spend, very good results may be obtained by using a single 8in. unit of high flux density in an enclosed corner mounting. The speaker must be situated off-centre, and the cuts for the skirting-board can be made slightly too big to provide some form of outlet. The cabinet (which is constructed of ½in. ply) is lined with cotton-wool to absorb reflected sound (Fig. 6).

(7) *The Equipment as a Whole*

To avoid electrical and acoustic feedback, separate units have much to recommend them: one unit will contain the "player" (the pick-up and motor); the second, mounted near the first, the pre-amplifier; the third, mounted near the speaker, the main amplifier; and the fourth, the speaker system. In practice, the second and third units can often be combined into a single "amplifier" unit.

The room, and the furnishings contained therein, have a considerable effect on the reproduction. Soft furnishings absorb sound easily, while wood and plaster reflect it. Sympathetic vibrations in pianos must be avoided, as must the accompaniment of bass notes by rattling plates. A correct reverberation time (i.e., the time taken for the sound to be absorbed by the room) is assumed to be about one second, but normally it is impracticable to alter room conditions.

SPECIAL CATHODE RAY TUBE OFFER

Brand New 12in. standard T.V. type, c.r. tube, **£12/19/6.** Carriage 15/- extra.

CONDENSERS

Electrolytic Cans.

16 mfd. 500 v.w.	3/6
24 mfd. 450 v.w.	3/11
32 mfd. 500 v.w.	5/11
60 mfd. 350 v.w.	3/6
64 mfd. 450 v.w.	4/11
8+8 mfd. 450 v.w.	3/11
8+16 mfd. 450 v.w.	3/11
8+32 mfd. 450 v.w.	3/11
15+8 mfd. 500 v.w.	4/6
16+16 mfd. 500 v.w.	4 6
16+24 mfd. 450 v.w.	4/11
16+32 mfd. 450 v.w.	4 9
20+20 mfd. 275 v.w.	2 -
32+32 mfd. 500 v.w.	4 11
32+32 mfd. 350 v.w.	3 11
60+100 mfd. 350 v.w.	7/6
250 mfd. 350 v.w.	4/11
1,000 mfd. 12 v.w.	3.11
8,000 mfd. 3 v.w.	6/11

Electrolytic Tubular.

1 mfd. 200 v.w.	1/-
1 mfd. 250 v.w.	9d.
2 mfd. 150 v.w.	1/-
2 mfd. 350 v.w.	1/6
4 mfd. 350 v.w.	1/3
4 mfd. 450 v.w.	1/6
8 mfd. 150 v.w.	1 6
8 mfd. 350 v.w.	2/-
8 mfd. 450 v.w.	1/9
8 mfd. 500 v.w.	2/3
15 mfd. 200 v.w.	2/-
16 mfd. 350 v.w.	2/3
16 mfd. 450 v.w.	2/9
16 mfd. 500 v.w.	3/3
32 mfd. 350 v.w.	3/6
32 mfd. 450 v.w.	4/9
50 mfd. 350 v.w.	4/6
250 mfd. 12 v.w.	2/-
250 mfd. 25 v.w.	2/11
8+8 mfd. 350 v.w.	3/-
8+8 mfd. 450 v.w.	3/11
12+12 mfd. 350 v.w.	2/6

SPECIAL TV CONDENSERS

By T.C.C. 32+100 mfd. Type CE15PE, 450 v.w., 7/6. .04 mfd. Type CP59V0 12.5 Kv., 7/6.

BIAS. 75 mfd. 12 v.w., 1/-; 10 mfd. 25 v.w., 12 mfd. 50 v.w., 50 mfd. 12 v.w., **1 3**; 25 mfd. 25 v.w., 25 mfd. 50 v.w., 50 mfd. 25 v.w., **1/6**; 50 mfd. 50 v.w., **1/9**; 100 mfd. 25 v.w., **2/-**; 100 mfd. 50 v.w., **2 6.**

Tubular Waxed, and Miniature Mica. 500 v.w. All values up to .1 mfd., **6d.** each, **5/-** per doz. .1 mfd., **9d.** each.

MAINS TRANSFORMERS

All 200-250 volts c.p.s. primary. Finest quality, fully guaranteed.

MBA/3. 350-0-350 v. 80 mA. 6.3 v. 4 a., 5 v. 2 a. Both filaments tapped at 4 volts. An ideal replacement trans. Price, **18/-.**

MBA/5. 350-0-350 v. 125 mA. 6.3 v. 4 a., 5 v. 3 a. With mains tapping board. Price, **27/6.**

MBA 6. 350-0-350 v. 100 mA. 6.3 v. 3 a., 5 v. 2 a. With mains tapping board. Price, **22/6.**

MBA/7. 250-0-250 v. 80 mA. 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. Price, **18/-.**

MBA/8. SPECIAL OFFER. Drop through type. 235-0-235 v. 60 mA. 6.3 v. 3 a., 5 v. 2 a., **12/6.**

AT/3. Auto transformer. 0-10-120, 200-230-240 volts, 100 watts. Price **17/6.**

AT/5. TV Type Mains Auto. 200, 220, 250 also 375 v. inputs. 250 mA, 5 v. 3 a., 6.3 v. 7 a., 6.3 v. 3 a., **25/-.**

FILAMENT TRANSFORMERS

6.3 v. 1.5 a., 7/11.
6.3 v. 3 a., **12/6.**
Special Transformer. 2 amps., with the following tappings; 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volts. PRICE **17/6.**
FIL/4. Heavy duty filament transformer. 6.3 v. 8 a., 5.3 v. 3 a., 5 v. 3 a. Shrouded drop-through type. With mains tapping board. Price **32/-.**

PERSPEX. 13½ x 10½ x ¼in. Neutral shade, slightly marked. **4/11** per piece.

TEST PRODS. Fused, with fully retractable points. Price **4/11** per pair.

ANTENNA ROD SECTIONS

Each rod is steel heavily copper plated. Any number can be fitted together. 12in. long, ¼in. diameter. Price **2/6** per dozen post free.

GRAM MOTORS. Rim drive. For 200-250 v. 50 c.p.s. Many uses. **9/6** each.

TANNOY PRESSURE UNITS

10 watts, 7.5 ohms impedance. LAST FEW ONLY. **59/6.** Carriage 3/6 extra.

R.1132A RECEIVERS. Complete with all valves. Store soiled, **50/-.** Carriage 10/- each extra.

5 WAVEBAND RADIO CHASSIS

LIMITED QUANTITY.
(Frustrated Export).

Circuit has R.F. stage. Magic Eye tuning indicator and many other features. For A.C. 100-250 volts. Waveband coverage 11.5 to 550 metres. Valve line up—2 EF39, 1 ECH35, 1 EBC33, 1 EL33, 1 5Z4, 1 EM34. **LASKY'S PRICE £10.19/6.** With valves. Less dial. Carriage and packing, 15/- extra. WILL MAKE A SUPER RADIO-GRAM.

SUPERHET COILS

For 465 Kc/s. 10-30 metres. Aerial and oscillator. **1/11** per pair. With Circuit. Postage 9d. extra.

I.F. TRANSFORMERS

465 Kc/s Iron dust cores in cans, midget type. Size: 1in. x 1in. x 2¼in. Price **9/6** per pair.

WEARITE TYPE 550. 445-520 Kc/s. **10/-** per pair.
WEARITE TYPE 500. 450-470 Kc/s. **10/-** per pair.

P.M. LOUDSPEAKERS

All less o'trans. new and unused. First quality.

3in. Elac.	12/11
5in. Plessey	12/6
6½in.	13/6
8in.	15/-
10in.	25/-

SUPERHET COIL PACKS

3 Wavebands: 12-35 metres; 35-100 metres; 200-550 metres; Size: 4 x 4 x 3in. Price **16/-.**

CAR RADIO PLUG SUPPRESSORS, 1/6 each.

V.H.F. SUPERHET TUNING UNITS

By well known manufacturer. (Frustrated Export.) Input 300 ohms balanced line. Frequency range:—54-89 Mc/s and 174-217 Mc/s. Uses 2 6AK5 and 1 6C4. I.F. 45 Mc/s. Blank scale. Permeability tuned. Provision for automatic gain control. Dimensions: 9in. wide, 6½in. deep, 4in. high, 9in. scale. **LASKY'S PRICE 17/6.** LESS VALVES. Carriage 2/6 extra. Circuit diagram supplied.

C.R.T. MASKS, Brand New

LATEST ASPECT RATIO

10in.	7/6
12in.	15/-
12in. flat face	15/-
14in. rectangular	21/-
16in. Double-D	31/6
17in. rectangular	27/6

SOILED OLD ASPECT RATIO

9in.	5/-
12in.	7/6
12in. with fitted armour glass. (New ratio.) Cream	11/6
12in. with fitted armour glass. (New ratio.) Black	8/6

9in. TABLE TV CABINETS

Medium shade mahogany finish. Complete with back, safety glass, speaker-fret. Internal dimensions: 19in. high, 16in. wide, 14in. deep.
LASKY'S PRICE 39/6 carriage 7/6 extra.
Adaptor frame available for 6in. C.R. tubes. The aperture can easily be enlarged to take 12in. or 14in. tubes.

OUTPUT TRANSFORMERS

40 mA. Multi-ratio	6/11
80 mA. Multi-ratio	14/11
80 mA Pentode	12/6
60 mA Plessey, 6,000 ohms	5/11
Standard pentode	4/11
Pentode	3/6
Midget pentode	4/3
Miniature pentode, 3S4, 1S4	4/6
PX4 Intervalve	8/6
5:1 Intervalve	5/11

15in. C.R.T. MASKS

Latest aspect ratio. New and unused. No. 1 Rubber. Overall size: 17in. wide, 13in. high. Price **17/6.** Post 2/-. No. 2. Plastic. Incorporating dark screen filter and gold finish tube escutcheon. Overall size: 15in. wide, 12in. high. Price **21/-.** Post 2/-.

SMOOTHING CHOKES

20 mA. 40 H.	3/11
40 mA. 8 H.	3/11
40 mA. 10 H.	4/3
100 mA. 10-20 H.	7/3
120 mA. 10 H.	15/-
200 mA. 5 H. 50 ohms	12/6

TELEVISION SELENIUM RECTIFIERS

The very latest "Sentercell" S.T.C. range.

K3/40, 3.2 kV.	7/6
K3/45, 3.6 kV.	8/2
K3/50, 4.0 kV.	8/8
K3/100, 8.0 kV.	14/8
K3/160, 12.8 kV.	21/6

S.T.C. METAL RECTIFIERS

RM1	3/6
RM2	4/6
RM4	18/-

AMPLIFIERS

4-Watt Model. Ex Government. Complete with 10 valves: 2 25L6; 1 6H6; 1 25Z6; 6 6SK7. For operation on 110 volts A.C./D.C. Balance and push pull. High, medium and low impedance inputs. A.G.C., etc. **LASKY'S PRICE £5/19/6** complete. No circuits available. Carriage 10/- per unit extra.

CRYSTAL DIODES

Germanium. Price **2/3** each. Post Free.

E.H.T. Transformer for VCR97, **45/-.**

Screen Enlarger for VCR97. Filter type, **17/6.** Postage 2/6.

E.H.T. Condenser.
.1 mfd. 2.5 kV. **2/6.**

FULLY ASSEMBLED POWER PACK AND OUTPUT STAGE FOR R1155 RECEIVERS. For use on 200-250 volt A.C. mains. Wired and complete with valves. LASKY'S PRICE. **79/6.** Carriage 5/- extra.

EX-A.M. RECEIVER TYPE R1155.
Brand new and unused. 5 Frequency ranges: 18.5-7.5 Mc/s; 7.5-3.0 Mc/s; 1,500-600 Kc/s; 500-200 Kc/s; 200-75 Kc/s. Supplied in maker's original wood transit case. LASKY'S PRICE. **£11/19/6** Complete. Carriage 12/6 extra.

USED MODEL R1155 RECEIVERS. Aerial tested before despatch. Complete with 10 valves. LASKY'S PRICE **£7/19/6.** Carriage 12/6 extra.

SECONDHAND R1155. Less valves and faulty. Ideal for breaking up for spares. **50/-,** carriage 7/6 extra.

VCR97 C.R. TUBES, new unused, **35/-.** Carriage 5/-.

VALVES. 10,000 IN STOCK AT THE LOWEST POSSIBLE PRICES.
SOME EXAMPLES.

50L6	...	10/-						
35Z4	...	9/-						
6AM6	...	9/-						
6H6	...	2/6						
EF50, Red New Sylvania		10/6						
1S4	...	9/-	1A5	...	9/-	6J7	...	6/6
3S4	...	9/-	12K8	...	8/6	HL2	...	3/6
1T4	...	9/-	12Q7	...	8/6	KT2	...	3/6
1R5	...	9/-	6AL5	...	9/-	6K8	...	9/6
1S5	...	9/-	6K7	...	4/6	U50	...	9/-
1C5	...	9/-				ECH35	...	13/6
EF39	...	7/6						
12K7	...	10/6						
6L6	...	10/6						
EA50	...	2/6						
EBC33	...	7/6						
35L6	...	10/-						

SPECIAL OFFER, 4 Valves: 1 each 1R5, 1T4, 1S5 and 3S4.
LASKY'S PRICE 32/6.
POST FREE.

LASKY'S RADIO

Lasky's (Harrow Road), Ltd.,
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Telephones: CUNningham 1979-7214. All Depts.

MAIL ORDER AND DESPATCH DEPARTMENTS: 485-487, HARROW ROAD, PADDINGTON, LONDON, W.10.

