HOME-BUILT TELEVISION RECEIVER

Television and SHORT-WAVE WORLD

JUNE 1939
No. 136 Vol. XII.
1/-

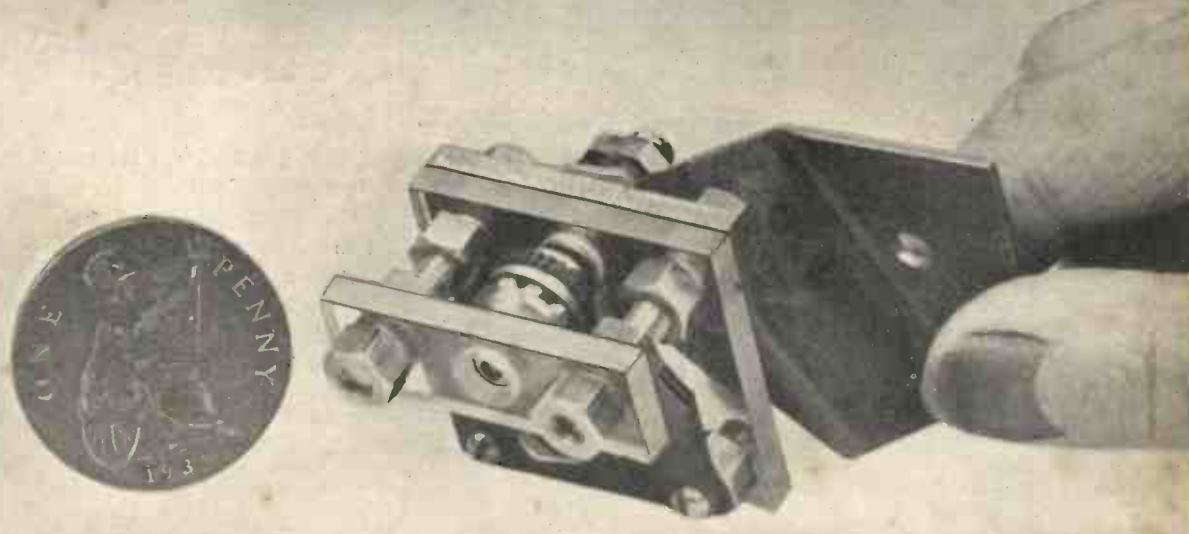
POINTS FOR PROSPECTIVE VIEWERS

USING LIGHT RELAY

SHORT WAVES

PORTABLE DIRECTION-FINDING RECEIVER

SIMPLE 22,000 R.P.M. MECHANICAL SCANNER



PAGE 324

PHONE AND C.W. MONITORS
SIMPLE LOW-POWER TRANSMITTERS

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IMPORTANT

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COMMENT OF THE MONTH

Television for the Provinces

THERE is every indication that the Government decision to institute a television service in the Birmingham area will be made almost immediately and although it appears to be improbable that the offer made by the television receiver manufacturers to the Government for the extension of television to the Provinces will be accepted, a certain amount of misconception has arisen over this matter. The manufacturers have for some time been pressing for a speedy decision and have argued that if this country is to keep the lead in television it now has, pioneer work must be pressed forward as there can now be no doubt that other countries are following hot on our heels. The answer of the Television Advisory Committee was, in effect, that while they agreed that television must eventually expand to the provinces, they were unable to make up their minds what method to adopt, i.e., by radio link or by means of the co-axial cable. The manufacturers' reply was that they did not care what method was used, so long as it worked, but it was important that some action should be taken quickly. They declared themselves in favour of the radio link method and they were so certain that it did not need any further experiments to show it would work that they were prepared to pay for any equipment that would have to be scrapped, should the method prove unsuitable.

The total cost of extending the system to the Midlands area by using the radio link method is estimated at something well under £100,000 and this would include the transmitter itself at Birmingham. The transmitter can in no sense be described as experimental, since it would be equally suitable for use with either the radio link or the co-axial cable and it will therefore be required sooner or later in any case. It will be evident that the Government are not asked to risk very much in going ahead with the radio link method, but it was to overcome any qualms that the Government may still have that the offer was put forward. It is, therefore, clear that there is no attempt by the trade to subsidise or control the transmitting side of television, nor has there been a promise of funds with which to continue provincial extension.

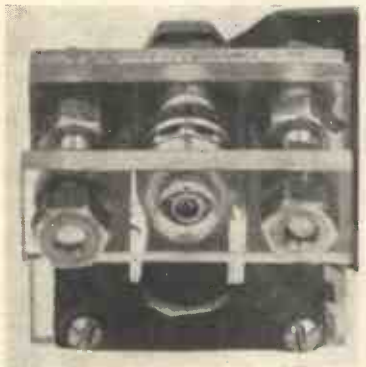
The offer was solely to pay for apparatus which might become useless if a wrong choice of system were made. Although no official announcement has been made of the results of experiments made by the radio link method it is understood that these are now practically complete and satisfactory, and that no outstanding technical difficulties have still to be overcome. Naturally the first practical steps in a project of this nature always bring problems which can only be answered by the kind of development work that has already given Britain its two-year lead in television.

American technicians are already convinced of the possibilities of the radio link method and France has provincial stations planned at Lyons and Lille, which it is expected will use this system.

MECHANICAL-OPTICAL TELEVISION

A SIMPLE 22,000 R.P.M. SCANNING MOTOR

By J. H. Jeffree



This photograph is approximately the actual size of the scanner

WE illustrate here a new synchronised nine-ball line scanner which, afer considerable experiment, has been developed for use in a home-constructed mechanical-optical receiver. This unit is now undergoing its final tests, and full constructional details will be given in a later issue. By its use, properly synchronised, pictures of 135-line definition will be obtainable.

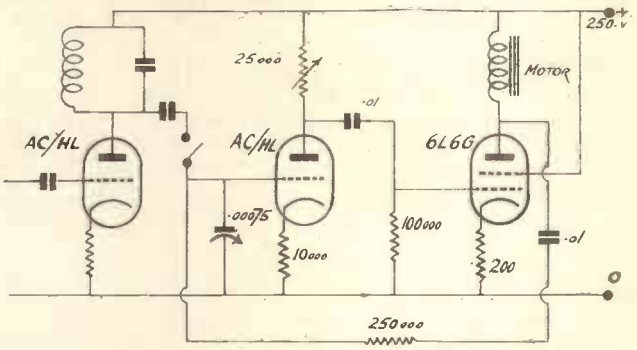
A few preliminary notes on the driving unit required by this scanner may be of interest. One 6L6G valve suffices to drive it, at the required speed of 22,500 r.p.m., providing it with about 6 to 8 watts of alternating current at the line frequency of 10,125 c.p.s.

The motor is connected directly in the plate circuit of this valve. In addition, one or more (probably two), small triodes are required for locking the driving current to the picture transmission and for starting the motor. The best circuit arrangements for these valves are still under consideration, but a circuit diagram is given here showing the principle involved, with some approximate values.

Starting the motor is by a somewhat unusual method adopted to keep down the cost as far as possible. A feed back path, through a condenser and a high resistance, is provided from the driver valve plate to the preceding triode grid, and the latter is shunted to earth through a variable condenser. As a result, the pair of valves form, when the motor is connected in circuit, an oscillator of which frequency can be varied over a range of about 1,000 to 10,000 c.p.s. by varying the condenser. The running speed of the motor is 22,500 r.p.m., with 10,125 c.p.s. current, but when fed with, say, 1,000 c.p.s. it will run quite well at 2,250 r.p.m. a speed to which it can (owing to its small size) be spun with a flick of the finger. Alternatively, a simple spring starter can be fitted.

When thus started, with the oscillator timed to 1,000 c.p.s., the motor readily drops into synchronism with the oscillator (this being facilitated by the feed-back characteristics of the circuit) and can then be run up to its final speed by varying the oscillation frequency by means of the condenser. Locking impulses from the transmission are then applied, through the second triode, to provide exact syncronisation.

Near its running speed the motor has self-correcting characteristics, so that if thrown out of synchronous speed, it promptly pulls in again. Construction is simple but H. E. Sanders & Co. are prepared to supply these motors to those who have not the facilities for making them.



Suggested driving unit circuit for nine-ball scanner. (Details subject to revision).

Book Review

CATHODE RAY TUBES, by von Ardenne, translated by McGregor and Walker. (Pitman & Sons, 42s., 530 pp., 465 figs.)

Manfred von Ardenne's classic on the Cathode Ray Tube first appeared in German in 1933, and it is greatly to be regretted that an English translation has not appeared until the lapse of six years from this date.

It may be argued that so much of the development of cathode-ray tubes has taken place within the last six years that the book is almost out of date, but in reading through the opening chapters it is realised that the fundamental theory has been dealt with in a manner which it would be hard for any later writer to improve on.

After preliminary notes on the production of electron beams, the author describes the theory and performance of the gas-focused tube, for which he was so largely responsible.

The construction of the tube and the characteristics of the screen occupy the remainder of the first portion of the book. In the second section, the associated circuits are dealt with, including amplifiers, time bases and photographic recording attachments. It is a pity that the translation follows the German too literally in parts as some passages appear needlessly involves. For example (p. 262): "It is usual, in practice, to communicate [*sic*] an alternating voltage to the grid of the control valve also by transformers instead of condensers."

The final section deals with special applications of the tube, including its use in sound recording. This has not been hitherto published in books on the cathode-ray tube and will be read with interest by cinema engineers. A complete account of the author's work in television development concludes the book, and here again it is to be regretted that particulars of the later types of television tubes have not been added to the English edition. Later information appears in the author's "Television Reception" (Chapman & Hall).

The name of von Ardenne has been associated with cathode-ray tubes since the earliest days, and the appearance of this book emphasises how much the industry owes to the untiring and careful research of the author.

COMPLETE DESIGN FOR HIGH-QUALITY TELEVISION RECEIVER

The designer of this receiver is Mr. S. West who has already produced several highly successful vision units. The objective for the receiver described in the following pages was very high quality within the ordinary service area and this has been secured.

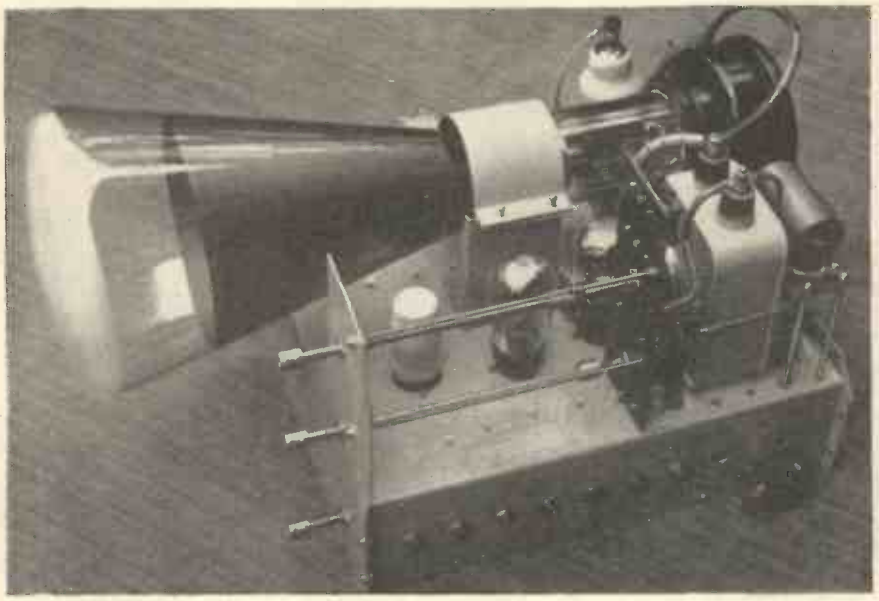


Fig. 5. The general layout of the time base and C.R. tube circuits is well revealed in the above illustration.

IN considering the design of a television receiver there are two important factors to determine, namely, the overall gain the vision section must possess and the size of the picture desired.

The question of overall gain in the vision unit is important because there is little object in aiming at sensitivity greater than is required fully to modulate the C.R. tube having in mind the signal voltage available at the aerial feeder termination to which the receiver is to be connected, and, it is this factor that will largely determine the circuit arrangements particularly from the point of view of the number of valves. Also wih a signal of reasonable amplitude, the simplicity and reduced number of stages of a tuned radio-frequency type of vision unit presents irrefutable advantages, and, with an adequate signal, such a design is excellent.

Considering the question of picture size, despite notions to the contrary, a small picture has much to commend it, indeed it can be shown that a small picture is essential for certain viewing conditions; these vewing conditions obtaining for the majority of ordinary domestic requirements.

The equipment herein described was designed for use within a 20 miles radius of Alexandra Palace, a T.R.F. circuit therefore being adopted. A quite drastic employment of the contrast control, in this case variable bias to the first R.F. stage valve, indicates the range as likely to be in excess of this estimate. A bright picture was desired and the audience would in general be restricted to not more than three persons. From a careful consideration of this requirement a C.R. tube having a 7 in. diameter screen was decided upon.

An electrostatic tube was chosen, mainly because such a tube has greater focus stability over the small magnetic types which do not in general utilise hexode focusing.

The complete equipment is entirely conventional in every respect, the aim being throughout to ensure the very highest picture definition and good quality of sound reproduction.

It will be seen from the following description that the various units comprising the complete assembly are separately constructed but this requirement was dictated by the particular needs of this installation and obviously considerable latitude in the arrangements and grouping of the units is permissible.

The Vision Unit

The photograph, Fig. 2, shows the general arrangement of the vision

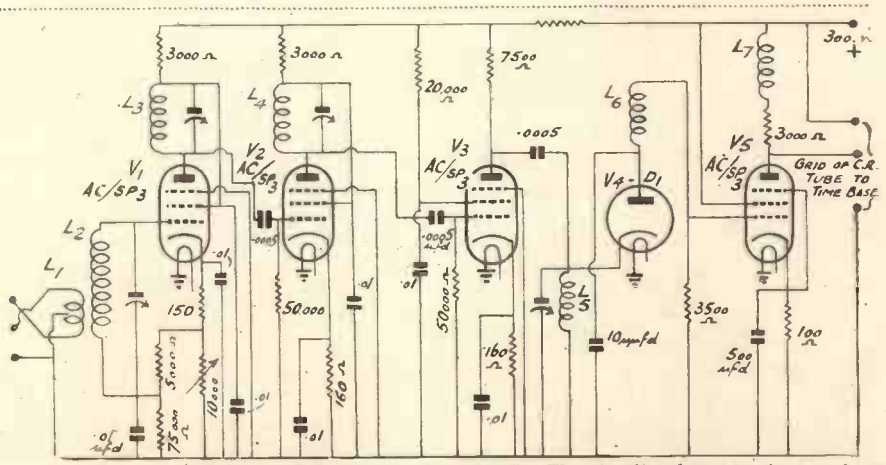


Fig. 2a. The circuit diagram of the 5-valve vision unit. The circuit values are given and any good quality components can be employed.

VISION UNIT

unit and its theoretical circuit is given by Fig. 2a. It is seen that the unit is entirely straightforward and comprises three R.F. stages, a diode detector and a single corrected V.F. stage. The unit is compact the overall dimensions being given in Fig. 3.

Mazda type AC/SP3 pentode valves are employed in the R.F. and the V.F. stages, a Mazda type D1 diode providing for demodulation of the vision carrier. Capacity tuning is employed for the R.F. stages because of the greater convenience of this method also, for the receiving conditions applying the resulting loss in gain (in any event slight) is unimportant.

A simple detector filter is included to remove the 45 mcs. carrier from the detector valve output, this simple filter being quite effective. As a matter of interest the unit tends markedly to be unstable without this filter and its inclusion is therefore worth while.

The V.F. stage anode coupling resistance and correcting choke are enclosed in the shielded compartment at the right-hand end of the unit. The constants of this circuit are such as to provide level response and negligible phase shift between 50 and 3×10^6 cycles but, it is pointed out that, as the synchronising separator is not included in the vision unit, the higher vision frequency response is somewhat reduced when the sync. feed and modulation connections are made. The measured response with these connections made and with the time base and C.R. tube assembly located immediately above the vision unit is, however, maintained linear to over 2.5 mcs.

The self inductance for the correcting circuit is chosen having in mind this layout and it is therefore not desirable to depart from such an arrangement, or in any event, not to exceed a length of 9 in. for the modulation feed lead.

Reference to the photograph, Fig. 2, which depicts the interior of the unit and the following description will adequately cover the constructional details of the 5-valve vision section. At the extreme left end in this photograph is seen the gain control which is mounted upon a simple box bracket. Details of this are more clearly seen in Fig. 4. The three R.F. valves are stagger mounted as this permits short anode to grid connections to be made, thereby reducing the stray capacity and the possibility of feedback which could result in uncontrollable regeneration.

The aerial and anode coupling coils are mounted across the 15-uufd. tuning condensers. No control knobs are fitted to these latter items as it suffices to slot the control spindles to permit adjustment with a screw driver. The coil winding data is given in the appendix.

In the detector and V.F. compartments of the unit the small Mazda type D1 diode is discernible just in front of the filter inductance screening can, this can being clamped down with a short length of girder section aluminium. The lead from the anode of the diode can be seen passing into the top of, and the V.F. valve grid lead from the bottom of, this screening can.

The diode coupling coil and its associated tuning condenser is assembled below the diode valve, the spindle of this condenser being discernible projecting from the side of the unit.

In the screened compartment at the right-hand end of the unit is contained the V.F. valve anode coupling resistance and the correcting inductance, the position for the latter item being chosen with a view to restricting the lengths of the anode connecting leads and at the same time keeping the inductance a reasonable distance from the metal box. This avoids undesirable capacity which otherwise would, with the fixed constants specified, reduce the upper frequencies response or, by assigning new values to the constants to combat this parasitic capacity, would reduce the stage gain. For the same reason the modulation output

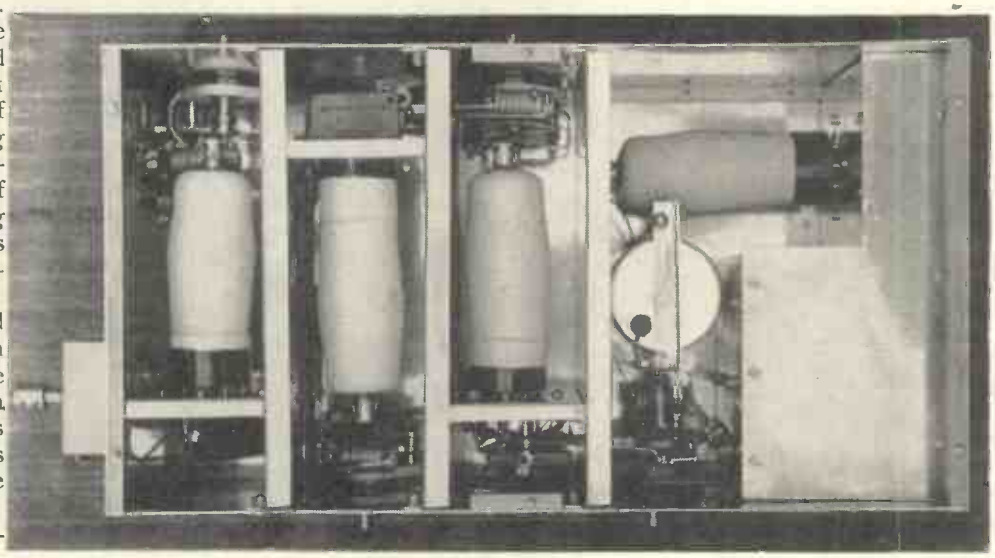


Fig. 2. The interior of the vision unit. Note the staggered mounting of the valves and the screened V.F. compartment.

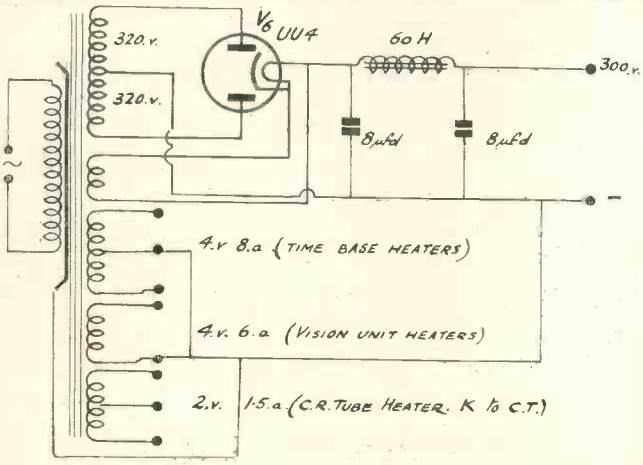


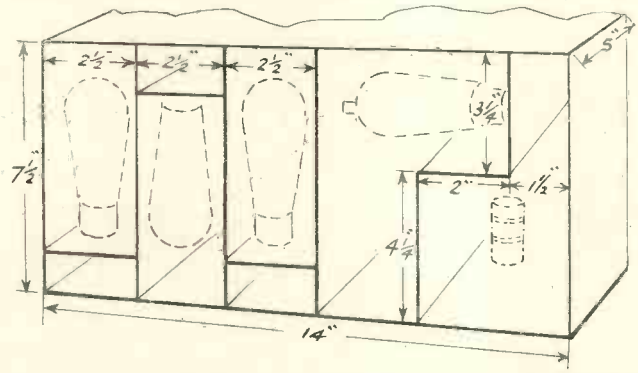
Fig. 2b. The circuit diagram of the vision unit power supply. The mains transformer includes windings for the heaters of the time base valves and for the C.R. tube. Only normal insulation is required for the latter winding as the C.R. tube is operated with an earthed cathode.

THE TIME BASE

is taken to a stand-off terminal, mounted clear of the metal case.

Such a unit as this, with careful adjustment, can provide extremely fine picture definition. Moreover, of this is well revealed by the photograph Fig. 5. The theoretical circuit is given by Fig. 6a, whilst Fig. 6b is the circuit diagram for the C.R. tube and time base supply unit.

trapezium distortion; it also tends to mitigate the defocusing effect prevailing at the limits of the sweep. Conventional triodes are employed as voltage amplifiers for the working



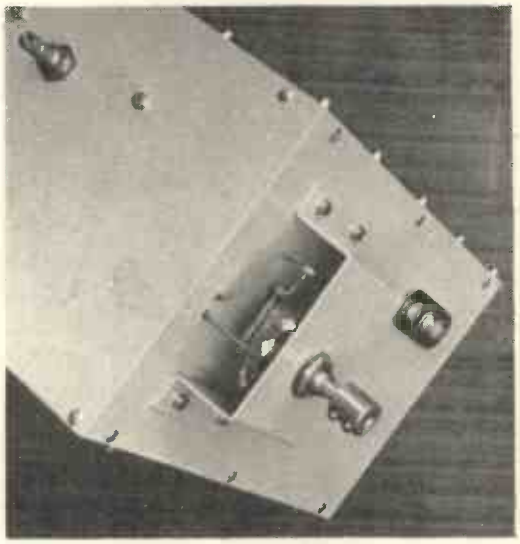


Fig. 3 (above). The dimensions of the metal vision unit container are given above.
Fig. 4 (right). The simple mounting adopted for the vision unit's gain control. By placing exterior to the container, layout symmetry is retained.

the characteristic "clean" screen background which is a feature of a T.R.F. circuit obtains. There is no doubt whatever but that the performance is superior to a simple superheterodyne unit wherein no signal frequency valve stage or stages is included. It is necessary to add, however, that provision for reception of the sound programme is not so readily accomplished.

Time Base

The time base and C.R. tube circuits are contained upon a single chassis. The general arrangement

Mazda type T41 gas relays generate the requisite saw tooth oscillations for the horizontal and vertical spot deflections. In each case the output of these oscillators is fed into a balanced amplifier thereby ensuring that the potential of the final anode of the C.R. tube is maintained uniformly in respect to the deflecting plates. This, as is well known, is necessary in order to avoid

conditions are not particularly onerous.

The C.R. tube is an Ediswan having a 7 in. diameter screen, this providing a picture approximately 6 in. by 4½ in.

At the back right-hand corner of the assembly can be seen the top of the sync. filter valve which is of the amplitude separator class. At the right-hand corner is assembled the

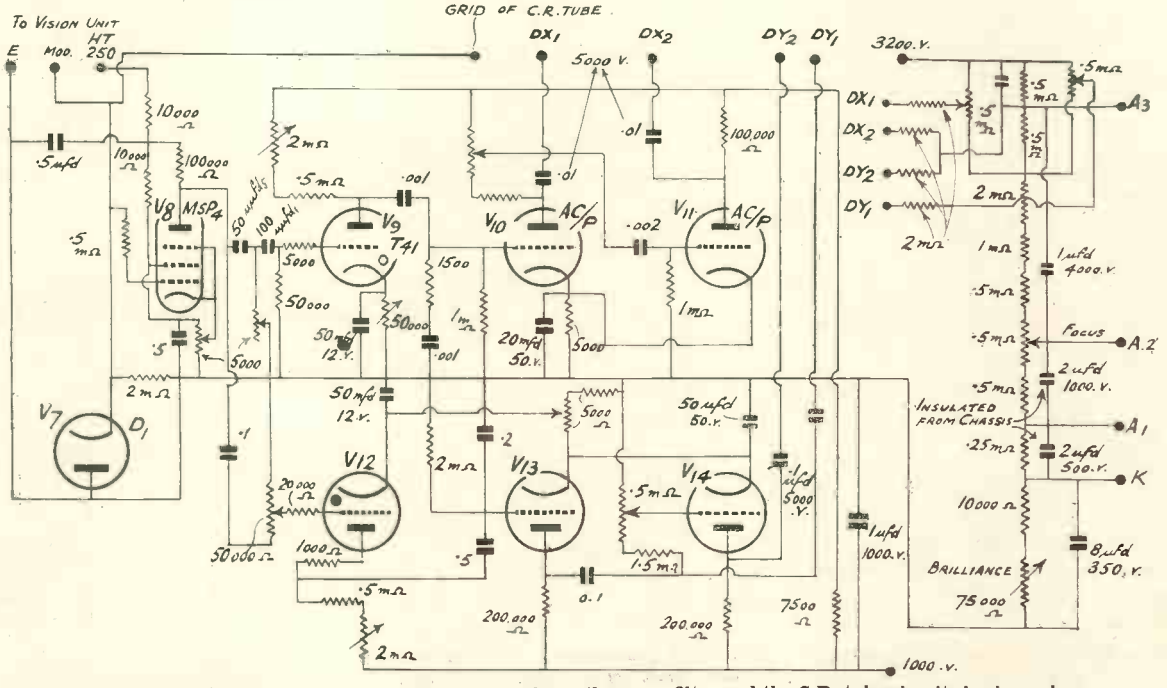


Fig. 6a. The complete circuit diagram of the time base, the sync. filter and the C.R. tube circuits is given above.

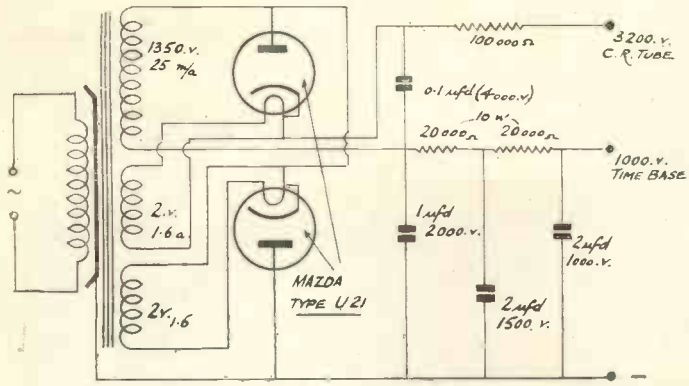


Fig. 6b. Circuit diagram of C.R. tube and time base power supply unit. Two indirectly-heated rectifiers in a voltage doubling circuit are employed; the need for some form of delay switch is thereby avoided.

potential network of the C.R. tube and the smoothing condensers associated with this network. The C.R. tube focus and bias (brilliance) controls, and also the vertical and horizontal blocking oscillators charge resistances controls, are brought to the front of the time base as they are then easily further extended to project from the cabinet front.

The various controls for the time base are all brought to one side of the unit. They can be seen grouped in a row in the photograph. The spindles are slotted to permit their initial adjustment with a screwdriver; once this adjustment is found the controls will rarely require further attention.

A Belling Lee high-voltage plug and socket, which fulfils the function of positive terminal for the 3,000 volt C.R. tube exciter potential is mounted at the right-hand end of this side. Adjacent to this plug are two holes which permit access to the shift circuits. The potentiometers responsible for this function can be seen in the photograph Fig. 7, which depicts the underside of the time base at the bottom left-hand corner.

The bakelite knobs supplied with these resistances are slotted so that adjustment can be safely undertaken with a screwdriver. It will be seen from the circuit that there is a possibility of the full E.H.T. appearing on the spindles of these controls, hence this precaution. For the same reason the variable resistances are mounted upon a paxolin sub-panel.

The sub-chassis assembly of the time base unit is conventional and most of the constructional details are securable from the photograph. The actual chassis dimensions are given by Fig. 8. The arrangement adopted to bring all the controls to one side of the unit is quite clear in the photograph.

THE CONTROLS

outside edge of the chassis is the stand-off modulation feed terminal and beneath this a plug and socket to provide H.T. for the sync. filter stage operation. It is convenient to derive this from the vision unit rather than to break down the time base voltage, because the screening grid's stabilising circuit, comprised by a heavy current bleeder potentiometer, is somewhat wasteful.

The amplitude separator valve's

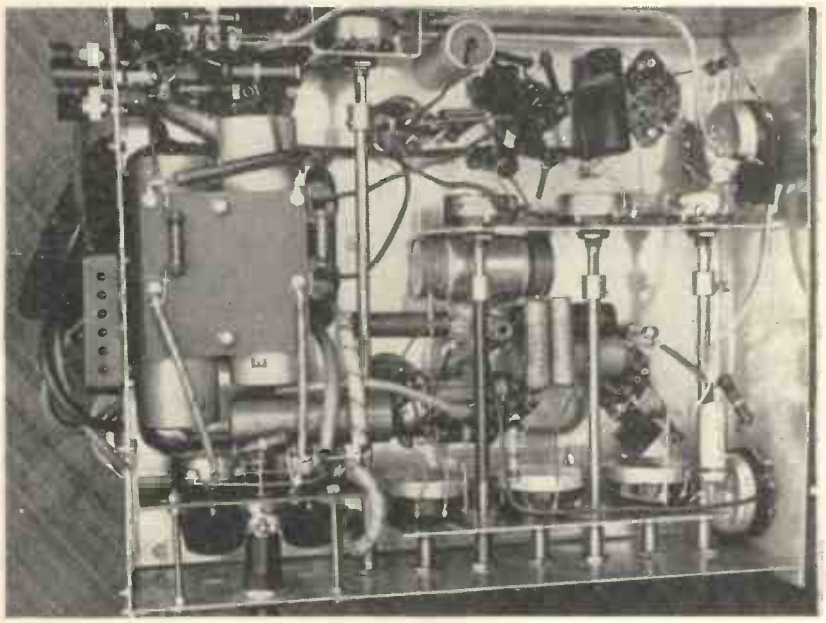


Fig. 7. A sub-chassis view of the time base from which the layout adopted can be obtained.

D.C. Component

The sync. separator valve base can be seen at the top left-hand corner. Immediately to the left of this is the D.C. restoring diode, a Mazda type D1. Further to the left and on the bias resistance is mounted upon a small box bracket to the right of the valve base. It will be noted from the circuits that no cathode by-pass condenser is fitted for the filter. It is found that better synchronising stability is secured by omitting this.

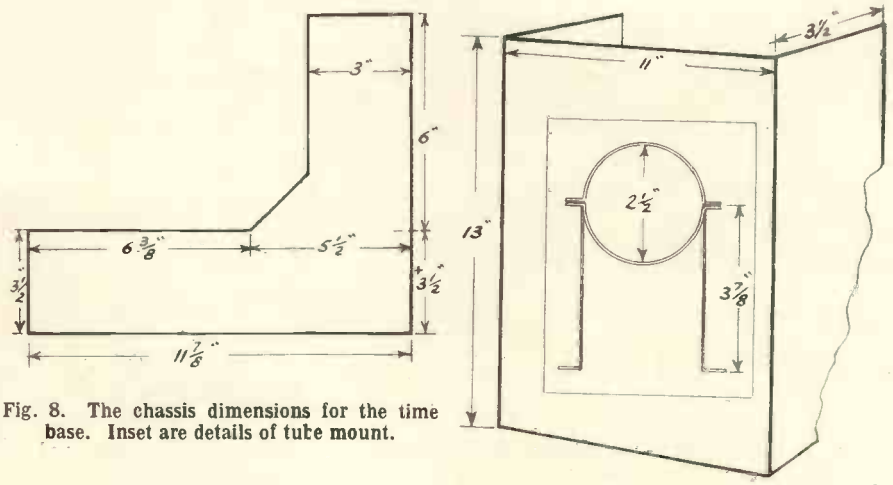


Fig. 8. The chassis dimensions for the time base. Inset are details of tube mount.

Furthermore, the ability to maintain a stable interlace is noticeably improved.

The two large tubular condensers that can be seen in the foreground at the left of the unit are Dubilier 0.1 uFd 5,000v. intermittent working condensers. By reason of the fact that the C.R. tube is operated with the final anode some 3,000 v. above the chassis it is necessary adequately to isolate the tube deflecting plates to this D.C. potential difference.

These condensers provide connection to the vertical sweep circuits. Two similar condensers, in this case of 0.01 uFd capacity are employed for the horizontal circuits. These are mounted through a slot in the chassis and are held securely by well insulated brackets. They can just be seen to the right of the vertical feed condensers. This method of mounting was adopted to mitigate the effects of stray capacity in the horizonal circuits. Failure to give attention to this point will result in slow "flyback" with its resultant distortion or loss of the left picture edge.

The arrangement adopted for the C.R. tube electrode-potential divider and the mounting of the associated smoothing condensers is shown by Fig. 9. The panel carrying the various fixed and variable resistances is of paxolin and is secured to the front panel by means of 2 B.A. studding. The brilliance and focus controls are carried through to this front panel. In the case of the focus control, an insulated coupling breaks the control spindle, thus avoiding the possibility of shock when carrying out adjustments. It should be noted that, due to the conservative rating of the smoothing condensers for the C.R. tube potentials, it is essential to insulate these when mounting, from the chassis, for, whilst the potential across them is well within their rating, the potential between them and chassis is higher than their insulation is likely to withstand.

