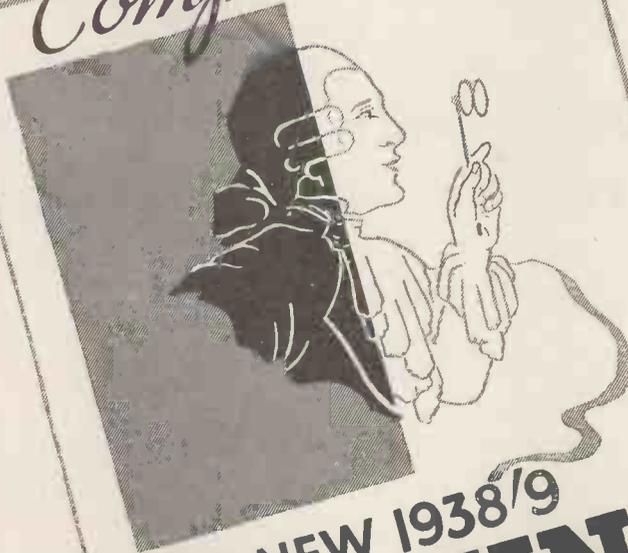




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The new Mazda economy valves
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Ediswan short wave transmitting
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THE EDISON SWAN ELECTRIC CO. LTD., 155 CHARING CROSS ROAD
LONDON, W.C.2



R.M.345

TELEVISION

and SHORT-WAVE WORLD

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COMMENT OF THE MONTH

The New Receivers.

A STUDY of the new receivers on show at Olympia and the Berlin exhibition indicates most definitely that television development is proceeding on standard lines. In other words, there is not the slightest promise, suggestion, or indication of any out of the way principle being developed which will revolutionise existing methods of reception and render the present type of receiver obsolete. This fact is gratifying, but to a large section of the public who regard television as a development which has arrived in the course of a period which may be reckoned in months it may come as a surprise, especially as for years the extravagant ideas of would-be inventors have been put forward as accomplished facts.

There are two systems of television reception that are possible and practicable—the cathode-ray and the mechanical-optical. As the demonstrations at Olympia show both are entirely practicable and both are the result of many years of intensive research and the expenditure of huge sums of money in all the most important countries of the world. America, Germany and France are working on lines concurrent with our own. Finality has not been reached by any means, but it is certain that future development will be upon the lines with which we are now familiar and the possibility of it being rapid is very remote.

Picture size and cost are the too-most frequent matters of criticism and however unfortunate it may be, they are bound up one with the other. Every effort has been made by manufacturers during the past year to increase the one and at the same time reduce the other, but it has been found that any very material reduction in price has only been possible by a reduction in picture size on account of technical reasons which need not be discussed here. The potential buyer whose pocket is not too deep has therefore been catered for by the production of receivers at prices little in excess of a radio gramophone giving pictures of small size but which is adequate for a small family circle. For those whose means are not so limited there is ample choice of receivers which from any point of view are beyond criticism.

So far as the cathode-ray type of receiver is concerned it appears likely that future development will be by projection methods and it is interesting to note that several examples have been developed both in this country and Germany which are capable of giving excellent results, results which are, in fact, the equal of the average home cinema. The prices of receivers of this type are, however, beyond the person of average means and there appears to be no possibility of any material reduction in the immediate future.

Mechanical-optical methods obviously have great possibilities in providing increased picture sizes both for home and public use. The mechanical home receivers now offered for the first time to the public are simple to operate and reliable.