Hours: Mon. to Sat. 9.30 a.m. to 6 p.m.; Thurs., half day, 1 p.m. Postage and packing charges (unless otherwise stated): on orders value £1—1s. 0d. extra; £5—2s. 0d. extra; £10—3s. 6d. extra; over £10 carriage free unless specifically stated otherwise. All goods fully insured in transit.

Time—The Highest Cost in Servicing

SOME IDEAS FOR TIME-SAVING FOR THE SERVICE ENGINEER By F. E. Apps

IN any service job it can be safely said that of the total cost of the job, 75 per cent. is for time spent on it. It is with the idea of reducing this time and thus reducing the cost of the job, that this article has been written. If this is successful, it will give satisfaction to the customer by the lower cost and speedier completion of job, and also to the engineer concerned, by ensuring more custom, as his charges will be lower than his less efficient competitors.

In this article I propose to state the probable causes of wasted time, and, dealing with each one separately, suggest ways in which considerably to reduce it. One cannot, of course, in a short article cover every point, but the reader will, no doubt, by following the same ideas, be able to discover ways and means of his own.

The Work-bench

This is an important point. The bench should be as clear as possible for the job on hand. Old valves and components should be discarded, and all there should be on the bench would then be the necessary tools required, and the instruments needed on the job. A complete set of test valves, very clearly labelled as such, should be kept handy to the bench, and care should be taken that these are returned to their proper place immediately after use on the chassis in hand. This will eliminate time wasted by searching "for that valve I had here yesterday."

Components

These can be "time wasters." See that all components for either replacing in set or as "substitute testers" are above suspicion. Discard all doubtful ones immediately. Keep all components in separate jars or boxes, labelled as such, according to values within reasonable limits. Thus, with condensers, .1 and .01μF can go together, but do not mix with .001μF or lower values. Resistors should be kept separately as well, distinguishing as between 1 kΩ, 10 KΩ, 100 KΩ, 1 MΩ, with the intermediate values. Wire-wound and high-wattage resistors should be kept separate. I expect many readers have wasted quite a time looking for perhaps a 68Ω $\frac{1}{2}$ watt resistor amongst a box of a couple of hundred assorted ones.

If obtainable, have handy a service sheet of the job in hand. The time wasted in trying to locate components in a receiver that is new to the engineer, without a service sheet, can be considerable.

Tools

Do use the correct tools on the job as far as possible. Use box spanners or ordinary spanners for nuts; pliers are not satisfactory, and waste time. Keep your screwdrivers ground and use the most appropriate size for the screw. Use trimming tools for trimmers only if these have to be reset, and do not forget to replace shakeproof washers if they have been previously used. A tool-rack in front of the bench is a good idea, but use it for replacing tools after use.

Instruments

Good instruments are necessary for every service engineer, but they will not remain so unless they are periodically checked. The universal meter is important. Each time it is used, see that it is "zeroed." A faulty reading can lead you astray for quite a while, searching for a fault that does not exist. Use a meter of the 1,000 ohms-per-volt type; this will ensure your getting readings near enough correct for ordinary service work. Know your meter and its vagaries (they all have them).

Signal generators, oscilloscopes and wobulators are generally included in a fully-equipped workshop. The signal generator is important for re-alignment, and, therefore, should be checked against standard broadcast frequencies once a week. Use a receiver capable of receiving these frequencies and beat the unmodulated signal from the signal generator with the received frequency. Adjust generator to zero beat and check reading, noting differences, if any. The oscilloscope and wobulator are not normally required for ordinary radio servicing. Their use, and an easy and rapid method of using them when servicing frequency modulation sets and television, will be explained in a later article.

The "on the site" service kit should be limited, as far as is possible, for efficiency. Major operations are not advisable in a customer's house. The lighting is often insufficient and as it is practically impossible to have everything that is required at hand, jobs are only patched up. Suggested make up of an "on the site" kit is as follows: A general purpose meter, soldering iron, small selection of tools, spare set of valves, small components such as electrolytics, fixed condensers of usual values and resistors. The service manual, if available, should be included. I advise that, if the job appears to be a bench job, you do not hesitate to inform customer immediately. Don't half do the job before telling him this. This is wasted time. If explained in the correct manner, most owners of sets will soon realise that the job can be done more efficiently on the bench, with all the necessary instruments, tools and parts to hand.

Fault-finding

This is the part of the job that a systemised method must be used, if rapidity and efficiency is to be desired. The "from grid-to-grid" method is the generally accepted means of fault-finding, whether the trouble is "no signals," "intermittency," "instability," or "hum." Two or three short leads with crocodile clips at each end are necessary and should be readily available. Start from power supply and proceed right through circuit to aerial, earthing each grid in turn from output to frequency changer or R.F. valve, and listen for the usual response. The point where the set fails, is

unstable, intermittent or, where the hum originates, can thus be quickly ascertained. An inspection and check of each component in that portion of the circuit should then result in a speedy cure. Take a voltage check at this point to ensure that the anode, screen and cathode potentials are correct. Should a condenser, or resistor, be found open circuit, do not put another one across it but remove the faulty one and replace with one of the correct value. Readers may think that this warning is unnecessary, but I have seen it happen many times, with the result that the set gave intermittent results after a time through the faulty component being left in the circuit.

Frequency Changer

Trouble in the local oscillator circuit of the frequency changer can be difficult to find unless some sound method is used to locate it. Generally, this trouble is caused by one of the following faults: (a) the frequency changer and/or local oscillator valve; (b) the wavechange switch contacts; (c) change in value of the oscillator grid condenser or the oscillator grid-leak; (d) the oscillator section of the gang; (e) insufficient volts on the oscillator anode or screen of the frequency changer; (f) the oscillator coil having open-circuited or shorted turns. Although the correct method of checking the local oscillator is to place a meter in series with the oscillator grid-leak (meter 1,000Ω/v), a rough-and-ready test can be made by touching the stator vanes of the oscillator section of gang with a screwdriver. If oscillating, loud clicks will be heard.

Noisy operation of gang is generally due to dust in the vanes. An easy way to get rid of this is to burn it out with the H.T. Connect one end of a short lead with a crocodile clip to the H.T. line and touch other end to stator of portion of gang causing trouble. Revolve gang at same time. It is advisable to remove frequency changer and I.F. valve whilst doing this. If an A.C./D.C. set remove grid connections. Examine gang before trying this to ensure it is not vanes dead-shorting.

The oscillator grid condenser is generally of the silver mica type, of about 100 pF, and will sometimes go "open circuit." The set then will oscillate on the S.W. band and on the M.W. at the highest frequency, or when the gang is fully open.

Squegging is nearly always due to a faulty oscillator grid-leak.

Unusual Faults

These are the troubles that can cause loss of time, as the usual tests do not seem to locate them. For instance, a set after being serviced for some minor fault, on being reboxed developed a loud hum. It was located in the output stage. A new output valve made no difference, nor did extra smoothing. After unboxing set it was found that the mains lead going to the on/off switch on volume-control had been moved so that it crossed over the grid leads to volume-control and thus induced mains hum in them.

Another set developed a H.T. short. A meter test showed that the short-circuit disappeared when the I.F. valve was removed. A new valve also showed short. Investigation of valveholder revealed a piece of solder between the upper and lower portions of paxolin of holder, causing a short when valve was plugged in, but just clear when valve was removed.

These faults, however, are not common and the only way to clear them is to be systematic in your testing and not to start going round in circles, testing the same things over and over again.

21 YEARS OF PROGRESS

(*Continued from page* 609)

for us to relax our efforts, indeed, we increased them, and for the next six years we continued to appear weekly and in the larger size of pre-war years.

Size Reduction

The declaration of war in 1939 and the restriction on paper supplies naturally caused us in common with all other journals to reduce the number of pages in each issue, but we continued to appear weekly in our pre-war size until July 27th, 1940, and as a monthly in that same size until November, 1941. The first issue of PRACTICAL WIRELESS in the present size was dated December, 1941. Naturally, the editorial policy of the war years was veered to suit the changed conditions. The Services required thousands of technical personnel as radio telegraphists and radio and radar operators, and we therefore commenced publication of articles of an educational nature.

Adequate tribute has been paid to the services we rendered to the State in this connection, and we continue to receive letters of gratitude from those now holding prominent positions in the Services and in the radio industry, for the instruction they received at our hands and which was responsible for their progress.

Except for the printers' strike in 1950 which compelled us to produce two issues in one (dated September-October, 1950), we have appeared continuously, and to date 564 issues have been despatched all over the world from this office. For PRACTICAL WIRELESS has a world-wide circulation, and we daily receive letters from almost every part of the globe. Messages of congratulation have poured in since the announcement some months ago of this Special Birthday Number from thousands of readers who have taken the paper from its first issue.

Other pages in this issue date-line the milestones in our history and list some of our most famous receivers. Earlier readers, however, will remember our introduction of Transfer prints by means of which, like a ladies' embroidery pattern, the wiring diagram could be imprinted on the chassis; our free gift Wire Gauge and set of B.A. Spanners; our free gift Data Sheets and Booklets; our Pocket Tool Kits, to mention but a few of our efforts to assist constructors.

"Practical Television"

As we pass the twenty-first milestone we observe the same enthusiasm for television as permeated radio in its early years. Instead of having to cramp this new branch of electronics into a small section of this journal it now has our sister journal "Practical Television" to cater for the needs of the amateur. The next twenty-one years will see marked changes in both of these allied sciences, and readers may rely on this journal promptly and accurately to record those developments and to bring to them, as hitherto, news from the four quarters of the earth. We express our sincere thanks to them, and to our advertisers for their loyalty and their continued support.

Aerialite, Ltd.

AS specialists in aerial equipment the principal exhibits on this stand consisted of aerials, aerial accessories, and various forms of cable and connecting wires, etc. The main items are, of course, for televisions reception and are dealt with in our companion journal. [Stand No. 79]

Allan Radio, Ltd.

AS manufacturers of loudspeakers this firm specialises in extension models of various types. They have introduced a new series of "Bafflette" models in which a special feature is made of the piano finish which is obtained by a new process and is now to be adopted as standard. All models are fitted with a constant impedance volume control, and range in size from 5in. to 8in. [Stand No. 85]

Ambassador Radio
(R. N. Fitton, Ltd.)

ALTHOUGH television is the main attraction on this stand, a special feature is made of a new radiogram fitted with new style three-speed auto-change mechanism. It is a miniature de-luxe model selling at £48. Other models include a larger de-luxe radiogram with eight wavebands and separate bass and treble controls selling at £88 10s. [Stand No. 5]

Antiference, Ltd.

IN addition to the special television equipment, this exhibit also features a new car aerial known as the "Autex" which has achieved considerable popularity since its introduction. Also shown are a full range of "Exstat" anti-static radio equipment, mains suppressors, plugs and sockets and other aerial accessories. [Stand No. 53]

Association of Radio Battery Mfrs.

THIS stand features the products of companies with the most famous names in the dry battery industry. These range from the specially developed miniature dry cells for hearing aids to larger models used for specialised electronic equipment. [Stand No. 99]

Automatic Coil Winder & Electrical Equipment Co., Ltd.

HERE are shown various examples of test equipment, ranging from small portable test-sets to large electronic testers. Of these the new 95-range multi-tester will particularly interest the research worker and experimenter. The popular 20,000 ohms per volt Model "8" Avo-Meter will be shown in its skeleton form so that the method of construction may be clearly seen and this is more or less standard in most experimental trade laboratories. In addition coil winding machines selected from the firm's 30 models will also be shown. [Stand No. 15]

Balcombe, Ltd., A. J.

AGAIN television is prominent on this stand, but prominent among the radio receivers will be seen Model 3841, a table radio in unique style cabinet and the new Model 101 all-dry/mains portable in a maroon and grey attaché case. Some new radiograms will also be seen, as well as the portable radiogram Model 707—which is claimed to be the

SPECIAL NOTE

This review has been compiled from information supplied by exhibitors, as we go to press with this issue before the Show opens. The omission of certain exhibits is, therefore, explained by the fact that the manufacturers concerned have not, at the time of going to press, supplied us with the information. Further reports will appear next month.

first portable radiogram to work off mains or batteries. Special export models will also be seen. [Stand No. 101]

Belling & Lee, Ltd.

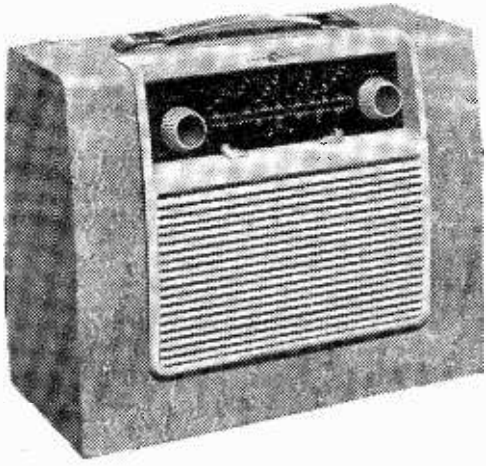
THE small products of this firm are already well known to our readers and to attempt to list them all would be impossible in the space available. From complete aerials for television or radio use, down to the smallest terminal the range includes a host of universally used sockets, plugs, interference suppressing components, fuses, etc. A new light-duty cut-out known as the "Minitrip" will be seen with other thermal delay switches, and for experimenters who are interested in the miniature receiver design specially produced extractors for B7G and B8A and B9A valves, which include a straightener for B7G and B9A pins, will prove particularly attractive. A flexible terminal block of the 5 amp. 12-way type is also to be featured. [Stand No. 102]

Boosey & Hawkes, Ltd.