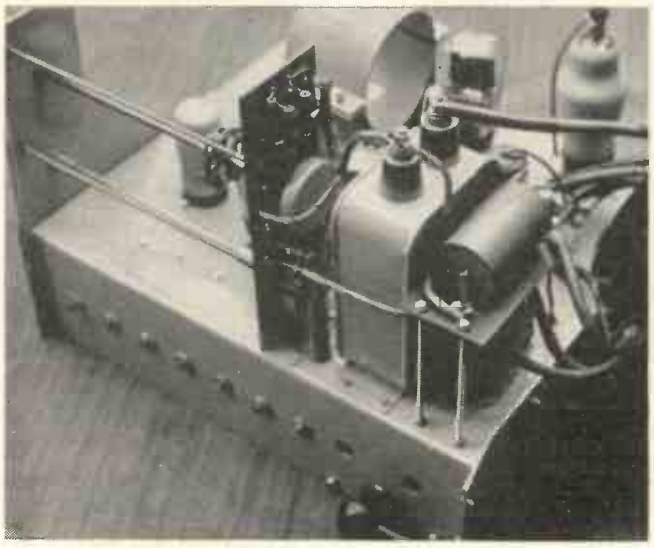


Fig. 9. The above photograph shows the arrangement of the C.R. tube's potential divider. Note the mounting of the smoothing condensers to ensure these are insulated from chassis.

Appendix

Coil-winding Data

L1 3 turns of 36 d.s c. tapped at centre.
L2 6½ turns of 22 d.s.c. occupying ⅞ in. winding length.
L3 and L4 6 turns of 22 d.s.c. wire occupying ⅞ in. of winding length.
L5 9 turns of 22 d.s.c. occupying 1 in. of winding length.
L6 21 turns of 22 d.s.c. wire occupying .65 in. winding length.
L8 2 turns of 34 d.s.c. at earthy end of L9.
L9 9 turns of 20 d.s.c. wire tapped 3 turns down for grid of V15.
L10 9 turns as above, centre tapped.
All the above are wound upon ½ in. diameter paxolin coil form.
L7 85 turns of 38 d.s.c. on ⅝ in. coil form.

Valves

V1, V2, V3 and V5 Mazda type AC/SP3.
V4 and V7 Mazda type D.I. diodes.
V6 and V19 Mazda type UU4 rectifiers.
V8 Osram type MSP4 or Mazda type AC/S2.
V9 and V12 Mazda type T.41.
V10, V11, V13 and V14 Mazda type AC/P.

Time Base and E.H.T. Transformer

Prim. to suit main's voltage.
Secs. 1,350 volts at 25 mA. Insulated for full voltage at inside of winding and 2x full voltage at outside end.
2 volts 1.6 amp.
2 volts 1.6 amp. Both windings insulated for 2x full voltage to frame.

Details of the sound section will be given in next month's issue.

America's First Programmes

THE National Broadcasting television programme schedule for the first week were as follows.

12.30 p.m. to 4 p.m., EDST.

President Franklin D. Roosevelt, Grover Whalen and others at opening ceremonies of New York World's Fair marking the beginning of high-definition television as an American public service. The programme was televised by the N.B.C. mobile unit and relayed to Manhattan for broadcast over Station W2XBS.

May 3 (Wednesday).

8 to 9 p.m., EDST.

Fred Waring and his Pennsylvanians; Richard Rodgers, composer, in the first studio programme of N.B.C.'s regular public television service. Hart, at the piano, accompanying Marcy Westcott, of "The Boys From Syracuse," in songs from the Rodgers and Hart Broadway hit production.

The programme also included Marjorie Clark and Earl Larimore in "The Unexpected," a dramatic sketch by Aaron Hoffman; The Three Swifts, jugglers; a relay from the New York World's Fair of 1939, and Walt Disney's cartoon comedy, "Donald's Cousin Gus."

May 5 (Friday).

8 to 9 p.m., EDST.

Mitzi Green, motion picture and stage comedienne, in a programme from the N.B.C. television studios. Also Josephine Huston in "The Choir Rehearsal," a musical piece by Clare Kummer; Roy Post, in a demonstration of his "lie detector," and The Novello Brothers, comedy whistlers.

At the bottom of the third column on page 272 of the May issue of TELEVISION, the Chairman of the Baird Company was referred to as Sir Harry Green. This, of course, should be Sir Harry Greer, and was a typographical error.

AMERICA MAKES A START

Impressions of the inauguration of a television service in the States.

David Sarnoff, President of the Radio Corporation of America, was televised on April 20th as he delivered a speech dedicating the R.C.A. Exhibit Building at New York World's Fair. Reception was in the R.C.A. Building, Radio City, eight miles from the actual scene of events.

TELEVISION made its formal debut in the United States on Sunday, April 30, when the National Broadcasting Company broadcast images of President Roosevelt, speaking at the opening of the New York World's Fair, to thousands of viewers scattered over the metropolitan area of New York City.

The historic broadcast was made by the system developed by the Radio Corporation of America. The N.B.C. television programmes will continue for the present with bi-weekly programmes for home viewers in and about New York.

Thousands of New Yorkers, to whom television was little more than a name, gathered in the shops of New York radio dealers and outside the windows of Manhattan department stores to witness the ceremonies at the fair grounds, eight miles distant. They saw a panorama of the fair buildings, the parade as it passed the reviewing stand and the entrances of Mayor LaGuardia, raising his hat as he advanced to the President's box.

Televiewers caught their first glimpse of the President at 2.09 p.m., when his official car, carrying several members of his bodyguard on the running boards, swept into view. Two minutes later viewers within fifty miles of the N.B.C. transmitter in the Empire State tower got an excellent view of the Chief Executive as he stood at attention in his box during the playing of the national anthem. Speakers televised, other than the President, were Mr. Whalen, Mayor LaGuardia, Governor Herbert Lehman and Sir Louis Beale, British Commissioner General to the New York World's Fair, who spoke for all the foreign nations participating in the Fair.

Those who witnessed the inaugural telecast on home receivers commented on the clarity and steadiness of the image.

Press Enthusiastic

" Amazement and then unbounded enthusiasm," reported the *New York Herald Tribune,* " marked the start of what will be a semi-weekly feature from now on. Many to whom television had been only a name admitted afterward that the demonstration exceeded anything they had thought possible. At receivers all over the city and in New Jersey representations of the Fair grounds, the images of the President and of other dignitaries at the exercises were witnessed almost as clearly as they could have been seen on the spot.

The *New York Times* said: " Reports from receiving outposts scattered throughout a fifty-mile radius of New York indicated that the spectacle by television was highly successful and that a new industry had been launched into the World of Tomorrow."

Seen 45 Miles Away

O. B. Hanson, N.B.C. vice-president and chief engineer, who looked in at his home in Westport, Connecticut, more than 45 miles from the transmitter of Station W2XBS, said the broadcast far exceded his expectations.

Other viewers in Westchester County and on Long Island reported " excellent images."

The first programme was televised by the N.B.C. mobile unit. The camera location was some 50 feet in front of the President's box and images were sent over coaxial cable from that point to the control van and the ultra-short wave transmitter stationed at one wing of the Federal Government Building. The transmitter van relayed the pictures on a frequency of 177 megacycles. A relay receiver at the Empire State tower, eight miles from the grounds at Flushing, Long Island, picked up the picture signals which were then put on Station W2XBS's broadcasting channel of 45.25 megacycles. Sound was broadcast on a frequency of 49.75 megacycles.

Long Preparation

The first programme marked the climax of seven months of the most intense preparation. The N.B.C. station, after several series of test transmissions last year, went off the air in August. Since that time the engineering staff has almost completely rebuilt the transmitter and studio equipment. The programme also brought to a close the strictly experimental test period that began in June, 1936. The N.B.C.-R.C.A. field tests, which have included experiment in research in both programme and engineering phases of television, have cost more than $2,000,000.

Scannings and Reflections

TELEVISION AND AMATEUR PHOTOGRAPHERS

A TELEVISION engineer who also makes photography a major hobby, is planning to give every aid to amateur photographers in the General Electric Company's television studio at the World's Fair, New York. Visitors will be invited to take part in television programmes, and a stand will be set up with an exposure chart to show the photographer how best to picture his friend's image on the television screen and inside the television studio.

WIRELESS LICENCES

The Post Office issued 536,427 wireless receiving licences during April, 1939. This figure represents a nett decrease of 5,259 in the number of licence holders during the month after making allowance for expired licences and renewals.

The approximate total number of licences in force at the end of April, 1939, was 8,962,850 as compared with 8,604,400 at the end of April, 1938, an increase during the year of 358,450.

TELEVISION DEPUTATION TO P.M.G.

The Postmaster-General, Major Tryon, received a deputation on May 9 from the Radio Manufacturers' Association urging that television should be extended immediately to the provinces.

The deputation was headed by Mr. J. H. Thomas, of Cossor, Ltd., chairman of the Association. He was supported by Mr. C. O. Stanley, of Pye, Ltd.; Mr. J. H. Williams, of Marconiphone Co., Ltd., and Mr. M. M. Macqueen, of G.E.C., Ltd.

The deputation pointed out that as the Government had decided that the present transmission system was satisfactory, and as recent development in the London area had been rapid, a provincial station should be opened as soon as possible or Britain would lose her initial advantage in television.

The Post Office has undertaken certain experiments with radio links between London and Birmingham to provide a means of relaying London programmes from Birmingham, and it is understood that these are now completed.

Major Tryon gave the manufacturers a sympathetic hearing and discussed the matter with them for an hour. He told them he was awaiting a report from the Television Advisory Committee on the subject.

According to well-informed sources the Television Advisory Committee is likely to recommend the Government to consent to make a grant of the necessary funds.

This grant would be made out of B.B.C. licence revenue, which is at present retained by the Exchequer. £100,000 is the figure mentioned.

SPECIAL LENS FOR DERBY BROADCAST

A special lens believed to be the largest of its type was specially made for the Derby broadcast. The lens was made at the works of Messrs. Taylor, Taylor and Hobson, Leicester. It is a 12½ in. diameter with an aperture of f1.5 and weighs 70 lb. In all there are seven glasses.

The order was executed within five weeks. It underwent thorough tests in the works laboratory and was passed as "perfect" before despatch.

B.B.C. SOUND STAFF FOR A.P.

In order to acquaint producers of sound programmes with the technique of television production, it has been decided that from time to time sound staff from Broadcasting House will be seconded to the Television Department at Alexandra Palace. Mr. Val Gielgud, Director of Features and Drama, will be temporarily transferred for six months, as from July 1 next, to the Television service. During this time Mr. Gielgud will act as a television producer, so obtaining practical studio experience.

It is hoped that Mr. Gielgud will be only the first to have the opportunity of studying television production under working conditions.

DU MONT TELEVISION LICENCES

The Allen B. DuMont Labs., Inc., of Passaic, N.J., have just filed applications for additional television transmitting licences. One application covers a portable mobile transmitter to be carried on a motor truck, for picking up outside events and flashing them via ultra short wave back to the main transmitter for retransmission. Another application covers a 1 kW transmitter to be installed at the New York quarters of the DuMont organisation, on the top floor of 515 Madison Avenue. This proposed television station is for the purpose of studying programme problems and possibilities under actual working conditions. A third application covers a similar television station to be installed in the Natonal Press Building, Washington, D.C.

"THE GREAT ADVENTURE"

Arnold Bennett's stage masterpiece, "The Great Adventure," is to be televised again on the afternoon of May 30, with D. A. Clarke Smith as Ilam Carve.

Based on Bennett's novel, "Buried Alive," this amusing comedy concerns the career of a great painter who shuns publicity. As the play opens, Shawn, his valet, is dying; Ilam Carve calls a specialist who, owing to a misunderstanding, thinks that the patient is the great Ilam Carve himself. The artist, seeing an opportunity to escape from himself, supports the illusion; the valet receives a Westminster Abbey burial and the real Carve retires into delightful anonymity for a time. But a vivacious widow, Jane Cannot (played by Marda Vanne) comes into his life. How Ilam Carve is discovered, despite his efforts to remain unknown, furnishes the material for a swift-moving comedy.

MARCONI'S AND TELEVISION

Speaking to shareholders at the annual meeting of Marconi's Wireless Telegraph Co., Ltd., on May 9,

MORE SCANNINGS

H. A. White, the chairman, dealing with the television activities of the company, said: " The development of television is still in its initial stages and will, without doubt, in the comparatvely near future produce results far more striking than anything yet accomplished in this field. When the various applications of television already within sight are successfully achieved, not only in entertainment but for many other purposes, it may well prove to be comparable with the invention of the printing press in the influence which it exercises on mankind.

" No other country had, up to the end of last year, taken television beyond the limits of experimental emissions, so that England has led the world in the first practical application of television to purposes of entertainment and instruction.

" There are immense opportunities for research, including, for instance, the investigation of the lowest band of ultra-short waves from 1 to 3 metres, and of micro waves measured in centimetres and perhaps ultimately in millimetres.

BOXING AND TELEVISION

The whole question of televising boxing matches is to be discussed at the annual general meeting of the British Boxing Board of Control, which is to be held at Cardiff on Saturday, June 10, instead of May 13, as originally arranged. The chairman of the board, Colonel R. R. Myddleton, is to give full particulars of the stewards' opinion and it is expected that a decision will be made on the Board's future policy.

STUDIO EXPLOSION TELEVISED

An explosion startled viewers who were watching Mr. R. B. Bennett, former Prime Minister of Canada, in the " Speaking Personally " item in the television programme on May 9.

Mr. Bennett was seen to put his hand to his face as if to ward off a flying missile. He murmured, " Shall I go on?" and the broadcast continued.

The origin of the explosion was a studio lamp which exploded. It was near the microphone, so the explosion sounded worse to viewers than was the case.

DR. PETER C. GOLDMARK, C.B.S., CHIEF TELEVISION ENGINEER

Dr. Peter Carl Goldmark, Columbia's chief television engineer, who is responsible for C.B.S. television activities and installation of the television station on top of the Chrysler building, was born in Budapest, Hungary, December 2, 1906.

He received his education at the University of Berlin and University of Vienna, graduating from the latter in 1931 with a B.Sc. and Ph.D. in physics. The same year he went to work for Pye Radio, Ltd., in Cambridge, England, taking charge of the concern's television activities until 1933. He then worked for several years as a consulting engineer and in 1936 joined C.B.S. to direct research on television developments. Two years later he became Columbia's chief television engineer.

SHORT – WAVE BROADCASTING FROM TRAINS

From short-wave radio equipment installed in a special studio built in one of the cars on the Union Pacific exhibition train, programmes were relayed last month for rebroadcasting by 16 major long-wave stations in cities of the United States from the Pacific to the Atlantic coast as the train travelled along on its transcontinental tour from Los Angeles to Kansas City.

This is believed to be the most extensive series of broadcasts ever attempted from a moving train. The equipment, installed by General Electric engineers, consists of a 50-watt transmitter, operating on a wavelength of 2,012 kilocycles, about 50 metres.

A 200-foot aerial was strung along the roof of three cars, projecting two feet above the roof. The signal was heard with sufficient strength for rebroadcasting for distances of 15 to 20 miles and this made it possible to originate programmes when the train was a half hour from the cities.

OPENING OF R.C.A. BUILDING AT WORLD'S FAIR TELEVISED

A preview programme of the beginning of American television broadcasting was given on the afternoon of Thursday, April 20, when the National Broadcasting Company telecast across the metropolitan area of New York, dedication ceremonies of the R.C.A. Building at the New York World's Fair of 1939.

The television images showed remarkable improvement in brilliance and detail since the N.B.C. transmitter was last on the air several months ago.

The preview programme marked the first time that pictures relayed by the N.B.C. mobile unit were rebroadcast from the transmitter on top of the Empire State Building.

Reception of the television broadcast was witnessed on the 62nd floor of the R.C.A. Building, Radio City, by reporters and invited guests. They saw and heard the dedication ceremony by David Sarnoff, president of the Radio Corporation of America.

At the conclusion of the ceremonies at the World's Fair, the audience was shown a televised boxing match, staged in the N.B.C. studios at Radio City.

RESIGNATION OF SIR LOUIS STERLING

Sir Louis Sterling, managing director of Electric and Musical Industries Ltd., has asked to be released from his duties as managing director. It is understood that Sir Louis has resigned owing to a divergence of view on a matter of internal policy. He has been prominently associated with the practical development of the Marconi and E.M.I. Television system, jointly owned by Electric and Musical Industries and Marconi's Wireless Telegraph Co.

OUTSIDE BROADCASTS IN JUNE

Both the B.B.C.'s mobile television units will be busy in June. On June 3 cameras installed in Hyde Park will show the whole of a fire-fighting and A.R.P. display organised by the London Fire Brigade and the London Auxiliary Fire Service. The Duke and Duchess of Kent will be present to inspect the four hundred men of the London Fire Brigade who can be spared from their stations. The London Fire Brigade is providing 150 vehicles, including fire engines, trailer pumps and lorries with A.R.P. appliances. The finale will be the burning of a 150-foot tower.

Trooping the Colour will be televised direct from the Horse Guards Parade on June 8, and on the same day the B.B.C.'s second mobile television unit will begin the first of three daily transmissions from Richmond Horse Show in the Old Deer Park with commentaries by Major Faudel-Phillips and Frederick Grisewood. On June 8 the main event will be coaching, June 9 will feature the Children's Jumping Contests, and on June 10 viewers will see the " Bending " competition for polo ponies. In

these the ponies have to zig-zag between closely-spaced posts, demonstrating their ability to "turn on a sixpence."

Another visit to Bull's Cross Farm is scheduled for June 14, and "Tuesday Night at the Coliseum" for June 20.

The Test Match at Lord's between West Indies and England will be televised on each of the three days, June 24, 26, and 27. Improved camera positions should give better pictures than last year, when the England-Australia match was televised. In addition to two cameras on the roof of the " Tavern," another camera alongside the commentators in the Pavilion will give close-up shots of the players.

F.C.C. TO REPORT ON TELEVISION

The U.S.A. Federal Communications Commission's television committee is expected to make its report on television within the next few days. One section believes television should be according to the standards of the RMA, while the other holds that new standards are needed.

"BEHIND THE SCHEMES"

The funny side of newspaper life will be presented in the afternoon of May 31. "Behind the Schemes" is a play about stunts and schemes to raise the circulations of rival newspapers, and the author—George H. Grimaldi—is himself a newspaper man with a Fleet Street experience of more than twenty years. The large cast also includes Laidman Browne, George Thirlwell, Hubert Woodward, and Cameron Hall, all of whom played in the first production of the play at the Richmond Theatre last year.

TELEVISING AN OPERATION

The television installation arranged by American Television Corp. at Israel Zion Hospital (Brooklyn, N. Y.) as reported last month, employed water filters to remove excess heat. Sight and sound monitor facilities in one corner of the operating room were supervised by a technician. The surgeon gave a running commentary and occasionally checked on a monitor C.R. receiving tube to see whether portions of the surgical technique were being properly picked up by the overhead pick-up tube.

MULTIPLE SCANNING SYSTEM

Radio-Amateur, of Germany, reports a new development which makes use of simultaneous transmission of a number of picture elements, giving a variation of time element in transmitting signals over the same carrier.

The pick-up tube uses five individual electron beams from as many cathodes, and each beam is caused to scan a certain area of the mosaic. The receiving tube operates in a similar manner.

TELEVISION AT RADIOLYMPIA

Television will again be an important feature of Radiolympia which this year will be open from August 23 to September 2. The R.M.A. exhibit will be a " Television Corridor" in which a number of receivers will be demonstrated. Receivers will also be in operation on individual stands though a proviso is made that these only be visible from the inside of the stands and thus avoid any obstruction of the gangways.

FOREIGN ARTISTS IN TELEVISION

The Variety Artists' Federation is concerned regarding the number of foreign artists who take part in B.B.C. television programmes. The Federation is negotiating with the music-hall and theatre managements for a quota agreement and efforts are being made to bring the B.B.C. into this. The B.B.C., however, claims that in the television programmes four British artists to every one foreigner are employed.

Record for Our Long-distance Receiver

" It might be of interest to you to know that we have been receiving television programmes here since April 28. The reception has been extraordinarily good, except for occasional car interference. We might mention as being particularly good the outside broadcast of " Me and My Girl," from the Victoria Palace, on May 1. This was held for practically the entire performance.

" Since then, we have been receiving programmes every day except for yesterday morning (May 5).

" The circuit being used is the ' Long-distance Low-Cost Televisor," 1937, by Spencer West, using 4 in. tube, with extra H.F. stage (Mullard E.F.8) added."

W. F. STEEL, Minehead.

CINEMA TELEVISION

The Postmaster-General received a deputation of representatives of cinema interests on May 18 to discuss the effect of the development of television on the cinema industry. The deputation included representatives of the Cinematograph Exhibitors' Association (Messrs. Hinge, Mears, Gale, Bell, Bromhead, Metcalfe, Bernstein and Fuller) and the Kinematograph Renters' Society (Messrs. Griffiths, Ditcham, Baker, Eckman, Hanbury, Dawes and Hill). At the conclusion of the discussion the deputation undertook to submit a written statement of their considered views on the subject.

The Postmaster-General promised to give full consideration to this statement, and to bring it to the notice of the Television Advisory Committee.

TELEVISION DIRECTOR RETURNING

Gerald Cock, chief of B.B.C. television is returning from America on the *Aquitania,* and it is reported that he is bringing with him a plan which will enable the B.B.C. and American Film Industries to co-operate in the matter of films for television.

40-METRE AMATEUR BANDS

With regard to the information published in our last issue under this heading, the B.B.C. inform us that certain corrections should be made to this statement. At the Cairo conference certain frequencies in this band were allocated for broadcasting and two frequencies have been chosen for use by Empire stations.

These will be GSU on 7.26 megacycles and GSW on 7.23 megacycles. In accordance with the Cairo regulations these stations will not be put into service before September 1 next and there is a restriction in their use that they should not be used for service to the Americas. They may be used for B.B.C. service to Europe, Australia and India.

The maximum carrier power permitted is 50 kilowatts so that the input power will be very much greater than 100 kilowatts.

THE MEISSNER TELEVISION KIT

AN AMERICAN PRODUCTION FOR HOME ASSEMBLY

WE have received from Messrs. Anglo-American Radio, Ltd., of Albion House, New Oxford Street, particulars of the Meissner Television Kit, Model 10-1153.

This is the first of its kind to be put on the market, and is, naturally, intended for use on the American television system. However, with one or two alterations it can be made to serve for the British system, and the design is such that it will form a useful set for the experimenter in television.

The following is the specification:

Video and sound channels combined in one compact and efficient receiver unit. 5-in cathode-ray tube to provide 3 in. by 4 in. pictures. Designed for standard 441 line scanning system. Controls include: volume (with on-off switch) focusing, background, contrast, channel selector, horizontal sweep frequency, vertical sweep frequency and centering.

A wide-band picture I.F. channel is provided using permeability-tuned iron-core coils, thus providing excellent stability and maximum gain. The video I.F. channel permits easy adjustment with test-oscillator and output-meter for any desired combination of band-width, degree of over-coupling and sensitivity.

The high-level synchronising chain includes pre-set coils requiring no adjustments by the operator. High voltage leads and components are completely protected by suitable enclosures, and two safety switches affording extraordinary protection against accidental shock to the operator.

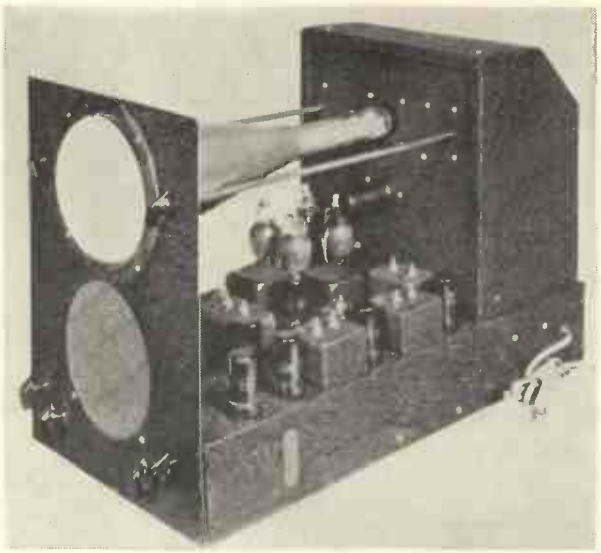


Fig. 1. This photograph shows the kit completely assembled.

The dimensions are 10¾ in. wide by 14¼ in. high, and 22 in. deep.

Conversion to British Standard

In converting the circuit for use on the British system, it must be remembered that the polarity of the transmission is reversed. Accordingly, to obtain a positive picture the connections of the diode detector must be reversed. It is usual practice in this country to directly connect the video amplifier to the diode output, and to do this the condenser coupling the diode to the 6F6 grid may be omitted, together with the leak. It will also be necessary to connect a D.C. restoring diode across the grid resistance of the tube.

The synchronising circuit will need careful re-adjustment as the amplitude of the British synchronising pulses is low compared with those of the American system. There are no radical alterations to the scanning circuit, but the speed of scan must be reduced from 441 lines and 60 ½-frames to 405 and 50 ¼-frames per second. (Note that in America, the "frame" corresponds to our "picture".) This can be done by varying the time constants of the multi-vibrator circuit slightly.

Fig. 1 shows the complete chassis assembly, and Fig. 2 the underside of the chassis. Further particulars can be obtained from the agents.

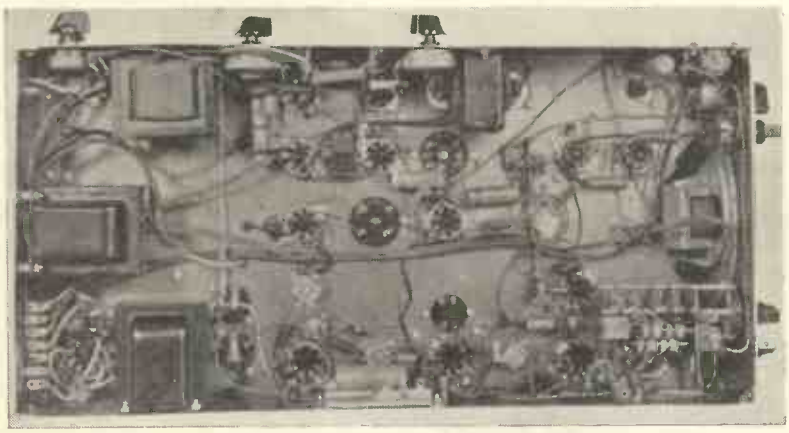


Fig. 2. An underside view of the chassis.

BOOK REVIEW

PRINCIPLES AND PRACTICE OF RADIO SERVICING, H. J. Hicks, M.C. (McGraw-Hill Publishing Co., Ltd., 18s.). Radio servicing is no longer limited to the repair of simple broadcast receivers by local radio stores. Modern sets of the multi-valve type and numerous tuned circuits require complicatd apparatus and also a definite system in order that the fault may be located in the minimum amount of time so that the servicing is a money-making proposition.

In America this work has been carried on consistently for many years and a service engineer has generally to pass a considerable number of examinations before he is a fully qualified man.

There are numerous books on the theory and practice of modern servicing, but few are so concise as the latest book by H. J. Hicks, M.S., the Radio Instructor of the Hadley Vocational School, St. Lewis. This book consists of 305 pages and includes not only the fundamentals of electricity and radio, but also complete chapters on valves, test equipment and set analysers, the theory of R.F. amplifiers and A.F. amplifiers and several chapters devoted to the correct methods of servicing radio receivers.

It is a book which every service engineer in this country will find of value.

POINTS FOR PROSPECTIVE VIEWERS

A BRIEF REVIEW OF TELEVISION FACTS

Although the average person is now reasonably well informed on radio matters, television with the majority of people still remains a mystery. To own and operate a television receiver does not require any technical knowledge whatever, but there are many questions which are continually being asked by those who have begun to take some interest in the subject and which probably the following notes will be useful in clearing up.

Obsolescence.—One of the greatest obsessions that the layman has is with regard to television receivers quickly becoming obsolete. Considering the rapid strides made in the early days of broadcasting this is perhaps natural. Television, as we know it to-day, has burst upon the public who almost a matter of months ago had only heard of it as a "will o' the wisp" of science which a few inventors hoped to achieve. Actually, however, there has been intensive development for the last ten years and millions of pounds have been spent on securing the results which are now possible.

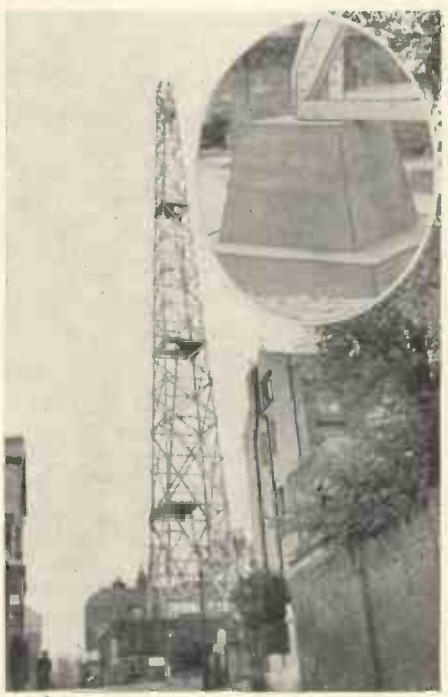
Another point is that for the most part it utilises well tried radio principles which have in the last fifteen years become practically standardised and even at this comparatively early date it appears that television principles have become more or less standard.

Improvements will be made, but there is not the slightest indication that they will be other than gradual as has been the case with all other scientific developments. There is, therefore, not any prospect of modern receivers becoming obsolete, or even old fashioned, before the end of their useful life.

Bound up with this question of obsolescence there is that of useful life. Will a receiver last 2, 3, or 5 years? No receivers have been in use for much over two years so it is a point on which it is impossible to be dogmatic. A very conservative estimate of the life of a radio receiver is three years, and this with probably an average of 5 hours use per day. There is no reason why a television receiver should not function for the same total number of hours, particularly as the materials and components used are, generally speaking, of superior quality. There is, therefore, no reason why it should not function satisfactorily for five or six years. There is, however, one proviso to make and this is the probable life of the cathode-ray tube which is generally placed at 1,000 hours before it shows signs of real deterioration. This item, of course, is easily renewable.

Receiver Cost.—Price is a factor which is preventing numbers of people buying receivers and there is a general hope, and indeed, expectation that prices will be considerably reduced when the demand is greater. This would appear to be a natural sequence but it is very improbable that it will obtain for a very considerable time and the reasons are as follows: In the first place receivers at present are not being produced at an economic figure, and it is unlikely that any saving that could be effected would be passed on to the public.

Secondly, it must be remembered that a television receiver is the equivalent of three high-class broadcast sets plus the cathode-ray tube. A little calculation therefore will show that the television receiver is good value for money. Also a large proportion of the components used must of necessity be of better quality than normally used for ordinary radio receivers, which are mass produced in the ordinary way of component manufacture and it is improbable, therefore, that any saving would be effected in this respect, as mass production will only affect certain parts of the receiver and general assembly; thus the saving is not likely to be very considerable. Altogether, therefore, any large price reduction would appear out of the question.



The ultra-short-wave radio link relay aerial at Swains Lane. Transmissions from the mobile unit are picked up on this for re-transmission from A.P. Inset is a mast leg base.

Picture Size.—A picture size of approximately 10 in. by 8 in. may appear to be somewhat small, but experience has shown that actually for home use this is quite adequate. Although larger screens are available, this size is the most popular choice as it provides sufficient detail and good picture value when viewed at the convenient distance that obtains in the average home. With screens that are considerably larger it is necessary to increase the viewing distance otherwise the line structure of the picture becomes evident with loss of apparent detail.

Viewing Conditions.—Pictures can be viewed in ordinary daylight but obviously they are better in subdued light or darkness, as is the case with the cinema. However, for daytime viewing the pictures are of such brightness that it is not necessary entirely to darken the room. The ordinary curtaining arrangements which are usually available are quite sufficient and, therefore, any elaborate preparation is not necessary.

Power Supply.—A supply of mains current is essential for the operation of a television receiver, and it should preferably be A.C. Direct current can be used, but this entails the use of a rotary convertor to convert the D.C. current into A.C. This method is entirely satisfactory, but the necessary equipment adds to the total cost. The use of batteries is quite impracticable and no receivers are made which will operate from batteries.

The Aerial.—A special aerial must be used for television unless reception is within about six miles from the transmitter, when any odd bit of wire will usually answer.

The aerial, termed a di-pole, is quite simple and can be used indoors or out of doors, but it must be used in

a vertical position, and, as its height is about 11 ft., as a rule it is not easily accommodated inside a house. The best position is on a chimney stack, but it should be as far removed from motor traffic as possible on account of interference. At distances of over 12 miles it is advisable to use a reflector in conjunction with the aerial proper. This consists of a single metal tube or rod placed behind the aerial at a distance of 5 ft. 4 in. As a rule the entire assembly forms one unit and is quite easy to erect. The distance from the aerial to the receiver is quite immaterial within reasonable limits and the feeder, which must be of a special type, can be led in any convenient manner as, for example, down walls or along fences, etc.

Maintenance Costs.—The average television receiver employs from eighteen to thirty valves and it will be evident, therefore, that running costs exceed those of an ordinary broadcast receiver. An all-round power consumption figure is approximately 200 watts which means that the receiver can be run about five hours on one unit of electricity. This is about the same consumption as a bowl-type electric heater. Excluding replacement costs in case of valve breakage, etc., this is the only maintenance charge. No additional licence to the ordinary broadcast licence is required.

Reception Range.—The distance at which reception is ordinarily possible may be regarded as about 35 miles, but to some extent it depends upon local conditions. This distance can be exceeded if special arrangements are made as, for instance, the use of a high and efficient aerial and a sensitive receiver and under these conditions consistent reception has been obtained at distances rather over 100 miles, though this is by no means the limit when conditions are good.

Provincial Television.—Although no official announcement has as yet been made it appears practically certain that work will shortly be commenced upon the erection of a transmitter in the Birmingham area which would relay the Alexandra Palace programmes. Experiments have been made with two methods of relay—the ultra short-wave radio link and the coaxial cable. It is probable that the former method will be used.

Safety.—Although high voltages are used in television receivers—from 4,000 to 6,000—adequate precautions are taken by the manufacturers to eliminate any possibility of shock. No source of high-tension supply is accessible and if the back of the receiver is removed all current supplies are automatically cut off. Any television receiver is, therefore, perfectly safe in use.

Operation.—A large number of controls are provided on a television receiver, but as a rule only four at the most are easily accessible; the remainder are the pre-set type only intended to be used when valve replacement becomes necessary.