TELEVISION AND SHORT-WAVE WORLD

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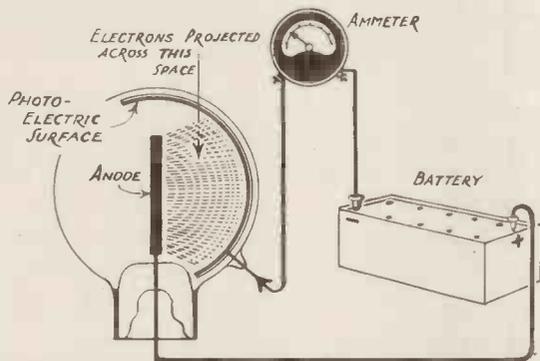
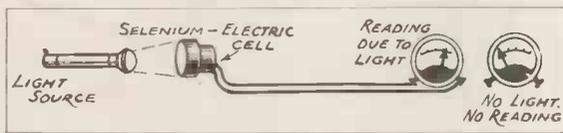
TELEVISION WITHOUT EYE-STRAIN —
FOR THE FIRST TIME AT RADIOLYMPIA
STAND 22

TELEVISION FOR THE BEGINNER

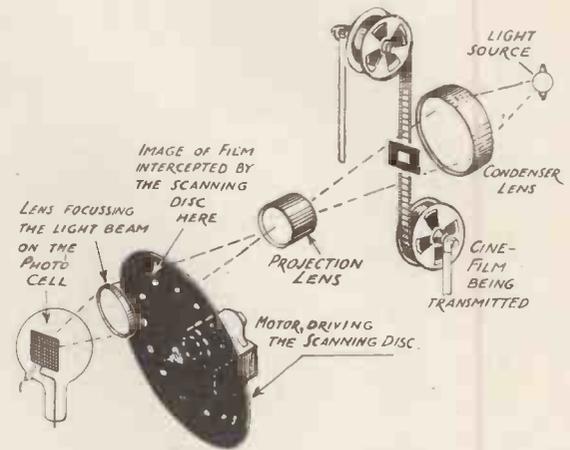
A SIMPLE PICTORIAL EXPLANATION

In broadcast transmission speech and music are converted into electrical impulses by means of the microphone, amplified to a high level and then impressed on the transmitter carrier.

amount of light falling on the cell. The scheme is very insensitive but for the purpose of this explanation the selenium cell be assumed to take the place of the microphone used in sound broadcasting.



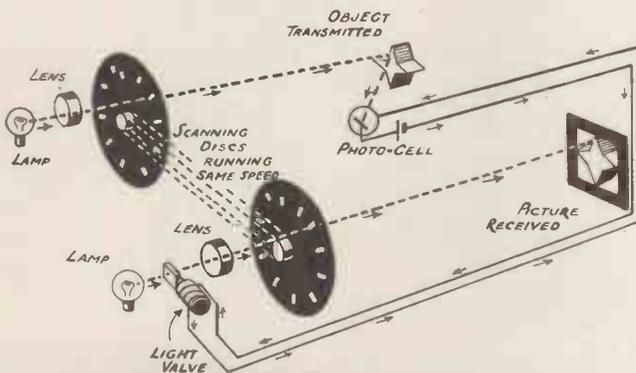
A. Two types of light cell for converting light into electrical energy.



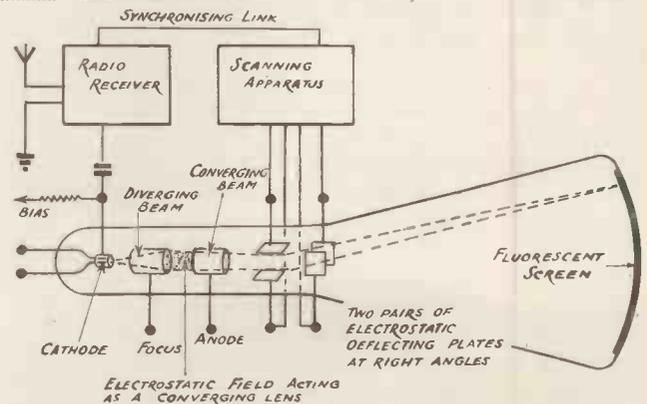
B. Simple outline of mechanical transmitter.