FOR the first time this firm will be showing a tape recorder of unusual design—claimed to be the only one of its kind in the country. Known as the "Reporter," this is a battery-driven model with spring-driven motor. There is a choice of speeds—7½in. or 3¾in. per second and one winding of the spring gives a recording time of eight minutes. The standard model weighs only 12 lbs., but a de-luxe version is available with small built-in loudspeaker and this weighs 1 lb. more. [Stand No. 209]

Bulgin & Co., Ltd.

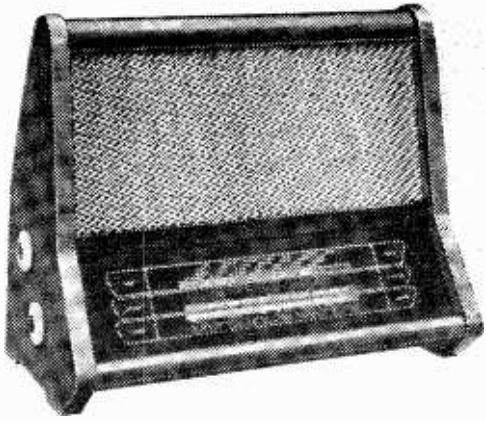
FOR many years the name of Bulgin has been a household word among constructors, and although to-day this firm concentrates mainly on the manufacturer their products are still used by constructors. They range from switches to control knobs and form a most picturesque display. It would be difficult to single out any one item, but we are particularly attracted by the signal lights of various types which in our opinion are not used as much as they ought to be. Expensive equipment which is properly designed should be absolutely hum-free, and unless a signal is being delivered to the loudspeaker it is a simple matter without a panel signal of some kind to leave the equipment switched on for many hours unnecessarily. An interesting range of these devices may be inspected and includes some which have multi-coloured fronts for various purposes. [Stand No. 1]



A neat portable from the Ekco range. Note the manner in which the switches have been partially concealed and protected in this model. They are below the dial.

Champion Electric Corpn.

THIS firm are displaying a full range of mains and battery receivers and portables, table and console radiograms and television equipment. In addition there will be seen the REV-LER transportable record player. This is a mains-operated three-speed unit with crystal pick-up and is provided with amplifier and loudspeaker in a light-weight travel case. A Junior model is also available. Both of these models are for A.C. only. [Stand No. 71]



An unusual shape has been adopted by Alba in this Model 3841. *The large full-vision dials are useful as well as attractive.*

Cole, Ltd., E. K.

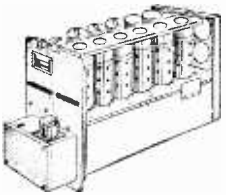
UNDER the trade name EKCO the products of this company are world-famous, and many new radio and television models will be seen on their stand. Among the new radio receivers will be seen four new models, two of which have plastic cabinets moulded by Ekco Plastics. Instantaneous selection of three pre-tuned stations with free tuning on long and medium waves are available on Model U199. This is a compact 5-valve superhet for either A.C. or D.C. mains. Model U195 provides four pre-set stations, one on long wave and three on the medium. Other exhibits will consist of car radio receivers and aerials for installation in any type of car, and fully tropicalised radio models for the export market.

Shown on the left is the "Stroller," a mains-battery portable which makes a feature of I.E.E. and B.S.I. safety precautions. [Stand No. 100]

Collaro, Ltd.

THE main Collaro exhibits for this year are the entirely new series of record changers known as the "53" series. They include a non-mixing and a mixing model, both of which are for single

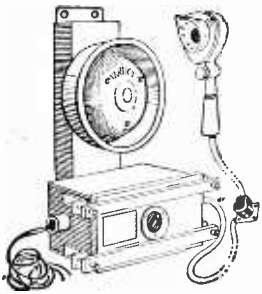
(*Continued on page* 629)



6 VALVE V.H.F. SUPERHET RECEIVER. Ex-W D. (R.1124), but brand new condition. 30.5-40 Mc/s, I.F. 7 Mc/s. 6-channel switching. Covers TV. sound, Fire, Amateurs, etc. Convertible to mains (A.C. or A.C./D.C.). Components include 30 ceramic trimmers, 30 small condensers, 30 resistances, 6 valveholders, cans and covers, 2 transformers, 3 coils, etc. Our price 7/6, post 2/6. Also supplied complete with valves at **17/6.** Drawings available at **1/-.**

EXTENSION SPEAKERS. Brand new 6½in. P.M. speaker (low impedance). Mounted on polished and veneered baffle stand, with gold sprayed metal fret. 5ft. lead ready connected. ONLY **19/9.** Post 1/9.

LOUD HAILER. Very powerful P.A. system, working off 12 or 24 volts. Brand new. No valve to break or damage. Independent of electricity failures. Weatherproof. Consists of microphone and combined amplifier/speaker. Total weight 20lb. Our price, **£8/17/6,** carriage 5/6.



INSULATING TAPE. Brand new and wrapped, ½lb. rolls, ½in. wide, list price **3/6.** Our price, **1/6.**

MICRO SWITCHES. Latest American midgets. 250 volt 3 A., ½in. x ¼in. x 1¼in., **3/6.**

VALVE SALE. SURPLUS AND SALVAGE

8/9d.	**8/9d.**	**6/9d.**	**5/9d.**	**3/9d.**	**2/6d.**
10P13	EL91	6L7	E1436	RL37	4D1
EF91	EL41	210DDT	EF92	12SJ7	8D2
EF41	6F15	KTZ41	6J5	LP2	9D2
3A8	6V6	KT33C	KTW61	TT11	15D2
10F1	35Z4	KTW63	SP2	37	AR6
1S4	1R5	EF50	12SK7	VP23	C2C
1T4	ECL80	ECC91	OZ4	EF36	EB34
X66	3S4	UF41	1A5	35Z3	VP133

T.R.F. BEDROOM KIT. Brand new 4-valve receiver. Excellent reception on Long and Medium waves. Available in white or brown plastic, or brown (walnut) wood. All complete at **£6 9s. 6d.** Also in kit form, with full wiring diagram and point-to-point instructions, at **£5 9s. 6d.** Carriage 3/6.

TELESCOPIC MASTS. Ex W.D., but unused. Extends to 7ft. 6ins. Base diameter ¾in., tip ⅛in. Ideal aerials, etc. PRICE **7/9,** post 1/3.

BURGLAR ALARMS. Brand new self-contained unit, made by Truvox. Consists of bell, and trip device mounted in metal cover. Works off 4½ volt battery. SPECIAL OFFER **18/9,** post 1/3.

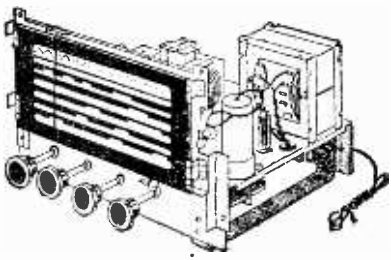
TV TUBES. All makes and sizes. 9in. **£3,** 10in. and 12in. **£5,** and 15in. **£6.** Each one shown in working order (personal callers only). Also slightly faulty ones at half these prices.

MIXED RESISTORS. All popular sizes from ⅛ to 1 watt. 20 for **5/-,** 45 for **10/-,** or 100 for **£1.**

ELECTROLYTICS. Daly, unused, 30-30 mfd., 450 V.D.C., **3/9** ; 16-16 mfd., 375 V.D.C., **4/9** ; 12-12 mfd., 350 V.D.C., **3/9** ; 8 mfd., 350 V.D.C., **1/9.** Post 6d.

MINIATURE 'PHONE SPEAKERS. Ideal quality microphone or personal extension speaker. New and guaranteed. BARGAIN PRICE, **2/9,** post 6d.

PORTABLE AERIAL COILS. Brand new. Wound on aluminium frame measuring 4in. x 6in. BARGAIN at **2/6,** post 6d.



RADIO-GRAM CHASSIS. Latest 1953 models, all brand new. Six waveband (illustrated) at **FIFTEEN GUINEAS,** and three waveband at **TWELVE GUINEAS** Escutcheons available at **4/9.** Chassis measurements 11½in. x 7in. x 8¾in. Also additional three-wave model at **£10 17s. 6d.,** including **FREE SPEAKER.** Gram switch and pick-up sockets, negative feed-back, etc. Carr. 4/6. Terms Available.

RADIO TELEPHONES. American walkie-talkie type transceivers. 53-75 mc/s. Complete in canvas carrying case, and packed in heavy wooden transit case. **£9 17s. 6d.** each. Operated from set of internal batteries, or a vibrator unit from 12 volts. Vibrators **27/6** each. **SPECIAL OFFER** of £21 per pair, including vibrators. Carr. 10/-.

TUNING CONDENSERS. Store soiled, tested .0005 mfd., standard size. **2/9,** post 6d. **BARGAIN OFFER,** three for **7/-.**

FIXED CONDENSERS. Various values, .005 mfd. to .25 mfd., 5,000 to 350 V.D.C. In mixed parcels of 20 for **5/-,** 45 for **10/-,** or 100 for **£1.**

O.P. TRANSFORMERS. Store soiled, tested. Match all normal O.P. valves to 2-5 ohm speech coil. **CLEARANCE OFFER, 1/9,** post 6d.

BULGIN RESISTORS. Spaghetti link type. New and boxed. Nine sizes from 240 ohms to 30 k. **4d.** each.

FUSE HOLDERS. Porcelain, 15 amp., with fuse (back wiring type). Listed at **2/9.** CLEARANCE FRICE **9d.,** post 4d.

RELAYS. New and boxed. G.P.O. pattern, break one make three, 1,000 ohms. **3/9,** post 1/-.

SPEAKERS. Brand new 5in. at **13/9,** 8in. at **18/9,** and 10in. at **22/9.** Reconditioned 6½in. at **14/9,** 8in. at **15/9,** and 10in. at **17/9.** Post 1/-. All these are P.M., low impedance.

25/1196 SETS. Partly dismantled, but approximately the following remain. 4 tuning condensers, 28 resistances, transformers, switches, valve holders, etc. As spare chassis these are priced at **3/9,** post 2/-.

I.F. TRANSFORMERS. All tested and guaranteed. 465 kc/s. TO CLEAR **7/6** per pair. Post 9d.

MIC. & 'PHONE TRANSFORMERS. Ex W.D. hand microphone and matching transformer for headphones (ratio 400-3), with standard Jack plug wired on. BARGAIN, **5/6,** post 9d.

MOTORS. Shunt wound, 80 volt D.C., 1/20 h.p Store soiled, but in working order. CLEARANCE PRICE **17/9,** post 2/3.

METERS. Brand new and boxed, made by Weston. Moving coil movement giving full scale deflection at 100 micro-amps. 2in. scale in 2½in. square mounting. SPECIAL PRICE **28/6,** post 1/6.

FUSE WIRE. Tinned copper fuse wire, brand new but store soiled. 18 S.W.G. Takes up to 60 amps. Spooled on wooden reels, net weight 1lb. Listed at **14/6.** OUR PRICE **5/9,** post 9d.

RECTIFIERS. Brand new, selenium, type I.T. and T., REC1. Input 180 volts, output 130 volts at 40 m/A. CLEARANCE OFFER **3/9,** post 6d.

C.W.O. OR C.O.D.

DUKE & CO.,

621, ROMFORD ROAD, LONDON, E.12. GRA. 6677.

STAMP FOR CATALOGUE. MONEY BACK GUARANTEE.

speed (78 r.p.m.) operation. Three-speed models are also to be shown, and a special feature of this is the heavy-duty rubber bonded turntable, which is driven through a new three-speed drive and completely eliminates "wow." A new centre post has been introduced to ensure satisfactory operation of 45 r.p.m. discs and this can be fitted or removed instantly. [Stand No. 35]

Cosmocord, Ltd.

NEW products to be introduced at this year's show will include a completely new range of general purpose microphones, and in addition to the existing range of pick-ups there will also be a new crystal model incorporating the latest "Hi-g" development, which enables it to track with ease all the latest types of record. This pick-up has separate heads for standard and L.P. records, and the tracking weight is only 8 grammes. The customary sapphire styli of the cantilever type are fitted to reduce wear. [Stand No. 234]

One of the well-known Avo testmeters. Every worthwhile serviceman should be equipped with an instrument of this type.

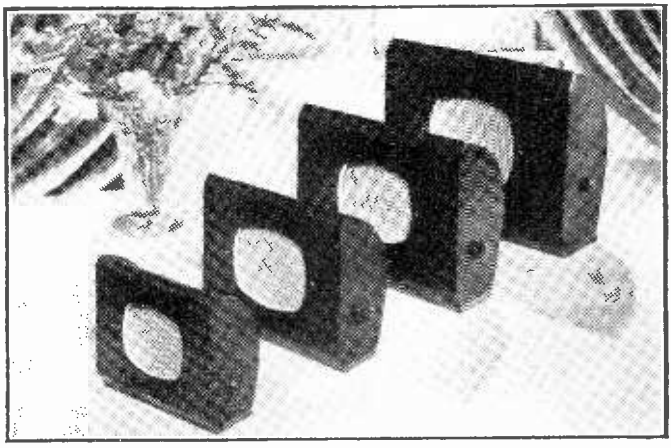
Dubilier Condenser Co. (1925) Ltd.