Ordinarily, two or three controls are all that need be touched and as the effect of these is immediately noticeable on the picture, their use is very simple, in fact the control of a television receiver is more simple than a broadcast set.

Film Television.—Why is not more general use made of film in television? The chief reason is that at present the film industry is not prepared to allow films to be generally used for television and, therefore, recourse has had to be made to certain foreign and feature films. Secondly, many films are unsuitable because of the amount of detail which would be lost in the comparatively small picture of the television screen.

Colour Television.—The question of colour television is a matter which is often raised despite the fact that even at this date the majority of films are in monochrome. Colour television is theoretically possible but in practice there are difficulties of a technical nature which at present appear to be almost insuperable, the major one being the very high frequencies that it would be necessary to use. It is improbable, therefore, that there will be any development in this direction except of an experimental character for a very long time to come.

Add-on Receivers.—There is a type of television receiver which is termed an add-on unit. This name is somewhat misleading as it seems to imply that a unit of this description can be added to an existing broadcast receiver to provide vision. Actually, receivers of this type are vision receivers only and do not provide the accompanying sound unless used in conjunction with a broadcast set. Most broadcast sets will not tune to the television sound wavelength and therefore a simple convertor is provided which is included in the vision receiver cabinet and is considerably cheaper to construct than a complete sound receiver.

A saving of total cost is therefore effected, but usually this method is only adopted in the case of receivers with small screens in which even a small saving is desirable.

SEEING THE DERBY IN COMFORT

Amazing success of Baird Cinema installation

THIS year for the first time cinemas were permitted, by arrangement with the Epsom Grand Stand Association, to reproduce the B.B.C. Derby television transmission on large screens to a paying public.

Most cinemas, of course, at present are not in possession of the necessary apparatus but Baird Installations have been made at the New Victoria Cinema, The Marble Arch Pavilion, and the Tatler News Theatre in Shaftesbury Avenue.

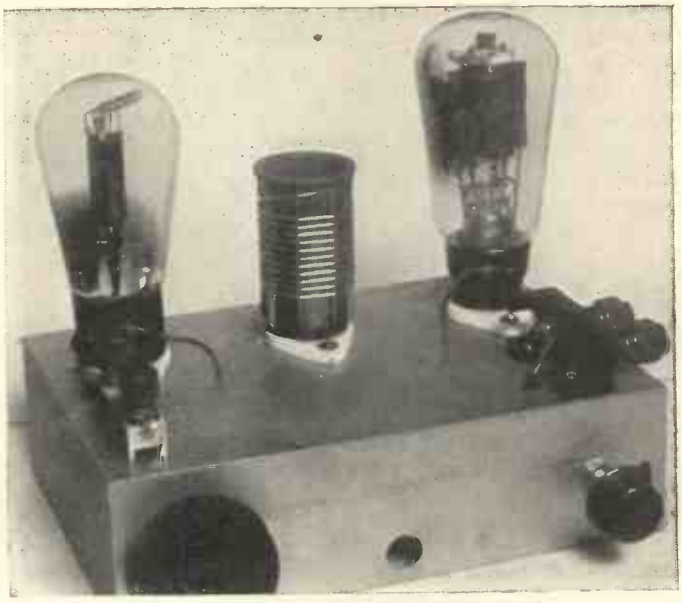
At the first mention of cinema the screen size is 12 ft. by 15 ft. and is not noticeably smaller than the usual cinema screen. The actual apparatus used was described in the April and May issues of TELEVISION. There can be no question now that cinema television has definitely arrived, for the results obtained were but little inferior to what would ordinarily be presented by film. The picture is a sepia colour and a little inferior in brightness, but considering the astonishing progress that has been made since last year it is not too much to expect that it will shortly practically be up to cinema standard and that cinemas will in their own interests be compelled to install equipment of this nature.

The audience at the Victoria Cinema was as enthusiastic at the conclusion of the transmission as it was at seeing the winner come in. Only once did the picture lose synchronism, and this for merely a couple of seconds. The remainder of the time it was perfectly steady. It was unfortunate that at the commencement of the race and during a period of the tracking shots the picture lost a certain amount of clarity and there was also a double image at one time, due apparently to some fault of the super emitron being used at that particular time.

THE SUPERSONIC LIGHT RELAY

BUILDING A MODULATED OSCILLATOR

With Some Practical Instructions for its Use

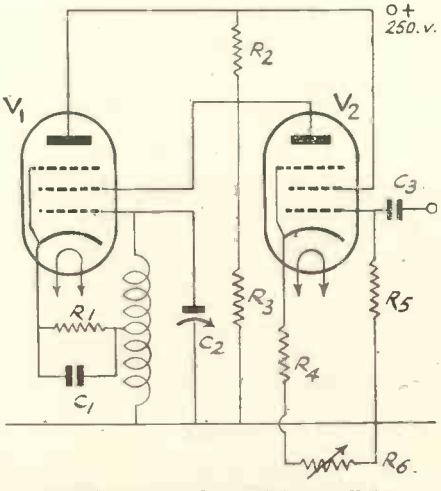


The modulated oscillator.

SOME months ago we gave an account of the elementary phenomena to be obtained with the supersonic relay, and suggested the use of a conventional type of oscillator to drive it. Now that mechanical scanning arrangements are available rendering possible the reception of the television transmissions with this relay, it is thought that a more detailed oscillator design, suitable for this purpose, may be welcome. It is intended either for use on picture reception with an existing vision receiver, or for any other experiments on supersonic light modulation that may be contemplated, replacing, for such purposes, the cruder arrangement suggested last September.

This oscillator will give a positive picture with the simple scanning arrangements so far suggested, when driven with a positive picture signal from an existing vision receiver suitable for C.R. tube reception; thus being the converse of the oscillator included in the mechanical television receiver described in the preceding issue. It has been designed to give, as simply as possible, a reasonably good frequency response to the picture signals and a reserve of power to drive the relay. Such a reserve is highly desirable in picture reception, because it permits operation of the crystal somewhat off tune, with consequent improvement of the over-all frequency response; it also allows the full range of light modulation to be obtained even if everything is not tuned up to the highest possible pitch of efficiency.

As can be seen from the accompanying circuit diagram, the arrangement comprises two pentodes, the modulator plate and oscillator screen being directly connected. This allows a high output from the oscillator with normal H.T. voltage (250 volts) while retaining the advantage, of plate modulation, that the "D.C." component of the modulation can readily be retained. To permit nearly 100 per cent. modulation, which is desirable, the mean voltage at the plate-screen connection is kept low; this could be done by the use of a high load resistor direct to H.T., but would then result in loss of the high modulation frequencies by effects of shunt capacity; so a bridge connection, giving a sufficiently low effective load resistance, has been adopted instead.



Circuit diagram of modulated oscillator.

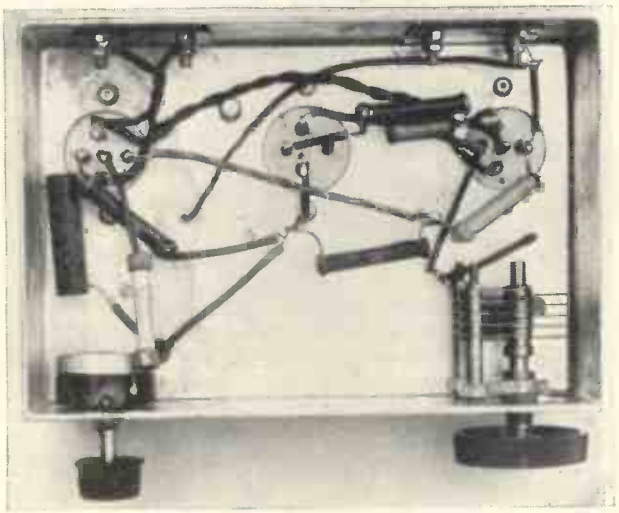
Cathode bias is adopted for the oscillator to avoid the errors introduced by the appreciable time constant of the more usual grid resistor and condenser at high modulation frequencies. It is easier to make these unimportant with cathode bias, even if the cathode resistor is bypassed, as here, by a condenser. It is also convenient to have the oscillatory circuit at earth (D.C.) potential, and to have one side earthed to H.F. also, which the present circuit permits. Actually the values chosen for the cathode resistor and condenser are such as to produce a small, but desirable, gain in the frequency response at the highest modulation frequencies.

The modulator valve cathode bias is obtained with a fixed and variable resistor in series, to permit of setting the mean level of oscillation as desired. A mean value of oscillation is obtained with a total cathode resistance of about 1,200 ohms, and if desired the variable resistor can be dispensed with, at least for preliminary experiments, and a single fixed resistance of this value fitted. No bypass condenser has been included with this resistor; if greater sensitivity to modulation is desired, it could be bypassed with a 50 uF., 50 volts working electrolytic, but then a useful effect, from the point of view of quality, namely the negative feedback produced by the un-bypassed resistor, would be lost. The modulation curve without this negative feedback, for a representative pair of valves, is shown in the figure, from which it will be seen that it is not un-

BUILDING THE MODULATED OSCILLATOR

duly distorted, but the author prefers to omit the bypass at the cost of a little sensitivity and straighten the curve a little.

Oscillator plate and modulator screen go straight to H.T. + if the valves specified are used; with some similar types the screen voltage must not be the full 250 volts, and a screen resistor of about 5,000 ohms to the modulator valve should then be included.

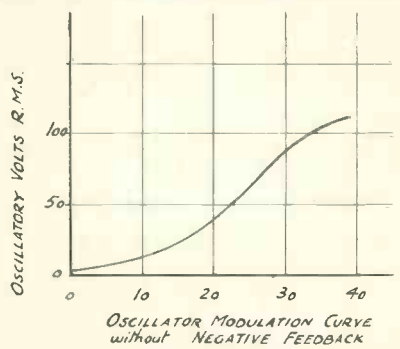


Under-chassis view of modulated oscillator.

The tuning inductance has ten turns in a space of $1\frac{1}{4}$ in. on the former specified, and is centre tapped. For a 10 mc. crystal, such as is now available for supersonic work, the correct frequency is given with the condenser specified about a third " in."

Five-pin valves have been used in this unit, instead of the possibly neater seven-pin form, for two reasons; first, because it was thought that many experimenters will have one or two, probably of the five-pin form, available, and secondly so that the unit can be used, in various ways, with triodes also. If a triode (e.g., an AC/P) be used instead of the pentode modulator, the results on sound frequencies will still be good, but the input impedance to the modulator at high (television modulation) frequencies will be very low. Alternatively, for simple experiments with the light relay, any type of output (mains) triode can be inserted in the oscillator holder and will give an unmodulated oscillation.

Some hints on the manner of use of the relay may not be out of place; they were given in the previous articles referred to, but are repeated for the benefit of those who missed those. While the supersonic relay is very easy to use when its mode of operation is understood, it is possible to waste much time without result, if unguided experiments are made without such understanding. It is further necessary, on account of the patent position, that the relay be constructed at home. Instructions are necessary, otherwise the experimenter may break the somewhat fragile crystal. It may be mentioned that only experimental use of these relays, for television, is permissible without infringing the patents.



Oscillator modulation curve without negative feed-back.

The essence of the construction is merely to fix a suitable crystal, with electrodes, over an opening in the side of a suitable transparent container. The type shown in the figure is suggested as suitable for use with the mechanical scanning arrangements that have been described in preceding issues; such containers are obtainable, as are crystals cut for supersonic work, from H. E. Sanders & Co. The crystal is of about 10 mc. frequency, but no great accuracy of cutting, as is needed for frequency control, is necessary on supersonic work.

If a crystal without electrodes is obtained, these must be stuck on. They should be of thin metal foil such as is used for wrapping the less expensive brands of cigarettes. Over one side should be stuck a piece as wide and three times as long as the crystal, to cover the whole surface, with the extra length projecting on one edge for connection. This side is to go in contact with the liquid.

Components for MODULATED OSCILLATOR.

RESISTORS.
R1 1,000 ohms 1 watt (Bulgin).
R2 15,000 ohms 3 watts (or two 30,000 ohm 1-watt in parallel, as in photograph) (Bulgin).
R3 30,000 ohms 1 watt (Bulgin).
R4 250 ohms 1 watt (Bulgin).
R5 250,000 ohms 1 watt (Bulgin).
R6 5,000 ohms W.W. volume control (Bulgin VC44).

CONDENSERS.
C1 .0003 uF. tubular (Bulgin).
C2 trolitule variable (Premier).
C3 0.1 uF. tubular (T.C.C.).

VALVE HOLDERS.
3—5-pin ceramic (Clix).

COIL FORMER (Raymart).
CHASSIS (Eddystone).

TERMINALS (Belling-Lee type B).
2—Pairs.
6—BA bolts and nuts.

SUNDRIES.
18—Gauge tuned copper wire
Systoflex sleeving.

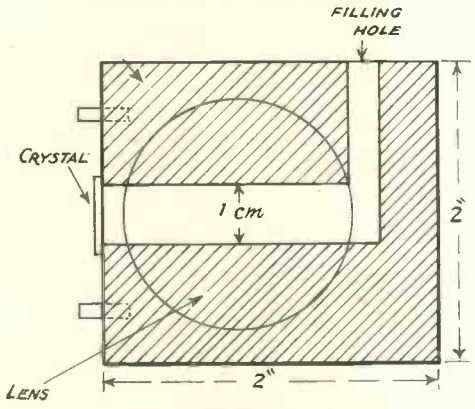
VALVES.
2—A.C.(Pen 5-pin Mazda, or Premier.

On the other side a narrower strip, as wide as the thickness of the liquid in the cell, is stuck down over an area as big as that of the liquid column only, so as to avoid wasting power on parts of the crystal that will touch only the walls of the container. This strip, also, projects, unstuck, to the side opposite from the first, for the other connection. These electrodes should be fixed with Seccotine, the excess cement being smoothed out carefully with a strip of stiff card or the like, from the middle to two edges, till the foil is in close contact with the quartz. These operations should be done on a sheet of plate glass, to avoid risk of breaking the crystal by flexure.

The crystal should be carefully fastened over the end of the cell, using a small amount of cement only, between it and the latter, to avoid forming squeezed out lumps that would obstruct the waves passing

USING THE LIGHT RELAY

into the liquid. After it is fixed, the edge can be gone round again outside to make it quite liquid tight, but the area of the back electrode, corresponding to the liquid column inside, should not be covered, as anything in contact with this area on the back is liable to affect the generation of waves. Suitable cements are Premofix, Seccotine and, for a final coat over the edges, one of the shellac preparations made for jointing pur-



Cell, with dimensions.

poses. These cements are specified because it is found that certain others are liable to loosen from the cell under the influence of the contained paraffin, and allow leaks. If a glue is used, care should be taken not to short-circuit the cell electrodes with it.

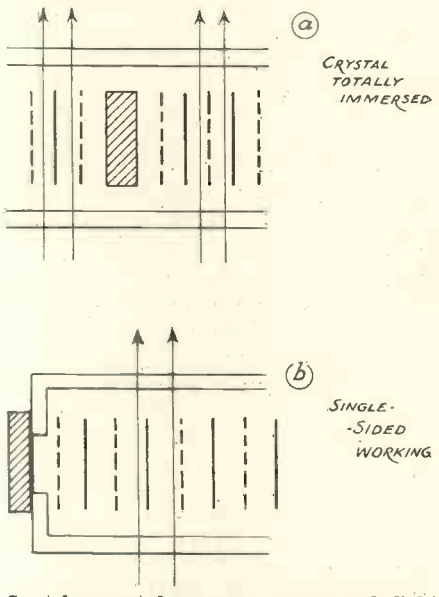
Common lamp paraffin is one of the very best liquids to use in the cell, and is therefore recommended, but others can, of course, be tried, so long as care is taken (with a cell of plastic material) not to use anything that will spoil the cell, or dissolve the cement.

The manner of operation of the light relay is, that an electrical oscillation of about the right frequency for the crystal (10 mc.) is applied to the electrodes, and causes vibrations of the crystal in the direction of its thickness, which are transmitted to the liquid in the cell. The crystal actually becomes alternately thicker and thinner, ten million times a second; it does not (essentially) move from side to side as a whole. The vibrations in the liquid travel, as waves, along it away from the crystal; at this frequency the wavelength is only about an eighth of a millimetre, so that some hundreds of these waves are present in the cell at once, like a series of parallel plates laid across the liquid column from one end of it to the other.

Now if we had such such a set of real plates, no light would pass through between them in any direction except parallel to their surfaces, and it would be obvious that if we attempted to pass it in any other direction we should get no results (as, for instance, in a multi-plate Kerr cell). In the supersonic relay, however, the " plates " thus formed consist of the liquid, and are transparent; therefore they are normally invisible, and light can pass freely through them. In fact they have no appreciable effect on it, at all, unless it happens to pass exactly parallel to their surfaces, and this is one of the reasons why it is fairly easy to play about with such a light cell and get absolutely no result at all. The light is passing freely through it, but it is skew to the invisible " plates " of the cell, and nothing happens that can be visibly observed.

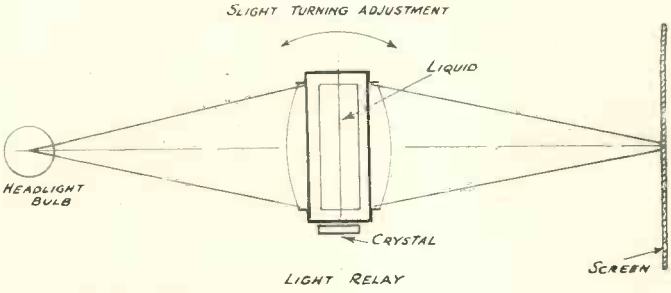
One necessary adjustment is, therefore, to turn the cell till the position is found where the light passes parallel to the wave fronts as above. The position is not very critical, but has to be right within a degree or so. At this setting, if the oscillation is also about right, a sudden spreading of the focused beam occurs, forming a diffraction pattern on the screen where it is focused.

This, however, indicates a second point. The effect desired is a slight spreading out of each elementary ray of the light passing through the liquid into a number of slightly divergent rays. This effect would be clearly visible, without more ado, if we used a single very narrow ray, but

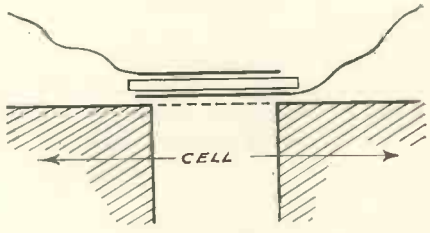


Crystal-generated pressure waves and light rays.

then the amount of light handled would be very small. To use the whole length of the liquid column a *parallel* beam of light is needed (to pass between the " plates " at every point) and this is best got from a concentrated filament such as that of a motor headlight bulb, with a lens at the right distance from it to focus its rays into a parallel beam going out to infinity; i.e., at its own focal length away. A bulb of the 36-watt, 6 or 12-volt type, with a single straight coil of filament, is suitable; the filament should be vertical, and a lens of 8 in. focus at 8 in. away will provide a sufficiently parallel beam. A smaller filament is permissible, for experiments, but if a wider one is used the lens must be of proportionately longer focus.



(Left.) Schematic diagram showing light relay in use.



Crystal electrode arrangement.

WHAT VIEWERS WANT

FIRST RESULTS OF TELEVISION QUESTIONNAIRE

A PRELIMINARY analysis has now been made of the results of the Television Questionnaire. Over 4,000 viewers sent in completed forms, but to make possible a prompt review a sample of 1,200 has been made the basis of a first report. It was found that 91 per cent. of the forms had come from those who owned television sets for entertainment only and not for business.

The results are encouraging, for they show that a large majority think that the programmes provided are satisfactory and improving. Moreover, the comparative popularity of different types of programme shows that the present proportions are well in line with viewers' preference.

Plays and variety programmes direct from theatres, news reels, "Picture Page," the weekly topical magazine, the light entertainment generally are all liked by at least 90 per cent. of viewers. Outside broadcasts of sporting and other events come next, followed by full-length plays, cartoon films, demonstrations and talks.

The popularity of studio drama is a remarkable feature of television today, and the preference is for full-length rather than for short plays. Asked whether an hour and a half was too long for a television play, over 80 per cent. replied "No"; but most of them liked the practice which has lately been introduced of including occasional intervals in such plays.

Programme Time

More than half the answers affirmed that the present length of the evening programme (1½ to 2 hours) was sufficient, although they would like it to begin earlier.

Asked about men or women announcers, 44 per cent. had no marked preference; the rest showed an overwhelming preference for women. At present two women and no men are employed as announcers at Alexandra Palace.

The new and difficult job of giving television commentaries without saying too much or too little seems to have been satisfactorily tackled, judging by viewers' votes, 85 per cent. of which agree that as a rule commentators strike the happy mean.

It appears that the average number of people who watch television fairly regularly on each set is four.

A further analysis will be made in due course.

The response from viewers has been remarkable. Many of those who completed and returned forms wrote enthusiastic letters showing a keen sympathy with producton problems as well as enthusasm as viewers. It is not thought likely that any further questionnaire will be issued to viewers yet, but the B.B.C. wishes to keep the viewers' register up to date by adding the names of those new viewers who are prepared to co-operate in similar ways in the future.

Television Committee for British Kinematograph Society

DURING the past eight years the British Kinematograph Society has played an important part in solving the technical problems of the industry. At the request of the British Film Institute a committee was appointed to consider the long-period storage of film, and its recommendations form the basis upon which the National Film Library is organised. Other Committees have considered problems associated with safety film, sub-standard film and equipment, and other matters.

In matters of standardisation the Society works in close contact with the British Standards Institution and thus represents the British industry in international negotiations. Matters now under consideration include the measurement of brightness of the kinema screen, the assessing of light output of substandard projectors, and the compilation of a technical glossary.

In order that these technical activities may receive more detailed attention, the Executive Committee has now entrusted the organisation and functioning of such technical committees to a newly-formed Central Technical Committee. This Committee represents the more important technical branches of the industry.

At the request of the Cinematograph Exhibitors' Association, a committee was appointed to consider the present position of kinema television, representatives of the leading manufacturers and of the Television Society were invited to serve.

The members of this committee are as follows:—

Mr. T. M. C. Lance, Baird Television, Ltd.

Mr. J. Siegar, Scophony, Ltd.

Mr. D. C. Espley, The General Electric Co., Ltd.

Mr. G. S. C. Lucas, British Thomson-Houston Co., Ltd.

Mr. G. Parr, Television Society.

The organisation is at the service of the film industry, and especially of the Patron members of the Society, for the investigation of any technical matters. Any organisation encountering a technical problem is invited to submit it for the consideration of the Central Committee. All enquiries should be addressed in the first place to the Organising Secretary, Dean House, 2 Dean Street, W.1.

Television Lectures

A special course of four lectures on Television is to be given at the Polytechnic, Regent Street, on Thursdays, from 7.30 p.m. to 9.0 p.m., commencing on June 8th next.

These lectures are to be delivered by Mr. H. J. Barton-Chapple who is a recognised authority on the subject of television and demonstrations of high definition television will be given, including the reception of the B.B.C. Television Service at each lecture. The fee for the course is 6s.

We have been informed by Westinghouse Brake and Signal Co., Ltd., of 82 York Way, King's Cross, London, N.1, that their Northern representative for metal rectifiers, Mr. W. E. Wilkins, B.Sc., A.M.I.E.E., has changed his address to: Agden Lane Farm, Agden, Lymm, Warrington. Telephone: Lymm 516.

Marconi Valve—KT44

A new Marconi valve for television scanning circuits has recently been generally released. Its general characteristics are similar to the KT66, but a 4-volt 2-amp. heater is used. A 7-pin base is fitted and the anode is taken to a top cap connection. A small number of these valves were issued in television receivers under the temporary type reference A855. The list price is 15s.

TELEVISION SOUND AT ALEXANDRA PALACE

THE MARCONI-E.M.I. AUDIO-FREQUENCY EQUIPMENT AT THE LONDON TELEVISION STATION

I. L. Turnbull, T.Sc.(Eng.), and H. A. M. Clark, B.Sc.(Eng.)

The following is an abstract of a paper read before The Institution of Electrical Engineers entitled "The Marconi-E.M.I. Audio-Frequency Equipment at the London Television Station." We acknowledge the kind permission of The Institution of Electrical Engineers to publish this paper.

IN view of the fact that no previous experience was available in connection with the operation of high-definition television equipment and also that a high order of performance was necessarily demanded of many of the components in the vision apparatus, it was obviously desirable that the sound equipment should be as reliable as possible so that, in case of a vision breakdown, contact might always be retained with those receiving the programme. This requirement had considerable bearing on the design of the equipment.

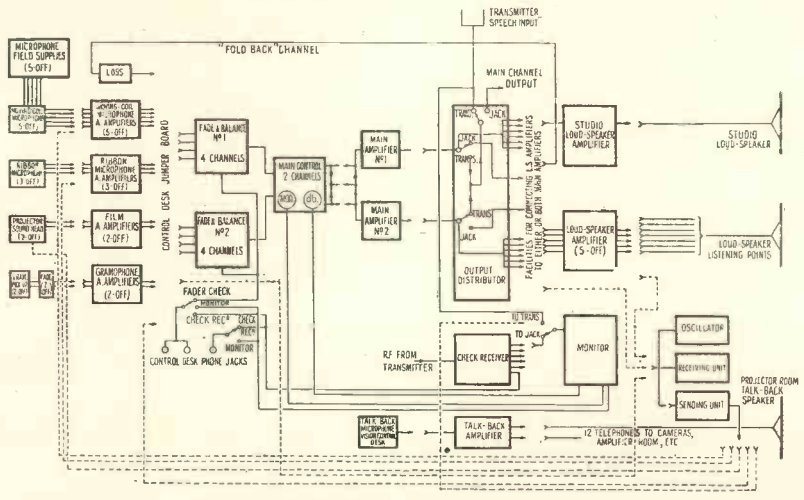


Fig. 1. Block diagram of complete system.

The outputs of all the " A " amplifiers are brought up to jack panels on the sound control desk, which incorporates arrangements for fading and mixing eight channels. These eight sets of fade-and-balance controls are divided into two banks of four, the combined output of each bank being controlled in turn by a main fader potentiometer.

The output from each of these main controls is then fed, via a special combining circuit, into two main amplifiers which raise the signal to a level sufficiently high for it to be fed directly to the sub-sub-modulator in the transmitter. By means of the combining circuit it is possible to feed the output from either main control into either of the main amplifiers, or alternatively to feed the combined main control outputs into either or both main amplifiers.

The output from each main amplifier is fed into the output distributor, where again it is possible to select either or both outputs to be fed to the transmitter. In addition, the output distributor divides the output from each of the main amplifiers into two channels, one to feed the transmitter and the other to feed the loud-speaker amplifier controls. The division is accomplished in such a manner that any load may be thrown on one channel without affecting the power transferred to the other in any way. Six loud-speaker amplifiers are provided which may be jumpered to the output distributor in such a manner that they may be fed from either or both main amplifiers at will.

Suitable metering arrangements are provided at the control position so that the programme level may be monitored by the operator. As an indication that the quality of the signals being radiated is satisfactory, a check receiver, fed from the sound aerial feeder, is supplied. The output from the check receiver is divided between two circuits, one of which provides an alternative supply to the control operator's headphones in place of that from the monitor panel, and the other of which is arranged to give the correct level to feed into the loud-speaker amplifiers.

It will be noticed that by throwing a 3-position key on the control desk, the operator may listen to outputs from (*a*) the monitor panel, (*b*) the check receiver, or (*c*) the fader check or " pre-hear " stud. The latter position enables the operator to listen to the output of any channel before he fades it into a programme channel.

In order that the producer may give instructions to the camera operators, suitable microphones and a talk-back amplifier are supplied.

Electrical testing equipment, consisting of an oscillator and gain set, is also provided, so that routine maintenance checks of amplifier gains and levels can readily be made. Testing circuits are shown dotted in Fig. 1.

General Arrangement

Fig. 1 gives a block schematic of the audio-frequency apparatus and shows the general arrangement of the equipment.

It will be seen that five moving-coil and three ribbon microphones, together with a similar number of associated " A " amplifiers, are provided. Two sound heads mounted on film projectors and two pick-ups associated with a gramophone desk, together with their " A " amplifiers, are also included.

Operation

The equipment may be used in any one of five ways, depending on the type of programme which it is desired to transmit.

OPERATION OF EQUIPMENT

When a simple transmission is required, any of the twelve "A" amplifier outputs may be connected to the four input channels of one of the fade-and-balance panels, while the output of the appropriate main control potentiometer is connected to the main amplifier which feeds the transmitter. The second fade-and-balance panel and main amplifier are then available as a stand-by channel, and may be connected at a moment's notice.

Secondly it may be required to transmit two completely separate transmissions consecutively, e.g., when using two sets in the studio, and where a quick change from one to the other is required. In this case the microphones, etc., appropriate to one set are connected to fade-and-balance panel No. 1, while those appropriate to the other set are joined to fade-and-balance panel No. 2. The outputs of the fade-and-balance panels may then be combined and fed through one main amplifier, leaving the other as a stand-by.

Thirdly, two completely independent systems can be arranged. For example, a transmission could be in progress from the studio through fade-and-balance panel No. 1 together with its associated main control with one main amplifier feeding the transmitter, monitor, and several loud-speakers. A rehearsal of gramophone or film sound may then be taken through the other fade-and-balance panel, main control, and main amplifier (which in this case has its output on the output distributor switched, not to the transmitter, but to the jack circuit). One or more selected loud-speaker amplifiers may be plugged to this particular main amplifier. In this case the two programmes will be completely separate from each other, with no chance of interference.

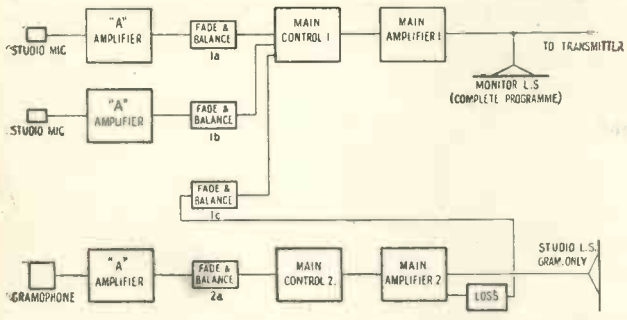


Fig. 2. Block diagram of apparatus arranged for "fold-back" transmission.

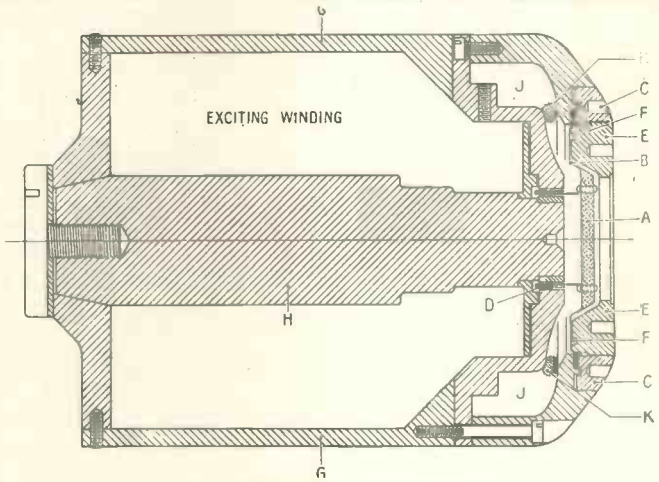


Fig. 3. Sectional drawing of moving-coil microphone.

Fourthly, the system may be operated in rather a specialised manner to cater for a condition that is peculiar to television. It is sometimes convenient to employ gramophone music as an accompaniment to a studio performance. In this case it is necessary to pass the accompaniment to the transmitter and also to the performer in order that he may hear his accompaniment. This is done by loud-speaker, since telephones would be visible in the picture. If a loud-speaker fed from the main channel were utilised for this purpose, trouble would probably arise due to acoustic feedback in the studio. This can be avoided by what has been called a "fold-back" circuit.

In operation, the equipment is arranged as in the last method, giving two independent systems, the first system carrying the sound from the studio and the second taking the gramophone music. A loud-speaker, operating from a loud-speaker amplifier connected to the second main amplifier, supplies the accompaniment to the performer in the studio, while another output from the same main amplifier is "folded back" through an attenuator, shown as "Loss" in Fig. 2, and fed through one of the controls on fade-and-balance panel No. 1 into the main studio programme.

Fig. 4. Moving-coil microphone used at Alexandra Palace.

Lastly, when handling a big production it is sometimes desirable to be able to control with one main fader more than four microphones or other sources at once. This is accomplished by employing a similar arrangement to that described above as a "fold-back" circuit. In place of the gramophone, however, four of the microphones are connected to fade-and-balance panel No. 2, and after amplification in main amplifier No. 2 the combined output is folded-back to one of the inputs on fade-and-balance panel No. 1. The other three inputs of this fade-and-balance panel may be connected to three further microphones and the combined output taken through main control No.

THE MICROPHONES

1 and main amplifier No. 1 to the transmitter. By this means it is possible to handle the outputs of seven microphones or other sources on main control No. 1.

Microphones

In view of the variety of acoustic conditions likely to be encountered in the transmission of television programmes either in studios or the open air, it was felt that both pressure and velocity microphones would be necessary.

About nine years ago a high-quality moving-coil pressure-operated microphone was developed for use in sound recording. This microphone has proved so successful in practice, both as regards electrical performance and reliability, that the same type of microphone has been employed for television studio work.

The microphone consists essentially of a rigid piston diaphragm to which is attached a light coil moving in a magnetic field. The mechanical resonance of the moving system is controlled by electromagnetic damping, which is obtained by applying across the terminals of the moving coil a shunt electrical circuit whose impedance is low at the frequency of mechanical resonance, but high at frequencies above and below it. A suitable circuit consists of an inductance, capacitance, and resistance in series, the inductance and capacitance resonating at the mechanical resonance frequency of the microphone. Movement of the coil in the magnetic field at this frequency will then produce a comparatively heavy current which will tend to oppose the motion of the coil.

An outline drawing showing the construction of the microphone is given in Fig. 3, and a photograph is given by Fig. 4.

In order that the diaphragm (A) may act as a rigid piston over the acoustic frequency range, it is made in composite form comprising a layer of Balsa wood about 2.5 mm. thick enclosed on each side by thin aluminium sheets, the whole being riveted and waxed together to form a rigid structure. An extension of one of the aluminium sheets, forming a surround (B) to the diaphragm proper, is used as a support and is clamped by a screwed brass ring (C) to the body of the microphone. The coil (D), which is of enamelled aluminium wire, is wound on a thin aluminium former which is in turn riveted to the Balsa-wood diaphragm; the whole assembly is therefore exceedingly rigid and light, the mass of the combined coil and diaphragm not exceeding 0.75 g.