With television a similar sequence of events occurs except that instead of speech there is light, that is a picture, to be converted in electrical impulses. The

Quicker response can be obtained from the photo-cell element also shown in A. The photo-cell provides a current output which varies in degree with the amount



C. Schematic outline of mechanical transmitter and receiver.



D. The outline of a vision receiver employing a cathode-ray tube.

easiest way in which light can be changed into electrical energy is by the use of a selenium cell, as shown in A. The current output from the cell varies according to the

of light applied to it.

The diagram B shows how the light cell is applied in vision broadcasting. A light source is projected

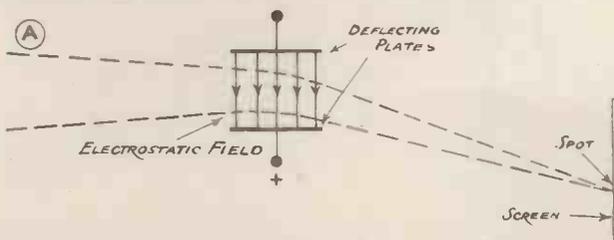


Diagram showing how the cathode beam is deflected electrostatically.

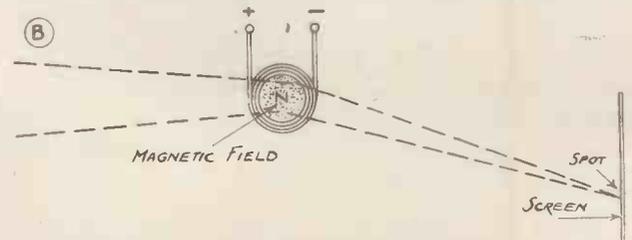
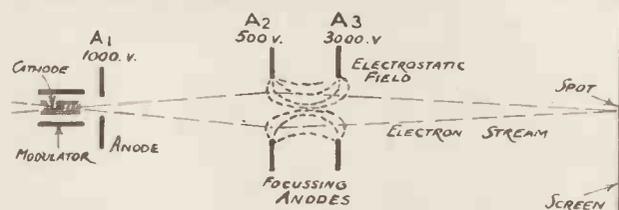


Diagram showing how the cathode beam is deflected magnetically.

ELECTRONIC TELEVISION

through a film to be televised and, according to the difference in density of the film so a fluctuating amount of light is applied to the photo cell. The rotating scanning disc is arranged so that it scans completely the film or object to be televised a certain number of times per second. In this way the light fluctuations of unit areas of the film are accurately impressed on the photo cell



How the cathode beam is focused by applying voltages to the anodes of the cathode-ray tube.

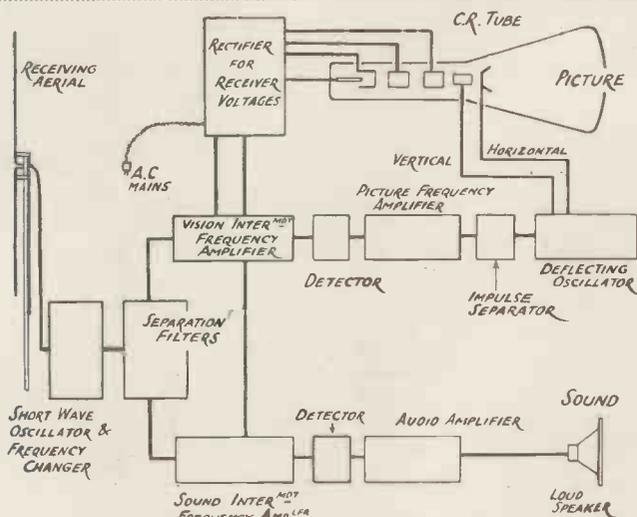
Movement of the beam is effected by means of voltages applied to two pairs of horizontal and vertical plates. In this way the beam can be made to travel horizontally and vertically in a similar way to the mechanical scanner. With some types of tube the beam is controlled by electro-magnetic means.

In the illustration D is shown the make-up of a simple modern television receiver. E shows how the signals from the transmitter are picked up and applied to the sound and vision receivers.