AMONG the large range of condensers to be shown on this stand the new range of metal cased, produced to meet the requirements of the highest category A Class H.1 of the Joint Services RCS.131 and Radio Industry Specification RIC.121 (Red Grade) will be seen. These are hermetically sealed containers of brass with glazed ceramic end discs with wire ends, containing extended foil type capacitors impregnated in a mineral oil. Another new line is the Interference Suppressor consisting of a standard three-pin 5 amp. or 15 amp. plug with suppressor capacitors incorporated in the body of the plug. This is made of hard rubber in place of the usual bakelite and is, therefore, virtually unbreakable. Other exhibits consist of volume controls, high-stability resistors, trimmers, etc., as well as ceramic capacitors in a range from 300 to 4,700 pF. The largest is only 3 by 16 mm. [Stand No. 98]

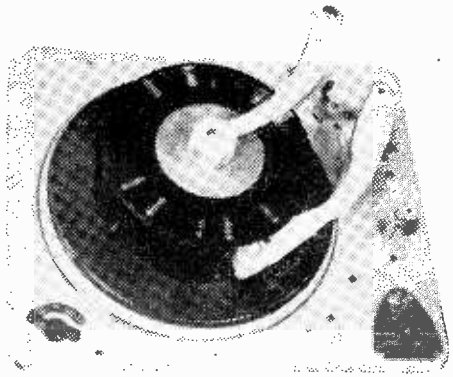
An interesting record-player from the Alba range to be seen on Stand No. 101.

Edison Swan Electric Co., Ltd.

IN addition to the television tubes which form the main display here, there may also be seen the wide range of Mazda valves, Ediswan Clix radio components and Ediswan radio products, whilst



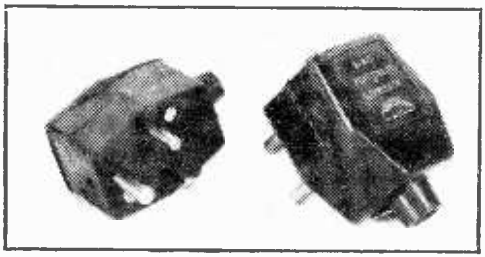
Extension speakers in various patterns are a speciality of Richard Allen, Ltd., and a group of their "Bafflette" models is seen here.



As specialists in gramophone accessories the name of Collaro is world-famous and this is one of their new three-speed auto-change units for incorporation in a radiogram. See it on Stand No. 35.

for the more technical visitor there are displays of industrial and transmitting valves and Ediswan electronic and electro-medical equipment.

[Stand No. 51]

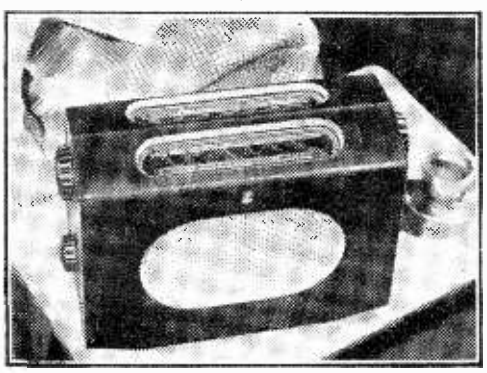


A novel plug-type suppressor which has just been produced by Dubilier and which greatly simplifies the suppression of interference from vacuum cleaners and other mains-operated apparatus.

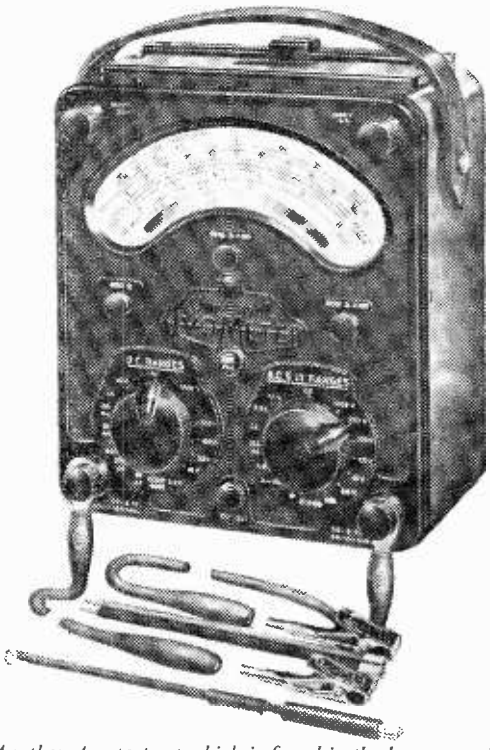
Goodmans Industries, Ltd.

THE main feature of this stand, which will be of interest to the quality enthusiast, is the demonstration theatre forming the centre of the section. In the theatre the visitor will be able to listen to selected recordings demonstrating the range of reproduction. Visitors are invited to bring along any special records they may have which they would like to hear—the playing of the record being, of course, subject to the time available, etc. Tickets will be issued from the stand to avoid overcrowding.

The loudspeakers to be shown range from miniature models to large types designed especially to handle big volumes at low frequencies such as are found in electronic organs. Microphones, transformers, etc., will also be seen. [Stand No. 37]



This novel Ferranti transportable A.C./D.C. receiver has "two-way" tuning scales. It may be seen on Stand No. 49.



Another Avo test set which is found in the keen experimenter's "den." It is a Universal model and has endless applications.

Ever Ready Co. (Gt. Britain), Ltd.

HERE will be seen a comprehensive range of high- and low-tension batteries, including the latest type of compact layer-built units. In the "Batrymax" range are the miniature and sub-miniature layer-type units for very small hearing aids and other electronic equipment. Receivers will also be on show, including the type "K" portable all-dry 4-valve superhet. The latest model, the "Sky Queen," is claimed to reduce the cost of listening to considerably less than one penny an hour. It includes a 4-valve superhet circuit and is for long and medium waves. Among the special export models the now famous "Saucepan Special" will also be on show. [Stand No. 30]

Ferranti, Ltd.

RADIO receivers again form an important part of the Ferranti display and three mains table models will be seen, ranging from 16 to 24 gns. In

(*Continued on page* 633)

VALVES

Guaranteed New and Boxed Majority in makers' cartons.

2/- 954, CRP72, EA50	**3/-** 4D1, 9D2	**3/6** 956, 2101, QP22, VR21, EB34, SP41, VU111, VU120A, VU133	**3/9** CV188, SP61, P61
4/- 215SG, 15D2, DDL4, VR116, 2D4A, VT105	**4/6** 6H6, 150A, DD13	**4/9** 955, PEN220A	**5/-** 3D6, 12H6, MS/PEN, VR137
5/6 6J5, 12SG7, KT2, 12SH7, AC6/PEN, MH4	**6/-** 6K7G, 6SH7, 12J5, EF50, OZ4, TT11	**6/3** 9001, 9002, 9003, 9004	**6/6** 6AC7, 6J7G, 12SK7, KTZ63, EF8, 6G6G, 6K7GT, DET19, VR35
6/9 1G6GT, 12A6, 6SK7, ILD5, KTZ41	**7/-** 6F8G, VR136, 6B8, 6D6, 6C6, 354V, EF36	**7/6** 1A5GT, 6B4, 6F6G, 6L7m, 6ZY5, 12SR7, EF39, KT44, IL4, 6C5, 6D3, 6J7M, 6X5GT, 12SJ7, 12Y4, BL63	
7/9 6N7, H63, X109	**8/-** IC5GT, 42, 5Y3G, 6AG5, 6C4, 6SS7, 6V6G, EL32, IR5, IS4, IT4, 1S5, 6AL5, 6C9, 6ST7, 6V6GT, VP23, 6X4, HL23DD, HL41, KT74, PEN25, EK32, EF50, SYL		
8/6 5U4G, 5Z3, 6SL7, 7B7, 7C6, 7R7, 7Y4, 25L6GT, 5Z4G, 6F6M, 6U5, 7C5, 7H7, 7S7, 12Z3, 50L6GT, CV21, PEN46, EF92, HL133DD, VP133, KT8, VU39		**8/9** 6SG7, 80 807, 2201PT, EY91, KTW61	
9/- 3A4, 3V4, 6AK5, 6J6, 6SA7GT, 6V6m, 12K7, 12SQ7, 25A6G, 3Q4, 5V4, 6AM6, 6Q7G, 6SQ7, 12C8, 12K8, 12Q7, 25Z4G, 35Z4GT, DH73M, EM31, FW4/500, HP4106, HP4115, OM9, SP4B, U22, UB41, UU9, X18, Y63			
9/6 3S4, 6K8G, 6Q7GT, 35L6GT, DL74M, 12AT7, 6K8GT, 6SJ7GT, 35Z3		**10/-** 1H5GT, 6AT6, 6SN7GT, EF41, 75, UY41, W81, 1U5, 6P26, DH81 EB41, KT76, U81, VR150/30, X73M	
10/6 6A8G, 20D1, 6L6G, K70B, X71M, ECH42		**11/-** 6BE6, 10F9, EBC41, KT33C, 10C1, 10LD11, EL41, TH233	
11/6 ECL80, UCH42, PL82, EF80, PY80, UBC41		**12/-** EY51, R12, Uf41, X65, 6A7	**13/-** ECH35, X66

VIBRATORS by Oak, Mallory, Wearite, etc. 6 and 12 volt, 4 pin, U.X. type, **6/6** ea.

SLEEVING. 1 m.m. Bright colours, 1/- doz. yds.

PLESSEY 8in. Mains Energised Speaker. 1500Ω Field. **21/-** ea.

TORCHES, Complete with Bulb and 2 U2 type Batteries. **2/-** ea.

T.C.C., 2 mfd., 500 v. ... ... **1/9** ea.
B.E.C., 8 mfd., 450 v. ... ... **1/11** ea.
B.E.C., 8 x 16 mfd., 450 v. ... **4/-** ea.
T.C.C., 24 x 8 mfd., 350 v. ... **2/-** ea.
B.E.C., 64 mfd., 350 v. ... ... **2/-** ea.
B.E.C., 32 mfd., 350 v. ... ... **1/9** ea.
YAXLEY, 4 pole 3 way ... ... **2/6** ea.
YAXLEY, 4 pole 2 way ... ... **1/9** ea.
YAXLEY, 1 pole, 8 way ... ... **1/6** ea.

Multicore Solder Packet. 6d. packet.

EF50 Valve Holder, Ceramic with screw retainer ring ... **10d.** ea.

Headphones. High resistance 4,000Ω. **10/-** a pair.

Headphones. Low resitance, 120Ω. **7/6** a pair.

B. I. Block Condenser. 4 mfd., 500 v. Flying Leads ... ... **1/6** ea.

T.V. Coil Formers, ⅜in. ... ... **9d.** ea.

T.V. Coil Formers, ½in.... ... **7d.** ea.

Microphone Transformer. 60 to 1 Ratio... ... ... **1/6** ea.

Intervalve Transformer ... **1/-** ea.

EHT Pencil Rectifier. K3/25, **4/3** ea. ; K3/40, **5/6** ea. ; K3/45, **6/3** ea. ; K3/50, **7/-** ea. ; K3/160, **17/6** ea.

HALF-WAVE RECTIFIERS

250 v., 45 ma. ... ... **6/-** ea.
300 v., 60 ma. ... ... **7/6** ea.
250 v., 75 ma. ... ... **7/6** ea.

Whanda Wire and Cable Stripper. Retail Price **15/-** ea. Our price **5/-** ea.

Single Gang Condenser, .0005 mfd ... ... **2/9** ea

T.R.F. Switch ... ... **1/-** ea.

Crystal Diodes. Wire ends ... **1/8** ea.

B.E.C. 16 x 16 mfd., 350 v. Can type ... ... **2/9** ea.

B.E.C. 16 x 16 mfd., 450 v. Can type ... ... **3/-** ea.

Bridge Rectifiers, 12 v., 3 a. ... **13/9** ea.

Octal & British. Screened Valve Caps ... ... **3d.** ea.

Standard Iron Elements, 450 watts ... ... **1/8** ea.

Morphy Richards and HMV Iron Element Replacements **3/-** ea.

Hydrometers. Brand new in wooden case ... ... **8/6** ea.

Bulgin Toggle Switch. DPDT ... **2/-** ea.

Bulgin Toggle Switch. DPST ... **2/3** ea.

Extension Speaker. Vol. Control **1/3** ea.

44Ω Variable Resistors. Suitable for train sets, etc. ... ... **5/-** ea.

Welwyn 50KΩ Pre-Set Carbon Controls ... ... **1/9** ea.

Polar 500Ω Pre-Set Wire Wound Controls ... ... **1/9** ea.

Colvern CLR902. 1,000Ω Pre-Set **2/-** ea.

B.I. Wire Ends. .02 mfd., 1,000 v. **7d.** ea.

Rubber Grommets. Mixed sizes. **6d.** doz.

S.T.C. Rectifiers. RM1, **4/-** ; RM2, **4/6** ; RM3, **5/9** ; RM4, **16/-.**

Throat Microphones. 2 in a box. **1/8** box

G.P.O. Jack Plugs ... ... **1/3** ea.

Sprague Condenser. .02 mfd., 750 v., **9d.** ea. ; .01 mfd., 1,000 v., **9d.** ea. ; .1 mfd., 350 v., **9d.** ea. ; .001 mfd., 1,000 v., **4½d.** ea.

T.C.C. Wax Tubular. .1 mfd., 500 v., **5d.** ea. ; .01 mfd., 750 v., **5d.** ea.

RECEIVER 1132A

Contains EK32, 4 EF39, 6H6, 6J5, 3 SP61, P61, In good condition. Fitted with tuning meter, slow-motion drive and dial. Complete, with Circuit Diagram, **50/-** each, carriage, etc., 7/6.

MAINS TRANSFORMERS

MT1 PRIMARY, 200-220-240 v. SECONDARIES. 250-0-250 v., 80 ma., 0-4 v. ; 5 a.-6.3 v. ; 4 a. 0-4 v.-5 v. 2 a. ... ... **17/6** ea.

MT2 as above, but with 350-0-350 H.T. winding ... ... **17/6** ea.