Fig. 4a. Pole piece and ribbon assembly of ribbon-type microphone.

To enable the diaphragm surround to be relieved of any irregularities or tendency to "kettle bottom," a stretching ring (E) is fitted to the inside of the clamping ring (C) mentioned above. By rotating the stretching ring the surround is stretched perfectly flat so that the diaphragm will move in proportion to varying sound pressure; at the same time rotation of the stretching ring forms a convenient method of adjusting the frequency of the overall mechanical resonance of the system.

To damp out any parasitic surround resonance which might be excited, the inner face of the stretching ring is brought very close to the surround surface in order to provide air-viscosity damping on the latter. Still greater damping is obtained by the presence of a small cavity or groove (F) cut into the surface of the stretching ring immediately inside the stretching ridge; movement of the surround then forces air through the narrow channel between stretching ring and surround into the groove beyond.

The magnetic system of the microphone consists of a small pot magnet (G), forming the main body of the instrument. The centre pole of the magnet (H) is constructed of cobalt iron. More recent microphones are fitted with permanent magnets; here again, the magnet forms the main body of the instrument, the centre pole-piece remaining of cobalt iron.

In view of the extreme lightness of the diaphragm assembly and the desirability of keeping the main resonance frequency of the system at a convenient equalising frequency, say, 500 cycles per sec., or lower, it is essential to avoid the presence of a high air stiffness acting behind the diaphragm. It is therefore necessary to provide a cavity (J) behind the diaphragm to reduce the air stiffness to a minimum, meanwhile preventing any Helmholz-resonator effect in the cavity by the insertion of a ring of loose cotton wool (K) at the mouth.

The length of the microphone, excluding terminals, is 4 in. and the diameter is $2\frac{3}{4}$ in.

The electrical output from the moving coil is fed into the low-impedance winding of a three-winding step-up transformer, the second of whose windings provides a suitable impedance (approximately 1,000 ohms) for the equalising circuit and the third winding of which provides a still higher impedance for connection to the grid of a valve.

Ribbon microphones are provided to enable certain types of work to be done requiring a directional microphone characteristic. The design of the microphone follows conventional lines except in that the ribbon is shorter than those commonly employed. Fig. 4 shows the pole-piece and ribbon assembly.

A thin uncorrugated aluminium ribbon, approximately 0.00005 in. thick and 1 in. long, is suspended between the poles of a permanent magnet of conventional design. Adjustment is provided to alter the longitudinal tension on the ribbon, and so control its natural resonance fre-

GRAMO AND FILM SOUND

quency. At the bottom of the magnet is fixed a small shielded transformer which raises the impedance of the ribbon from approximately 0.25 ohm to 200 ohms, a suitable value for connecting to a line and a microphone amplifier.

Recorded Sound Gramophone

The gramophone desk, which is of conventional design, is equipped with stroboscopically marked twin turntables. Magnetic induction between the electric driving motors and the pick-up windings is reduced by the provision of mumetal screens fitted immediately below the turntable. Cueing indicators, to enable selected portions of a record to be interpolated into the programme at the correct moment, are also provided. The indicators are sufficiently sensitive to enable a selected spot on a rotating record to be located within one groove pitch.

Film Sound

Two film projection machines are provided as part of the station equipment. The machines are standard theatre projectors and were equipped with sound heads; as operated normally, however, the latter, although capable of good commercial quality, were not quite of the class required for high-quality broadcasting, and several modifications have been made.

As finally installed, each sound head is equipped with a photocell whose output is fed to a transformer which in turn is connected to the film "A" amplifier. The transformer, which is elastically mounted to avoid pick-up due to machine vibration, is purposely wound with a high leakage inductance, which is resonated with a preset condenser contained in the sound head. By this means it is possible to obtain a frequency characteristic which has not fallen appreciably by 8,000 cycles per sec., although by operating a key which cuts out the preset condenser the higher frequencies are considerably depreciated.

There are 21 amplifiers in the equipment. The general design of all of them being largely conventional, only a brief description of the amplifiers themselves will be given here.

The types of amplifier used in the system fall into three general groups. The microphone or "A" amplifiers, of which 12 (including film and gramophone channels) are shown in Fig. 1, are required to raise the level up to 1 milliwatt, which is the input level of the mixing circuits. A typical "A" amplifier circuit (actually that of a ribbon microphone amplifier, is shown in Fig. 5.

Since the sound level at the microphone may vary considerably for different types of programme, it was considered advisable to include in the amplifier a coarse gain adjustment in the form of two grid potentiometers. For normal studio use the amplifier is used with 20 db. less than its maximum gain, which is about 80 db. The bulk of the gain is provided by the first two stages. The third valve is capable of supplying the normal output of zero level (1 milliwatt) with a considerable overload capacity.

The second group of amplifiers consists of the two main amplifiers (Fig. 6) which are required to bring the output of the control-desk circuits up to a distribution level of + 22 db. Since the output level of the mixing circuits is commonly quite low, the first stage is similar to that of an "A" amplifier. In order to supply the greater output level, however, the final stage is of the push-pull type.

The third amplifier group contains the loud-speaker amplifiers.

Frequency Characteristic

The general principle of maintaining a very level frequency response for each individual amplifier has been necessarily adopted in order to allow for the interchange of amplifiers which is demanded.

Similarly the compensation of a

(*Continued on page 349.*)

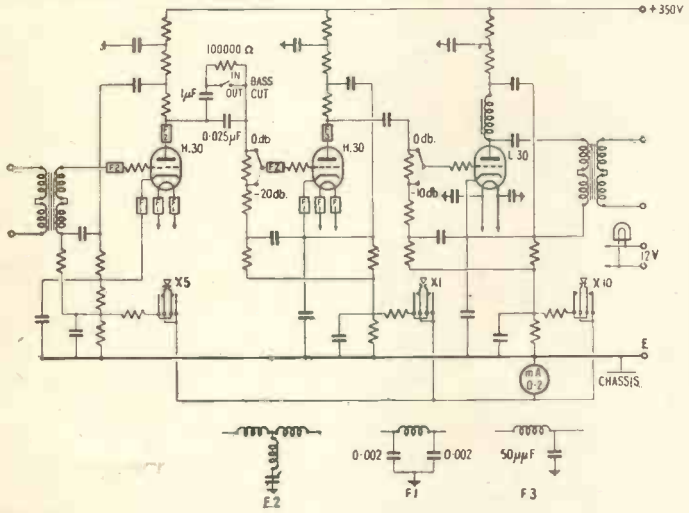


Fig. 5. Circuit of ribbon microphone "A" amplifier.

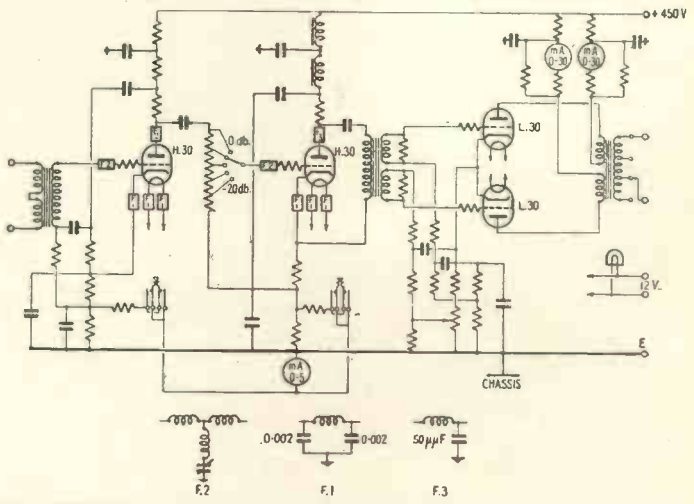


Fig. 6. Circuit of main amplifier.

Telegossip

A Causerie of Fact, Comment and Criticism

By L. Marsland Gander

TELEVISION prospects to-day are rosier than ever before. Since last month, when I wrote about the hesitancy of the Advisory Committee and the leisurely course of Post Office experiments with the radio links to Birmingham, the situation has been transformed.

Despite the shrouds of official secrecy there can be little doubt that the Television Advisory Committee, under the chairmanship of Lord Cadman, has unanimously decided that television must be extended to the provinces with the least possible delay. A report on these lines is to be handed to the Government.

The Government may, of course, refuse the money. The committee is asking for an amount variously estimated between £100,000 and £350,000—this to come from licence revenue still diverted to the Exchequer. According to one theory the Government will decline further grants for such a frivolous purpose as television until the international situation is more settled.

Wiseacres say that the next crisis is due in September and that the Government will not budge before then. I do not believe this. On all previous occasions the Government has unhesitatingly accepted the advice of its advisory committee. The country's scientific and industrial progress cannot be held up by vague half-formed fears of the future.

Seldom has a campaign yielded such rapid results as that organised by the Radio Manufacturers' Association to press for a Birmingham station. But the most joyful surprise for the industry is yet to come, for I believe that the committee will recommend not one, but at least two, provincial stations.

The First Station

In these notes I have repeatedly urged that the first station should be built between Leeds and Manchester, and not, as generally suggested, at Birmingham. Certain members of the committee have been impressed by this argument. But if there is to be a radio or cable link with London, it must pass through the Midlands; therefore why not have a Birmingham station as well?

It is certain that if a Birmingham station alone were built the populous industrial districts of the North would immediately begin to agitate for another transmitter to serve them. The original plan of the committee was, of course, to have ten transmitters serving their chief areas of population. To build ten would, however, involve £1,000,000 of capital outlay and is out of the question at the moment..

I believe also that the coinmittee will now decide that the moment is opportune for instituting a separate licence fee for television. They would be tempted to make it £1 per set, but ten shillings is a more likely figure.

Studios at A.P.

So far, so good. But what of the plans for better studio accommodation at Alexandra Palace? The old theatre is in precisely the same desolate condition as it was a year ago. I begin to think that the B.B.C. has given up all idea of developing further in London until the provincial scheme is under way.

I hear that when the King and Queen return to London on June 18 the B.B.C. will again televise pictures from whatever terminus they arrive it. Incidentally, those from Waterloo on the departure of their Majesties were the best the B.B.C. have ever transmitted from an outside event. Never have the general public had such an opportunity of seeing intimate, living portraits of the Royal Family.

Another Big Screen ?

I am writing in advance of the Derby transmission but I learn that E.M.I. are to disclose big screen television apparatus which yields most impressive results.

The boys of the outside broadcasting department will be exceptionally busy this summer, apart from the unusually large number of open-air broadcasts of all kinds.

I met Mr. Gilbert Seldes, the Columbia television chief, the other day shortly before he returned to America with Mr. D. H. Munro, of the B.B.C. In Britain we have become so accustomed to looking to America for a lead in radio that even now it is hard to realise that in television the position is reversed to Cousin Sam. Mr. Seldes frankly admitted that practically everything he saw was new and educational to him. Columbia is starting off with only one studio and half as many camera channels as the B.B.C. True the Columbia studio is very much larger than either of the boxes at Alexandra Palace, but there the advantage ends. Lack of technical facilities will make it impossible for Columbia to do any but the simplest programmes at first.

Mr. Munro took with him to America film records of B.B.C. television productions transmitted in the earlier days, when changes from one camera to another were still a haphazard affair, when long erratic tracking shots were the vogue, and when to use five different cameras for a single show was unheard of complication.

I was interested, for two reasons, in the re-appointment of Miss Olga Edwardes, the 22-years-old actress, as deputy to Miss Jasmine Bligh for the period July 31 to September. In the first place it shows that the B.B.C. prefers brunettes; in the second, it means that men announcers are definitely superseded for television purposes. The three girls, Miss Bligh, Miss Elizabeth Cowell and Miss Edwardes, will all be on duty during the Radiolympia period. Personally, I should not be surprised to see Miss Edwardes a permanent addition to the staff.

The Theatrical Garden Party

The Theatrical Garden Party at Ranelagh this year is to be televised for the first time. Television cameras will roam the gardens and side-shows on the afternoon of June 6 to give viewers the impression that they are actually attending this colourful function, which is held each year in aid of theatrical charities. The transmission will begin with the opening ceremony by Noel Coward, President of the Actors' Orphanage, and Leslie Mitchell will take viewers on a visit to the Tyrolese Beer Garden for an excerpt from the Ivor Novello show, " The Dancing Years." As Frederick Grisewood accompanies the television cameras round the side-shows fortunes will be told, and famous stage and screen stars may be persuaded to talk to the viewing audience. At the balloon stall a balloon will be bought on behalf of viewers, inflated with gas, and sent on a journey which brings a prize to the owner whose balloon descends at the greatest distance from Ranelagh.

RECENT TELEVISION DEVELOPMENTS

A RECORD OF PATENTS AND PROGRESS

Specially Compiled for this Journal

Standard Telephones and Cables Ltd., :: Electrical Research Products Inc. :: J. Kessler :: The General Electric Co., Ltd., and F. Poperwell :: F. W. Cackett (Telefunken Ges fur drahtlose Telegraphic m.b.h.) :: Marconi's Wireless Co., Ltd., D. J. Fewings, and R. J. Kemp.

"Multiple-stream" Tubes

(Patent No. 500,005.)

A SINGLE cathode-ray tube is arranged to produce a number of separate electron beams, each of which travels through the tube independently of the others.

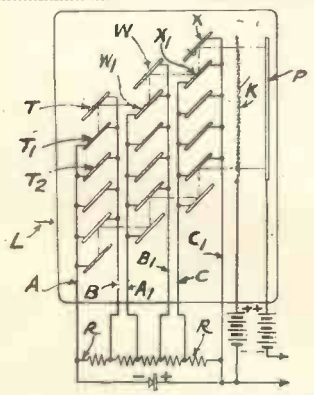
For instance three cathodes, each with its own control grid, are mounted to form three "guns" on a common support at the base of the tube. The three electron beams pass through separate tubes, which act as anodes, towards a common accelerating electrode, where each beam passes through a different aperture. Three deflecting systems are used to traverse the beams over a fluorescent screen in the case of a receiver, or over a photo-sensitive screen in the case of a transmitter. The beams are prevented from interacting on each other at any point along the tube.

The tube is intended for television systems of the kind in which "multiple" scanning is used either to increase definition or to produce coloured effects. — *Standard Telephones and Cables, Ltd.*

High-powered Multipliers

(Patent No. 500,170.)

The figure shows the construction of an electron-multiplier designed to



High-power Multiplier. Patent No. 500,170.

give a large output current. The electrodes, which are coated on both sides with a caesium-silver compound, are arranged in three vertical rows T, T1, etc., W, W1, etc., and X, X1, etc., respectively. The opposite faces of the electrodes in each row are connected to common bus-bars A, B and A1, B1, and C, C1, as shown, these being tapped across a common potentiometer R, so that they carry progressively-increasing voltages.

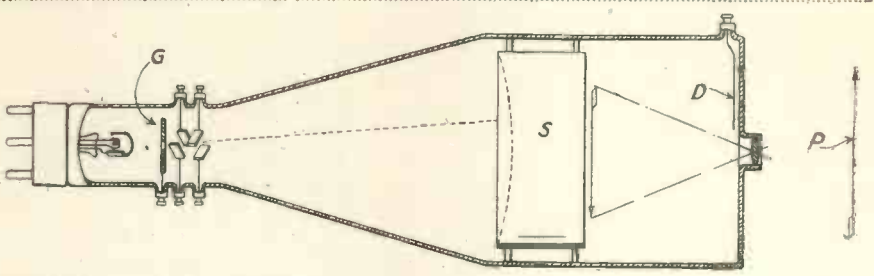
Light falling from the direction L, say on the electrode marked T1, liberates an electron stream which is first attracted upwards towards the lower face of the electrode T, where it produces a fresh supply of secondary electrons. The amplified stream then passes sideways on to the electrode W1, then upwards to the electrode W, then sideways to X1, and upwards to X. From here it passes through a screen electrode K carrying a still higher voltage, and is finally collected by the output plate P.

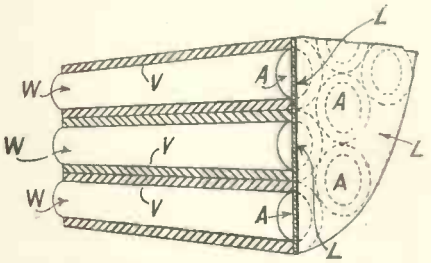
The same process is repeated by each of the electrodes in the row nearest the incident ray of light, and the separate streams flow in parallel across the three rows, from the first to the final or output electrode P, where they are combined.—*Electrical Research Products Inc.*

Generating Picture-signals

(Patent No. 500,430.)

The figure shows a cathode-ray transmitter tube which is fitted with a special form of mosaic screen S. The screen is built up of a number of short pieces of wire W, W (shown greatly enlarged in Fig. A) set close together. The wires are covered with insulating material V along their length, but the ends are left bare and are ground down to form a plane surface. This is covered with a layer L of photo-sensitive material, only a few molecules thick. In this





Transmitting tube with mozaic of metal elements. Patent No. 500,430.

condition its resistance is so high that the surface acts as a "mosaic" of separately-insulated cells so that local charges produced by the action of light remain in position and do not spread.

Light from the picure P is focused upon the coated side of the screen, and liberates electrons to set up an electric "image" of the picture on that side of the screen. The other side of the screen is scanned by an electron stream from the gun G of the tube. As the stream strikes against the uncoated wires, it releases the built-up charges and sends corresponding impulses to a positively-biased electrode D, which collects them and feeds them as signalling currents to an amplifier.—*J. Kessler.*

"Close-up" Effects

(Patent No. 500,809.)

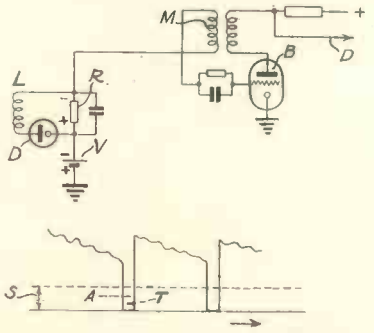
It is possible to make small alterations in the size of the received picture, so that it properly fills the screen, by adjusting the time-base circuit. This, of course, controls the angular velocity of the scanning beam.

According to the invention, a similar method of adjustment is used to make the size of the complete picture very much larger than the whole size of the screen. Any selected part of the picture can then be made to occupy the full area of the screen, and in this way to give the effect of a "close-up." During such time only the part of the scanning stroke that falls on to the screen need be kept rectilinear, though, of course, both the line-scan and the frame-scan must be altered in the same ratio.—*The General Electric Co., Ltd., and F. Poperwell.*

Time-base Circuits

(Patent No. 500,876.)

The figure shows a simplified arrangement for separating the line synchronising impulses from the picture signals in a television receiver. The combined signals are applied at L to a rectifier D which is shunted by a resistance R in series with a biasing volage V.



Method of sync. separation. Patent No. 500,876.

The voltage variations developed across the resistance are applied, in series with the bias, to the grid of the "blocking oscillator" valve B. The combined voltage is not, however, sufficient to start the oscillator B into action until the amplitude of the radiated carrier-wave drops below the level S within which the synchronising impulses are transmitted.

But as soon as this point is reached, the oscillator B is triggered into operation to produce a discharge current of constant amplitude, irrespective of the actual strength or duration of the triggering impulse. The blocking oscillator is automatically cut off directly the impulse T ceases, owing to the reversal of current in the coupling coil M. The impulses taken off at O are applied to synchronise the saw-toothed scanning oscillator.—*F. W. Cackett (Telefunken Ges fur drahtlose Telegraphie m.b.h.)*

Preventing "Fading"

(Patent No. 501,349.)

The application of A.V.C. to a television set presents a certain difficulty which does not exist in the ordinary broadcast receiver. This is due to the so-called D.C. component, which is superposed on the carrier-wave in order to follow gradual changes in the background illumination of the scene being televised. In the ordinary way, A.V.C. voltage is controlled by variations in the amplitude of the received carrier-wave, so that the result of applying this method to a television receiver would be to "level out" the D.C. component referred to, and so lose the advantage it is designed to give.

According to the invention, an A.V.C. voltage which will compensate for natural "fading," but which does not remove the desired D.C. component, is derived from the synchronising signals. These are fed to a storage circuit of resistance and capacity, which is fully charged by a synchronising impulse of normal amplitude. However, if fading occurs, the circuit is not fully charged, and the synchronising impulse is distorted to a flat-topped shape, the degree of distortion being utilised by rectification to produce the required A.V.C. bias.—*Marconi's Wireless Telegraph Co., Ltd.; D. J. Fewings; and R. J. Kemp.*

Other Television Patents

(Patent No. 493,043.)

Cathode-ray television transmitter in which the picture currents are amplified by secondary-emission.—*Radio Akt. D. S. Loewe.*

(Patent No. 493,217.)

Electron multiplier with an electrode system which operates as a push-pull amplifier.—*Standard Telephones and Cables, Ltd.*

(Patent No. 493,620.)

Arrangement of magnetic deflecting-coils for a cathode-ray television receiver.—*Ferranti, Ltd., and I. Vaughan-Jones.*

(Patent No. 499,860)

Photo-electric tube with a double-sided mosaic structure and an associater grid for generating television signals.—*Radio Akt. D. S. Loewe.*

(Patent No. 499,878.)

Time-base circuit for generating saw-toothed oscillations used for scanning.—*Mullard Radio Valve Co., Ltd.; C. C. Eaglesfield,* and *J. Archer.*

(Patent No. 499,891.)

Process for preparing photo-electric surfaces of high sensitivity.—*Farnsworth Television Inc.*

(Patent No. 500,017.)

Construction and arrangement of electrodes forming the "gun" of a cathode-ray tube.—*C. Lorenz Akt.*

(Patent No. 500,036.)

Amplifying and demodulating circuit for use with a light-cell of the kind in which high-frequency pressure waves are set up by a piezo-electric crystal.—*Scophony, Ltd.; J. Sieger,* and *S. H. M. Dodington.*

(Patent No. 500,358.)

Cutting out interference in a circuit for separating picture signals from synchronising impulses in a television receiver.—*Marconi's Wireless Telegraph Co., Ltd.,* and *D. L. Plaistowe.*

(Patent No. 500,502.)

Scanning system with means for adjusting the relative length and width of the picture.—*Hazeltine Corporation.*

(Patent No. 500,842.)

Preventing undesirable effects during the fly-back stroke, and preserving the right level of background illumination.—*Hazeltine Corporation.*

(Patent No. 500,978.)

Means for controlling the scanning stream in a cathode-ray tube so as to allow a "close-up" of the televised picture to be shown.—*Fernseh Akt.*

Rotary Convertors

We have received from The General Dynamic Construction Co., Ltd., of St. Mary Cray, Kent, a catalogue of rotary convertors and generator sets. A large number of models with various inputs and outputs are listed to cover every requirement for radio, public address and television. The last will be of interest to readers who wish to receive television and are on D.C. mains. Six models are available with outputs from 180 to 600 watts. Lists can be had on application and mention of this journal.

SOME OF THE FIRST AMERICAN RECEIVERS

FIVE television receiver models, ranging from a picture receiver with sound convertor to consoles combining television and all-wave radio, have been announced for spring production by the General Electric Co. (U.S.A.), Bridgeport, Conn. For more than a year, General Electric has been designing television receivers, testing them, and building them on a production line, but these receivers are the first which will be offered for sale to the public.

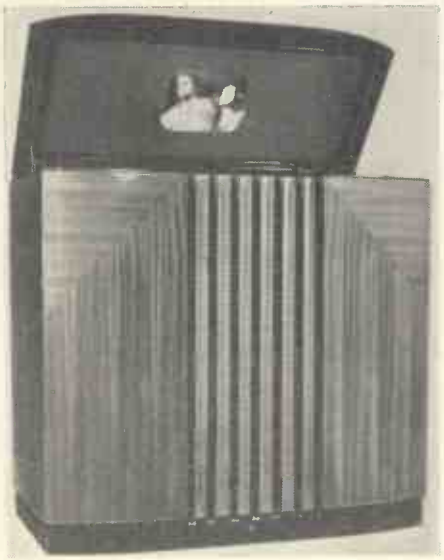
HM-171 (right) picture receiver and sound converter, table model.

HM-185 (below) television receiver, console.

The smallest receiver is the HM-171, which is a table-type picture receiver with sound converter. It can be used to receive television pictures without sound, or can be used in conjunction with special types of radio receivers which will be made available later. The table model employs a 5 in. tube and sixteen valves. Front controls include brightness, contrast, focus, and tuning, and rear controls include horizontal and vertical size, hold and centring. The set is 14½ in. high and is approximately 20 in. wide and 19 in. deep.

Model HM-185 is a console-type television receiver for both sight and sound, employing a 5-in. tube. It employs 18 valves in all, gives average high-fidelity audio, and is 38 in. high, 23 in. wide, and approximately 18 in. deep. Controls are similar to those on the smaller set with the addition of volume and tone control.

Model HM-225 is a console-type television receiver for sight and sound employing 2 valves and a 9-in. tube. It has two chassis, video-sound and power, and high fidelity audio. This model is slightly larger than the HM-185.



HM-275, television receiver and all-wave radio lowboy console.

The two remaining console models, the HM-226 and the HM-275, combine all-wave radio and television. The former employs 28 valves and the latter 29 valves, with a 12-in. tube. Each has a video-sound, power, and radio chassis. The approximate price range of the new television receivers is from $250 to $1,000.

HM-226, television receiver, console.

RADIO MARKETING TRADE ANNUAL, 1939 edition. (Radio and Electrical Marketing, 5s.). All radio retailers and engineers interested in radio or television should make a point of obtaining a copy of this annual which gives all the data the average retailer is likely to require.

It consists of 192 pages of reference matter and is divided into three sections, commercial and legal, technical and directory. There are full details of radio associations and societies, an alphabetical directory of manufacturers and wholesalers, and voltage directory of the entire country, and a Who's Who of the radio industry.

A feature of this annual is a completely new servicing section occupying 22 pages, while there is also full information on automatic tuning and problems met in every-day receivers.

New Philips' Headquarters

Philips Lamps, Limited, have vacated their offices in Charing Cross Road and are now occupying an 8-storey building in Shaftesbury Avenue. From May 22 last the new address was Philips Lamps, Limited, Century House, Shaftesbury Avenue, London, W.C.2, and the phone number remains unchanged at Gerard 7777.

"TELEVISION SOUND AT ALEXANDRA PALACE"

(*Continued from page 344*)

loss in one part of an amplifier by a corresponding gain in another part of the circuit has not been applied to any great extent. This has in turn involved what amounts to an extension of the frequency range, since the losses due to such factors as valve capacitance and the capacitance and inductance of transformers, have of necessity been made low enough to enable components to be changed without altering the frequency characteristic within the operating range.

As the circuits connecting the amplifiers are all of 200 ohms impedance, input and output transformers are used for all amplifiers. In the case of input transformers the secondaries are not loaded by shunt resistances. The step-up is not very great and the main inductance is made high, so that the effective input impedance to the amplifier as seen on the primary side is very high compared with 200 ohms throughout the working frequency range. A type of winding is used which enables the leakage inductance to be kept down to 1/3000 of the main inductance, with a secondary capacitance of about 30 $\mu\mu$F when the primary is earthed. In this way the resonance of the leakage inductance and the secondary capacitance (including the input capacitance of the valve) is kept well above the working frequency range. This resonance is damped chiefly by the primary load, together with some additional series grid resistance where necessary. The substantially open-circuit input impedance which the amplifiers thus have is an important feature in the design of the control-desk circuits, and also enables the full open-circuit voltage to be obtained from ribbon microphones, etc.

The anode load of all first-stage valves is purposely kept low in order to reduce the effective input capacitance.

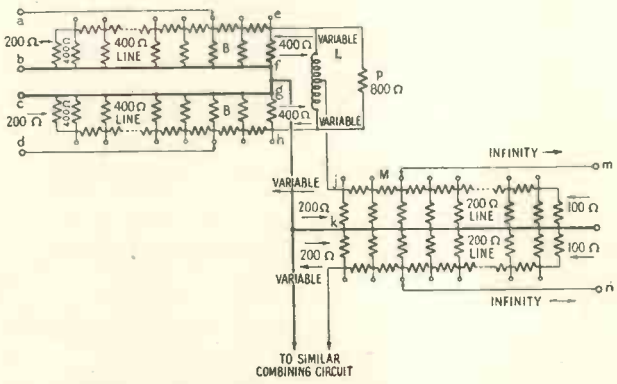
Intervalve coupling for balanced stages is by transformer. Particular care has been taken to prevent any sign of " in-phase " resonance of the secondaries which would produce an unbalance of the valves at high frequencies.

Resistance coupling with fairly long time-constants is used between most single valve stages. In a few cases a very small low-frequency rise, generally not more than 0.2 db., is introduced in the adone first decoupling circuits to compensate for grid-circuit and other low-frequency losses.

R.F. Interference

Owing to the studios being in the same building as the ultra-short-wave transmitters the audio-frequency amplifiers were liable to be situated in a very strong radio-frequency field from both sound and vision transmitters. Whilst a very small pick-up from the sound transmitter would not be important, the nature of the modulation of the vision transmitter, together with its greater power, made it necessary to take every precautionary measure against interference.

In audio-frequency amplifiers there are so many components between valves, such as potentiometers and switches, which require to be brought away from the chassis on leads, that it is not easy to screen completely such amplifiers. This being the case, the method employed is to screen and filter the radio-frequency (r.f.) currents thoroughly only from parts of the circuit in which modulation might occur, i.e., from the valves. In this way no attempt is made to prevent r.f. currents from flowing in the transformers, potentiometers, wiring, etc., but these currents are very carefully filtered out before the valve is reached.



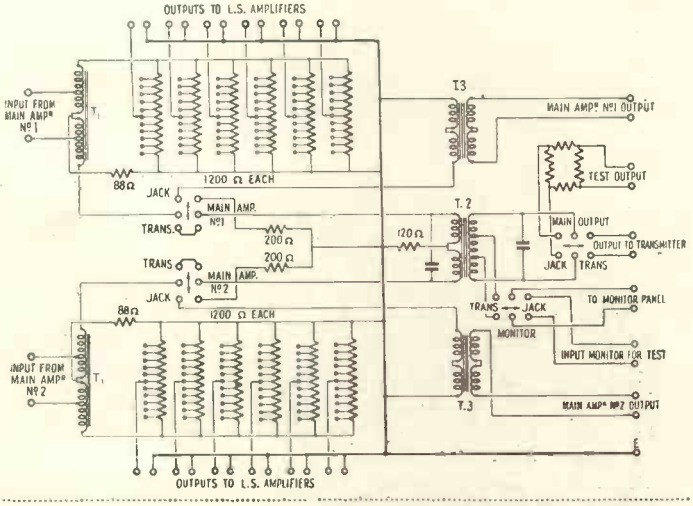


Fig. 7 (above.) Basic mixing circuit.
Fig. 8 (right.) Complete circuit of output distributor.

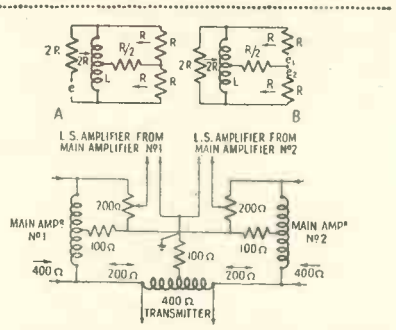


Fig. 9. Basic circuit of output distribution networks.

Fading and Balancing Circuits

The control circuits perform two broad functions. One is the selection, level adjustment, and combining of the channels required, and the other is the adjustment of the complete programme level to a value suitable for modulating the transmitter. These two functions, referred to as " fade and balance " and " main control " respectively, take place on one control desk in this equipment.

The object of a fade-and-balance panel is to provide a fader which is used only as a fading switch,

its purpose being to add or to remove a channel from the programme circuit in a gradual manner. It is always left in its maximum or minimum position and is never used for level-control purposes.

The balance adjustment which follows this, enables the correct relative levels to be maintained between the several circuits to be combined. There are two fade-and-balance panels, each carrying four channels combined into a single output. Each of these combined circuits is connected to one of the two attenuators on the main control panel. Their outputs supply, through an optional combining circuit, either one or both of the main amplifiers.

Combining Circuits

The balance attenuators are connected to the main control attenuators through centre-tapped auto-transformers, each shunted by a resistance of 800 ohms. The function of these components will be better followed from Fig. 7, which shows the combination of two balance attenuators with one-half of a main control.

It will be seen that the circuit can be considered to consist fundamentally of two sources, namely, the balance attenuator outputs *ef* and *gh*, feeding a load *jk*, which is one-half of the main control input, through the medium of a centre-tapped inductance L. It may be shown that if a resistance P be connected across L equal to four times the load resistance, the power from the two sources will divide equally between P and the load M, and that the impedance facing each source will be equal to twice that of the load M, irrespective of the impedance of the other source.

The half of the main control attenuator M under consideration will have a constant 200-ohm impedance at *jk*, facing the remainder of the circuit, since it is terminated at the right-hand end and the amplifier input impedance on the tapping *m* is substantially infinite. Hence the resistance P is made equal to 800 ohms. The impedance facing each balance attenuator is therefore a constant value of 400 ohms, which provides them with good terminations. Thus the impedance seen at their inputs *ab* and *cd* is 200 ohms, which is the correct load for the " A " amplifier output circuits. The 10,000-ohm fader (not shown in Fig. 7) is in shunt across *ab*, but its effect is negligible.

The most important feature of the circuit, however, is that although the impedance of each of the sources referred to above, i.e., the impedance looking into the balance-attenuator outputs, is variable, owing to the 200-ohm " A " amplifier impedance being tapped across the attenuator, the power supplied to the main control by the other balance circuit is unaffected.

Control Desk

The control desk has the two fade-and-balance panels on the left and the main control panel on the right. The latter contains the two programme monitoring meters, which will be described later. Between these panels is a jack field carrying all the " A " amplifier outputs, main amplifier inputs, the terminations of the inputs and outputs of the control sets, and any Post Office lines used for sending and receiving programmes outside the building. Supervisory lamps are fitted to indicate which channels are alive.

The operators' headphones can be connected to the monitor panel, the check radio receiver, or the check position on the fader.

Output Distribution

An unusual feature of the equipment is the absence of trap-valves for the distribution of the audio-frequency output from the main amplifier to the transmitter and monitoring circuits.