On the sound side the signals are amplified, rectified and applied to the loudspeaker in the usual manner.

On the picture side the signals are amplified and applied to the cathode-ray tube. Also transmitted and recorded are synchronising signals which keep the beam in step with the transmitter.

In this way variations of current are recorded and



E. Outline of a combined vision and sound receiver employing a cathode-ray tube.

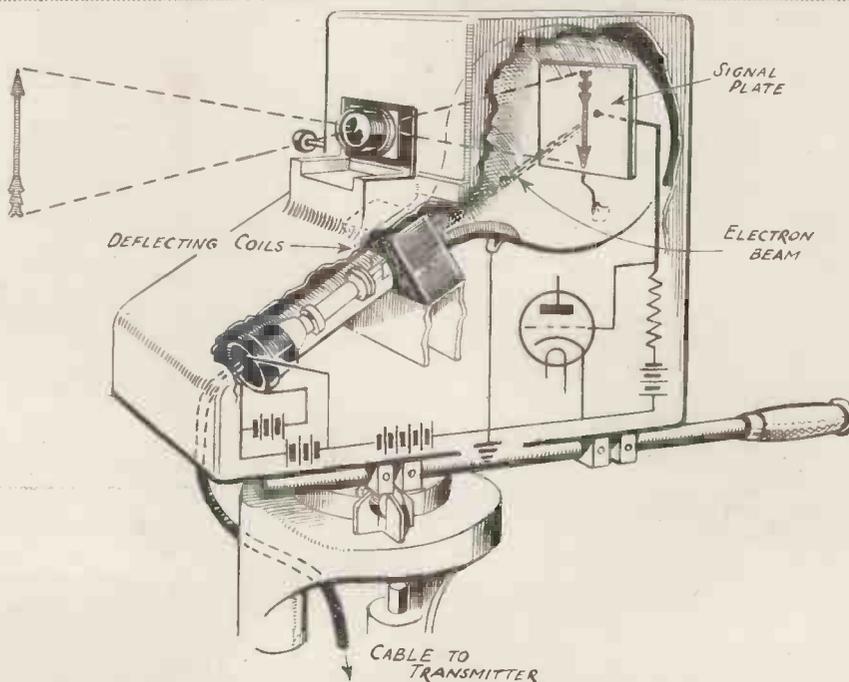
behind the scanner. This light is then converted into electrical impulses which, after amplification, are broadcast.

A very simple pictorial explanation is shown by C, in which light projected through the scanner on to the object to be transmitted is reflected back to the photo cell, converted into electrical energy and transmitted. The signals are received, converted back into light and passed through the scanner on to the screen. As the scanner rotates at exactly the same speed at both transmitter and receiver the light fluctuations are in the same position and sequence, so that the picture is built up at the receiving end.

In place of the mechanical scanner a cathode-ray tube can be used. This tube, built on large valve lines, consists of a heater, cathode, anodes and both vertical and horizontal deflector plates.

An electron beam is produced from the cathode and impinges on the screen of the tube.

The screen consists of material which fluoresces as the beam strikes it and is revealed as a spot of light.