RESISTORS, 1 WATT

330Ω, 22Ω, 470KΩ, 10K. 30KΩ, 150KΩ, 56KΩ, 33KΩ, 330KΩ, 1KΩ, 18KΩ, 1.8KΩ, 39Ω, 47KΩ, 27KΩ, 150Ω, 68Ω, 39KΩ, 100Ω, 68KΩ, 40KΩ, 680Ω, 220Ω, 12KΩ, 4.7KΩ, 680Ω, 2.2KΩ, 100KΩ, 15KΩ. All **6d.** each.

MOTORS

COLLARO AC37 Motors, with ⅜in. dia. Spindle. Variable speed. 100/120 v. 200/250 v. **32/-** ea. Post 1/6.

COLLARO AC37 Gramophone Motor. Complete with 10in. turntable variable speed, manual adjustment. **46/-** ea. Post 1/6.

COLLARO AC49 Tape Recording Motors. Available Clockwise and Anti-clockwise. Retail Price **77/-** pair. Our Price **57/-** pair.

INDICATOR UNIT TYPE 255

Case size 17⅞in. x 13in. x 11¼in. All controls to front panel. Contains VCR517C ; 15, VR91 (EF50) ; 2, 6X5G ; 7, VR54 ; 1, EF55.

BRAND NEW. All Complete **£8** each, Carriage 7/6.

LOUDSPEAKERS

PLESSEY, 3in Round Type for Personnel Portables, 3 ohm ... **12/9**
ELAC, 3½in Square Type 3/09, 3 ohm **13/6**
ELAC, 5in. Round Type **12/3**
LECTRONA, 5in. Latest Type ... **12/3**
GOODMAN'S, 6½in. Lightweight, 2 to 3 ohm **13/6**
TRUVOX, 6½in. Wafer, 1⅝in deep **20/-**
PLESSEY, 8in. Lightweight, 2 to 3 ohm **15/-**
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LECTRONA, 8in.... ... ... **14/-**
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TRUVOX, 12in. Heavy Duty Model, 15 ohm Speech Coil. Model SS9 ... ...**£5/15/-**

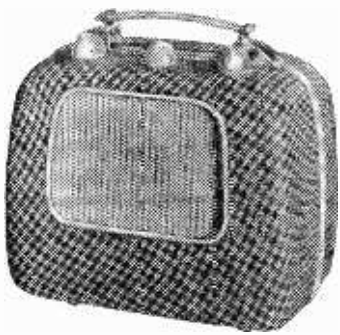
TERMS : Cash with order or C.O.D. **MAIL ORDER ONLY.** Illustrated Catalogue send **6d.** Minimum C.O.D. fee and postage 2/3. To cover cost of packing and post please add to all orders as follows ; 9d. to 10/- ; 1/- to 20/- ; 1/6 to 40/- : 2/- to £5.

ALPHA RADIO SUPPLY CO.

5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS, 1.

addition two suitcase portables will be shown, available in either lizard or blue leathercloth. Completing the range will be two distinctive radiograms, one of which is a high-fidelity model with 10 watt push-pull output stage, twin speakers, and three-speed changer for handling a mixed group of discs. This costs 76 gns., and an interesting feature is that the volume-control is tone-compensated.

[Stand No. 49]



Two samples of the Twinvicta portable. The waterproof cases are available in other finishes.

Hunt (Capacitors), Ltd., A. H.

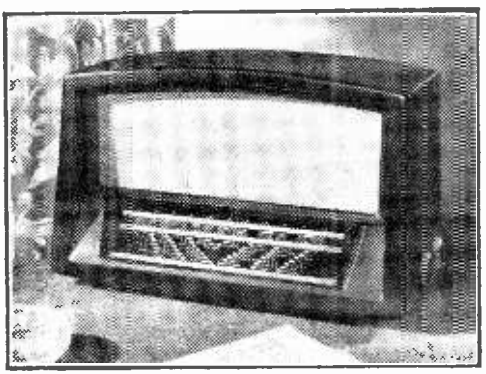
HERE will be seen standard and miniature fixed capacitors for all radio and electronic equipment. Dry electrolytics, metallised paper (a Hunt patent), foil and paper, silvered mica, stacked mica are among the main types, whilst a new circuit printing process will be shown in the form of Bondac Printed Circuits. The exhibit will also include a capacitor analyser and resistance bridge which will interest the keen experimenter.

[Stand No. 88]

Masteradio, Ltd.

IN addition to various television receivers, among the radio models will be seen a high-fidelity radiogram with three-speed auto-change motor and two record storage cupboards. One of the most interesting exhibits will be the TV and radio listening aid designed to enable deaf persons to hear the radio without spoiling the enjoyment of others. A car radio at 25 gns. will also be shown.

[Stand No. 46]



This Pilot Model 85 is another of the table models which devotes a considerable part of the available space to the tuning scale to reduce the difficulties of station searching.

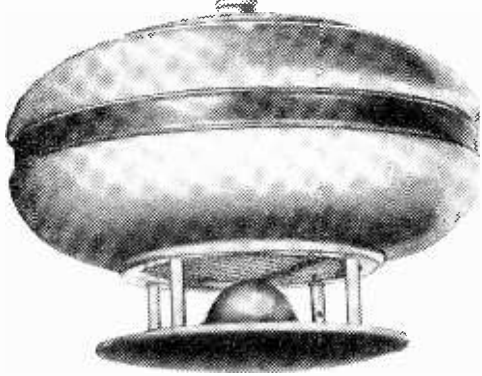
Mullard, Ltd.

A SPECIAL feature of the Mullard stand will be the Information Centres that they are providing on Stand 91. Here expert advice on a wide variety of viewing and listening problems will be available free of charge. There will be three of these centres, one to help a prospective buyer in his choice of a set, one on maintenance and one for the home constructor. The electronic valve tester will be prominently displayed as will the well-known Mullard valves, and complete radio receivers. A section which will attract considerable attention is an amusing display designed to show, with the aid of distorting mirrors, the way in which worn-out valves can affect reproduction.

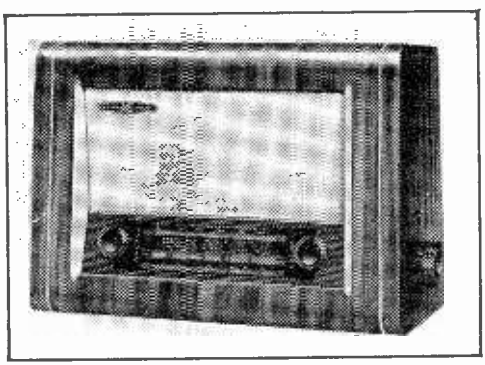
[Stand No. 91]

Multicore Solders, Ltd.

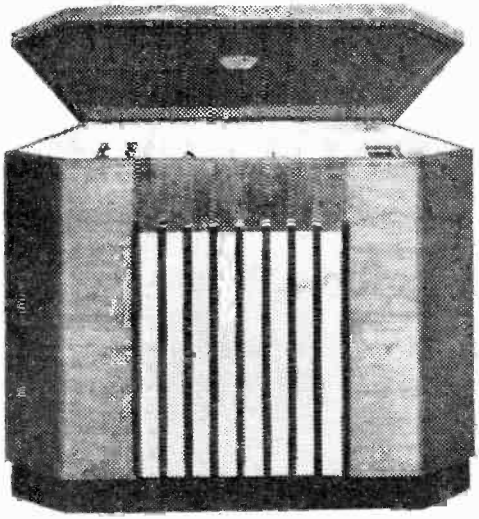
THE well-known solder will be shown here in various packages and



From the Goodmans range we have selected for illustration this novel type of speaker. Designed for outdoor use, it covers a wide area.



A novel feature of this Pye receiver is the wave-change knob on the right of the cabinet which carries the appropriate indications on the surface.

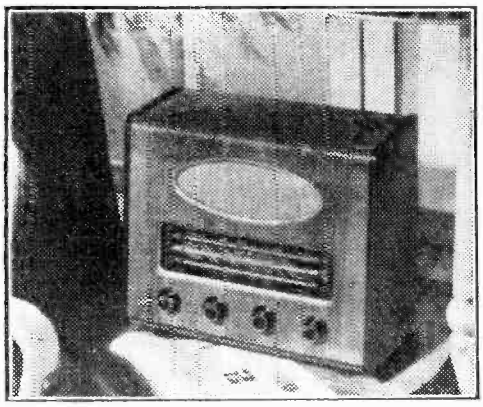


A very attractive radiogram in the Reproducers range on Stand 233. This is a de luxe model for high-fidelity radio and record reproduction.

forms, and its use will be demonstrated in the wiring up of a projection television receiver, carried out in conjunction with Philips. It is claimed that this will be the first public demonstration of the wiring and soldering of sub-assemblies used in the projection receiver. It is estimated that 25,000 soldered joints will be made during the run of the show, using standard factory size 7lb. reels. The new tape solder, which melts with the heat from an ordinary match, will also be seen and it should be emphasised that this is also of the self-contained flux type in spite of its thinness. A number of special trade types of fluxed solder will also be seen. [Stand No. 111]

Murphy Radio, Ltd.

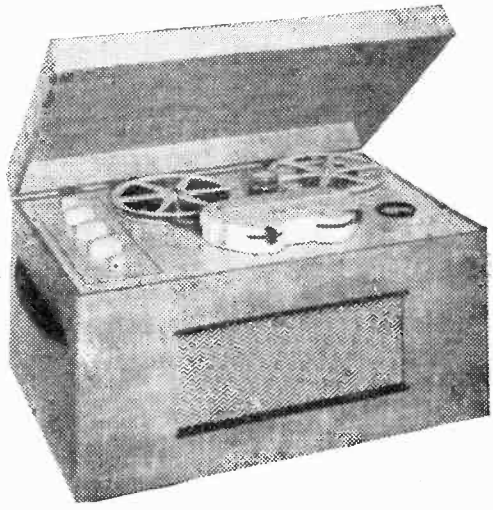
APART from the television equipment to be seen there will be several Murphy radio receivers ranging from portables of the battery/mains type to special export models. Model A.182R is four-valve plus metal rectifier superhet radiogram with three-speed auto-change unit. It is for A.C. mains only. This costs £72 5s. and includes a short-waveband in addition to the normal medium and long waves. [Stand No. 31]



Sobell make this neat little table receiver, a feature of which is the small speaker-opening compared with most other models.

Pamphonic Sales

THE latest range of PAM high-quality radio and television receivers and radiograms will be seen on this stand. In the radio range will be two portables and two radiograms, the Model 609/53 being a de luxe three-speed autochange radiogram with eight waveband bandspread tuning incorporating a 10in. speaker enclosed in its own baffle chamber.



Amongst the many tape recorders and amplifiers this transportable by Rudman, Darlington (Electronics), Ltd. has a number of attractive features. Examine it on Stand No. 208.

Amongst the special equipment will be the Pampli player consisting of a player, radio receiver and amplifier, together with loudspeaker housed in a cabinet. The speaker is an 18in. twin-cone mains-energised model handling 18 to 20 watts. [Stand No. 108]

Peto Scott Electrical Instruments, Ltd.

IN addition to the television receivers a new table radiogram will be featured, but at the time of going to Press no details have been released. [Stand No. 77]

Philips Electrical, Ltd.

THE predominant feature will be "Philips for your Complete Home Entertainment," and this underlines the fact that, with the advent of Philips gramophone equipment and records, the company's products now cover the whole range of domestic equipment. Radio will be prominent, and of the range on display special emphasis will be given to the "Starlet" and a portable. Considerable emphasis is also to be placed on record-playing

(*Continued on page* 637)

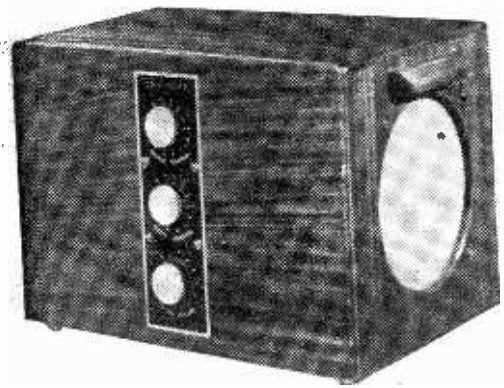
equipment, which now includes a comprehensive range of products, including records.
[Stand No. 33]

Pilot Radio, Ltd.

ON this stand will be home and export sections and although the emphasis is to be on television, ordinary radio receivers will be prominently displayed with the Little Maestro as the centre of attraction. This ever-popular model is again redesigned and brought up to date and in moulded brown, cream or green cabinet costs £15 10s. Other models to be seen are the "Dandy," "Pilot 75," "Pilot 85" and "Mariner." The export models will consist of designs specially produced for the particular needs of various countries. [Stand No. 56]

Portogram Radio Electrical Industries, Ltd.

AS specialists in portable amplified gramophones the exhibits here will consist of record reproducers, record storage cabinets, amplifiers and the well-known visual pack long-playing needles. The



An unusual type of unit to be seen on Stand 233. *This is a record-playing amplifier with treble and bass controls.*

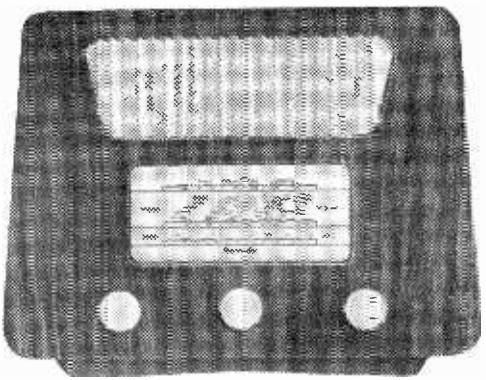
main feature will be the "Junior Eight," a five-valve amplified reproducer including three-speed auto-change, speed controlled or non-auto. A special schools model suitable for dancing is also being shown. [Stand No. 36]

Pye, Ltd.