The function of a panel known as the " output distributor " is, first, to divide the output from each of the main amplifiers in order to feed the loud-speaker amplifier input controls on the one hand, and the transmitter on the other, without cross-talk. This means that any load may be thrown into one channel without affecting the other. Secondly, the outputs intended for the transmitter from the two main amplifiers must be combined into a single channel to feed the transmitter input line.

The complete circuit of the output distributor is shown in Fig. 8, but the manner in which it is built up is more clearly understood from Fig. 9, which illustrates the basic principles. At A is shown a generator of impedance R and e.m.f. e. L is an ideal auto-transformer with an accurate centre tap. R,R, are two loads, and R/2 a balancing resistor, the whole forming a bridge circuit similar in principle to the " hybrid " coil of a telephone repeater. Each load R will receive one-half of the power delivered from the source and will be fed from an impedance equal to R. There will be no power dissipated in R/2. If, however, the impedance of one load varies, the power passing to the other load will not be changed but the balance resistor R/2 will carry the surplus power.

At B is shown a similar arrangement in which two generators of e.m.f.'s e_1 and e_2, each of impedance R, supply a load $2R$ through a centre-tapped auto-transformer and balance resistor R/2. One-half of the total power from the two sources will be delivered to R/2 and the other half to $2R$, the current to the load $2R$ due to one source being independent of the impedance of the other source.

At C is shown a combination of these two circuits. Each main amplifier forms the source of a circuit of the type shown at A. One output is the 200-ohm potentiometer which supplies the loud-speaker amplifier, while the other output forms one of the sources for a circuit similar to B. The combined output from the latter feeds the transmitter. If R is made equal to 200 ohms, then the impedance facing each amplifier and the transmitter will be 400 ohms, and the three balance resistances must be 100 ohms each. Thus any noises or loads thrown on to the loud-speaker amplifier circuits will not be communicated to the transmitter channel.

Monitoring Circuits

The checking and monitoring arrangements comprise the following:—

(1) A meter reading the average level sent to the transmitter, in decibels, above 1 milliwatt. This meter is duplicated on the control desk and in the apparatus racks.

(2) A meter reading the peak modulation percentage, also duplicated on the control desk and apparatus racks.

(3) Check telephones. Four positions are provided, two in the control desk and two in the gramophone desk.

(4) Five loud-speaker amplifiers, each capable of supplying two loud-speakers.

Programme-level Meter

The average-level meter circuit consists of a pentode amplifying stage with a small variable feedback for sensitivity adjustment, a diode recti-

fier, and a moving-coil meter circuit.

The meter indicating peak modulation consists of a full-wave diode peak voltmeter.

Check Radio Receiver

In order that the modulated r.f. output of the transmitter may be observed, a check receiver is provided. This consists of a diode rectifier fed through a tuned circuit directly from the transmitter output via an r.f. line coupled to the main feeder.

Loudspeaker Monitoring

The loudspeaker amplifiers are required to raise the level from the potentiometers of the output distributor or check receiver to loudspeaker level. The input transformer is of low ratio and is suitable for working from a widely varying impedance, such as is seen looking into the potentiometers, with no appreciable change in characteristic. A low-gain first stage feeds a push-pull output stage of conventional design.

For the operation of a large loudspeaker in the studio, a similar amplifier is provided with an output stage consisting of 2 D.A.60 valves in push-pull. An audio-frequency output of 40 watts is available.

Talk-back System

In a television station the producer must be able to speak to any of the cameramen or to the film operators. This facility is provided by means of various microphones—located on the producer's desk and near the vision monitors, etc.—the output from which, after suitable amplification, supplies a distribution network. This comprises a number of keys for switching any required camera headphone set on to the talk-back circuit. A further key closes all camera headphone circuits simultaneously. In addition, the studio loud-speaker can be connected to the talk-back circuit to allow speaking to artists in the studio. Further, in the case of outdoor broadcasts a loud-speaker can be connected to the camera talk-back circuit, which is then fed at loudspeaker level.

Power Supply

The whole of the equipment is operated from a 50-cycle 240-volt single-phase supply, no batteries of any kind being employed. The use of large units capable of supplying a number of amplifiers has been preferred to the use of individual supply units, as being more efficient and facilitating simple stand-by arrangements.

After being in service for a period of 2 years, the equipment appears to have fulfilled the desiderata, somewhat uncertain at the outset, for a single-studio television station. All the facilities included have been of value at some time or other, whilst if there was any error in the original specification it appears to have been more in the nature of an under-estimation of the number of channels required, than the reverse.

BAIRD TELEVISION IN AMERICA

ABOUT four weeks ago Mr. Ian H. Cremieu-Javal, a director of Baird Television, Ltd., accompanied by technical experts, left for America to expedite plans for the "television invasion" of the United States.

Work is now in hand for the installation of big-screen television equipment in Broadway cinemas, and in addition standard Baird home receivers are being demonstrated in New York.

At the present moment work is proceeding with the big screen installation, and it is anticipated that this will be ready to demonstrate pictures radiated on the American standards within a very short period. In this connection it is interesting to refer to a cable by Mr. Javal from New ork in the following terms—

> "Interest in theatre television is increasing daily here. One of the major circuits is waiting on prices and information, and claims they will want soon a possible total of over one hundred sets. We are also receiving daily visits, and inquiries from out-of-town exhibitors.
>
> "We have received visits from several architects who are building new theatres for their clients, asking what structural changes or provisions they should make for television. One of New York's leading hotels is asking for the price to equip with large screen for the opening of their roof garden.
>
> "The unions here are fighting to see who will control television employees and talent.
>
> "Mr. Joseph Schenck has announced in an interview that Mr. Sidney Kent had been in touch with Baird representatives, and through their affiliation with G.-B., their theatres would be protected.
>
> "Engineers are working day and night to hurry the first showing of big screen in America.
>
> "A home set has been installed in Mr. Javal's suite, where he gave reception to friends who saw, heard and enjoyed television entertainment with perfect clarity. Another set installed in the G.-B. office thrills everyone who sees it."

The home receiving set referred to in this cable is a sandard current model T.18 which gives a picture 10 in. by 8 in.

Prior to shipment to New York these home receivers were modified slightly to permit reception on the different transmission standards used in America. Although these changes were made in England, where there is no comparable transmission to permit checks to be made, the receivers worked quite satisfactorily when installed.

Receiver Noise

As the gain of modern receivers is increasing due to improved design and high-slope valves, it becomes increasingly difficult completely to remove unwanted noise. It is absolutely essential with a modern superhet that it be wired with a heavy gauge wire and soldered at every joint. The old scheme of using a nut and bolt for connection cannot now be used, for in time, joints become loose.

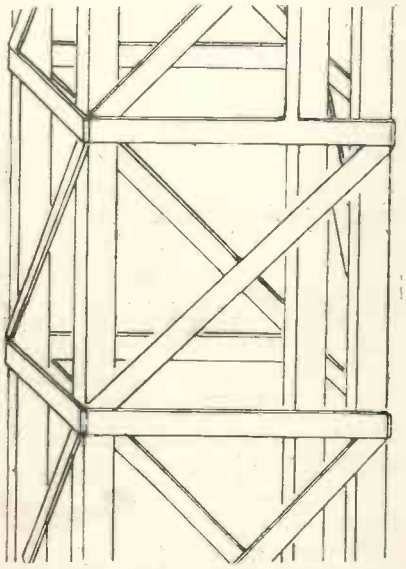
Constructors should make a point of making all connections to a soldering tag with the bolt fixed to the chassis very tightly plus a shake proof washer.

Soldering the connections is quite a simple job providing an electric soldering iron is used and one that reaches its maximum temperature fairly quickly. A good iron rarely becomes dirty and makes soldering a particularly simple job and one that the rawest amateur can confidently tackle. We have always used electric irons and have found them very easy to use. An iron we can recommend is manufactured by W. T. Henley's Telegraph Work Co., Ltd., of Holborn Viaduct, E.C.1. It is sold under the name of Solon and priced at 8s. 6d. complete with solder, flex and lamp adaptor.

Making A Cheap Lattice Mast

By A. P. Kerford-Byrnes, G6AB

MOST amateurs are interested in obtaining the maximum possible height for their antenna, and some time ago the writer wished to increase the height of his own antenna at the lead-in end. The far end of the antenna was secured to a 35 ft. pole properly fixed in a tabernacle. The lead-in end was secured to a special



This is how the middle section of the mast is built.

bracket attached to the side of the chimney stack, which was installed when the property was built. Unfortunately, as the building is only a bungalow, the chimney stack is not as high as the 35 ft. pole, and the problem was how to raise this end so that the antenna top was 35 ft. from the ground for the whole of its length.

At the back of the bungalow is a large bay window with a lead flat over which is 10 ft. from the ground. It was, therefore, decided to stand a mast on this fixed with the necessary guys, etc. The main problem was how to get a light mast which would not be likely to damage the roof of the bungalow if it was carried away in a south-westerly gale. Another item was how to keep the cost down, which ruled out aluminium. A wooden lattice mast of cigar shape was eventually decided on and a visit to the local timber yard revealed that it was possible to obtain 1¼ in. by 1¼ in. planed red fir in lengths of 25 ft. Four of these, moderately free from knots, were then purchased together with a bundle of builder's laths and 1 lb. of 1 in. wire nails.

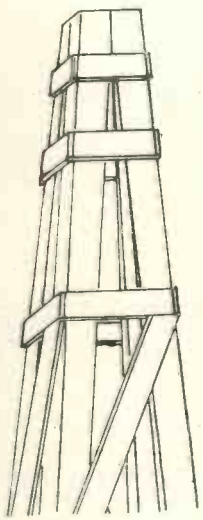
A start was made at 6 p.m. one summer evening. The four 25-ft. lengths were divided into pairs, and each pair was screwed together at each end. After marking the centre point a piece of lath 10 in. long was cut and the pair of uprights were bowed out and the 10 in. length of lath inserted between them in the centre to keep them apart. Then cross laths were cut to size and nailed on at 1-ft. intervals. When these were all fixed, diagonal braces were cut to size from laths and nailed on as shown in the sketch. This completed one side of the mast. The other pair of uprights were then treated in the same manner with cross laths and diagonal braces until the two sides were complete.

The next step was to join the two sides together at the ends. This was done with 2½ in. wood screws and two 10 in. lengths of lath were inserted at the centre point to spring out the two sides parallel to one another. Cross laths and diagonal braces were then nailed on the two open sides of the mast to meet the existing laths on the two completed sides, and this completed the constructional work after four hours. I would point out that all lengths of lath were carefully selected before cutting and if there was a knot in the piece it was rejected. Over half the bundle was not used in spite of this so that there is no need to be economical when cutting the cross laths and diagonal braces.

An idea of the rigidity of the mast when completed can be gathered from the fact that when the mast is lifted by one end and shaken, the other end being on the ground, there is no whip whatsoever, and the mast is very rigid for such a light weight, i.e., about 30 lb. It can be lifted with one hand and is very easy to handle.

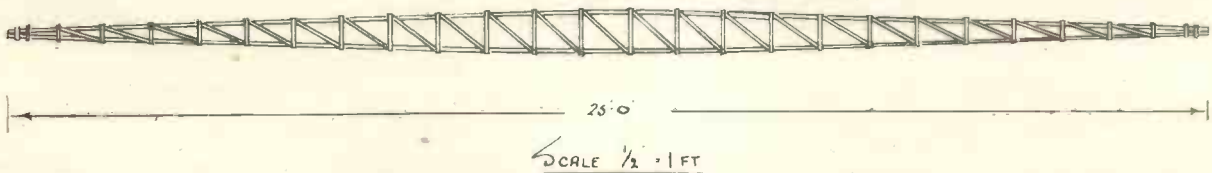
After receiving two coats of creosote the stay wires were attached 1 ft. above the centre section. These were fastened to some loops in some stranded galvanised wire which was bound right round the mast at this point, so as to avoid any direct pull on one individual upright.

A piece of 7 in. by 2 in. wood 4 ft. long was then cut and a square socket made in the centre by nailing 1 in. square stuff to the 7 in. by 2 in. to form a hole 2¼ in. square for the square foot of the mast. The pulley was attached to the top by means of galvanised stranded wire bound round the top of the mast and after passing the halliard



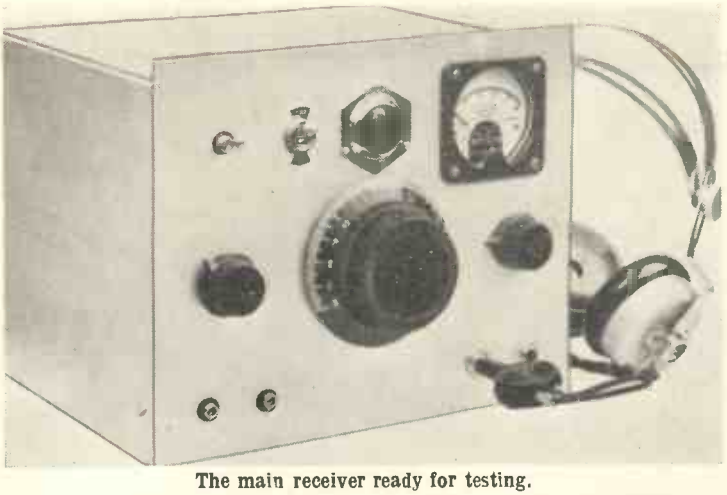
When erected the mast does not look unsightly and it certainly gives the station a realistic appearance. The item which may appeal so much to amateurs is that it only costs 7s. 4½d. to construct, which is a very reasonable figure.

through the pulley the mast was erected with no trouble at all. The writer climbed on to the lead flat and just lifted up the mast and held it in position while his wife made fast the three stays to the stay anchors, which were 1½ in. diameter iron pipes, 5 ft. long, driven into the ground four feet with a 14 lb. sledge-hammer. Before the pipes were driven into the ground a ½ in. diameter hole was drilled through the pipe 6 in. from the top and a ½ in. diameter bolt passed through. The stay wires were wound round the pipe and the ½ in. bolt prevented them being pulled off the top of the pipe. The writer has found that these make very good stay anchors, as when the wires are wound round the pipes there are no sharp corners which tend to weaken the wire.



The finished mast, suitable for television or short-wave radio.

In view of the increasing interest in amateur direction finding contests, many of which are being held in various parts of the country this summer, J. M. S. Watson, G6CT, the secretary of the Southend Radio and Scientific Society, has designed this portable equipment. It was used on May 14 during a contest organised by a number of societies and proved satisfactory in every respect.



The main receiver ready for testing.

A 5-valve Portable Direction-finding Receiver

IN recent years radio direction finding has become of ever increasing importance in the navigation of ships and aircraft, and highly specialised and complicated apparatus has been developed to give bearings of great accuracy and reliability under the most severe conditions.

For some years amateur enthusiasts have shown increasing interest in this field of work and as far back as some ten years ago the Slade Radio Society of Birmingham organised Field Days with direction finding apparatus, and during the last five years the Southend Radio Society in conjunction with other societies in Essex and the Home Counties have held regular inter-club competitions on similar lines.

1.7 Mc. *Band*

In these events an amateur portable transmitter, operating in the 1.7 megacycle band, and with a comparatively limited power of usually some 5-10 watts, has been concealed in the country, and the competing parties, each with some form of suitable direction finding receiver and means of transport, have started off together from a point 10-15 miles away.

The object is to actually locate the transmitter itself as soon as possible and this often proves more difficult than it sounds, as not only is every advantage taken of the natural difficulties presented by the surrounding country but transmissions may be only of short duration at irregular intervals.

Field Days of this nature are now meeting with such active support that it is felt that a description of a suitable receiver will prove of general interest and though no doubt an enthusiastic supporter will readily be able to obtain details of any tests being held in his district from the local societies' secretary, it is pointed out for the benefit of the more practically minded amateurs, that a receiver of this description is not only interesting and cheap to build, but can readily be adapted for more utilitarian purposes, and will provide a means for obtaining vital information from B.B.C. stations in an emergency.

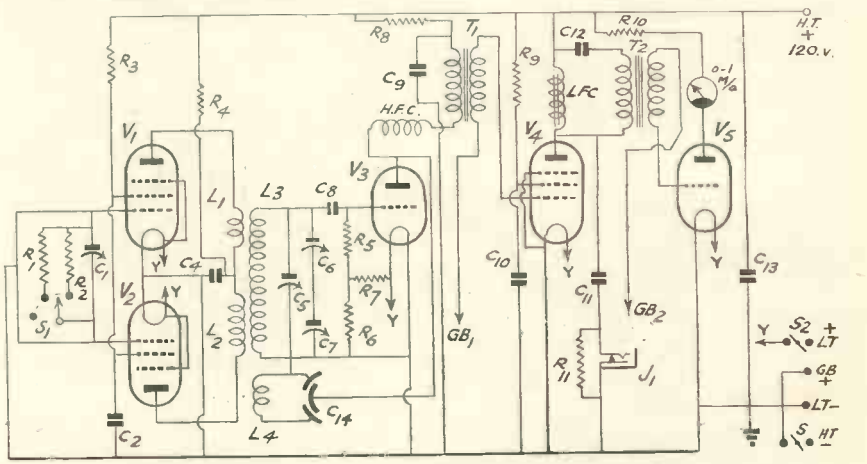
The essential requirements are accuracy of bearings combined with a rugged construction and complete portability. The receiver to be described has been built after several other alternative designs had been thoroughly tried out. The circuit is conventional except for the addition of a number of refinements that have proved their value in practice, while construction is quite straightforward and should present no difficulty to an amateur with limited resources.

At the frequencies used the only form of aerial with marked directional properties that can be usefully employed is the familiar loop or frame aerial. The loop in this case consists of 10 turns of 16-gauge d.c.c wound on a wooden frame which surrounds the receiver and batteries.

When the plane of the loop points in the direction from which the signals are arriving the maximum pick-up will be obtained, and conversely, when rotated 90 degrees so that the vertical plane of the loop is at right angles to the direction from which the signals are arriving, the pick-up will be at a minimum; in fact under theoretically perfect conditions should become nil.

It will be appreciated that it is easier to judge changes in a faint signal than in a strong one. Direction finding bearings will be taken by obtaining a compass reading of the minimum signal position, then adding to or subtracting 90 degrees from the compass reading to obtain the true bearing.

In practice, however, it does not always prove easy to achieve a sharply defined and accurate minimum. Firstly,



A push-pull R.F. stage is used so as to include a balanced centre tapped frame aerial. Notice also the valve voltmeter circuit.

Push-Pull R.F. Stages

when close to the transmitter the minimum signal position may be marred by direct pick-up on the internal wiring of the receiver itself, though this effect can easily be overcome by the complete screening of the R.F. and detector portions.

Secondly, pick-up may occur on the turns of the frame at the grid end of the winding. This can be readily understood if the frame is looked upon as an R.F. choke when it can be seen that the grid end itself can function as an aerial to the electrostatic component of the wave, whereas it is desired that the electromagnetic component only should be impressed on the grid of the first valve.

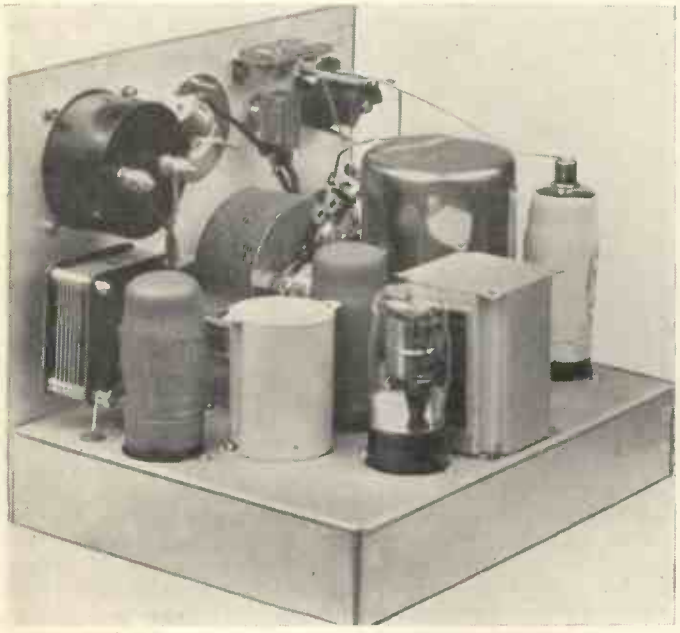
This effect is referred to as vertical pick-up and in order that the directional properties should be most marked can most easily be nullified by centre tapping the frame. This provides a loop, each half of which is balanced to the centre tap itself which is at chassis or "earth" potential. Before, however, this can be applied to the receiver some form of coupling must be provided to combine the signal from the two halves of the frame in such a manner that the electro-magnetic pick-up will become additive, whereas, the electrostatic pick-up in the two halves will cancel out. Such a coupling can be provided by means of a suitable input transformer with an electrostatic screen between the centre tapped primary and secondary windings. Experience has proved that even with the addition of iron dust cores to increase the coupling, the presence of the screen not only makes the transformer difficult to construct, but also introduces considerable inefficiency where, to maintain a high signal-to-noise ratio, losses can least be tolerated.

Although satisfactory transformers have been built, a much easier method by which the same results can be achieved is made possible by the provision of two screened R.F. valves in push-pull. The combination and cancellation of the wanted and unwanted pick-up then takes place in the centre tap push-pull anode, R.F. transformer, to which the grid coil is inductively coupled.

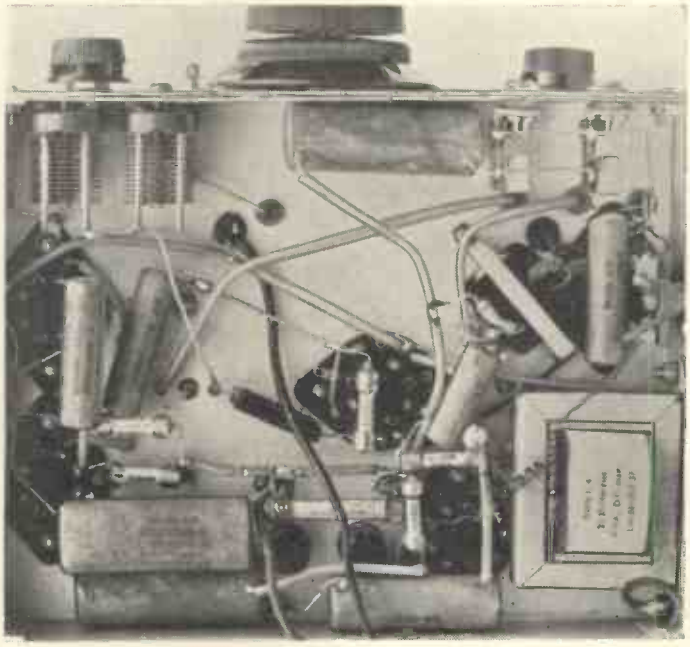
This grid coil provides the main tuned circuit, and is shunted by a .0003-mfd. J.B. condenser. It will be noticed from the circuit diagram that two air-dielectric trimmers are provided at this point, one in parallel and one in series with the main tuning condenser. Suitable adjustment of these trimmers will enable any desired station to be spread over the rotation of the main tuning condenser, and the object of this refinement is to ensure that once the desired station has been found no time need be lost through the necessity for continual re-tuning of more than a few cycles.

The stability of the receiver described has proved so satisfactory that no re-adjustment has been found necessary even after a lengthy period and considerable rough handling.

When the tuning of the grid circuit has been set the frame trimmer condenser, C1, is adjusted for maximum response. Owing to the unavoidable damping in the circuit this is by no means critical.



The actual receiver itself is quite small, and in this view can be seen the output pentode, detector and valve voltmeter valve.



There is ample space for all the components as can be seen from the sub-chassis view.

The coil has to be home made. The primary which is variable is made up of 60 turns centre tapped with a secondary of 80 turns plus 12 turns for reaction, all in one length. 28 gauge enamelled wire is used throughout and all windings are covered with wax.

Detector and L.F. Circuits

To achieve the maximum sensitivity with simplicity a normal leaky grid detector is employed, and the reaction feedback is provided by an H.F. choke in the detector-anode circuit and reaction winding on the R.F. transformer,

H.T. AND G.B. VOLTAGES

and is controlled by a differential condenser.

Owing to the small amount of pick-up available it may be necessary to operate with the receiver at its most sensitive point. Smoothness and stability of reaction control are of paramount importance, and these can be achieved by returning the detector grid leak to a point rather more negative than the usual L.T. positive.

Correct bias point can be provided by a potentiometer across the L.T. which in its simplest form need only consist of two fixed resistors of correct relative values. The actual resistance is unimportant provided the ratio gives the required voltage division which will depend to some extent upon the constants of the circuit and the H.T. value employed.

With the HL23 valve, 120 volts H.T. and de-coupling resistance values indicated, it was in fact found most satisfactory results were obtained with the grid leak returned to the L.T. negative, but this point can readily be confirmed by experiment.

To obtain the greatest possible gain the detector is coupled by a 4/1 transformer to the PEN-25 L.F. valve to which the headphones are coupled by means of a .5-mfd. condenser and L.F. anode choke. Provision is also made for an additional pair of headphones to be connected in parallel if necessary.

Although this completes the normal audio frequency section of the receiver, it will be noticed that an additional HL-23 valve is employed, fed by means of a midget transformer from the anode circuit of the PEN-25.

The grid of this valve is coupled through the transformer secondary to negative 6 volts on the bias battery, and thus operates as an anode bend detector or valve voltmeter, indication being obtained on the 0-1 mA. Turner model 909 meter connected in the anode circuit.

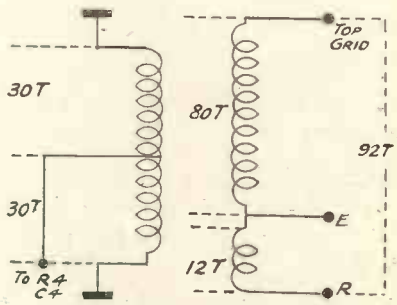
A 100,000 ohm resistance is also connected in series with the meter and while this resistance will have no appreciable effect at low readings, it will gradually limit the meter deflection as the current increases and will, in fact, provide an approximate logorithmical indication of signal strength and will preclude any possibility of damage to the meter by overloading. The valve-voltmeter provides a very useful indication of signal strength when taking bearings and proves a much more reliable guide than an aural estimation in deciding whether the transmitter is still being approached or possibly has already been overshot.

It will be appreciated that bearings are taken with the set in oscillation, the resultant beat note being tuned to any convenient pitch to give a continuous note in the headphones and a steady deflection on the meter. Under this condition it will be much easier to obtain accurate bearings than by attempting to do so on the modulation if telephony is being used.

It will be noticed that a form of attenuator is provided by means of the Bulgin stud switch which introduces alternative values of shunt resistances across the frame, so enabling the input

At a recent meeting of Romford, Ilford, Brentwood, Welwyn and Southend Societies these members had their photograph taken at 6 a.m. after an all night contest. The receivers used can clearly be seen.

Photo: Courtesy Southend Times.



How the coil is wired.

A 5-valve Portable Direction Finding Receiver.

CABINET
1 wooden supporting frame to specification 10 in. × 14 in. × 7 in. (Peto-Scott).
1 cabinet with turn table to specification (Peto-Scott).

CHASSIS, PANEL, SCREENING BOX.
1 aluminium panel, 6½ × 8½ ins. 16 gauge (Peto-Scott).
1 chassis 6½ × 8½ × 1½ ins. 16 gauge (Peto-Scott)
1 screening box 18 gauge to specification (Peto-Scott).

COIL FORMERS
1—1 in. × 4 in. paxolin (Peto-Scott).
1—1½ in. × 1 in. (Peto-Scott).
1 screening box (Bulgin).

CONDENSERS, FIXED AND VARIABLE
1—.0001 mfd. air spaced, type SW88(C1)(Bulgin).
1—.1 mfd. type 4603/s (C2) (Dubilier).
1—.1 mfd. type 4603/s (C4) (Dubilier).
1—.0001 mfd. air spaced type SW88 (C5) (Bulgin)
1—.0001 mfd. air spaced type SW88 (C6) (Bulgin)
1—.0003 mfd. type 1047 (C7) (Jackson Bros.)
1—.0003 mfd. type 690W (C8) (Dubilier).
1—.25 mfd. type 4606/s (C9) (Dubilier).
1—.5 mfd. type 4608/s (C10) (Dubilier).
1—.5 mfd. type 4608/s (C11) (Dubilier).
1—.01 mfd. type 4601/s (C12) (Dubilier).
1—.5 mfd. type 4608/s (C13) (Dubilier).
1—.0003 mfd. differential reaction condenser type 2048 (C14) (Jackson Bros.).

CHOKES
1 type HF10 (Bulgin).

CHOKE L.F.
1 type LF20 (Bulgin).

DIAL LIGHT
1 type D7 (Bulgin).

HOLDERS, VALVE
5 type VH56 British octal (Bulgin).

HEADPHONES
1 pair supersensitive (Ericsson).

JACKS
2 single circuit type J2 (Bulgin).

METERS
1—0-1 mA. flush mounting type 909 (Ernest Taylor Ltd.) (Premier Supply Stores).

PLUGS, SOCKETS, ETC.
3 sockets type X351 (Clix).
3 plugs, type P16 (Clix).
2 top cap connectors (Bulgin).
4 plugs, type JSP (Clix).
2 connectors type R420 (Clix).

RESISTANCES, FIXED
1—100 ohm type ½ watt (R1) (Bulgin).
2—50 ohm type ½ watt wired in parallel (R2) (Bulgin).
1—250,000 ohm type ½ watt (R3) (Bulgin).
1—5,000 ohm type ½ watt (R4) (Bulgin).
1—1 megohm type ½ watt (R5) (Bulgin).
1—500,000 ohm type ½ watt (R6) (Bulgin).
1—1 megohm type ½ watt (R7) (Bulgin).
1—20,000 ohm type ½ watt (R8) (Bulgin).
1—1,000 ohm type ½ watt (R9) (Bulgin).
1—100,000 o m type ½ watt (R10) (Bulgin).
1—2,000 ohm type ½ watt (R11) (Bulgin).

SUNDRIES
½ lb. 16 gauge tinned copper wire (Premier Supply Stores).
3 coils push back wire (Premier Supply Stores).
1 dozen shake proof soldering tags (Premier Supply Stores).
2 dozen shake proof washers (Premier Supply Stores).
6 rubber grommets (Premier Supply Stores).
¼ lb. 16 gauge D.C.C. wire (Premier Supply Stores).

SWITCHES
1 toggle type S80T (Bulgin).
1 stud switch type S160 (Bulgin).

TRANSFORMERS
1 type LF36 (Bulgin).
1 type LF33 (Bulgin).

VALVES
1 PEN25 (Mazda).
2 HL23 (Mazda).
2 SP22 (Mazda).

ACCESSORIES
1 2-volt accumulator non-spill type S150 (Ever Ready).
1 120-volt battery type "Super" (Ever Ready).
1 9-volt G.B. battery type "Winner" (Ever Ready).

A complete kit of components for this Direction Finder can be obtained from Messrs. Peto-Scott, Limited, of Pilot House, Stoke Newington Church Street, London, N.16.

Operation :: Frequency Range

to be reduced on approaching the transmitter. After a little practice it becomes possible quite accurately to esti-

A compass is mounted on the end of a piece of wood so as to keep it well away from the receiver, particularly the moving coil meter, the magnet of which would affect the reading.

mate the distance of the transmitter by noting the position of the switch at which the beat note becomes audible. For example, on the type of transmitter

This is the receiver complete in its case with carrying handle.

generally employed, it has been found that no signal at all can be heard with the switch in position 4 (that is with 25 ohms across the frame), at a greater distance than some 300 yards.

The operation of the receiver is quite simple and calls for little comment. With the series trimmer set at about half capacity and the parallel one at minimum, no difficulty should be experienced in tuning in a number of top band amateur transmitters, particularly if the receiver is tested on a Sunday morning. A quite sharp and pronounced minimum position for the frame should be apparent on all stations received during daylight, but it should be mentioned that attempts to obtain bearings on distant transmissions after dark will prove unsuccessful because of the presence of the reflected waves.

It may be stated here that if it is desired to extend the frequency range to cover reception on the lower half of the broadcast band, this can be achieved without alteration to the coils by bending the edge of one end of a moving plate of the series air trimmer in such

It can be seen that the receiver is completely screened and that there is a gap on either side of at least half an inch to keep the metal away as far as possible from the frame aerial.

a manner that the trimmer will short circuit when the vanes are fully meshed. This will place the total capacity of .0004-mfd. across the tuned grid circuit and will enable reception to be obtained up to approximately 375 metres.

Although no actual details of the methods found most successful in tracking down a hidden transmitter have been given, it is hoped that this may form the subject of a later article. Briefly, the basic method employed is to obtain a compass bearing of the direction from which the signal appears to be emanating, to plot this on a large scale map of the district and then to move a distance of several miles, pre-

A special plug-in socket, both halves of which are screened, is used to connect the frame aerial into the grid circuits of the H.F. amplifiers. Controls are bottom row, condensers C5 and C6, plus two jacks for headphones wired in parallel. Centre row, switch S1, tuner C7, and reaction. Top row, frame aerial trimmer, C1, on-off switch, dial light and valve meter indicator. All references are from left to right.

ferably at right angles to the indicated direction and obtain a similar bearing which should intersect the first one at a point adjacent to the location of the transmitter. This procedure is then repeated at decreasing ranges until the location is actually discovered. In transferring the compass bearing on to the map, due allowance must be made for the fact that the compass needle points (at present) slightly to the west of true north. The amount of error, known as the magnetic deviation, is at present 11 degrees approximately, though this varies annually and is usually marked in the margin of the map. When this allowance has been made bearings taken in a reasonably clear spot and transferred to the map with care can usually be relied upon to be correct to about 5 degrees. It can be mentioned that under favourable conditions and from a distance of 10 miles it has been found possible to locate and reach the transmitter in 47 minutes, with a total of only 15 minutes of radiation during this period, although where unexpected difficulties are encountered and especially where tests are held at night a very much longer period may be found necessary.

The author would like to express his appreciation of the help and work done by many people and his indebtedness to Mr. G. T. Peck, whose assistance has made possible the preparation of this article.

The Short-wave Radio World

A Review of the Most Important Features of the World's Short-wave Developments

A DOUBLE-DIODE VOLTMETER

In the April issue of Q.S.T. designed by W3DZL is a most interesting double-diode voltmeter using an 0-1 mA. meter in which D.C. or A.C. voltages of 0-10, 0-100, 0-300, 0-1,000 can be measured. A curve is also provided in order to take up slight inaccuracies at the top end of each scale, while there is no necessity to have fixed resistors of extreme accuracy.