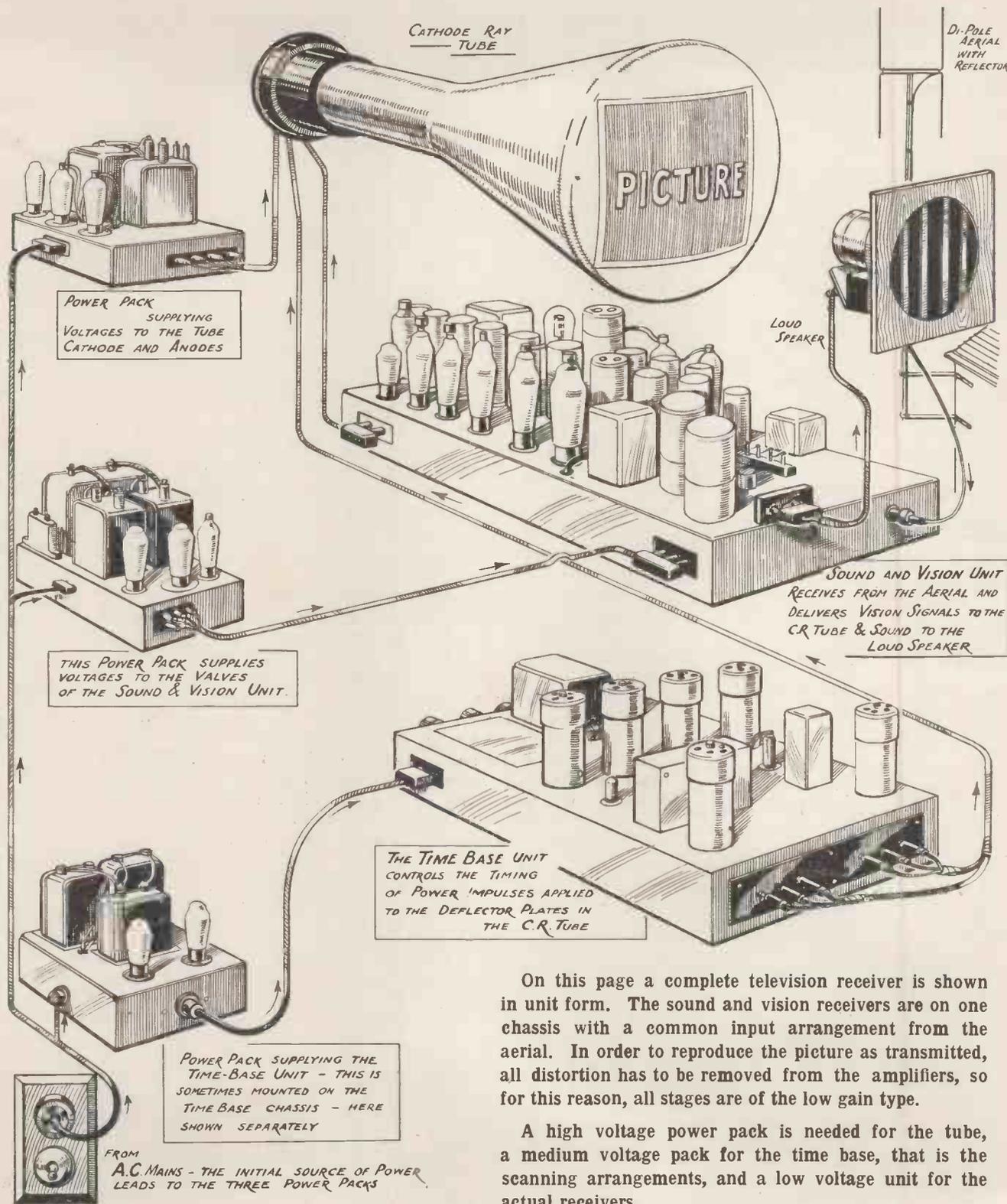


F. Diagram of pick-up camera which converts light into electrical impulses.

converted into light variations which correspond with the original scene.

A schematic diagram of the electronic camera used for transmission is shown at F.

THE SCHEME OF A MODERN CATHODE-RAY RECEIVER



On this page a complete television receiver is shown in unit form. The sound and vision receivers are on one chassis with a common input arrangement from the aerial. In order to reproduce the picture as transmitted, all distortion has to be removed from the amplifiers, so for this reason, all stages are of the low gain type.

A high voltage power pack is needed for the tube, a medium voltage pack for the time base, that is the scanning arrangements, and a low voltage unit for the actual receivers.

THE PLAIN FACTS ABOUT TELEVISION

We present here a plain statement of the present position of Television which should remove certain misconceptions which exist in the public mind

AS a result of an enormous effort involving tremendous application of intellectual and financial resources there has been perfected what is unquestionably a most astonishing art, namely, the ability to transmit moving pictures via the ether.