AMONG the new models seen here will be the two new radios, Nos. P75 and P76. The latter is a five-valve A.C. model priced at 24 gns., plus P.T., and incorporates a four-waveband circuit with large loudspeaker designed for quality reproduction. Other models will be featured round the main television exhibit. [Stand No. 76]

Rola Celestion, Ltd.

ON this stand will be seen the speakers of three manufacturers: Rola, Celestion and Truvox. The comprehensive range will include direct radiator speakers from 2½in. to 18in., elliptical models 6in. by 4in. and 10in. by 6in., as well as reflex horn-type models with ratings from 3 to 120 watts. The problems of correct matching are solved by an interesting

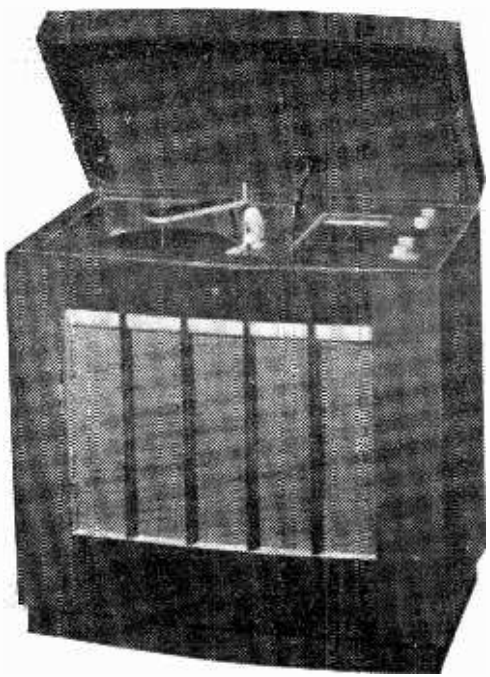


This receiver has a distinctly modern appearance. It is Masteradio model D. 153 *and covers three wavebands.*

range of output transformers. New models in the direct radiator range include 2½in. and 3½in. models for radio, inter-office communication, and so on.
[Stand No. 8]

Reproducers (Electronic), Ltd.

HERE will be seen "Truchord" record/radio reproducers and amplifiers of various types. At the top of the list is the "Festival," a de luxe radiogram with two Garrard high-fidelity pick-up heads and Warfedale "Golden" 10in. speaker, and



A fine radiogram from the Stella range. This is Model 305a *and incorporates an auto-changer.*

costing 105 gns. Some interesting radio units may also be seen on this stand. [Stand No. 233]

Rudman, Darlington (Electronics), Ltd.

TAPE recorders are to be featured on this stand, all carrying the trade name "Reflectograph." They will include a console model, a transportable model, an industrial model, a multi-channel long-playing (five hours) monitoring recorder and master recorder and slave units for land, sea and air transport application. [Stand No. 208]

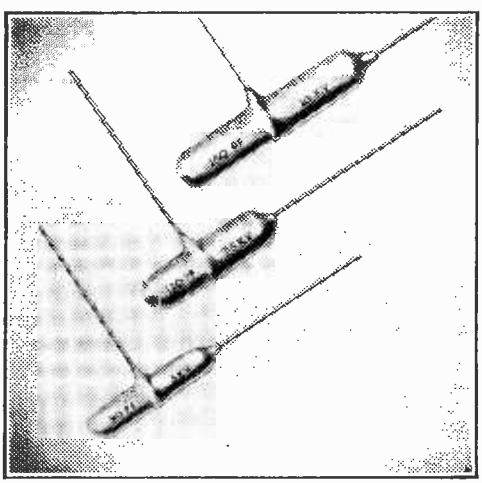
Sobell Industries, Ltd.

AMONG the radio receivers to be seen on this stand will be Model 553, a five-valve all-wave receiver of contemporary design for 'A.C.' operation only. Model TRG.174 is a combined 17in. television receiver and auto-radiogram in one compact design, the gramophone section being of the three-speed type. [Stand No. 55]

Stella Radio and Television Co., Ltd.

AMONGST the radio receivers to be seen here the six-valve all-wave auto-radiogram will attract quality enthusiasts. This includes a Mullard EBC41 valve as a pick-up response corrector, and is fitted with three-speed motor and special pick-up. The price is £72 9s. [Stand No. 72]

Although not readily recognisable as a radio component this is actually a loudspeaker of the high-power projector type and is to be seen on the Rola Celestion Stand No. 81.



Among the many familiar T.C.C. components may be seen these high-voltage tubular ceramic condensers. Full details of these, as well as of many other T.C.C products are given in the special Technical Bulletins available on Stand No. 107.

Telegraph Condenser Co. Ltd.,

UNDER the T.C.C. trade-mark many familiar ranges of condenser will be seen—paper, mica, ceramic, plastic and electrolytics. Apart from miniaturisation, the problems of temperature have been dealt with, and certain compact equipment presents considerable difficulty in this respect. Sub-miniature tubular electrolytics will be seen and it is claimed that these are the smallest of their kind ever made. As in previous years, a feature will be made of the specialised machines developed by T.C.C., this year an automatic mica-laying machine being on show. Designed and made at their Acton factory, this machine will lay-up stacked mica plates on all sizes from 1in. by 11/16th to 2½in. to 2in. at 4,500 micas per hour. The running speed of this machine will be reduced during the show to one-fifth of normal so that visitors can see how it works. [Stand No. 107]

Telequipment, Ltd.

THE exhibits here are designed primarily for television and are dealt with more fully in our companion journal. [Stand No. 28]

Telerection, Ltd.

AERIALS for all purposes are shown here, and are for television reception. Accordingly, they are covered in our companion journal. [Stand No. 7]

Whiteley Electrical Radio Co., Ltd.

A NEW range of high-fidelity loudspeaker unit will be seen here under the W/B trade-mark. This new range has been developed to provide reproduction that takes full advantage of the latest high-fidelity recordings and the special television sound transmissions. The cone of the speaker is made from uncured cambric and bonded pulp, the whole being completely cured together and made into one composite cone by a new process. The bass response is substantially lower than that using the conventional cone, and colouration is, therefore, removed. The high frequencies are well maintained. The speakers are available in 6in., 8in., 9in. and 10in. models. In addition, matching transformers and cabinets, and other well-known Stentorian models will be on view. [Stand No. 109]

Wright and Weaire, Ltd.

THIS stand will be devoted to the exhibition of some of the major uses of magnetic tape recording. There will be exhibits of a talking model; an inter-services tape recording equipment in use; a Ferrograph dispensing music; a multi-channel airport type recorder, and a simultaneous dual-track recording showing two or three of the uses. In addition will be seen vibrators, coils, switches and transformers. [Stand No. 110]

October VALVE LIST Cancels All Previous Lists.

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1A5	9/3	6C8G	12/-	7A3	10/6	37	9/-			TH62	10/-	HD24	10/-	L13	12'6
1B4	10/-	6D6	9/-	7A7	9/6	41	10/6	CBL1	14/6	UCH42	13'-	KL35	10/6	HL4	10/-
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1G3	6/6	6G6G	9/6	7B7	9/6	45	10'6	CL4	12/6	UY41	10'6	KT32	10/6	U71	10/-
1LN5	6/6	6G3	9/6	7C5	12/6	46	10'6	DL2	9/6			KT33C	10/6	U74	10/-
1LA5	9/6	6H6	7/6	7C6	11/6	50L6GT	11/-	EBC33	9/6			KT72	10/-	W76	10'3
1P5	9/6	6J5	7/6	7S7	12/6	58	10/-	ECC31	12/6			KT74	10/-	W77	10/-
1R4	9/6	6J6	14/6	7V7	10/-	72	10/6	ECL80	15/6	D43	8/6	KTW61	8/6	X73	11'3
1R5	11/6	6J7G/GT	8/6	7Y4	10/-	73	10/6	EF36	7/6	D63	8/-	KTW62	8/6	Z77	14/6
1S4	11/6	6K6	10/6	12A6M	10/-	75	17'-	EC31	12/-	D77	8/6	KTW63	8/6		
1S5	11/6	6K7G/GT	8/9	12K8	11/6	76	9/6	ECH42	12/6	DH73	11/-	KTW73	10/3	41MPT	8/6
1T4	11/-	6K8	13/-	12C8	10/6	77	9/6	EL3	13/-	DH77	10/6	KTW74	10/3	SU2150A	12/6
1T5	9/3	6L5G	7/6	12H6	6/6	117Z6	11/6	EL50	7/-	DL63	12/-				
1V	10/6	6L6	12/-	12J5	8/-	117L7GT	17/-			DL74	11/6				
1C6	9/6	6L7	14/-	12Y4	9/6	117N7GT	17/-			ACSP3	11'6	Pen1360	12/-	VP133	10/6
2A3	9/6	6N7	14/-	12SA7GT	10/6	805	42/-	4D1	9/6	HL13	10,6	Pen46	11/-	SP42	12'6
2X2	8/-	6P5	9/-	12SG7	9/-	807 Br.	12/6	8A1	11/6	HL23	7/9	Pen2530	11/6	UU7	10'6
3V4	11/-	6Q7	12/-	12SH7	8/6	807 Am.	14/6	8D2	11/6	HL133DD	9/6	P41	9/-	U21	12'-
5X4	12/-	6R7	10/-	12SJ7	9/6	813	112'-	9D2	8/6	HL13DD	11/6	SP2	8/-	U22	11/6
5Y3	10/6	6SA7	9/6	12SK7	10/-	860	14/6	10D1	7/6	HL1320	10/6	SP41	10'6		
5Z3	11/-	6SG7	9/6	12SL7	9/6	866A	12/6	11D3	12/6	HL41	9/6	TH233	13/-	C1	10/6
5U4	12/6	6SH7	8/-	12SR7	8/9	84/6Z4	9/6	15D2	14/6	HL41DD	11/6	TP1340	12/-	XP (1.5)	6/-
5Z4	11/-	6SK7	9/6	14F6	10/-	9004	7/6			Pen25	10/-	TP22	10/6	XH (1.5)	6'-
6A7	14/6	6SL7	11/6	15	12/-	954	5/6	AC6PEN	8'6	Pen1340	12/-	VP23	9/6	ACDD	10 6
6A8	14/6	6SN7	12/6	18	11/-	955	6/6	ACP1	8.6	Pen383	12/-	VP41	10/6		
6AC5	9/-	6SS7	8/-	19	9/6	956	6'6								
6AC7	8/-	6T7	9/6	25AC5	6/6	1299A	8/-			PD220	12'-	MX40 (MH4105)	13'6	**PRACTICAL WIRELESS BIRTHDAY**	
6AG5	9/6	6TH3	9/6	25L6	10/-	1625	9/6	VP2	9/6	VMP4G	10.6	FW4'500	13/6		
6AQ5	11/-	6U5	9/6	25Z5	10/-	1626	9/6	SG215 (210SG)	7'6	DDP4 (MHD4)	14'-	TDD13	12/-		
6AM3	12/6	6U7	9/6	25Z4	10/-	7193	6/6	210LF	5/6	MU12 (VU30)	11 6	FC13	10/6	*BULLS WISHING MANY HAPPY RETURNS.*	
6B1	8/-	6V6G	11/-	28D7	8/6			210HF	5 6	VP4G (KTZ41)	9 6	TH2321	14/6		
6B7	11/-	6ZY5	10/-	32	8/6	**Re types not listed — ask for quotation or order C.O.D.**		230XP	6/-	U12 BVA216	11'6	VP13C (+D2)	8/-		
6B8	10/6	6W5	11/-	33	9/6			PM22A	6 3	354V (HL4)	10 -	8D2	8/-		
6BR7	11/-	OD3/VR150	14/6	35	9/6			LP2	5/6	M14	7 6	AC2PEN (APP4E)	13/6		
6BW6	11/-			35L6	10/6			QP22B	11/-	MSPen (7-pin)	9 6				
6C4	8/6	6X4	10/-	35Z4	11/-			TDD2A (HD24)	10/6						

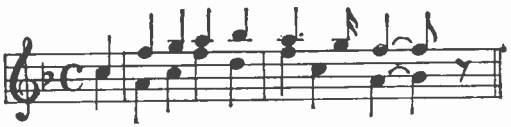
Identifying Musical Interval Signals—4

A SUMMARY OF SOME OF THE MORE POPULAR MUSICAL INTERVAL AND IDENTIFICATION SIGNALS USED BY FOREIGN TRANSMITTERS. A SPECIAL ARTICLE FOR THE LONG-DISTANCE LISTENER

(*Concluded from page 520 September issue*)

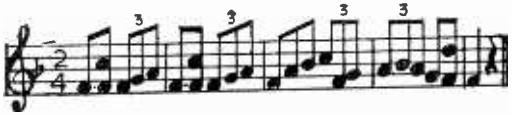
Rumania

THIS country can also present some difficulties for the long-distance listener, as it also broadcasts in several languages. Some of these are mid-European which may be unfamiliar to English listeners, but there are two or three things which will help to identify broadcasts originating there. From Bucarest a hymn tune may be heard, and the words "Radio Romania Liberia." The melody shown below will be heard repeated over and over again, usually on a celeste. Certain broadcasts are made in English, and then there is little difficulty in recognising the station. The most likely wavelengths are in the 25, 32 and 48 metre bands.



Spain

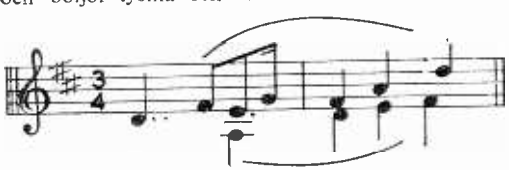
There are a number of systems radiating in Spain, the most likely to be heard here being those originating from Radio Nacional de Espana, in Madrid. The following tune, sometimes preceded by a gong, will readily identify this broadcast.