In each range, the resistance network consists of both a fixed and a variable resistor; a variable resistor enables the network to be adjusted accurately so as to give an exact reading.

The 6H6 twin-diodes are recommended and these are of the miniature metal type which take up the minimum amount of space. In order to obtain zero current reading, a small bias cell is connected between anode and cathode and it was found that when unpolarised, there was a steady current of approximately .4 mA.

The rectifiers are connected in a full-wave bridge circuit and according to the designer are better in this particular instance than oxide-film rectifiers as they are not affected by extreme temperature variation. (See Fig. 1).

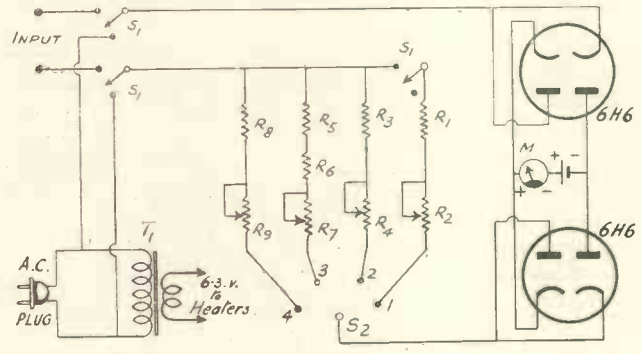


Fig. 1. This meter will read up to 1,000 volts and the resistance values are as follows: R1 5,000 ohms, R2 1,000 ohms, R3 70,000 ohms, R4, 15,000 ohms, R5 200,000 ohms, R6 25,000 ohms, R7 50,000 ohms, R8 800,000 ohms, R9 100,000 ohms.

A MULTI-BAND TRANSMITTER

An effective transmitter built with an eye to cost is fully described in the May QST by the Cuban amateur, CM2AD. The valve line-up is the now almost universally used 6L6G regenerative oscillator, having a fixed cathode-coil L1 which can be seen in Fig. 2. The 7-megacycle crystal is recommended and the anode circuit is arranged so that both 20 and 40 metre output can be obtained without coil changes.

A point of interest is that the cathode circuit is still in use even with fundamental output and apparently there is no need to worry about crystal current.

The output from the 6L6G oscillator is ample to drive an 809 triode on both 40 and 20 metres, and this valve is anode neutralised in the normal way. The tank condenser is a single section unit but the tapping on the tank coil is slightly off-centre and arranged so that the neutralising capacity remains constant on both 40 and 20 metres.

The idea of this is to save the cost of a split-stator condenser. The aerial coil is mounted on a stand-off insulator close to one end of the tank coil and swung so as to give the correct amount of coupling. A switch is also arranged for series or parallel feeder tuning.

A wooden chassis 17 by 12 by 4 is quite large enough to accommodate the entire transmitter, less power unit, while the oscillator coil is mounted underneath the 6L6G valve holder and is the only coil beneath the chassis.

A combination of oscillator-cathode and amplifier-grid block keying is used which gives very clean note and permits of break-in operation. It is recommended that the power unit delivers 750 volts at 200 mA., the total voltage being supplied to the 809 but broken down for the 6L6G through a 6,000 ohm 50-watt resistor.

If the amplifier is to be modulated then the anode voltage should be reduced to 600 and the coupling adjusted so that the anode current is approximately 85 mA. In such circumstances a modulator driving 25 watts of audio would be satisfactory.

This transmitter has been very satisfactory in use and from Cuba all continents have been worked on CW.

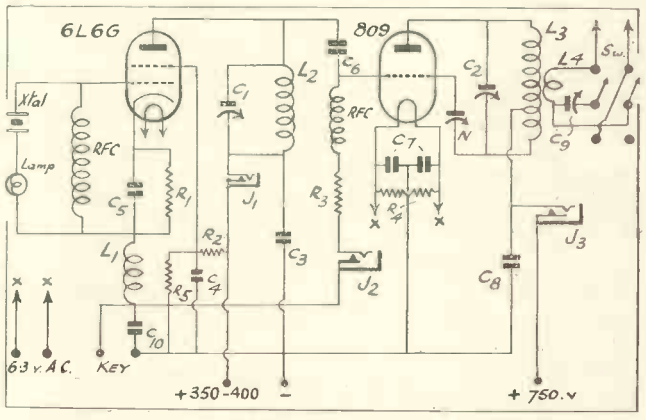


Fig. 2. Up to 60 watts can be obtained from this simple transmitter. Despite the fact that the cathode coil is left in circuit when operating on fundamental frequency, the designer states that crystal current is not high. The transmitter can be arranged for two-band operation without coil changing while the aerial is switchable for series or parallel tuning.

SIMPLE VOLUME COMPRESSION

W. C. Lamb, W6OCG, who is well known to amateurs, discusses simplified volume compression system, in the May *Radio*, and describes an amplifier of straightforward design suitable for use with a crystal microphone.

The entire amplifier consisting of power supply, speech amplifier and compressor, is built on a chassis 8 by 12 by 2½ in. As can be seen from the circuit in Fig. 3 the first two stages are pentode connected, using valves 6SK7 and 6SJ7. According to the designer the 6SK7 is an ideal valve to follow a crystal microphone.

The important part of this amplifier is the compressor, which gives excellent results. A double-diode type 6H6 is used as a bi-phase rectifier with the anodes fed by the secondary of a push-pull L.F. transformer. It will be noticed that the primary winding is connected across the output of the speech unit. Positive bias is applied to the cathode of the double diode and controlled from an accessible point by the potentiometer R17.

A very simple capacity filter removes the L.F. component and a varying D.C. voltage is impressed on the suppressor grid of the input valve of the amplifier.

A variation from zero to 30 volts positive on the 6H6 cathode enables any desired range of compression to be obtained. A resistance capacity filter network in the D.C. line to the suppressor of a 6SK7 is sufficient to prevent L.F. feedback, but still does not introduce noticeable lag.

All the constants and full operating data are given in this article which should prove of particular interest to British amateurs.

A U.H.F. Convertor

A 4-VALVE S.W. CONVERTOR

Convertors in general are very thoroughly described and criticised in an article by W6DHG and W6CEM in the May issue of *Radio*. The first convertor used an 1852 with a 6C5 R.F. oscillator. The second one, however, uses four valves. A 6SK7 R.F. amplifier followed by an 1852 detector with a 6C5 separate oscillator. There is also a VR-150-30 ballast valve in order to maintain the D.C. voltage absolutely steady.

The 6SK7 is a single ended valve of new construction which very shortly will be one of the most popular pentodes for use in R.F. stages. It is arranged so that the grid and anode leads are extremely short while the input capacity is almost as low as that of an acorn valve.

In order to keep controls as simple as possible the input to the R.F. amplifier and to the mixer are both tuned and the condensers ganged together so leaving a separate oscillator control. Band-spread condensers are also included and these have rather unusual values being arranged to provide correct tracking over the ultra-high frequency bands.

According to the designers anode and screen voltages are not critical and can be varied between 125 and 350, with the optimum value being around 200 to 225 volts.

These remarks rather tend to give the impression that the voltage stabilising valve is rather unnecessary, but this has been included in order to maintain the voltage on the oscillator at a constant figure, consequently, the convertor is as free from frequency drift as it possibly can be.

Gain is also increased by using a tuned transformer in the output stage made up of a 1,500 kc. I.F. transformer. This transformer has the secondary coil and trimmer removed from the can and replaced with 12-turns approximately $\frac{1}{8}$th of an inch below the bottom of the primary winding. This transformer then matches up the average broadcast receiver quite satisfactorily.

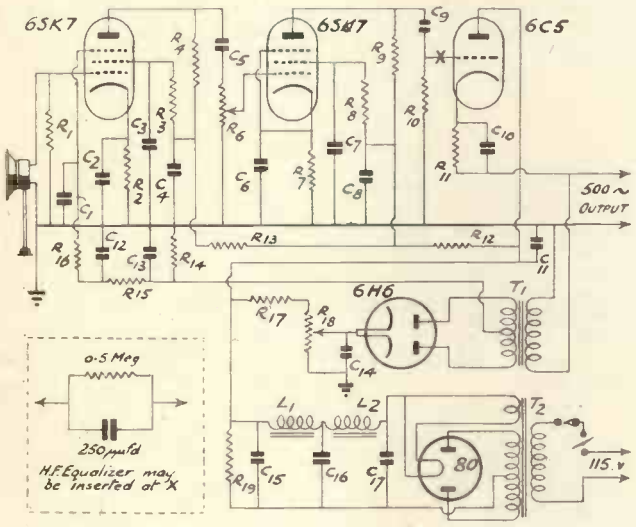


Fig. 3. In the heart of this amplifier is the simple volume compressor built around the 6H6 double diode. It requires a positive voltage of between zero and 80 to give complete variable compression.

The conventional method of injecting into the suppressor with a coupling condenser and a 50,000 ohm resistor to earth proves quite as satisfactory as connecting the suppressor directly to the oscillator cathode, so for this reason the simpler method, that of connecting to the cathode is used. It also apparently has its virtues of being free from drift and is particularly useful when the convertor is being used with mobile equipment.

A chassis $5\frac{1}{4}$ by $7\frac{3}{4}$ in. provides ample space for the four valves providing they are mounted in the manner suggested. The chassis design also permits of easy wiring and enables various components to be adjusted should it be necessary without having to dismantle part of the unit.

The convertor as it stands is particularly effective on the ultra-high frequencies up to 80 or 90 megacycles and should be of great use to amateurs who this summer will be on the U.H.F. band intent on working DX. The special valves required for this convertor are now available in this country from the usual American stockists.

Second-hand Apparatus

Second-hand receivers, etc., if they are sold by a reputable firm with a guarantee of efficiency, are practically as good as receivers when they first leave the factory.

Messrs. Webbs Radio, of 14 Soho Street, W.1, now have a second-hand section and have for sale a considerable number of modern receivers and other apparatus. All these sets are serviced and guaranteed and can be relied upon to be satisfactory in every way. The following are but a few of the receivers available.

Numerous Sky Buddys—£5 to £6 10s.
A new 1938 Sky Buddy—£8.
Sky Chief—£8.
Sky Champion—£12.
National 81X—£21.
Hallicrafter SX16—£27 10s.
Hallicrafter SX17—£30.
Hammarlund superpro—£35.
R.M.E.-69—£27 10s.
R.M.E. LS1—£32.
National 1-10—£10.

Readers who are interested in the purchase of a low-priced receiver are advised to get in touch with Messrs. Webbs Radio for their stock of second-hand receivers is rapidly decreasing.

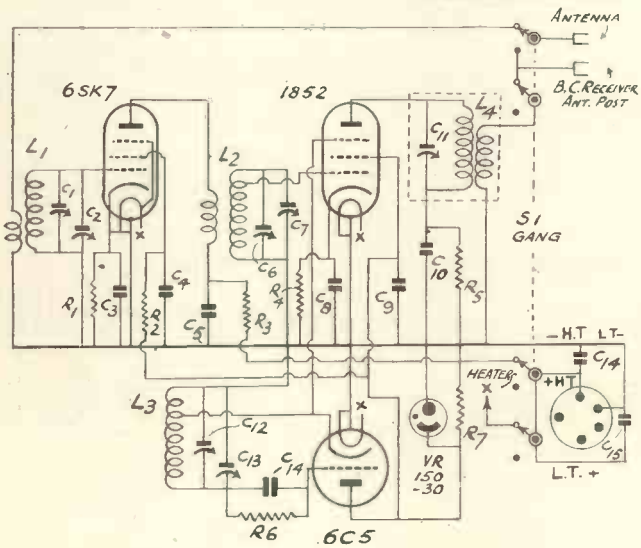
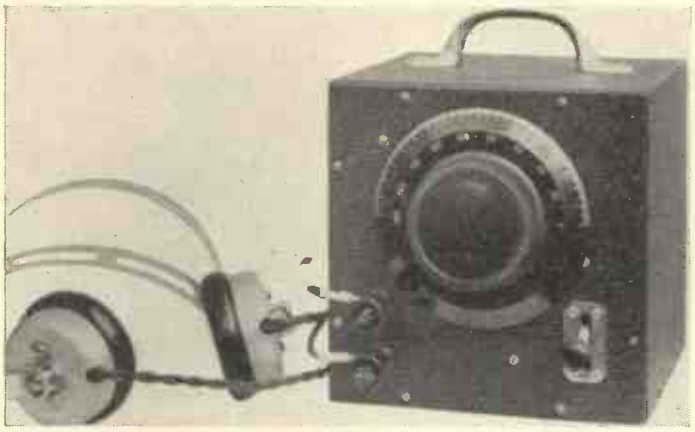


Fig. 4. Two of the latest valves are used in this convertor designed to provide high efficiency on the U.H.F. bands up to about 80 megacycles. Notice also the voltage stabiliser in the oscillator circuit which accounts in a certain degree to lack of frequency drift. A special type of output transformer is also employed.

Building Simple C.W. and Phone Monitors

Three simple monitors for phone and C.W. are described in this article by Hugh Fricker.



This is the C.W. monitor built in a special Peto-Scott metal cabinet which is only 6 ins. cube.

VERY few C.W. or telephony transmitters, no matter how well they may be built, provide a clear note or perfect modulation indefinitely unless they are checked from time to time.

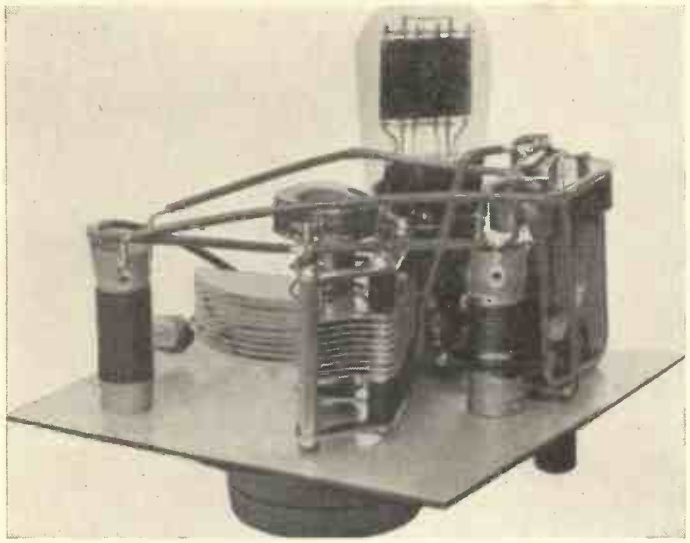
Variations do occur and although they be only very slight the accumulative effect is great, after a few weeks or so. A lot of the poor sending, chirpy signals, and bad modulation can be prevented if monitors are constantly employed. Also, telegraphists find when they are not in good trim that a monitor is a distinct help and this applies particularly to some of the new amateurs.

Monitors, if they are to be trouble free, should be of the simplest type and mains operated so that there is never any need to bother about accumulators and dry batteries. Generally speaking for C.W. operation a single valve monitor, as shown in Fig. 1 with a pair of headphones, is quite suitable and provides a reliable indication as to the type of signal being transmitted.

On the other hand, some operators do not at any time use headphones, in which case a two valve unit, as shown in Fig. 2, is more satisfactory. However, first of all consider a simple one valve monitor.

Coil Switching

Coil switching if it is of a simple nature is far more satisfactory than plug-in coils particularly as so many amateurs have multi-band transmitters. I have had built for me by Messrs. Peto-Scott, Ltd., two rather nice coils which when tuned with a .0003 mfd. condenser, cover no less than five amateur bands with only one switching. The coils have been arranged so that with a certain inductance and capacity they just cover the required frequencies. For example, coil L1 tunes quite nicely from 75 to 185 metres in one sweep, so with almost minimum condenser capacity the 3.5 megacycle band can be covered, or with a little more capacity the 2-3 Mc. R.A.F. channel and with almost maximum capacity the 1.7 megacycle amateur band.



All the components in the C.W. monitor are mounted on the panel. On the left-hand side is the high wavelength coil and on the right-hand side the low wavelength coil. Wiring should be very rigid.

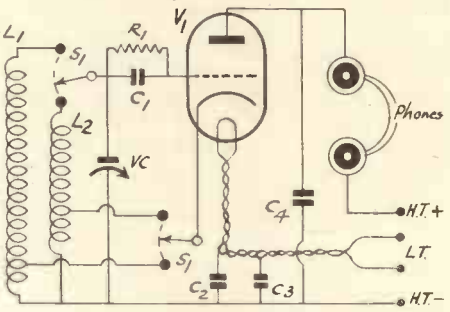
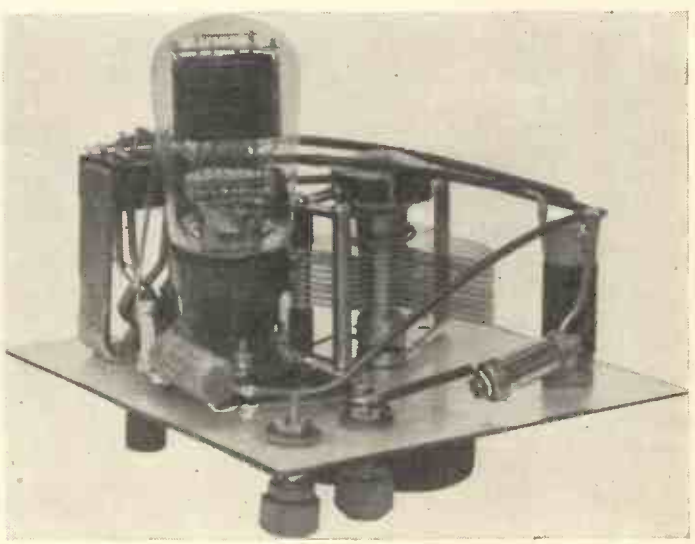


Fig. 1. The single valve C.W. monitor.

By switching over to the second coil with minimum capacity it can be tuned to the 28 megacycle amateur band, a slight increase in this capacity the 14



This view shows the grid condenser and the anode by-pass condenser. Although a valve with a clear bulb is shown, it has since been found advantageous to use a metallised bulb.

The Phone Monitor

megacycle amateur band, and with almost maximum capacity the 7 megacycle band. From this it will be appreciated that the two coils cover the main requirements of the amateur operator.

Switching is simple, merely the grid taken to the top end of L1 or L2 as required, and the cathode tap changed over to the appropriate point.

The circuit actually is a single valve regenerative oscillator with fixed regeneration, and this has proved to be quite satisfactory, although it was my intention to use a screened-grid valve and variable regeneration. However, an excellent note can be obtained—irrespective as to whether minimum or maximum is used. C4 which partially governs regeneration has a maximum capacity of .0003 mfd., but this rather a variable quantity and can be adjusted from .0003 mfd. up to .002 mfd., the correct value being found by experiment.

The whole is carefully screened, and althouth there are one or two little holes in the cabinet through which go mains leads, this is not important, and with an input of 50 watts or so to the transmitter there is no trace of blocking and the monitor can be turned to fundamental frequency in every case.

The power supply is separate and is used to power not only the C.W. monitor, but the phone monitor and other items required at the same time. Constructors will find that any voltage between 120 and 250 can be used without difficulty as the only component to be varied is condenser C4.

For those who prefer a loudspeaker, the circuit shown in Fig. 2 will be more

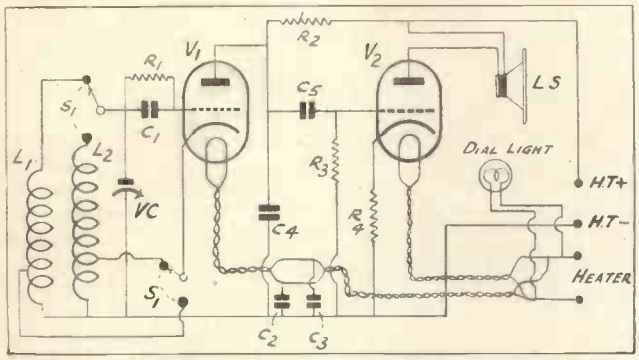


Fig. 2. A suggested two-valve C.W. monitor suitable for feeding a loudspeaker.

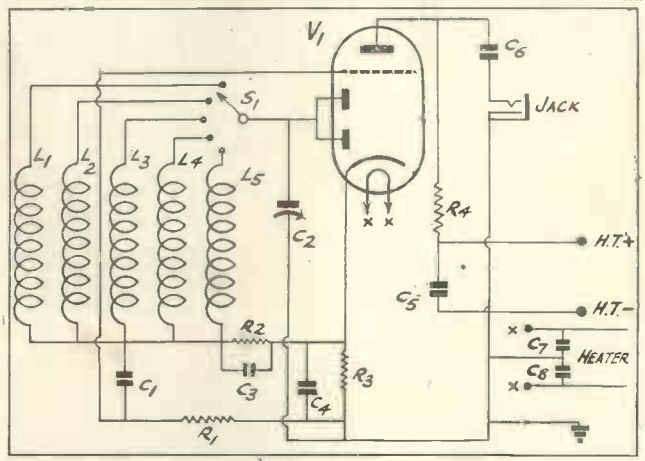


Fig. 3. On the right is the diode-triode phone monitor circuit.

A Mains driven C.W. Monitor.

CABINET.
1—6 × 6 × 6, finished black, with handle, type TMB (Peto-Scott).

COILS.
2—Type TMC to cover 9-43 and 75-180 metres (Peto-Scott).

CONDENSERS, FIXED.
1—.0001 mfd. type 690W (C1) (Dubilier).
1—.01 mfd. type 4601/s (C2) (Dubilier).
1—.01 mfd. type 4601/s (C3) (Dubilier).
1—.001 mfd. type 4601/s (C4) (Dubilier).

CONDENSERS, VARIABLE.
1—.0003 mfd. type 1047 with type 2011 dial (Jackson Bros.).

HEADPHONES.
1—Pair supersensitive (Ericsson).

HOLDER, VALVE.
1—5-pin type VH19 (Bulgin).

RESISTANCE, FIXED.
1—3 megohm type ½ watt (Bulgin).

SWITCH.
1—Lever type J.12 (Wright and Weaire).

TERMINALS.
1—Insulated terminal, type 1001, marked "Phones positive" (Belling-Lee).
1—Insulated terminal, type 1001, marked "Phones negative" (Belling-Lee).
1—Terminal block 4-way type 1139 (Belling-Lee).

VALVE.
1—AC/HL met. (Mazda).

EXTRA COMPONENTS FOR 2-VALVE MONITOR

CONDENSER, FIXED.
1—.01 mfd. type 4601/s (C5) (Dubilier).

DIAL LIGHT.
1—Type D9 (Bulgin).

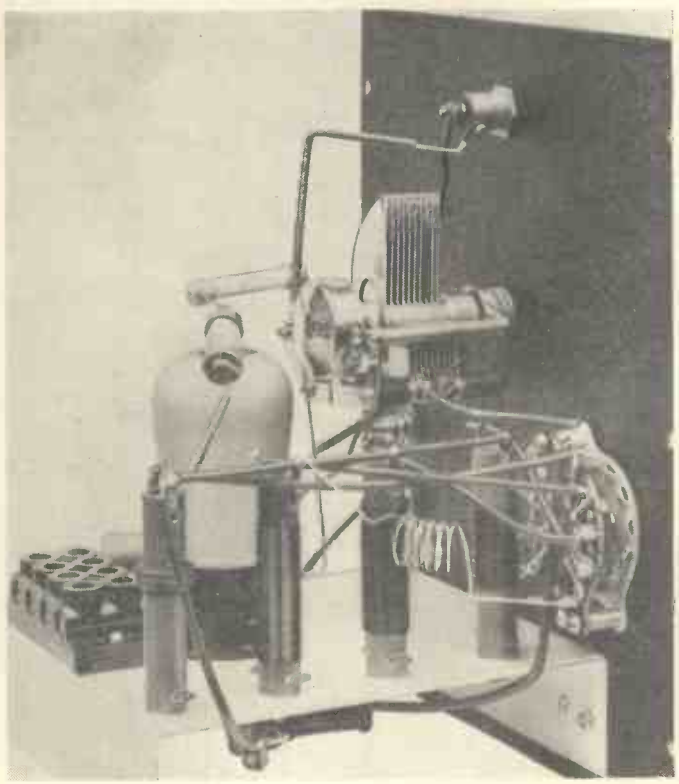
HOLDER, VALVE.
1—5-pin type VH19 (Bulgin).

LOUDSPEAKER.
1—6½-in. P.M. unit type "soundex" (Premier Supply Stores).

RESISTANCE.
1—500 ohm type 1 watt (Bulgin).

VALVE.
1—AC/HL met. (V2) (Mazda).

In view of the limited number of components there is no need for a separate chassis. Refer to the illustration from which it can be seen that there is ample space for all the different items to be mounted on the panel. The two coils are quite clearly shown and also the special right and rear lever switch.



A small chassis has to be used on which to mount the components for the phone monitor and notice that the 10-metre coil is air spaced and mounted in the wiring. The remainder of the coils have a very simple fixing with one 6 B.A. bolt.

suitable. It is the same fundamentally as the arrangement shown in Fig. 1, except that an R.F. coupled triode amplifier has been added. This provides ample gain for feeding a cone-type loudspeaker which is suitable for C.W. monitoring or even a crystal tweeter which is ideal for C.W. monitoring.

A phone monitor is little more complicated, and a complete change in design is recommended. The arrangement shown in Fig. 3 is excellent in every respect for it provides a true indication as to the tone or quality of transmission and will handle quite a big input without overload. However, despite the fact that two stages are employed, you do not use a loudspeaker owing to the possibility of feedback. The phone monitor uses five separate coils, each one covering an amateur band with the exception of L5.

L1 is for 1.7 Mc., L2 3.5 Mc., L3 7 Mc., L4 14 Mc., L5 28 and 56 Mc. It will also be noticed that L1 will just cover the C.W.R. band of 2-3 megacycles.

The value of diode load resistor and also the value of the cathode resistor is most important, but otherwise the circuit is a quite conventional diode rectifier and triode amplifier. Also notice that the two diodes in the TDD4 valve are strapped.

Condensers C7 and 8 should also be included, otherwise there is a very strong modulation hum. Owing to the fact that additional components are used as compared with the C.W. monitor, a small chassis is essential. The coils are mounted down one side, and although this is not technically a good scheme no difficulties have been experienced.

The tuning condenser need only be of 60 mmfd. capacity, but should wider coverage be needed then a 300 mmfd. condenser such as is used in the C.W. monitor can be substituted with advantage.

The switching circuit is again quite simple and is merely breaking the grid end of each coil, all earthy ends being common.

A simple filter circuit in the output of the triode portion enables either a headphone jack or terminals to be used as no D.C. voltage is applied to this portion of the circuit. The anode circuit of V1 is the load resistance R4, which has a value of 10,000 ohms, but if increased gain is required this can be increased to as much as 50,000 ohms.

Both these monitors are in use and coupled to the same power unit, as neither of them need an aerial they can be left tuned for any particular band and then it is the simplest job to monitor every transmission sent out.

The inclusion of a small milliammeter in the diode circuit of the phone monitor enables the unit to be used as a field strength meter if required. In any case it is a good plan to include this meter to get an idea as to the relative amount of R.F. available each time the transmitter is on the air.

A Diode-triode Phone Monitor

CABINET AND CHASSIS
1—Steel cabinet type 1033 (Eddystone).
1—Aluminium chassis 6 × 6 × 2 ins. (Peto-Scott).

COILS.
1—Set of 5 for 10, 20, 40, 80 and 160-metre bands (Peto-Scott).

CONDENSERS, FIXED AND VARIABLE
1—.001 mfd. type 4601/s (C1) (Dubilier).
1—60 mmfd. type 1093 (C2) (Eddystone).
1—.0003 mfd. type 4601/s (C3) (Dubilier).
1—.001 mfd. type 4601/s (C4) (Dubilier).
1—1.0 mid. type 4609/s (C5) (Dubilier).
1—1.0 mfd. type 4609/s (C6) (Dubilier).
1—.05 mfd. type 4602/s (C7) (Dubilier).
1—.05 mfd. type 4602/s (C8) (Dubilier).

DIAL.
1—Standard indigraph (Peto Scott).

HOLDER, VALVE.
1—7 pin type X312 (Clix).

HEADPHONES.
1—Pair supersensitive (Ericsson).

JACK.
1—Closed circuit insulated type (Premier Supply Stores).

RESISTANCE, FIXED.
1—500,000 ohm type ½ watt (R1) (Bulgin).
1—3 megohm type ½ watt (R2) (Bulgin).
1—500 ohm type ½ watt (R3) (Bulgin).
1—10,000 ohm type 1 watt (R4) (Bulgin).

TERMINAL BLOCK.
1—4-way type 1039 (Belling-Lee).

VALVE.
1—TDD4 met. (Mullard).

The R.A.F. C.W.R.

THERE has been an increasing amount of activity in the Civilian Wireless Reserve section of the R.A.F. during the past few months. Groups "A," "B," and "C," under trained controllers, who are training the members in their Groups are active on most evenings of the week.

Members attached to various groups in the London and district areas who so far have been inactive owing to lack of equipment or other causes have presented a problem as regards training. The Chief Technical Instructor has now made arrangements for such members to attend Morse code and procedure classes at the C.W.R. headquarters, Adastral House, Kingsway. Any member who may not have been invited to attend should send a formal request to the Chief Technical Instructor, Civilian Wireless Reserve, Room 814, Adastral House, Kingsway.

An increasing number of C.W.R. members between the ages of 18 and 32 are joining the R.A.F. Volunteer Reserve as W/T operators. The training of such members consists of instruction at town centres which are located in all parts of the country and this instruction includes regular W/T procedure and the use of aircraft W/T apparatus. In addition, members study at aerodrome centres W/T communication between air and ground, visual signalling and machine gunnery course. This instruction at aerodromes always takes place during the week-end.

C.W.R. members who wish to transfer to the R.A.F. Volunteer Reserve can now do so, and they should apply to Room 814 at the address given. However, at the moment, the positions available in the R.A.F. V.R. are limited and include such sections as W/T operators, etc.

The ground section of the R.A.F. V.R. is not yet available, but all members of the Civilian Wireless Reserve will be transferred, if they desire, directly the conditions of service are arranged. Members will be circularised when these conditions have been fixed, which it is expected will be around the middle of June.

Owing to the introduction of Summer Time, the exercises for groups "A," "B," and "C," together with the automatic Morse transmissions, have had to be revised owing to difficulty in maintaining contact during daylight hours.

At the moment the times for groups "A," "B" and "C" are 19.30-21.00 G.M.T. Automatic Morse transmissions for training purposes take place on Mondays, Wednesdays and Fridays at 21.00-21.30 G.M.T. on a frequency of 2,727 kc. The transmission on Monday evenings will be at approximately 18/20 W.P.M., and on Wednesdays and Fridays at 8/10 W.P.M.

A number of well-known amateurs who until recently were members of the Civilian Wireless Reserve have now been granted commissions in the R.A.F. V.R. Amongst the more well known are H. C. Page, G6PA, J. Hunter, G2ZQ, H. A. M. Whyte, G6WY, G. R. Scott-Farnie, GW5FI, S. G. Morgan, G6SM, J. W. Paddon, G2IS, C. H. Parsons, GW8MP, W. M. Craig, GM6JJ, C. S. Goode, G2OH, W. G. Money, G2UP, R. K. Budge, G8XH-G8XI, Kenneth Jowers, G5ZJ.

A very popular commission is that of J. C. Hosburn, Esq., who is well known to C.W.R. members as the chief technical instructor. A number of the commissioned officers who are within a reasonable distance of headquarters are receiving additional training taking the form of lectures in R.A.F. procedure, and also lectures on various topics relating to the R.A.F.

A Constant-voltage Power Unit

A considerable amount of useful information on a constant output power unit using metal rectifiers is given in the Westinghouse handbook No. 11 H. Additional uses for metal rectifiers are also discussed.

THIS is a completely new system, not employing D.C. saturated chokes, gas discharge tubes or barretters. The equipment is simple, essentially comprising only a rectifier, two transformers and condenser, and in addition to compensating for load variations, provides a remarkable compensation for variations in input voltage. Low percentage ripple in the output voltage is achieved by the circuit not only providing constancy of mean voltage, but also constancy of instantaneous voltage by conversion of single-phase to three-phase power at medium and large loads, and by reproduction of a flat-topped rectifier input wave at light loads and open circuit.

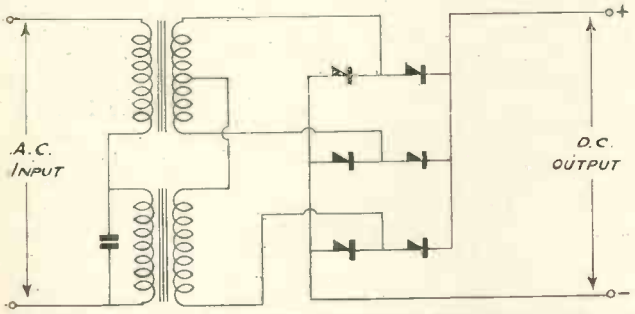


Fig. 1. This is the Noregg circuit which has an efficiency of 70-per cent. and a power factor of 0.94.

Efficiency and Power Factor

The material of the equipment is all used at economical densities, so that the initial cost and efficiency are not very different from those of a rectifier and transformer of ordinary design. Input power factor is also good. Typical figures for the 600 watt Noregg at full load are: efficient 70 per cent. and power factor 0.94.

Degree of Compensation

The compensation for load is such that the output voltage can be made to fall or rise with increase of load as may be desired. However, most Noregg sets are required for constant voltage outputs, and it is usual to design them to give an output voltage which will not vary by more than ±4 per cent. for changes in load from open circuit to full load, and mains variations of ±6 per cent.

At constant load, this variation can be made less than ±1 per cent. for mains variations of ±10 per cent.

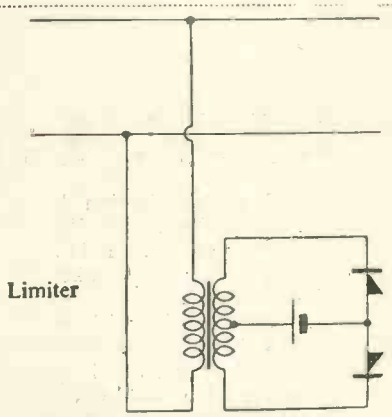


Fig. 2. A simple limiter circuit.

Smoothing

Smoothing equipment can be designed for use with the Noregg, and, within reasonable limits, the design can be such as to compensate for the drop in the smoothing choke, so that the original limits are maintained.