Unfortunately, up to the present the public has not availed itself of this new art to any considerable extent, and it is of interest to inquire why.

Firstly, are present day television methods good enough, and are they technically sound?

The answer is, without reservation, —Yes.

It is a fact that no one has criticised the quality of television pictures. In truth, they cannot, for the quality possible and in general attained with receivers conforming to accepted practice is outstandingly excellent.

The question then as to whether the technical perfection of the art satisfies is disposed of with an unqualified affirmative.

Standardisation

But in spite of this fact the public, it would appear, generally feel that some bright inventor will quite suddenly discover a very simple unit which, at an extremely low cost, can be attached to existing radio receivers and provide pictures in addition to sound. But they do not feel that a similar genius will suddenly present them with a simple attachment to convert their motor cars into flying machines. The comparisons are essentially analogous.

The fact of the matter is that, despite popular opinion to the contrary, no epoch-making invention has ever been suddenly developed, but has been the result of the painstaking application of contemporary knowledge.

There is, therefore, no reason whatever to suppose that the present principle of television is likely to be supplanted by a system radically different to present-day methods.

In the U.S.A., Germany, France, Russia and other countries, independent development of television has progressed on lines identical to ours. Pictures have been received in this

country from France and Germany employing standard receivers designed in the first place to receive our own transmissions.

It is obviously a fallacy to imagine that present-day television is all wrong technically, and that in the near future some new principle will render obsolete existing apparatus.

Cost of Receivers

Next, there is the question of the cost of a television receiver. Throughout the development of sound broadcasting, the public witnessed and took advantage of continual price reductions. The supposition exists that because of this television prices similarly will come tumbling down, and that the best plan is to wait until the television receiver is cheaper.

Is there any justification for this view? Well, let us see. Prices become lower as mass production methods become applicable so that, on the face of it, it would appear that the cost of television outfits will be reduced concurrently with increased demand. It is obvious, however, that some must buy at present prices to create this demand. Is there any sound argument that can be presented to these people to convince them they are not wholly lacking in wisdom in thus seemingly giving magnanimous support to the industry and assisting the pockets of their more cautious fellows?

It happens there is, and a very good one too.

A complete television receiver is an elaborate radio receiver. As such it is comprised of components and valves identical to those contained in a normal sound receiver. All these parts, without exception, are at present mass produced. Their cost already is a minimum. They cannot be further cheapened. As the cost of these items represents a very large proportion of the total cost of a television receiver it is difficult to imagine the possibility of the mass production of vision receivers affecting their cost to any worth-while extent.

Undoubtedly cheaper receivers will be available, but their lower cost will be made possible by a reduction in

size of the picture and probably employment of existing sound receivers to furnish the sound accompaniment.

Now the arguments set out above are largely irrefutable. There is no reason why they should not be accepted as representing accurately the present technical position but, even assuming they are accepted in part or whole, the success or otherwise of television must rest finally with the British Broadcasting Corporation.

This is obvious, but require enlarging upon somewhat if we are to see in what way the B.B.C.'s policy should be shaped to make full use of this new medium.

The B.B.C. Programmes

At present the television service occupies the unsatisfactory position of being a poor relation to the established parent organisation. Furthermore, it is directly in competition with this parent organisation, and the parent holds the purse strings. Also, it has the final say in all matters pertaining to its rival's development. A certain form of obstruction exists.

An obvious fact is that sound conveys a part illusion. Accompanied by the appropriate scenes, this illusion is enormously augmented. Indeed, the enhancement of the illusion is enormously greater than can ever be achieved with large improvements of reproduced sound quality, no matter how close to the original sounds these improvements bring us.

If the imagination be permitted to dwell upon a typical evening broadcast and be further encouraged to envisage the degree of entertainment that could be reached if all items were accompanied by vision, a vista of an absorbing home entertainment is presented.