La Voz de la Falange at the beginning of every broadcast radiates a few bars of the "Cara al Sol," which sound like this:

Sweden

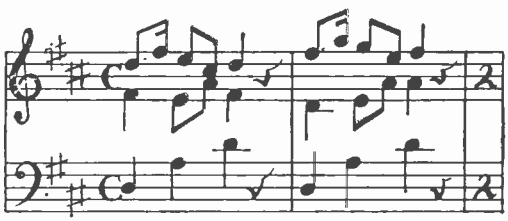
European and Overseas broadcasts are made from Sweden and the most likely interval signal to be heard here would be the following, which is the first movement of Carl Michael Bellman's "Storm och böljor tystna ren":



The words "This is Radio Sweden" are also included from time to time amongst foreign interpretations of the same title.

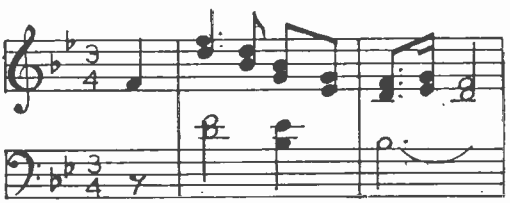
Switzerland

German, French and Italian are the main languages used in broadcasts from Switzerland, and each town has its own particular interval signal. From Radio Basel the following ("Z'Basel a mym Rhy") will be heard:



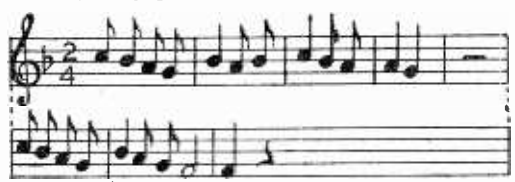
From Radio Bern the following ("D'Zyt isch do"):

Zurich is identified by "Chum Bueb tind lueg dis Ländi a":

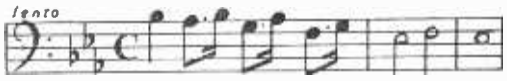


From Sottens (Radio Lausanne) the air is "Voice l'ami ete":

Geneva, Radio Genève, with "Quelle Fatale Journèe," a popular air:

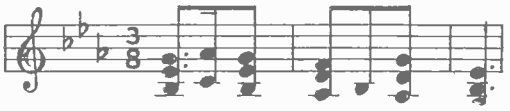


and Monte Ceneri with "Campane delle Chiesa di Pazzalino"



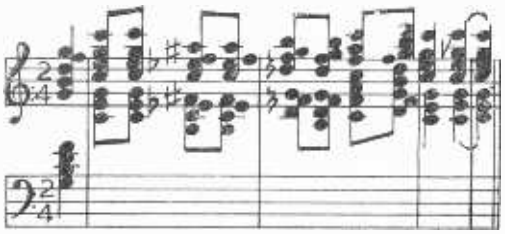
completes the Swiss list. All these it will be seen are distinctive airs and once logged little difficulty should be experienced.

Certain foreign broadcasts are made from Switzerland and carry their own identification, one intended for Swiss living abroad had the following interval signal :



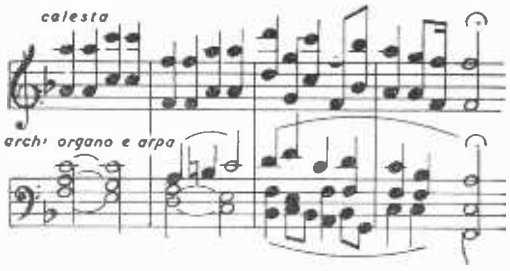
Trieste Free Territory

Mainly in Italian and Slovene the main interval signal which will be heard from this area is a motif played on a harp as follows :



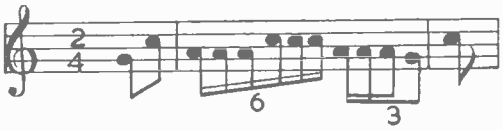
Vatican State

Practically every language is used in broadcasts from the Vatican, the announcements in English being unmistakable. As an opening signal this transmitter relays a recording of the bells of St. Peter's and for its interval signal a carillon-melody, "Christus Vincit," which is played on a celeste with orchestral accompaniment. This is the melody :



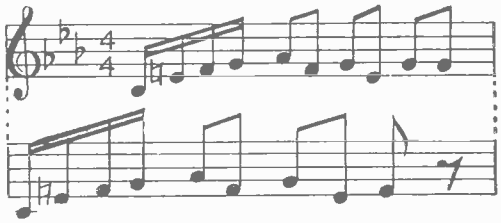
Belgian Congo

Dutch, Portuguese, French and English are freely used from the Belgian Congo station, and a xylophone melody is the general interval signal :



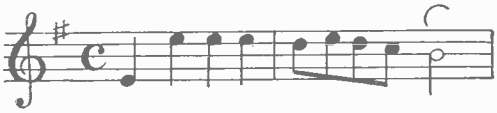
Near East

Passing from the European stations to the Near East and maintaining the alphabetical order the Cyprus station is the most likely to be heard. Again, this presents an unmistakable interval signal consisting of Arabic music played on a stringed instrument and sounding like this :



Israel

Certain changes have taken place in the relays from this country, but the following air may be heard :



Republic of Lebanon

On the medium and short waves the following air will be heard from Beirut :

Turkey

The majority of the broadcasts likely to be heard from Turkey will be in Arabic, but certain European languages will also be heard at certain times. The interval signal on most transmissions consists of an old Turkish dance tune which goes like this :

R.S.C. MAINS TRANSFORMERS (FULLY GUARANTEED)

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s Screened.

TOP SHROUDED, DROP THROUGH
250-0-250 v 70 mA, 6.3 v 2.5 a 12 11
260-0-260 v 70 mA, 6.3 v 2 a, 5 v 2 a ... 14 11
350-0-350 v 80 mA, 6.3 v 2 a, 5 v 2 a ... 17 9
350-0-350 v 80 mA, 6.3 v 2 a, 4 v 2.5 a 14 11
250-0-250 v 100 mA, 6.3 v 4 a, 5 v 3 a... 23 9
300-0-300 v 100 mA, 6.3 v-4 v 4 a, c.t. 0-4-5 v 3 a 23 9
350-0-350 v 100 mA, 6.3 v-4 v 4 a, c.t. 0-4-5 v 3 a 23 9
350-0-350 v 150 mA, 6.3 v 4 a, 5 v 3 a... 29 11
350-0-350 v 150 mA, 6.3 v 2 a, 6.3 v 2 a, 5 v 3 a 29 11

FULLY SHROUDED UPRIGHT
250-0-250 v 60 mA, 6.3 v 2 a, 5 v 2 a, Midget type 2½-3-3in.... ... ... 16 9
350-0-350 v 70 mA, 6.3 v 2 a, 5 v 2 a ... 18 9
250-0-250 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a 25 9
250-0-250 v 100 mA, 6.3 v 6 a, 5 v 3 a, for R1355 conversion 29 9
300-0-300 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a 25/9
350-0-350 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a 25 9
350-0-350 v 150 mA, 6.3 v 4 a, 5 v 3 a... 33 9
350-0-350 v 160 mA, 6.3 v 6 a, 6.3 v 3 a, 5 v 3 a 45 9
350-0-350 v 250 mA, 6.3 v 6 a, 4 v 8 a, 0-2-6 v 2 a, 4 v 3 a, for Electronic Eng. Televisor 37/6
425-0-425 v 200 mA. 6.3 v-4 v 4 a c.t. 6.3 v 4 a, c.t. 0-4-5 v 3 a, suitable Williamson Amplifier, etc.... ... 51/-
450-0-450 v 250 mA, 6.3 v 6 a, 6.3 v 6 a, 5 v 3 a 65/6

ELIMINATOR TRANSFORMERS
Primaries 200-250 v 50 c/s, 120 v 40 mA 7/11
120 v 40 mA, 6-0-6 v 1 amp 14 9
90 v 10 mA, 8-0-8 v 250 mA 9/9

FILAMENT TRANSFORMERS
All with 200-250 v 50 c/s primaries : 6.3 v 2 a, **7/6**; 0-4-6.3 v 2 a, **7/6**; 12 v 1 a, **7/11**; 6.3 v 3 a, **9/11**; 6.3 v 6 a, **17/6**; 0-2-4-5-6.3 v 4 a, **16/9**; 12 v 3 a or 24 v 1.5 a, **17/6.**

CHARGER TRANSFORMERS
All with 200-230-250 v 50 c/s. Primaries : 0-9-15 v 1.5 a, **14/9**; 0-9-15 v 3 a, **16/9**; 0-9-15 v 6 a, **22/9**; 0-4-9-15-24 v 3 a, **22/9.**

SMOOTHING CHOKES
250 mA 8-10 H 200 ohms, Potted ... 16/9
250 mA 3-5 H 100 ohms 10/11
200 mA 3 H 80 ohms 5/9
100 mA 10 H 175 ohms 7/6
80 mA 10 H 350 ohms 5/6
60 mA 10 H 400 ohms 4/11

E.H.T. TRANSFORMERS
2,500 v 5 mA, 2-0-2 v 1.1 a, 2-0-2 v 1.1 a, for VCR97, VCR517, ACR2X. etc. **35/-**

OUTPUT TRANSFORMERS
Midget Battery Pentode 66 : 1 for 3S4, etc. 3/9
Small Pentode, 5,000Ω to 3Ω ... 3/9
Small Pentode, 8,000Ω to 3Ω ... 3/9
Standard Pentode, 5,000Ω to 3Ω ... 4/9
Standard Pentode, 8,000Ω to 3Ω ... 4/9
Multi-ratio 40 mA, 30 : 1, 45 : 1, 60 : 1, 90 : 1. Class B Push-Pull ... 5/6
Push-Pull 10-12 Watts 6V6 to 3Ω or 15Ω 15 9
Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω 16/9
Push-Pull 15-18 Watts to match 6L6, etc., to 3Ω or 15Ω Speaker ... 22/9
Push-Pull 20 Watts, sectionally wound, 6L6, KT66, etc., to 3, or 15Ω 47/9
Williamson type exact to Author's spec. 85/-

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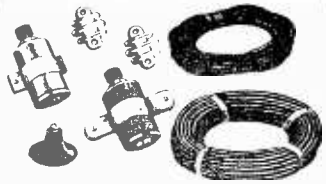

The aerial is designed for reception of long, medium and short waves with any ordinary or communications receiver, having an input impedance greater than 1,000 ohms long medium waves and 150 ohms short waves. The installation discriminates against locally generated electrical interference, especially on the short wave bands. The equipment enables the installation of an 8-36 Metre fully-tuned dipole which operates as a "T" aerial on medium and long waves. The aerial and receiver transformers are intended to be interconnected with a 70 ohms co-axial cable.

COMPONENT PARTS

Aluminium Aerial Transformer Assembly. Comprising one each: Aluminium transformer, Transformer clip, Rubber sucker, 1in. x 1in. brass screw, 4BA x 1in. brass bolt, 4 BA nut.

Receiver Transformer. Complete with Insulators, clips etc.; Porcelain Insulators 2 each, 60ft. Insulated Aerial Wire, 60ft. Screened Co-Axial Down Lead.

Installation instruction leaflet included.

LESS CO-AXIAL CABLE & AERIAL WIRE 15/- *plus 1/6 p/p. & carr.*

COMPLETE. 35/- *plus 1/6 p/p. & carr.*

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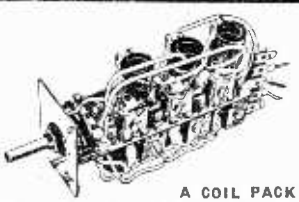

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If you wish to make good equipment we recommend these Leaflets at 1/6 each any 3 for 2/6.

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EL1—Signal Generator (13 preset frequencies)
EL2—Signal Tracer.
EL3—5v. Superhets (2 models, A.C. and A.C. D.C.)
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EL6—Small Amplifiers.
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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).

Tuning Coils

SIR,—Many different types of tuning coils are advertised, and it seems likely that beginners, in particular, do not always realise that no standard method of arranging the tags exists. Because of this, care is necessary when alternative coils are used in published receiver designs, and it may not be possible to follow the coil wiring plans exactly as shown. In some cases results will be unsatisfactory (or absent) when wiring in alternative coils without suitably modifying connections; in other cases damage to the coils or other components may arise, from H.T. shorts or other reasons. It is usually best to employ the specified coils, but if substitutes are used then the manufacturer's data or leaflet of tag connections should be consulted. It is also desirable to see that such alternative coils are suitable, and coupling windings, in particular, differ widely in number of turns and their relationship to the other sections of the coil. Some such windings may be used for reaction purposes; others are totally unsuitable for this purpose. Again, some coil-makers use large primaries tightly coupled, and such coils are desirable when maximum volume is required, but not when the winding is used for reaction. In view of these facts, beginners, in particular, should use only the coils for which any particular circuit was designed.—F. G. RAYER (Glos.).

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page 656.

The Amateur Transmitter

SIR,—With reference to the letter from Mr. C. Roberts, of Worcester, on this subject, as a licensed amateur myself, I feel that he takes quite a wrong view of the position. First of all, the possession of a transmitting licence (unlike a broadcast receiving licence) is a *privilege*, not a right. There is little doubt that the main reason why amateurs are allowed to operate at all, in this and other countries, is that a useful reserve of skilled operators is thereby built up for times of national emergency, but it would obviously be against the interests of all users of the air to have it cluttered up with amateurs who could not read morse and who had insufficient knowledge of theory to avoid severe interference.