Circuit

The circuit, which is shown in Fig. 1, comprises two transformers and a condenser which is connected in parallel with one of them. The design is such that at full load, the E.M.F. of one transformer leads the mains voltage by 45 degrees and the E.M.F. of the other lags by 45 degrees, thus producing two transformer voltages at 90 degrees to one another. The secondaries are Scott-connected and the three output connections lead to a normal three-phase bridge rectifier. As the load is reduced, the phase displacement diminishes so that the balanced three-phase condition is progressively lost, and the mean output can be arranged to fall to the same extent as the reduction in internal resistance drop of the rectifier, thus maintaining the output voltage constant.

Fluctuations of the mains voltage produce similar compensating effects. Action is instantaneous, except for the usual dynamic regulation effect which occurs during the first cycle or two

(*Continued on page 374*)

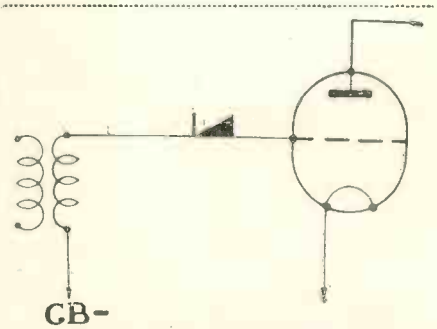


Fig. 4. Grid current rectifier.

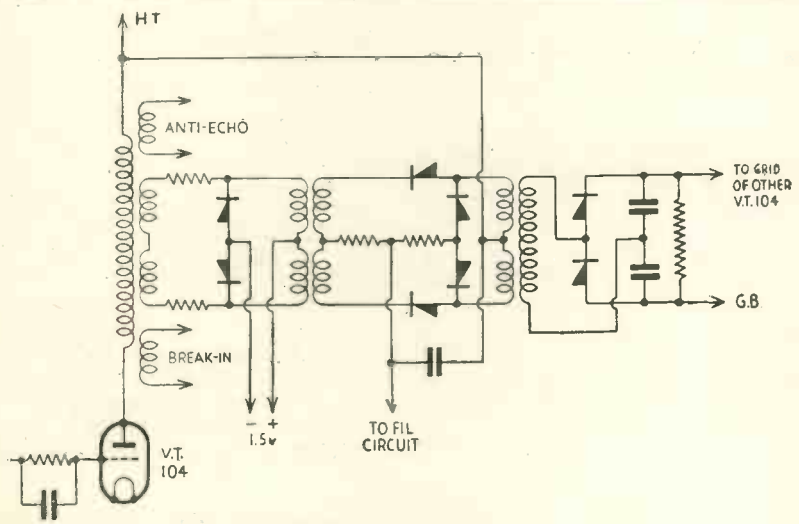


Fig. 3. Section of Post Office stabilised repeater showing three uses of metal rectifiers.

With the Amateurs

In this article by G5ZJ is news and gossip on amateur events and also information on a new rotating head for beam aerials sponsored by W1KKP

A STATION located on Treasure Island, San Francisco, with the call sign W6XBE is putting over a very strong signal into Europe and other parts of the world. Transmissions are 3.30 p.m. to 7 p.m. Pacific Standard Time, and also from 4 a.m. until 7 a.m. Pacific Standard Time.

W6XBE located at Treasure Island, San Francisco operates on the 19 and 31-metre bands. In this illustration can be seen Harold Towlson on the right, the chief operator, and Howard King the operator.

This station carries programmes from the Golden Gate International Exposition, but in view of the large number of letters that have been received from listeners all over the world it is decided to maintain this station after the completion of the Exposition.

The station is shown on this page and operates on 15,330 kc. during the afternoon and 9,530 kc. in the early morning. Reports are requested, and will be acknowledged.

Rotary Beams

Rotary beams are all the fashion at the present time, so W1KKP, Tim Coakley, who is on holiday over here at the present time, has introduced a very fine rotating head which solves most of the problems connected with rotary beams. The photograph gives a good idea as to the compactness of the unit. It operates from A.C. mains, with a motor of the induction type which is absolutely noiseless in operation. It is designed for one full revolution per minute while the housing includes an impulse switch for direction indication. The hollow spindle $2\frac{1}{4}$ in. in diameter and $1\frac{1}{8}$ in. internal diameter is suitable for the feeding of co-axial cable from the radiator down the mast.

This is the rotating beam head which is designed for one full revolution per minute. Write to W1KKP for details.

W1KKP during his visit to England stayed with G6DT the well-known DX worker. He is seen here on the left with his host in the centre.

An interesting refinement is a magnetic brake on the motor which is effective only when no voltage is applied to the motor. This prevents any movement of the aerial elements in strong wind. The dimensions of the base are 20 in. and the starting head 18 in.

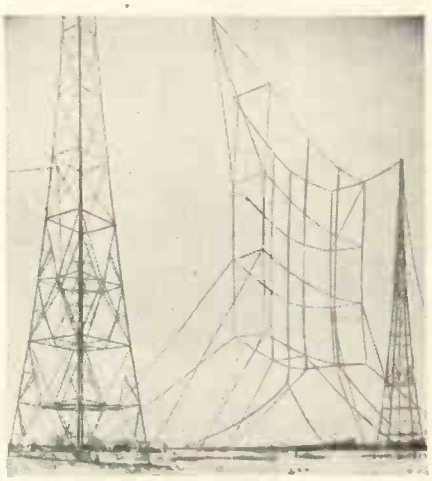
With this unit and wooden supports for the radiating elements, a rotating beam can quite simply be made. They are not available in England at the present time but can be obtained from Tim Coakley, W1KKP, 673 Boylston Street, Boston, Mass.

The I.S.W.C.

Since the International Shortwave Club changed their headquarters to the R.A.C.S. Hall, Cavendish Road, Wandsworth Road, S.W.8, a lot of improvements have been made to their headquarters. A large lattice mast has been erected on the roof of the building and fitted with a di-pole for television reception. They are now in a position to arrange quite a large number of demonstrations of modern television receivers so that members can compare results. The secretary of this society is A. E. Bear, of 100 Adams Garden Estate, S.E.16.

The International Short-wave Club have put up this impressive mast for their television aerial and hope to be able to stage a number of demonstrations during the next few months. Details of their new headquarters are given in the text.

Dr. E. F. W. Alexanderson, the G.E.C., U.S.A. consulting engineer, has designed a new aerial for use at W2XAD in order to provide a very narrow vertical beam from this transmitter. It is expected that the aerial equipment will practically double signal strength by decreasing its vertical depth, so keeping the signal path nearer to the earth's



Dr. Alexanderson has designed this aerial for use at W2XAD.

Transmissions from Australia

horizon. The masts are 300 ft. high and so far the beam is directed on to South America where reports have been obtained claiming a complete freedom from fading. The aerial is tuned to a frequency of 9,550 kc.

XX2JQ

G2JD, of Ipswich, tells me that XX2JQ can be heard in this country in the early evening and that he is anxious to work G stations. ZC6RL is also active and claims to be on top of Mount Carmel. Another station from Palestine is ZC6HS located at Haifa and when working G2HK recently he mentioned that he was using a standard Hallicrafter HT-1 transmitter and Hallicrafter SX-17 receiver on a frequency of 14,234 kc. Transmissions are every evening, except Monday, 17.00 to 22.00 G.M.T., and on Saturdays 14.00 to 22.00.

More 5-metre Schedules

Amateur radio station G5ZT, operated by H. Jones, of 69 Ribbleton Avenue, Preston, Lancashire, is very anxious to arrange schedules on 56 megacycles. It is suggested that contacts be made on either 7 or 1.7 mc. and then for each station to change over to 56 megacycles and to establish two-way communication.

The transmitter at G5ZT consists of a 42 crystal oscillator on 14 megacycles, an RK-25 frequency doubler for 28 megacycles, with a pair of RK-25's in parallel for frequency doubling to 56,020 kc. The final amplifier is an RK-35. With this rig the input can be between 25 and 100 watts with telephony, I.C.W. or C.W. as required.

The antenna is normally an 8 ft. vertical on top of a 47 ft. pole with zepp. feeders, but there are also an horizontal 8JK beam and a vertical end fed aerial available. For reception, there is a 5-valve superhet, a 3-valve receiver and a straight receiver for C.W.

Schedules are asked for the following times :—

Monday—22.00 to midnight.
Tuesday— do.
Wednesday— do.
Thursday—14.00 to midnight.
Friday—22,00 to midnight.
Saturday—22.00 to midnight.
Sunday—All day.

Will any amateurs interested in 56 megacycle work please get in contact with G5ZT at the above address.

The Paley award for 1938 has been presented to W. E. Burgess, of Westerley, Rhode Island, and the presentation is to be broadcast on Tuesday, June 6, over the Columbia network between 7.45 and 8 p.m.

The selection of Mr. Burgess was based on his heroic performance during the hurricane which devastated large sections of that part of New England. Forseeing possibility of an emergency, Mr. Burgess assembled all available batteries and at great personal risk carried them to his home. When power was wrecked, he established the only communication source Westerley had with the outside world. With trees falling all around him and houses collapsing, he rigged up temporary antenna and kept his feeble battery-operated transmitter working. For 46 hours he handled all rescue messages to and from Red Cross national headquarters, bringing relief to the stricken community, notified relatives of the dead, and carried reassuring messages for survivors.

A good example of modern transmitter design is this P.A. stage using a pair of Taylor T-55's in push-pull. It was built for Colonial use and the station is receiving excellent reports from all over the world.

Mr. Burgess is the third recipient of the William S. Paley Amateur Radio Award which is presented annually " to that individual who, through amateur radio, in the opinion of an impartial Board of Awards, has contributed most usefully to the American people, either in research, technical development or operating achievement, and to be open to all amateur radio operators in the United States and Canada."

The first award went to Walter Stiles, jnr., of Coudersport, Pa., and the second to Robert T. Anderson, of Harrisburg, Ill., both of whom were responsible for rescues of their native towns during floods.

PK6XX

PK6XX is a rare DX station, but has been heard on one or two occasions in this country. Reports generally agree that the frequency is around 14,300, and reports can be sent to PK6XX, Raymond E. Booth, c/o Indisch Amerikaansche Expedite, Hollandia, New Guinea, Netherlands East Indies.

There seems to be very rapid increase in the interest in short-wave transmission and reception and quite regularly new radio societies are being formed in all parts of the country. There are two new ones starting right away. First is the *Stourbridge and District Radio Society* in which there will be twelve fully licensed amateurs and 20 AA members. The Honorary Secretary is G8TR, and readers can get all information they require from him by writing to 4 Linton Road, Old Hill, Staffordshire. The second society is called *The Durham and District Short-wave Society,* which is being formed by Mr. G. F. Chatt, of 23 North View, Sherburn Hill, Co. Durham, and Mr. C. R. Bowes, 2DCA, of 10 Blackgate, Coxhoe, Ferry Hill, Co. Durham, from whom all details can be obtained.

During June the Sydney, Melbourne and Perth short-wave stations will be active and should be well received in this country. The following schedules have been arranged, but will change on July 1.

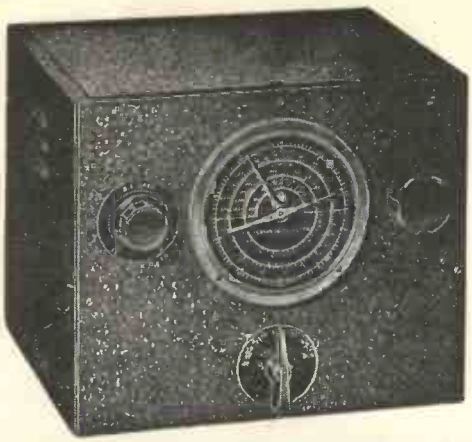
SYDNEY—VK2ME. 31.28 metres.
Sundays, 05.00-07.00 G.M.T.
10.00-14.00 G.M.T.
Mondays, 16.30-18.30 G.M.T.
MELBOURNE—VK3ME. 31.5 metres.
Monday to Saturday, 09.00-12.00 G.M.T.

(*Continued on page* 374)

G3VY of the Sheffield Short-wave Club.

R. T. Dealey, G6DT, with his R.M.E.-69 at Horndean.

2DVJ has just applied for his full call sign.



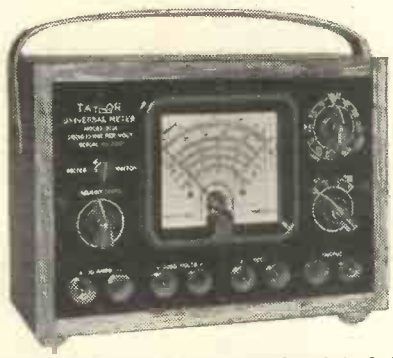
Interesting New Equipment for Short-wave Experimenters

Amateurs are advised to study manufacturers' catalogues and displays very closely during the next few weeks for a large amount of new equipment is about to be released all of which is of particular interest.

The new Peto-Scott pre-selector uses two of the latest EF8 low-noise R.F. amplifiers. It covers five bands and has its own power unit.

PRICES of components and equipment are still dropping very rapidly while the new gear which is being developed primarily for amateur use is becoming more and more interesting.

One of the most useful neutralising condensers available at the present time is the National NC-800, which has two circular plates 1¾ in. in diameter, one



Taylor's universal test set model 80A includes 70 different ranges.

of which is fixed and the other movable to such an extent that at minimum capacity there is a gap between plates of 1 in. The condenser is fitted with a locking device so that when the correct neutralising position has been obtained, the plate can be locked into position.

This condenser is on show at Webbs Radio, and is priced at 12s. It is ideal for use with low-capacity valves.

Servicing is becoming a science and no longer can receivers be put into good shape without the use of up-to-date equipment. The Taylor Electrical Instruments Co. have produced a universal meter having 70 ranges, priced at 10 gns. for the model 80A, which is 2,000 ohms per volt D.C. There is also a 5,000-ohm and a 20,000-ohm model priced at 12 gns. and 14 gns. respectively.

On the model 80A one can read D.C. voltage from zero to 2,000, D.C. current from zero to 20 amps., A.C. voltage from zero to 2,000, A.C. current from zero to 5 amps., resistance from zero to 50 megohms, and it can be used as an output meter up to 2,000 volts, a capacity bridge covering .0002 mfd. to 100 mfd. inductance up to 1,000 henries. This meter is most flexible and is complete with a 4½ in. moving coil type meter.

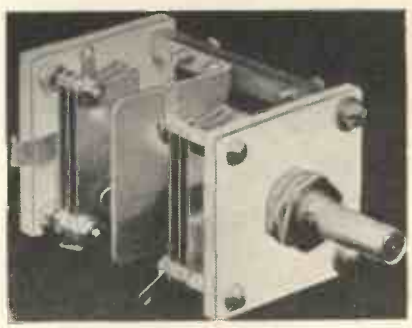
Interest in ultra-short wave working is rapidly growing and for this reason many makers are now producing specialised equipment suitable for operation up to 200 megacycles. In this class is the Cardwell type ER25-AD condenser which is a miniature two-gang with ceramic insulation. It has an extremely low minimum capacity and makes an ideal tank condenser. At its price of 10s. 6d. it is much lower than one would expect for this type of equipment.

Some of the interest in ultra-short waves may be due to the fact that the

An excellent neutralising condenser; low C valves such as the T55 or HF100 can be neutralised with this new condenser made by National. The type number is NC-800.

10 and 20-metre bands are not so productive of DX as they used to be. However, results with any receiver can be vastly improved by the addition of one or two well designed R.F. stages.

Pre-selectors for this purpose, if they are to be of any value, must be noiseless, positive in action and give the highest possible gain. The Peto-Scott Co., Ltd., realise this point, and have built a pre-selector covering 5 bands of 7 to 520 metres. They have made use of the recently produced "E"



For use as a tank condenser on the new H.F. transmitters, try this two-gang Cardwell unit priced at 10s. 6d.

series valves which do give extremely high gain with negligible noise.

This pre-selector, which is self-powered, frequency calibrated and housed in a metal case, is priced at only £6 15s., and during our tests a gain of 12 to 14 db. was obtained when it was connected in front of a good communication type receiver already employing one efficient R.F. stage.

U.H.F. valves are also becoming very popular, primarily due to the introduction of the new HK24 and the Eimac UH35. The HK24 is an extremely efficient valve suitable for use down to at least 200 megacycles, which will operate effectively with an anode voltage of 1,500. It is approximately only 3 in. in height as regards the electrode system and only a little over 4 in. including the top cap and pin. It is priced at 24s. and is a good example of modern valve technique as applied to amateur radio requirements.

The high efficiency is due to a certain degree to the use of an anode which

A Cheap 'Scope :: The HK-24

completely encloses the grid and heater systems so preventing stray emission, which sometimes occurs when the electrode systems are not accurately placed.

The cheapest oscilloscope of its kind on the market at the present time is the Raymart at £4 19s. 6d.

The UH35 Eimac product is a development of the popular 35T. It is priced at 80s. and in intermittent telegraphy service is rated for an anode dissipation of 70 watts. It requires approximately 35 mA grid current and when operating in class-C telephony will provide a carrier power of 120 watts with an excitation power of approximately 1/10th of the input power.

Supplies of these valves are available from Messrs. Webbs Radio.

Service engineers are finding that with the modern communication receivers an oscilloscope is absolutely essential. Cost is, however, generally on the high side with the exception of the new Raymart product which is all complete with tube and valves for £4 19s. 6d. The tube size is approximately 3 in. and the built-in power unit provides 1,000 volts D.C. so that the tube is operated at full sensitivity. Horizontal and vertical plates are brought out to the side of the cabinet while a self-contained 50-cycle sweep is provided. The cabinet is the same height as the average communication type receiver.

Most amateurs complain of the cost of crystal holders. The ceramic holder, type T9, which Hamrad Wholesale are marketing, is priced at 7s. 6d. while the Trolitul socket is only 3d.

These crystal holders have very well ground plates and are enclosed in a ceramic holder. The standard American two-pin fitting is used.

This holder has the usual American 2-pin fitting while the plates are extremely well ground. Hamrad also have some Trolitul switches of the low-capacity type suitable for R.F. use. They vary in price from 1s. 3d. for a two-way, to 1s. 9d. for a nine-way. This switch may solve the problem of aerial and R.F. switching in general.

It is hardly creditable that a commercial transmitter can be built covering the ultra-high frequency band from 70 to 140 megacycles and to be semi-pretuned and crystal controlled. Hallicrafters have produced such a transmitter under the type number of HT6-HF. It is actually an 80-megacycle telegraphy and telephony transmitter

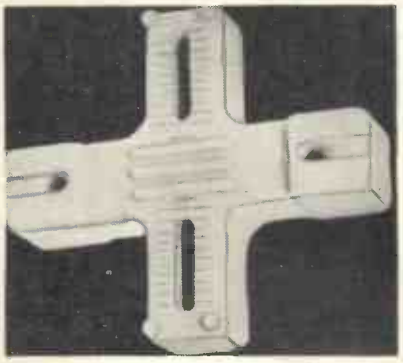
This is one of the new type heavy bar keys marketed by Webbs Radio. They vary in price from 12s. 6d. to 25s.

with a crystal included complete with a temperature oven. The amount of drift with this transmitter is negligible while the whole equipment is quite self-contained and is arranged so that the carrier power of 25 watts is available for both phone and C.W. Price is £63.

Even those amateurs who could not possibly afford such a transmitter would be well advised to examine it very closely, it is shown at Webbs Radio.

A valve which before very long will be used by most amateurs is the new HK24, a new high-slope triode suitable for U.H.F. working. It has an anode which completely encloses the grid and filament. The heater is 6.3 volts.

With so many amateurs joining C.W.R. and the R.N.W.A.R., etc., C.W. is coming back into fashion, and



The simplest way to make a neat and tidy zepp aerial is to use one of these Johnson cross feeder blocks which are priced at only 2s. 6d.

consequently manufacturers are going ahead with the design of suitable but inexpensive keys; the average light key is not too good, for when amateurs switch from a very light key to the average service bar key something generally happens. Webbs Radio have produced two new heavy keys, one of which is illustrated on this page. It is priced at 12s. 6d. and is mounted on a solid metal base. It is ideal for amateur and service use and is very positive in action.

A transmitter which has small diameter meters of the square pattern always looks most commercial in appearance and for that reason we do think that the new Premier moving coil meters should be popular amongst amateurs generally. They are available in all types including one reading up to 500 microamps., suitable for use as an R meter or a field strength meter. This particular instrument is priced at 31s., but there are others reading 0-10 mA., 0-50 mA., 0-100 mA. and 0-250 mA., which are priced at 22s. 6d. and are guaranteed to an accuracy of plus or minus ten per cent.

A good example of the new Premier meters which are 3 ins. in diameter.

Building Simple Low-power Transmitters

In this article three simple transmitters are described for battery, A.C. mains or D.C. mains operation.

IT is not necessary to have expensive apparatus, high power or even mains available in order to operate an efficient but simple transmitter suitable for spanning long distances on C.W. Many amateurs have been able to work amateurs on the other side of the world with an input of only 3 or 4 watts when conditions have been favourable.

The three transmitters described in this article are all of widely different types. The first is purely for battery operation, having an input of only 3-4 watts at the most. The second is a simple two-valver with single-valve speech amplifier which operates from A.C. mains. Thirdly, comes the most interesting one, another two valver using a pentode and a tetrode to run from D.C. mains.

Consider first the circuit in Fig. 1. It shows the complete simplicity of a two-valve transmitter which will run quite satisfactorily from a 120 volt high-tension battery and a two-volt accumulator. The maximum voltage which can be applied to this simple unit is 250, either from mains or batteries. Actually the total current taken by the final valve is less than 10 mA. and is less than 15 mA. with 240 volts on the anode and 150 volts on the screen.

The efficiency is approximately 41 per cent. and the carrier power 1.3 watts. In the first stage is one of the latest Osram transmitting triodes type DET9 which is used as a straightforward crystal-oscillator. A certain amount of bias is applied to the grid of this valve by virtue of the grid current drop across the 50,000 ohm resistance shunting the crystal. This crystal has to be purchased from one of the normal manufacturers and ground to the frequency on which it is desired to use the transmitter.

Coil L1 plus the condenser in parallel with it should also be arranged so that it will tune to the frequency of the crystal chosen. In order to reduce the voltage applied to the crystal a resistance of 10,000 ohms is connected in series with the main H.T. feed in, with a second resistance in series with the H.T. line and the screen of the second valve.

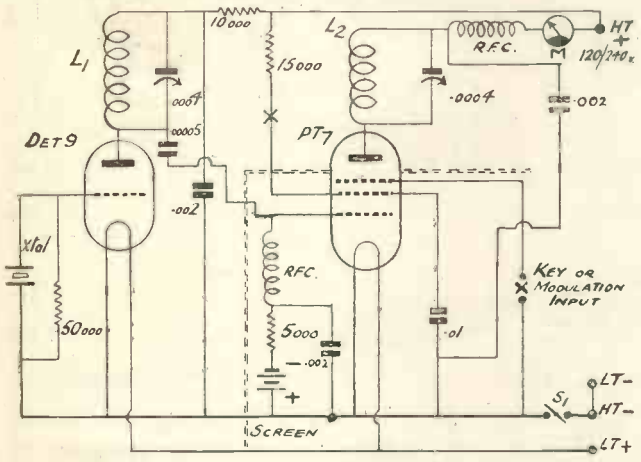


Fig. 1. Battery operated transmitter uses the latest type of Osram two-volt transmitting valve, and the input is restricted to about 3 watts.

The radio-frequency output generated in this crystal-oscillator stage is fed into the grid of an amplifying valve, in this case a pentode, via a fixed condenser having a capacity of 50 mmfd. However, in the case of the output amplifier bias is obtained by means of a resistance of 5,000 ohms plus a normal grid bias battery. Coil L2 is approximately the same inductance as L1, but to the output valve is applied the highest available voltage.

The key for Morse operation is connected in series with each suppressor grid of the PT7, but should the transmitter be used for telephony, that is transmission of speech or music, then the output from a separate speech amplifier can be connected in the point provided for the key.

Beginners who make this transmitter can use a wooden baseboard with a dividing screen in between the two stages, although this is not strictly necessary providing the components are well arranged. A modification of the circuit is shown in Fig. 2, while in Fig. 3 some idea as to how these valves are used can be gauged. Actually, the photograph in Fig. 3 is part of a transmitter for battery operation which was published in our November, 1938, issue.

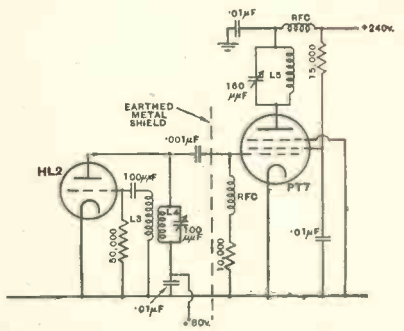


Fig. 2. In this circuit the crystal has been omitted but the scheme is not to be recommended unless a good frequency meter is available.

Those who have A.C. mains available are well advised to make use of them and the circuit shown in Fig. 4 is a very good example of extremely simple transmitter construction for telephony use. The first valve shown as V1 is a 6F6 pentode used as a speech amplifier following a high output car-

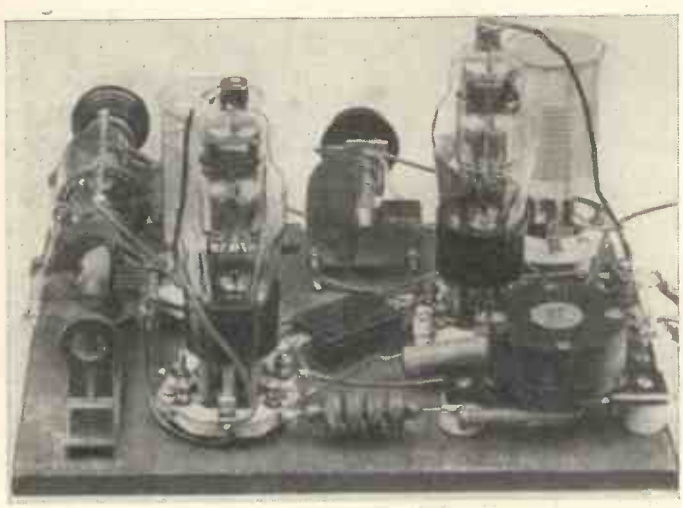
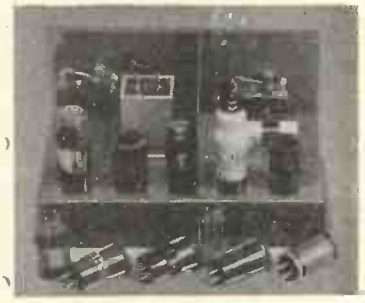


Fig. 3. A typical design of a battery-operated transmitter using two pentodes which was originally described in the November, 1938, issue.

PREMIER 1939 RADIO



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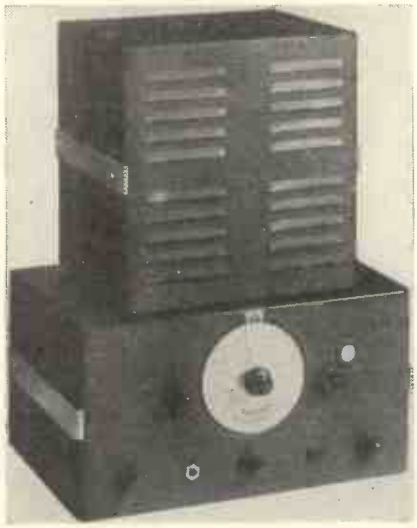

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A Tx for D.C.

bon microphone. V2 is a crystal oscillator which provides a certain output on the frequency of the crystal. V2 should preferably be a valve such as the 6J5G.

V3 is a pentode of the 802 or RK25 class and can be used either as a suppressor grid modulated amplifier or as an anode modulated amplifier. The efficiency when used as a suppressor grid modulated amplifier is not very high, but this method has been chosen because it does make the design of the transmitter so simple. Approximately 1 watt of audio is more than enough to provide maximum modulation.

With this transmitter the voltage used is much higher than for the circuit of Fig. 1, but as it is assumed that A.C. mains are available this is no drawback. With 500 volts applied to the anode of V3 and approximately 250 volts to the crystal-oscillator, the maximum power input is about 20 watts, although a 10-watt input would be more desirable.

With this circuit, however, the crystal-oscillator is made slightly regenerative by means of the choke in series with the cathode. This enables the transmitter to be used on two wave bands, fundamental and harmonic. For example, normally with a 7-megacycle crystal the succeeding stages would all be tuned to 7 megacycles as there would be ample drive from the crystal-oscillator stage on the second harmonic.

As a further example, a 1.7 megacycle crystal could be used and the output either on 1.7 or 3.5 Mc. as required. It is important that the potential divider R3 be included. This is connected across the main H.T. supply and is provided with tapping clips in order that the correct voltage to the anode of the crystal-oscillator and to the screen of the output pentode can be accurately maintained.

As this transmitter is designed primarily for telephony no keying position has been shown, but for those who are interested the key should be connected in series with the high-frequency choke in the cathode circuit of the oscillator.

Next consider the speech amplifier. The microphone must be of the high-gain carbon type with 3 to 4½ volts applied to it. The transformer T1 should have a ratio of 60/1 or 70/1 in order to provide a high step-up in voltage. The modulation transformer shown as T2 has a ratio of 1/1 with the secondary connected in series with the bias supply and the suppressor grid of the 802.

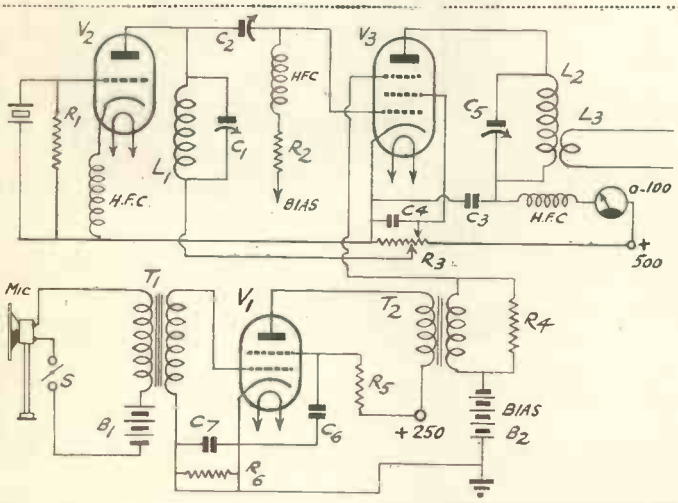


Fig. 4. With this arrangement the transmitter has been designed for telephony use and to run from A.C. mains.

It is not often that transmitters for D.C. mains are described. However, there are several valves suitable for D.C. use and in this instance, we recommend a 6F6G crystal-oscillator and a 25L6G power amplifier. Both these valves are of the low current type so that they can be connected in series with the D.C. supply. The resistance R6 connected in series with the heaters is actually a voltage dropping resistor or it can be a barreter if required.

The circuit is fundamentally similar to those previously described, but the transmitter is designed for C.W. only. As a pentode valve is used in the first stage, care must be taken not to have too high a crystal current, and for this reason a small bulb has been connected in series with the crystal, not as a protective device, but to show if the crystal is being consistently overrun. A small bias resistor is also connected in series with the cathode of the crystal-oscillator.

The coil L1 depends entirely on the frequency of the crystal, but it must be remembered that with this particular circuit the transmitter must operate at crystal frequency. It is also important that the voltage to the screen of the crystal-oscillator be reasonably steady and to make sure of this point a potentiometer network is included and made up of resistances R3 and R4.

There is no need for bias for the output valve as this is obtained automatically by means of R5 and R7; R7 really being more of a protective device than of a biasing resistor.

Coil L2 is centre tapped for the tetrode valve requires neutralising. This also means that the number of turns on L2 will exceed those on L1 by about 25 per cent. The whole of the power unit is included in this circuit for it is of such a simple type merely being one smoothing choke, and two electrolytic condensers.

As regards keying, the key can be connected at the point marked J in the anode of the crystal-oscillator or in series with R2.

Component values of these transmitters are as follows: For the circuit shown in Fig. 1 strictly as shown, with the exception that the resistor across the crystal should be experimented with in order to obtain smooth operation. In Fig. 4 R1 50,000 ohms, R2 10,000 ohms, R3 20,000 ohms, R4 10,000 ohms, R5 10,000 ohms, R6 200 ohms. C1 60 mmfd., C2 50 mmfd., C3 .002 mfd., C4 .002 mfd., C5 60 mmfd., C6 .01 mfd., C7 1.0 mfd. For Fig. 5 R1 50,000 ohms, R2 300 ohms, R3 10,000 ohms, R4 10,000 ohms, R5 5,000 ohms, R6 barreter tube, R7 100 ohms, C1 .01 mfd., C2 50 mmfd., C3 60 mmfd., C4 .002 mfd., C5 .002 mfd., C6 .002 mfd., C7 1.4 mmfd., C8 60 mmfd., C9 .002 mfd., C10 8 mfd., C11 8 mfd.

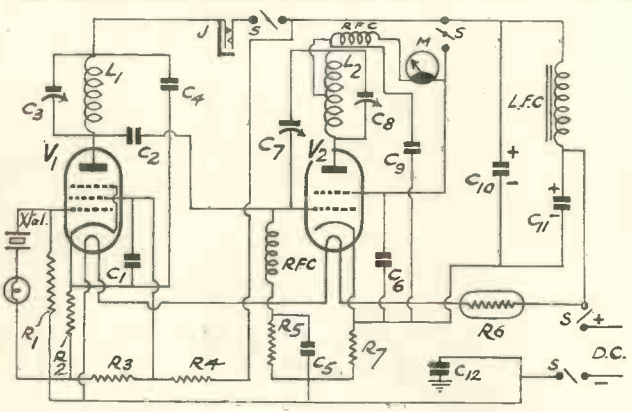


Fig. 5. For those who are limited to operation from D.C. mains this transmitter should prove very serviceable. The output is low but no additional batteries are needed.

Long Skip

G5KA would like reports from any amateur logging new DX stations.

THE absence of these notes last month (owing to pressure on space) has resulted in such a collection of DX data that we are going ahead without undue preliminaries.

G6QX, who has been a C.W. man for as long as we can remember, apparently thinks there is something in this 'phone business after all, as he is busy putting the finishing touches to a 'phone outfit. He is still finding a trace of life on 28 mc. and has worked GB8AA and PY1AZ. On 14 mc. he has accounted for three new countries. LX1KI, CR4HT and CT3AB (14,380 kc.).