As a brief example of what we may expect in the near future we commence, say, with the "News Bulletin." Here we shall see and hear the lugubrious weather prognostications rendered plainer with simple charts. We then go on to the news from the various fronts, fading from the speaker frequently to have shown

(Continued on page 583)

TELEOLYMPIA



Special Television Exhibition Report

AUGUST 24 to SEPTEMBER 3 inclusive. 11 a.m. to 10 p.m.

ADMISSION 1/6 including tax

This year Television occupies a very prominent position at the Radio Exhibition. It is, in fact, the newest and principal feature of the show and provides the first real attempt to show the public that the future home entertainment will be sound and vision. Each television receiver manufacturer has been enabled to demonstrate receiver performance as an exhibit and the public are able to appreciate that no longer are darkened rooms necessary to enjoy the television programmes. In addition a large television studio with glass walls has been provided and from this special programmes are being radiated which the public can see in actual production. During the period of the Exhibition approximately six hours of television programmes are being radiated daily.

BAIRD TELEVISION LTD., Worsley Bridge Rd., Lower Sydenham, S.E.26. Stand No. 19

The Baird Company have produced a new range of models which has been graded carefully to meet the varying needs of a rapidly expanding viewing public and each set is a fine example of

what television has to offer to-day. Incorporated in each receiver is a Baird "Cathovisor" cathode-ray tube, which is completely electro-magnetic in operation.

a power consumption of 150 watts, and the price is 44 guineas.

Console Model T.18.—The Console model gives a picture 10 in. by 8 in. in size. The general specification is



This table model, T.18, by Baird, provides a picture 10 in. by 8 in. and also includes a 4 waveband superhet radio receiver.

The vision chassis of each set has an overall frequency response adequate for the B.B.C. transmissions, while sensitivity has been adjusted to meet the varying reception conditions prevailing over the service area. In addition, however, due to improvements in design, a very simple set modification will enable these receivers to provide reliable pictures outside what is normally regarded as the television service area.

In all six new models are available, one of which it is interesting to note is a projection instrument giving a picture 18 in. by 15 in., or 24 in. by 19 in.

Table Model T.18.—This model has been designed to meet the requirements of those who are needing a compact, low-priced television receiver which, at the same time, incorporates high quality all-wave radio. The brilliant black-and-white picture 10 in. by 8 in. in size is directly viewed.

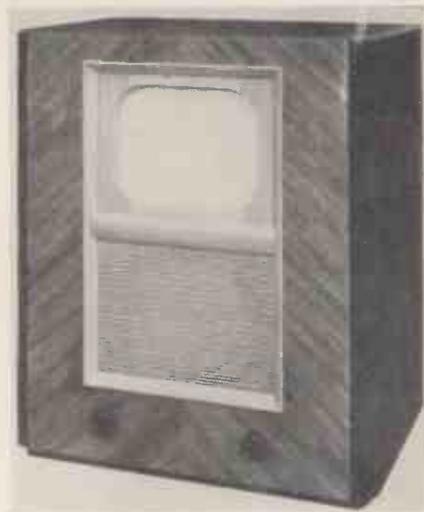
A four wave-band superheterodyne radio receiver included in the T.18 receiver embodies several unique features. Covering the television sound wave-band, it is possible to receive sound from the Alexandra Palace with or without the picture. This condition is effected by means of a switch integral with the contrast control. The cabinet size is approximately 18 in. by 16 in. by 25 in. high.

The cathode-ray tube, time base generator, and vision unit form a single compact chassis assembly in the top section of the cabinet. Vision tuning is pre-set and requires no further adjustment. The Superheterodyne Radio Receiver has five valves. The receiver has



The Baird console model T.18. A television receiver which also includes a radio receiver. The picture size is 10 in. by 8 in.

similar to the T.18 table model, but has been built in this way to satisfy those who prefer their receivers in console form. The cabinet is made from high-grade walnut and the size is approximately 20 ins. by 16 ins. by 44 ins. high. The price is 47 guineas.