The theoretical examination is *easy*, provided one has average intelligence and is willing to work hard and systematically in one's spare time. As an example I should like to give my own experience: I started from scratch at the end of January, 1949, knowing nothing of the subjects, sat for the theoretical examination in May, 1949, and passed easily. I worked through a correspondence course (which I can heartily recommend) and put in about ten hours of study a week. I had no special knowledge of radio when I commenced, except that possessed by the average short-wave listener, nor am I connected in any way with the radio trade.

It must be remembered that the main object of the examination is to ensure that holders of licences know enough theory to avoid interference to other users of the air, particularly Government, commercial, ship and broadcast stations.

Only complete duffers fail ultimately to pass the examination after several attempts, and that class of amateur should never be allowed on the air in any case!

As regards morse, that has always been required before a licence could be granted; there never have been "good old days" (*vide* Mr. Roberts) when it was not essential.

If an amateur transmitter could not read morse, a very serious situation might arise if he happened to be interfering with, say, a ship-to-shore station in an emergency, and if he were asked temporarily to QRT or to QSY and could not read the message. I had no previous knowledge of morse, and started it only after the theory examination was over; I took the test early in September, 1949, and passed.

Apart from other considerations, the ability to read and send morse adds a lot of pleasure to ham radio, because with it one can make contacts which would be impossible on 'phone, either owing to distance or conditions.

I have always found Post Office officials most considerate and obliging; they are out to *help* licensed amateurs, but they quite rightly require a certain minimum standard of knowledge and performance before a licence can be granted.

Finally, I would say that no one of average intelligence need fail to obtain a licence, provided he has reasonable ability to express himself clearly in writing, works hard and systematically, and retains his keenness to the end. There is undoubtedly a lot of drudgery in the early stages, but the ultimate delights make it well worth while.—VERNON G. P. WILLIAMS (G3FYY).

A.C. Band-pass 3

SIR,—I have just completed constructing the A.C. band-pass 3 as specified in your magazine.

This is the first radio set I have ever made, for I am only sixteen years old, but I was thoroughly

delighted with the results. I have not seen anyone else recommending this set in a letter, so I thought I might as well be the first. Congratulations on designing such a good little set.—BRYAN K. MANSFIELD (Worcester).

Noise and the R.1155

SIR,—Apropos the article in July issue on "Noise and the R.1155," Mr. C. B. Cruickshank advocates replacing the 6K7's (VR100) with EF50's (VR91).

It is not necessary to go to all that trouble as I have found by experiment that the 6K7's can be retained and that valve noise can be completely eliminated simply by increasing the value of the screen resistors from 22 KΩ to about 75 KΩ on the R.F. and one or both I.F. stages.

There was no appreciable loss of sensitivity, and what little there was was well worth the sacrifice resulting in improved signal/noise ratio.

In fairness to Mr. Cruickshank it must be mentioned here that this would not have been discovered except by trying out his suggestion which worked, but only by retaining the 22 KΩ resistors.—G. H. HOBSON (Capt. s.s. *Regent Hawk*).

Reader from No. 1

SIR,—With reference to "Thermion's" article last month, I would very much like to confirm that I have been a most consistent reader of PRACTICAL WIRELESS—right from the days of No. 1.

Fortunately, I have still managed to retain almost every issue—although by now some of them are becoming very stained and dog-eared through repetitive reference thereto.

In actual fact, as far as "radio" is concerned, my collection of PRACTICAL WIRELESS forms a veritable "Encyclopaedia Britannica."

It is a great pity indeed that we cannot revert to the pleasure and contemplation of a weekly issue of your most valuable publication.

When one considers the varied publications relating to radio that have "fallen by the wayside," i.e., *Popular Wireless*, *Wireless Constructor*, *Modern Wireless*, *Wireless Magazine*, and *Amateur Wireless*, which was absorbed into PRACTICAL WIRELESS, there is much credit due to you for keeping the flag flying.—G. WHEATLEY (Worksop).

SIR,—As it is the 21st Birthday of PRACTICAL WIRELESS, and you are asking anybody who has taken your journal from No. 1 to write, I thought I would as I have taken it from No. 1 and I am still taking it.

I have spent many happy hours through PRACTICAL WIRELESS, both from circuits and useful tips, which have been printed in previous issues from time to time.

Some of these circuits will be very well remembered by many, such as the Leader Three, 1933; The Crusaders A.V.C.4, 1933; The Hall-Mark Three, 1934; Silver Souvenir, 1935; The A.C. £5 Superhet, 1935; The Universal Hall-Mark, 1935; The Fury Four, 1936, was an outstanding success; and the Elf Portable, 1936; Universal £4 Superhet 4, 1936; and there are so many more that have been published since PRACTICAL WIRELESS started it would fill pages to include all.

I wish you every success on the 21st Birthday of your publication, and I hope that it will continue to give us all the fine circuits, hints and tips that it has given us in the past.—E. L. GARWOOD (Stanmore).

"Those Were the Days"

SIR,—In your PRACTICAL WIRELESS issue of August, 1953, there appears an account of Mr. Apps' life in "Those Were the Days!"

I was extremely interested in the writer's experiences, as I, myself, was an experimenter with a licence to use wireless telegraphy. My eyes brightened up when I saw the diagram of the magnetic detector.

In 1908 I was trying out an improvement on the Marconi "Coherer," and had the idea constructed by the Cossor firm who, incidentally, made a very fine job for me; but while I was constructing the required additional works (at that time we had to make practically all our gear), I heard about this magnetic detector referred to by Mr. Apps, so I wrote to the editor of the *Model Engineer*, a weekly journal, and asked if they could supply me with any particulars. A week or two later my answer appeared and a drawing almost identical to the one Mr. Apps shows was also given and a brief description of the apparatus. I still carried on with my idea on the "Coherer" and, about a year after, I completed it. I was asked to loan it to the Royal Engineer School at Chatham, because a demonstration was to be given of how wireless telegraphy was sent and received. Very few people knew anything about tuning and when I had a casual glance at the gear to be used it makes me wonder now how they managed to send or receive properly; as the principle part used to tune seemed to me to be a zinc cylinder about the size of a small breakfast cup and a resemblance of a stair rod in brass. I was told by the naval officer who was giving this demonstration that my "Coherer" worked well as he was able to pick up morse from a German ship in the Atlantic. He had one objection to my "Coherer" in that it was not as mobile as a crystal, which was then very popular. I think those used by the navy were carborundum and steel and a small electric current was required. I made some crystal sets but I found galena and silver to give best results. I still have that "Coherer," and if Mr. Apps lives near this part of the country I should be very pleased to show him round my den, and the gear, as I am still experimenting and just cannot give it up.—H. KEMP (Tupsley).

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Programme Pointers

By MAURICE REEVE

"Off" Season

THE summer always seems an "off" season with BBC programmes. Popular and sometimes good features come off for a rest and refurbishing, whilst the quality of much of what remains falls and is often carried into view with an air of lassitude and indifference. Normally the show would "close up" for a period whilst folks went on holiday and business slumped. Seeing that this wise procedure is apparently impossible with radio —business doesn't slump, anyhow—the Panjandrums of Portland Place owe it to everyone to avoid this annual decline in standards. It is perhaps more noticeable this year than most, as the appalling weather is compelling more listening than would normally be the case. Even symphony concerts are metamorphosed into Promenade concerts. So be sure your sins will find you out.

Nowhere does the seasonal decline in standards, however, seem to be more marked than in the theatre pieces recently heard. We have had some pretty rubbishy stuff and Monday's, Wednesday's and Saturday's selections have been equally below par. The double bill, Curtain Call and "World of his Own," "The Flower in the Rock," "The Happiest Days of Your Life," "Lord Cummerleigh's Secret" and "Come Live with Me"; all these can be lumped together as a pretty poor lot. Their entertainment value seemed to me to be of the minimum, whilst each and all were utterly devoid of intellectual, social or moral interest whatever.

How greatly a piece like "Caste" showed them up. This excellent play, a near or minor masterpiece by T. W. Robertson, is already almost a hundred years old, yet it seemed as fresh, witty and topical as it doubtless did on the day it first came out. Pointing the moral of the folly of all class prejudice *qua* prejudice, both low against high as well as the other and more usual way round, it carried both us and its point right to the end. The characters were real and, like Dickens's, are met with everywhere; the plot develops logically and conclusively, whilst the subject put before us is both important and interesting.

Stanley Groom's study of the father was a gorgeous portrait of the soused and the idle working class parent of those times, and must come at the head of a fine cast, including David Peel, Richard Johnson, Ann Cullen, Joan Newell and Geoffrey Bond.

Talks

There are some very interesting and commendable reminiscences in the current series, "Personal Story," on Sunday mornings. I was particularly struck with Mr. John Coast's narrative, "Dancers from Bali." His account of how he gathered these enchanting people of an enchanting land together whilst a prisoner of war, making them into a Broadway sensation, was quite absorbing. Mr. Coast has a very pleasing microphone personality.

Another personality of great attraction, now a fully developed and mature microphone artist, is Spike Hughes. He knows his job and how to put it over, two accomplishments not always in harmonious ensemble. His recently concluded series in "Music Magazine," "Have You Brought Your Music?" was vastly entertaining, erudite and opposite. I am looking forward to his forthcoming venture, "Immortal Bohemian."

Music

Apropos of "Music Magazine," now on its summer vacation, I would suggest that its producers do all they can to save it from getting into the kind of rut so many weekly features fall into. Many issues this year have not been up to earlier standards. It seems to have lacked some of its former punch since Alec Robertson retired from it.

Cor de Groot is a very accomplished pianist, if rather lacking the grand manner. He was probably at his best in a recital of French music, the chief item of which was the second book of Debussy's "Wonderful Preludes." Although Gieseking, and formerly Cortot, extracted far more poetry from them, de Groot played them all in a thoroughly pleasing manner. The showy ones had great glitter.

It was good to hear the Toscanini records of the Beethoven first and ninth symphonies—new L.P.s. Even under a lesser master they seem to gain 50 per cent. when divorced from the ballyhoo of a Promenade audience.

Serials

The current Sunday evening serial, "Jane Eyre," is one of the best, and is proceeding very strongly and competently. For once, in these productions, the narrative is nicely balanced with the story and made to seem an integral part of it. Belle Chrystalle is doing it excellently.

The new parlour game, "The Name's the Same," is very good, and Raymond Glendenning an excellent chairman, well in the McPherson and Harding class. Run on the "Twenty Questions" formula, I have often found it agreeably funny.

"West Point Painter," the story of Whistler—one of many great Americans whose genius flourished in this country—was very good. I could have wished for more epigrams; Whistler was an epigrammist almost of the Wilde class. Whether Whistler was as Sam Wanamaker presented him, I wouldn't know. But Mr. Wanamaker's exuberant personality largely contributed to a capital item.

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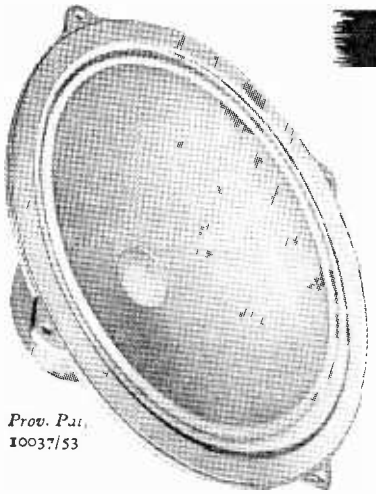

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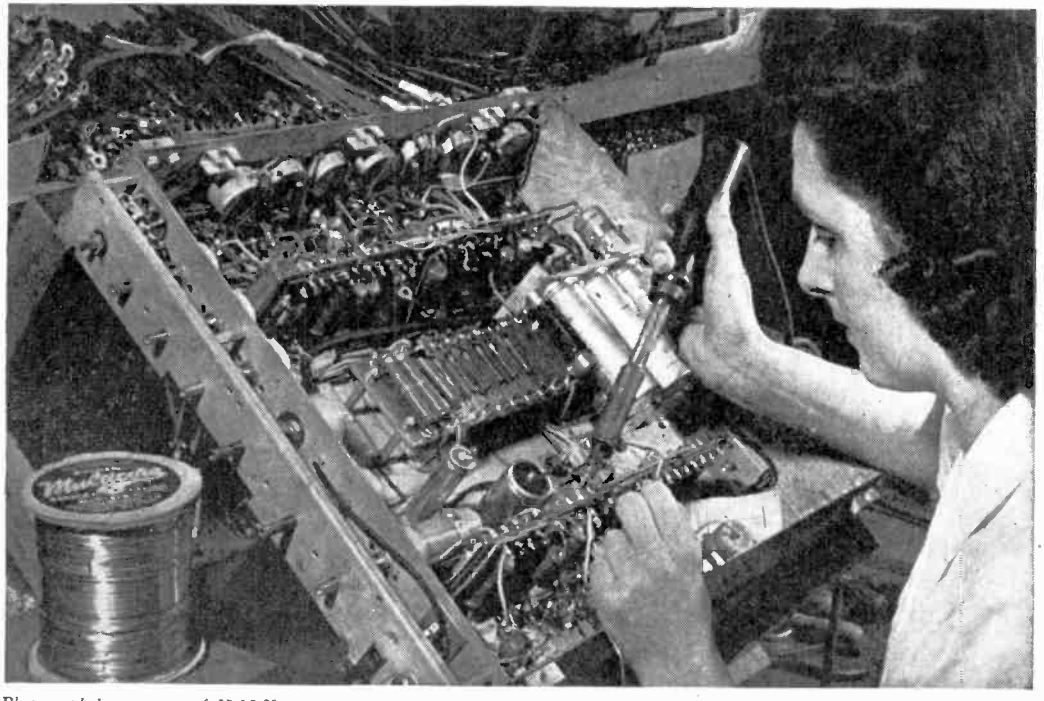

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