Lots of newly licensed stations have had their first QSO with Spain, thanks to EA7BA, Cadiz, whose 'phone has been a fine signal on 14,030 kc. G6ID reports this one, together with lots of other nice 'phones, inccluding YN1IP, Northern Nicaragua, 14,030 kc., CE3AA, 14,040, VQ2CM, 14,180, and CX2CO, 14,070.

A card from VP2AT gives G8PL the laugh on us as we told him not to expect a QSL! We are still living in hopes of getting one ourselves! On C.W., G8PL grabbed VP5PZ, FB8AA, XZ2AB, and J8CB in Korea. This last heart-throb has also been reported by R. W. Finch, of Ilford, Essex. The frequency seems uncertain, so all we can say for the moment is he is somewhere up the H.F. end of 14 mc. G8PP has now worked VU7BR, in Bahrein, and EK1AA. Cards for the latter station go to c/o Consulate Itale, Tangier.

G6BW, Somerset, finds that the best times for 10.metre DX are a few days prior to the arrival of the new moon. This theory has worked a few months running so it looks as though 6BW has found something here. We shall be pleased to hear from any others keeping watch on this band during the summer. During the recent eclipse, G6BW was running a three way 'phone QSO with FN1C, French India, and VU2SQ, in Bombay, with R8 signals all round. He tells us that VP6MY, Barbados, is leaving late in May for a visit to this country and that he will be calling on a number of stations in June.

From Macclesfield, J. D. Heys reports the following 20 metre 'phones: LU5AN, L.F.; ZL4UK, H.F.; KA1LB, L.F.; K4ESH, H.F.; VP5PZ, H.F.; VP6FO, L.F.; OA4R, H.F.; ZC6CF, American 'phone band; YV5AC and YV4AE, both on the L.F. side. On C.W. there is ZL1DM, ZE1JH, PK4FS and TA1AA, all H.F. end.

G4AJ, Basingstoke, Hants, is now W.A.C. on 7 mc. We shall be glad to hear whether any other G4 has yet achieved W.A.C. on this band. He is running two W8JK beams on this band and the results speak for themselves! He is now going strong on 14 mc. and as he is getting some nice 599X reports from the U.S.A. we expect to see him raising some good DX.

Dennis Tyler is learning the code, but is not letting this keep him from logging DX 'phones. The highlights from his massive lists are OQ5ZZ, ZE1JA, HK1AO, HH4AS, KA3KK, HH5PA, CP1AA, HI4F, FY8AC, HP1BZ, and CT3AQ, all on H.F. end. In the American 'phone band he ran across W5BEK, Texas, W6QLD, Nevada, W7DUN, Idaho, K6KCB, Honolulu, W6CUD, Utah, and W6BIC, Reno, Nevada. After reading these DX lists from Dennis we always feel that we spend too much time calling "Test DX" instead of sitting down and waiting for it to appear!

G5KA has been more active of late, and on C.W. chalked u panother country, thanks to CT3AB, 14,380 kc. Others on the key were CM2BK, 14,325, and KA1LB, 14,260. Some nice 'phones have been contacted around 08.00 B.S.T., and HK3CO, 14,250 kc., suddenly came back to us from a dead band one morning to give us our 89th country. If we had worked all DX heard, we would be reporting VK7LZ, 14,345; PK4KS, 14,335; K5AF, 14,000; CS2V, 14,350; VP5PZ, 14,310; and VU2AA, 14,310, all on C.W. VS2AK, 14,090, kept us busy at the "mike" for an hour or so, but the calls were so much waste of time.

Radio CT3AB the only active amateur station in Madeira.

G2QL worked SU5BO, who is ex-ZB1T. SU5BO has been putting over one of the best signals from Egypt and is hard to miss on 14,125 kc. GI6TK, Belfast, has not been very active, but worked W5AVF on 7 mc. On 14 mc. he contacted XZ2AB (14,320 kc.), whose QRA is A. B. Raye, 78 Fraser Street, Rangoon.

On 14 mc. 'phone EI3J has worked 62 countries, and on 'phone and C.W. his total is 84. He complains that the number of countries confirmed is another matter. That's our complaint as well! G3BS, Chelmsford, Essex, is up before dawn these days showing the W6's just what a "G" signal should sound like! Hector tells us to look for KB6ILT, Guam, who has been appearing on 14,375 kc. around 17.00 B.S.T. Around this frequency, PJ3CO, Curacao, has been heard trying to push through the QRM. These two are both exclusive for the C.W. men!

If any of you are wondering why Pitcairn is no longer being heard, it is because they have transmitter trouble. They are likely to remain off the air until some passing ship drops its radio operator at the island to help Andrew Young locate the fault. Thanks to W2IXY for this information. In a letter to us, Dorothy passes along the data on DX worked from her station. She has contacted 88 countries on 'phone, with 83 verified. The transmitter is a 1 kilowatt job, but it usually runs between 600-700 watts. The extra 300 watts makes no difference to signal strength so it is not used.

G8TL is one of the very few "hams" licensed for portable-mobile work. He is doing well on 56 mc. and 1.75 mc. While out late one night working "top-band" DX somewhere in the region of Blackwall Tunnel, someone passed through word to the C.I.D. that an I.R.A. radio plant was touring the streets of London! G8TL had an unpleasant half-hour next morning convincing the detectives that he was only a "ham," and therefore harmless!

"Constant-voltage Power Unit"

(*Continued from page* 362)

after conditions are changed. If the system is required for energising fast operating relays, a condenser across the output may be necessary, but this must be preceded by an inductance.

A Volume Limiter

In order that speech shall not interfere with signalling on a line, it is frequently necessary to limit its maximum amplitude.

This can be effected by so biasing a pair of rectifiers connected back to back across the secondary of a transformer which is connected to line, that the speech voltage above a figure determined by the bias potential are short-circuited. An example of the use of limiter, attenuator, and voltage-doubler rectifiers is shown in the portion of the established repeater illustrated in Figs. 2 and 3.

Preventing Damage from Grid Current

Amplifying valves used to give large output at high efficiency can be damaged by abnormally strong signals. If the signal voltage exceeds the grid bias voltage and drives the grid to a positive potential with respect to the cathode, grid current flows. Owing to its low thermal mass and the fact that a certain amount of the cathode coating is usually present on it, the resulting temperature rise of the grid may be sufficient to cause an electronic emission. As soon as the signal drops, the grid bias voltage will drive current round the cathode grid circuit with the grid acting as the emitting surface, and, since the greater part of the impedance of this circuit lies outside the valve, the drop in potential from cathode to grid will be small. The grid will no longer limit the anode current which will rise to a dangerous value.

The valve can be protected by a Westector in series with the grid, since this prevents the possibility of grid current. This arrangement can be seen in Fig. 4.

"With the Amateurs"

(*Continued from page* 364)

PERTH VK6ME. 31.28 metres. Monday to Saturday, 11.00-13.00 G.M.T.

These stations all use comparatively high power but results will be vastly improved should an aerial be erected which is directional on Australia. During the morning transmissions an aerial beamed on Peru will be satisfactory, and for the evening an aerial beamed on the line Cairo-New York will be satisfactory.

There is considerable activity at the moment in Sheffield where stations are springing up with great regularity. G2VY is operating on 40 metres, both phone and C.W., while 2DPJ has just applied for his full licence.

W9BNX arrived in England on May 13 for a flying trip and several G stations were able to have a personal QSO. 9BNX is better known as Elmer H. Conklin, the associate editor of *Radio*. He has been on a cruise and in order to gain time flew from Sweden to London, which gave him an extra three days in England. W1KKP was here for quite a time and it looks as if England is becoming quite popular with American amateurs.

Romford Radio Society.—This society now has a membership in the region of 40 and meetings are held in the Red Triangle Club, North Street, Romford. The entrance fee is 2s. 6d. and there is a weekly fee of 6d. Meetings are held every Tuesday at 8.30 p.m., and G5KA, who writes "Long Skip" in this journal, is also a member. Details can be obtained from the Hon. Secretary, G3FT, 3 Geneva Gardens, Chadwell Heath, Essex.

The latest Howard receiver, the Howard 460, is now available in this country and with its wonderful specification and valve complement should

prove popular amongst amateurs interested in multi-band long-distance work. Its frequency range is 43 Mc. to .54 Mc.

The New Howard 460

The Newest Communication Set Available to British Amateurs

DURING recent years, the American Howard Co. have come to the forefront in the design of high-grade communication receivers for amateur use having a particularly high degree of efficiency above 15 megacycles.

Just available is the latest Howard set which completely "tops" all other receivers produced by this company both as regards specification and performance. It appears to have all the refinements the amateur is likely to need, while at the same time, the price is infinitely lower than that which the average amateur would expect to pay for a receiver embodying so many excellent refinements.

Frequency Monitor

This frequency monitor was designed as an integral part of the receiver and does four jobs for the operator. First it enables the frequency of the transmitter to be checked against the crystal control standard of broadcast stations. Second, the incoming transmission can be checked for exact frequency; third, amateur bands can be located and calibrated with only the slightest degree of error. Fourth, and perhaps most important, the monitor makes it possible for the amateur to pre-set the dial to an exact frequency so that he may be positive of returning to any station which he has already worked, or to set the dial on the exact frequency of a station which has not been previously worked. As far as we are aware, this is the first receiver to embody a frequency monitor.

The dial on this monitor is of the drum type having a total calibration length of 12 in. enabling the high-frequency bands to be read to less than 10 Kc. The same switch that selects the frequency monitor also selects the B.F.O. for C.W. reception.

Noise Limiter

Very few amateurs are free from local interference particularly from car ignition systems. The noise limiter embodied in the Howard 460 is designed to cut off interference disturbances having modulation percentages above 85 per cent. Noises having a steep wave front characteristic, such as motor car ignition, are very effectively reduced making it possible to receive signals that might otherwise be blanketed by this type of noise. The suppression circuit is a modified R.C.A. system which operates entirely in the L.F. channel.

Frequency range is 43 megacycles to .54 megacycles with ceramic coil forms used on all high-frequency bands. A band-spread dial is provided with 340 degrees and a reduction drive on to a special three-gang, band-spread condenser.

R Meter

In order that amateurs can accurately check the signal strength of incoming stations, a carrier level meter has been embodied which uses a moving coil type meter fed from a sensitive valve voltmeter arrangement. This circuit is most effective on weak signals such as might be obtained on the ultra-high frequency bands.

Tuning Dial

The frequency-meter dial, band-in-use indicator, main tuning calibrations, band-spread dial and carrier-level meter are all combined in one very long horizontal dial with raised calibrations and no less than four dial lights so that the calibrations are easy to read.

There are numerous controls as can be expected. These include B.F.O., frequency-monitor selection, frequency-monitor corrector and B.F.O. fixed control, frequency monitor and B.F.O. output attenuator, frequency-monitor tuning control, range control, main tuner, A.F. gain, band-spread, crystal-phase control, R meter zero adjustment, R.F. gain and mains on-off control, noise limitor switch, A.V.C. control, send receive switch, crystal switch. In addition, headphone jacks are provided on the rear of the chassis and there is also provision for a loud-speaker having a 5 ohm speech coil.

The aerial circuit is designed to take either a Marconi or conventional doublet. All I.F. transformers are of the iron-cored type including the crystal coupling transformer. The crystal circuit is arranged so that broad selectivity can also be arranged when reception of telephony is required.

We were very pleased to notice one interesting feature in that the valves can be removed through a hole in the rear of the cabinet, this hole being covered by an easily detachable perforated metal plate.

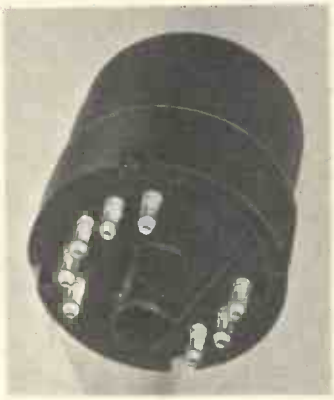
A loudspeaker is supplied in a separate metal cabinet which matches up to the main receiver. This receiver is 9⅛ in high, 8½ in. long and 8¾ in. deep. The valve line up is 6SK7 radio-frequency amplifier, 6K8G modulator, 6SK7 in two I.F. stages, 6SQ7 diode detector and first audio frequency amplifier, 6H6 double diode noise limitor, 6SF5 carrier meter and amplifier, 6K6G frequency monitor and B.F.O., 6V6G tetrode output and a type 80 rectifier.

The information regarding this extremely interesting new set has been supplied to us by Messrs. Radiomart (G5NI Birmingham), Limited, of 44 Holloway Head, Birmingham, 1, who tell us they have supplies of these receivers available, and that complete with valves, matched speaker and suitable for 110/240, volt 40-60 cycle mains, the price is £23 10s. 0d. or complete with the special crystal filter at £25 10s. 0d.

Revolutionary Changes in Valve Technique

New Tungsram "Footless" Valves

DETAILS are now available of the latest development in modern valve technique, the new Tungsram "footless" valves which to all intents and purposes are acorn types in mass production. They are larger, of course, than the acorn valves, but the average amateur set designer will find that these valves will have practically the same advantages as the more expensive acorns. The acorn valve comes into its own on the really high frequencies, and has yet no substitute.



All the new valves in the Tungsram range embodying the footless principle have the same external appearance.

The new "footless" valves comprise a range of 9 types, all of which are suitable for use in short-wave receivers down to 3 metres. They all have the same external appearance, exactly the same type of base and without any top cap connections and the R.F. types are enclosed in copper cans.

It is on short waves, however, that these valves will prove of value. They have low inter-electrode capacities, but lend themselves to extremely efficient receiver design. As the screening elements are attached to the external circuit by much shorter leads than normal, even with the identical electrode sizes the mutual input to output capacity of the valve is several times smaller on high frequencies such as is encountered on medium and short. For this reason, reception on medium and long waves will be achieved with the greatest stability, while on ultra-short waves real amplification will be possible. It has been estimated that the new R.F. pentode in this range will provide a useful amplification of eight to ten times at 3 metres and about thirty times at 10 metres.

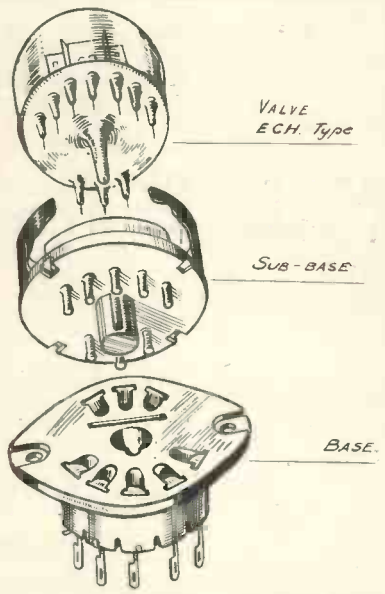
There are two high-frequency pentodes type EF11 and EF12 priced at 10s. 6d. These valves include many of the advantages of the "E" type valve, such as low noise, etc., in addition to including valuable new changes in construction. The heater is 6.3 volts at .2 ampres, while the total overall dimensions are approximately 2 in.

A triode-hexode type ECH11, priced

The new Tungsram ultra-short wave valves mark a complete change in valve technique. Amateurs will now have an opportunity of building U.H.F. receivers providing a performance almost as good as those embodying acorn valves but at very nominal prices.

at 11s. 6d., a double-diode R.F. pentode EBF1 at 11s. 6d., output pentode type EL11N and CL11N at 10s. 6d., rectifiers type AZ11 and CY11 at 9s. and a magic eye type EM11 at 8s. 6d. are all now available.

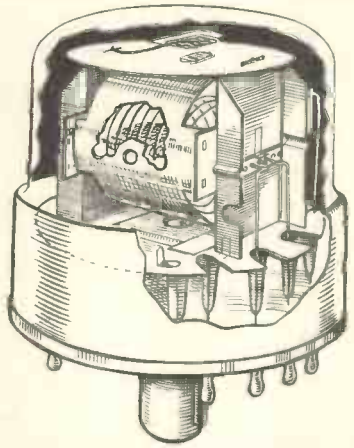
The construction of these valves is illustrated on this page. The heater is mounted horizontally around which is a cylindrical grid system with a rather large cylindrical anode. The connections to the electrode are brought out around the edge of the bulb and spaced so as to provide a low minimum capacity. The sub-base is provided with screens so that the anode and grid lead, etc., are mutually screened, while the whole plugs into a special type of valve base,



This special drawing shows the glass bulb and lead out wires underneath which is the sub-base and finally the new type of valve holder.

It will be noticed that the conventional glass foot in normal types of valves has been completely eliminated, a most desirable feature, for in the old method of construction most of the electrode leads had to be bunched together in a foot generally half-an-inch or so in width.

All the valves are mounted on the same glass disc with the same number of lead-out wires so that every type is fitted with exactly the same 8-pin base.



The electrode system is mounted horizontally with a cylindrical grid and anode in this manner.

Surface leakage across the pins has also been obviated by this new type of design, while the possibility of fracture at the weakest part of the valve is completely eliminated. The amount of leakage is now reduced by 10 to 15 times as compared with an ordinary valve employing the conventional foot.

Possibly these new valves will cause a rapid change in the design of commercial broadcast and particularly short-wave receivers, for amateurs will be quick to realise the advantages of these valves in sets designed for U.H.F. work.

Full information and operating data can be obtained from British Tungsram Radio Works, Limited, Tungsram House, 82/4, Theobalds Road, London, W.C.1.

Curing Feedback

When a microphone is used close to a powerful loudspeaker a very loud howl is often set up which is hard to eliminate. With the average public address system this trouble is a general one, but fortunately is easily stopped.

The loudspeaker should be as far away as possible from the microphone and so arranged that it is not in the same plane. Rotate the loudspeaker until the howl is stopped or reduced to a minimum. Then reduce the gain of the head amplifier following the microphone.

Radio Society Activities

Will Hon. Secretaries of Radio Societies who wish for news to appear in this column please send the information before the 15th of the month.

Romford and District Amateur Radio Society Headquarters.—Red Triangle Club, North Street, Romford, Essex. Hon. Secretary, R. C. E. Beardow, 3 Geneva Gardens, Chadweel Heath, Essex.

The membership of this society is now in the region of 40, and meetings are held weekly. An entrance fee of 2s. 6d. is made with an additional weekly fee of 6d. Meetings are held every Tuesday at 8.30 p.m. and details can be obtained from the hon. secretary at the above address. F. L. Postlethwaite, G5KA, the author "Long Skip," is a member of this society. A Field Day held on April 15 was won by the Brentwood Society which was six minutes ahead of the Romford Society. The Southend Society entered unofficially and were very successful.

The Maidstone Amateur Radio Society.—Headquarters, 244 Upper Frant Road, Maidstone, Kent. Hon. Secretary, P. M. S. Hedgeland, 8 Hayle Road, Maidstone, Kent.

Eighteen members of this society attended the amateur meeting on May 10, organised by the Medway Amateur Transmitting Society. The President, G5XB, will be operating his portable station on June 3-4 as an unofficial National Field Day station. Members of the M.A.R.S. will be co-operating with them. On Sunday, June 18, in the neighbourhood of Maidstone will be held a direction finding contest and full information can be obtained from the hon. secretary. Members are constructing their own equipment under the guidance of G5XD and a prize will be awarded to the winning competitor. This contest will take place on the 160-metre band. Club membership includes two full calls and 8 AA members, while an 8-valve communication receiver for club use will shortly be in operation.

Wirrall Amateur Transmitting and Short-Wave Club. — Headquarters, Beechcroft Settlement, Birkenhead. Hon. Secretary, J. R. Williamson, 13 Harrow Grove, Bromborough.

Meetings of members and interested amateurs are held on the last Wednesday of each month at 7.30 p.m. Membership at the moment is in excess of 45 including two full licences and several AA calls. Amateurs in the Wirrall district are advised to get in touch with the secretary for this society has an interesting programme arranged including morse classes and Field Days. A club magazine is also published.

The Aldershot and District Radio Society.—Headquarters, 41 Grosvenor Road, Aldershot. Hon. Secretary, H. Atthill, G8CV, Ardvarney, College Road, Heath End, Farnham, Surrey.

The inaugural meeting of this society was held as recently as March 17, but already a large number of members have joined. Meetings are held at the headquarters at 8 p.m., while lectures and morse classes have been arranged with outdoor events in the summer. The technical advisor is Mr. W. James, G6XM.

Surrey Radio Contact Club.—Headquarters, Alhambra, Wellesley Road, West Croydon, Surrey. Hon. Secretary, K. W. Drummond, 7 Hill Close, Coombewood Hill, Riddlesdown.

This society was formed originally to cater for the experimental and technical amateur. A very large number of amateurs have joined and a considerable amount of experimental work is carried out. The Radio Contact Club is of particular use to amateurs wishing to discuss technical problems, and is not really intended for the beginner desiring more class and an introduction to amateur radio.

The North Manchester Radio Society.—Headquarters, 14 Fairfax Road, Prestwich. Hon. Secretary, R. Lawton, 10 Dalton Avenue, Thatch Leech Lane, Whitefield, Manchester.

Members of this society come from all parts of Manchester, for the headquaters are only two minutes from Prestwich Railway Station. Membership fee is 5s. per year plus a supplementary charge of 3d. at each official meeting attended.

Club headquarter are open on Sunday afternoons for meetings, while a selection of radio magazines are available for the use of members which can be borrowed if required. Modern communication receivers are being demonstrated from time to time, while conducted tours and outdoor events have been scheduled.

Hoddesdon and District Radio Society.—Headquarters, Blairgowrie, Station Road, Broxbourne. Hon. secretary, C. Knight, jnr., Caxton House, High Street, Hoddesdon, Herts.

An interesting talk and demonstration was given on May 10 on television, while May 21 was a 160-metre Field Day with home constructed equipment. During the summer months several Field Days have been arranged including one on the 56-megacycle band. H. Jones has now received the full call of G4HJ, while other members are qualifying for their licences. The club have their own transmitter operated by G5HO, which is used mainly on 160 metres.

Dollis Hill Radio Communication Society. — Headquarters, Braintcroft School, Warren Road, N.W.2. Hon. Secretary, E. Eldridge, 79 Oxgate Gardens, Cricklewood, N.W.2.

On April 11, a junk sale was held which was a great success. Mr. Ash, G6OV, gave a talk on first aid in the case of an electric shock on April 25. This apparently was of particular interest to the transmitting members. At the last meeting on May 9, G8PI gave a talk on the frequency control of amateur transmitters in which causes of frequency drift were mentioned. Meetings are held at the headquarters on alternate Tuesdays at 8 p.m.

Medway Amateur Transmitters Society.—Headquarters, Naval Wives' Club Hall, Dock Road, Chatham. Hon. Secretary, R. Nicholson, 8 Pine Road, Strood, Rochester, Kent.

A large number of members attended the Maidstone Society's "ham evening," and there were also a number of visitors from local societies, so it is intended to reciprocate by holding a similar event at Chatham when all Kentish amateurs will be invited to attend. Several lectures have been arranged, and a most interesting one was by Messrs. A. C. Cossor, Limited, on cathode-ray measuring instruments. A talk has also been given by G2IG on television and by G6WY on the use of amateur bands.

The Woolwich and North-Kent Amateur Transmitting Club. — Hon. Secretary, K. Willis, 33 Westergate Road, Upper Abbey Wood, S.E.2.

This society has just been formed and members are required. Any reader living in this area who is interested in amateur radio should get in touch with the hon. secretary, at the above address.

The Southend and District Radio and Scientific Society.—Headquarters, 152a High Street, Southend, Essex. Hon. Secretary, J. M. S. Watson, 23 Eastwood Boulevard, Westcliff-on-Sea, Essex.

The first Field Day which took the form of a Direction Finding Contest to be run under the auspices of the Brentwood, Ilford, Romford, Welwyn and Southend Societies, was held on Sunday, May 14. The transmitter was located about 7 miles N.W. of Chelmsford and having covered 24 miles, Mr. Pugh, of Southend, won the contest in one hour thirty-two minutes.

Ilford was second and Brentwood third. The next contest is on May 11 and full information on this can be obtained from the hon. secretary, at the above address.

Phone Versus C.W.

An interesting debate held at the Edgware Short-wave Society headquarters between G2AI and G2IM on "Phone v. C.W." ended in a draw. It was agreed, however, that C.W. stations should be separated from phone stations and that the phone users should have two-thirds of each amateur band.

Three members of this society have now obtained their full calls. Mr. P. A. Thorogood, the chairman, is now G4KD, Mr. F. Bell G4JU, and Mr. M. Pugh G4JD.

A Receiver with 500 Valves

At a recent Post Office lecture on radio communication it was disclosed that one of the new receivers to be used at the Post Oce radio station near Rochester will use no less than 500 valves. It is, of course, anticipated that about 1942 will be extremely difficult to maintain 100 per cent. communication with New York unless special diversity receivers are used. The Post Office have designed extremely efficient aerial systems which will pick up not only at different horizontal angles, but also at different angles of vertical reception.

International Short-wave Club

In futuure the meeting place for members of the International Short-wave Club will be at the R.A.C.S. Hall, Cavendish Grove, Wandsworth Road, S.W.8, which is more convenient for most members and at the same time is much larger than the old club room.

Full information regarding the activities of this society can be obtained from the Hon. Secretary, A. E. Bear, 100 Adams Gardens Estate, S.E.16.

Freak U.H.F. Reception

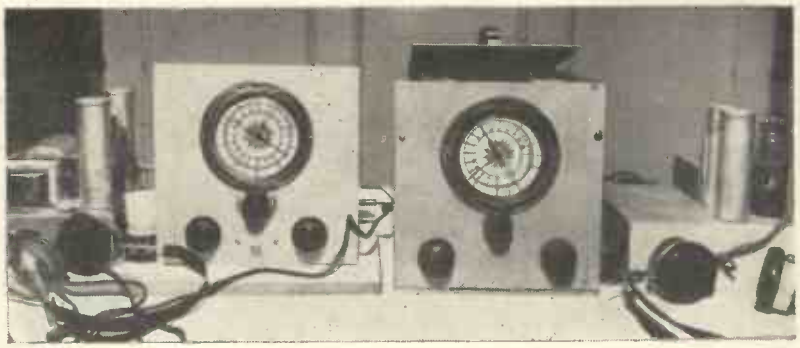
At the present time on frequencies between 25 and 40 megacycles freak reception is possible during the afternoon. Amateurs have already discovered that long-distance communication is possible with very low power between 26 and 30 megacycles, while it is also possible to pick up American police radio stations both from the control and mobile ends. These stations are best receved on a frequency of about 33 megacycles. About 30 megacycles an efficient receiver will at the present time bring in quite a large number of transmissions, many of which have rarely been heard before this year. Even the U.H.F. landing signal used at Croydon is now covering quite a wide area. The ground wave of 28-megacycle transmitters has increased, and it is quite usual to obtain good coverage in this way.

Tube Maintenance

In the electrostatic tube all the apparatus for influencing the electron stream gun, both for focusing and scanning, is situated in the vacuum inside the bulb of the tube. When the tube becomes worn out, either from cathode or screen failure, this focusing and scanning gear (which, of course, is not worn out all) has to be discarded along with the old tube.

On the other hand, in the case of the electromagnetic tube, the focusing and scanning arrangements are in the form of coils surrounding the neck of the tube and *outside it*. The tube itself contains only the electrode elements and screen. The coils, being fixed to the chasis, will last during the life of the receiver and do not have to be replaced with the tube.

Norwegian amateurs are particularly active at the present time with portable equipment and requests for schedules are made in this short article describing some of their work.

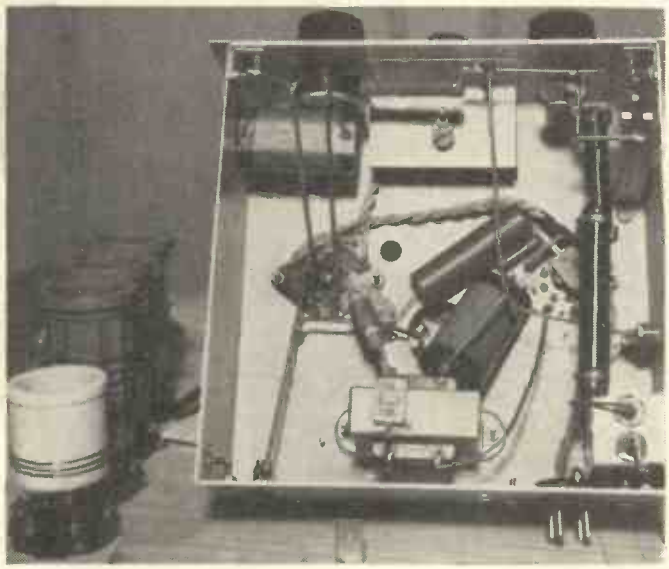


This photograph shows two receivers with their power packs.

Norwegian Portable Equipment

ONE is accustomed to hearing a lot about the activities of American amateurs even from Canada and Australia, but there is very little information regarding the work carried out by the smaller countries in Europe.

A few months ago we heard from a well known Norwegian amateur, LA1G, that the Norwegian Amateur Sending Union, which has a large number of members, now over 200, were building 35 receivers and 20 transmitters for portable use. The receivers were two-valvers to a design published in TELEVISION AND SHORT-WAVE WORLD for March, 1938, by Kenneth Jowers. This set was originally designed for 10-metre operation, but has been found to give a good performance on all other amateur bands.



As can be seen from this sub-chassis view the very minimum of components are required while coils cover all amateur wavebands. It is recommended that the U.H.F. coil be wound on ceramic.

The portable transmitter used by LA1G with an input of 5 watts.

The transmitters have been made all complete including a meter and a common power supply for the transmitter and receiver. The total cost of the receivers was approximately 50s. and of the transmitters, etc., £5. The circuit of the transmitter is shown on this page from which i can be seen that it consists of a 6L6G electron-coupled oscillator, arranged so that a crystal can be connected into circuit and the coil removed without much difficulty. The power supply is quite conventional providing 400 volts D.C. The total input is kept to approximately 5 watts or less, as the balance of the power is taken by the receivers

Despite this low input, good DX has resulted, and LA1G, when operating a portable, worked W1COI, and obtained a report of QSA5 R9. The R9 was not estimated, but actually measured on a signal level meter. Other good contacts were VE1DC at R8 and PY1GR at R7. During these contacts the input was actually 250 volts at 20 mA. to the single 6L6G.

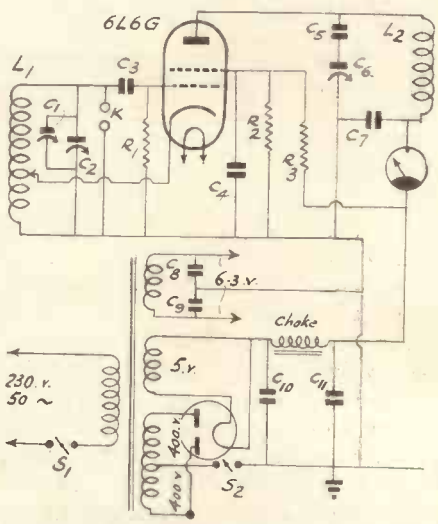
Some idea as to the size can be obtained from the illustration. The actual chassis is only approximately 8 in. wide and this provides ample space as can be seen from the sub-chassis view.

All bands are covered, but it is stressed that the ultra-high frequency band should have coils wound on ceramic coil forms. The suggested coil form is illustrated.

Refer to the theoretical circuit of the transmitter. The grid circuit of the 6L6G is tuned by C1 and C2. L1 is a standard plug-in coil on a 1½ in. former. An adjustable cathode tap is provided and condenser C1 provides a reasonable degree of band spreading.

A crystal if required can be plugged

(*Continued on page 384*)



This is the circuit of the single valve transmitter with which contacts have been made in America Canada and South America.

"Norwegian Portable Equipment"

(*Continued from page 382.*)

in at the point marked K, but the coil L1 must be removed.

In the anode circuit L2 is an air spaced coil terminated in 5-amp. power sockets. Across it are C5 and C6. C5 is a semi-pre-set type of condenser with C6 providing band-spreading to line up with C2. In order to maintain a steady note, the screen voltage is obtained by means of a fixed potential divider made up of R2 and R3, which are in series and connected across the main H.T. supply.

Aerial coupling is by means of a link plugged into L2.

This equipment, which has proved so successful in Norway, could well be used by British amateurs, particularly as the design of the receiver has been so fully described.

The secretary of the Norwegian Amateur Sending Union is LA9D. Members are particularly keen to co-operate with British amateurs in contests or Field Days, particularly on ultra-high frequencies. They also wish for contacts on 10 metres, with stations outside the skip area. It is also mentioned that as the N.R.R.L. does not forward QSL cards to non-members, which the N.A.S.U. do, British amateurs would be advised to sends cards via P.O. Box 2084. The N.A.U.S. distribute cards immediately without delay.

Mullard TV06-20

A recently introduced valve by the Mullard Company is a transmitting pentode, type TV06-20, designed for use as crystal-oscillator, frequency-doubler and class-C R.F. amplifier.

When used as a class-C amplifier,

the output is approximately 38 watts. The anode-grid capacity is only 0.1 mmfd. while the total cathode-grid capacity is approximately 16.4 mmfd. This valve is provided with a 6.3 volt heater at which the current is approximately 1.3 amperes. A total emission of 800 mA. is claimed.

The operating limits are as follows:

Max. anode voltage 600
Max. anode dissipation 18 watts.
Max. cathode return current 110 mA.
Max. screen voltage 300.
Max. screen dissipation 5 watts.
Minimum wavelength, at maximum voltage, 5 metres.

Full information on this valve and how it should be used is obtainable from the Mullard Wireless Service Co., Ltd.

Hamrad Wholesale Limited

Amateurs should make a special point of visiting the showrooms of Hamrad Wholesale, at 32 St. Lawrence Terrace, Kensington, where they will find un unbelievably large number of components, most of which are completely new to British amateurs.

In addition, Hamad Wholesale have now produced two more new communication sets, both of which set a new "high" in value for money. The model 140, a 12 valve receiver costing £27 10s., is an exceptionally fine example of British workmanship. It includes an excellent crystal filter, amateur band or general coverage, and a direct reading R meter which works both on phone or C.W. It is fed from a valve voltmeter circuit connected into one of the diodes in the double-diode triode. This diode also is in turn fed from the final I.F. amplifier.

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BUSINESS :: EQUIPMENT :: EMPLOYMENT :: MISCELLANEOUS

The charge for miscellaneous advertisements on this page is 12 words or less 2/-, and 2d. for every additional word. Single-column inch rate displayed, 12/6. All advertisements must be accompanied by remittance. Cheques and Postal Orders should be made payable to Bernard Jones Publications Ltd., and crossed, and should reach this office not later than the 15th of the month previous to date of issue.

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