The Baird table model T.20 receiver giving a picture 7½ in. by 6½ in.

the Baird projection tube receiver, comprising: 1, projection tube unit; 2, time-base generator; 3, vision unit; 4, power pack and sound unit; 5, E.H.T. unit; 6, all-wave broadcast chassis and speaker.

The projection tube with the lens is supported in a vertical position. The time-base generator unit is located as near to the tube as possible. These are set when the receiver is installed and require no further adjustment.

The radio broadcast unit consists of a six-stage all-wave superheterodyne with six tuned circuits employing five valves (including rectifier). The price of this receiver is 150 guineas.

Table Model T.20.—This represents television reception in its simplest and cheapest form, one control only being required to adjust the picture. Although priced at an exceptionally low figure, the results obtained are excellent. The black-and-white picture is 7½ in. by 6½ in., and has remarkable detail and brilliance.

The sound is provided by a superheterodyne radio receiver which is preset to receive television sound, the high fidelity energised moving coil speaker being mounted below the cathode-ray tube.

The cabinet dimensions are approximately 18 in. by 13 in. by 22 in. high.

The T.20 table model consists of two main units:

1. Time-base generator, cathode-ray tube and vision unit.
2. Power supplies and sound unit.

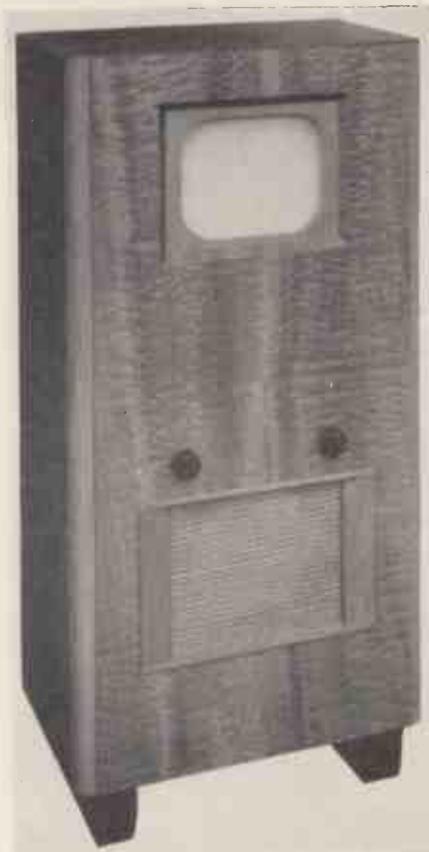
The time-base generator, cathode-ray tube and vision unit form a single compact and easily accessible chassis assembly in the top section of the cabinet. The power consumption is 150 watts.

This set is priced at 35 guineas.

Console Model T.20.—The general specification of the console T.20 model is similar to the table model, but has been built in this form for those preferring a console design. The cabinet is approximately 18 in. by 13 in. by 48 in. high, and the price 38 guineas.

Radiogram Model T.21.—The model T.21 radiogram receiver offers combined television, radio and gramophone entertainment.

The black and white picture, size 10 in. by 8 in., is viewed in a hinged part-mirrored lid. The television picture control of this receiver is the acme of simplicity, for the occasional adjustment of picture contrast is all that is



This is the Baird console model T.20. The picture size here again is 7½ in. by 6½ in.

Projection Tube Model T.19.—The Projection Tube model receiver is a deluxe modern instrument for those who require a large size television picture. It is ideal for television and radio reception in clubs, hotels and large rooms, and is an outstanding achievement in large-screen television. Incorporated in the receiver is a Bush high-fidelity all-wave radio receiver having push-button tuning.

The brilliant black-and-white picture 18 ins. by 15 ins. in size is viewed on a special non-inflammable screen. The Baird projection tube, mounted vertically in the cabinet, projects the picture through a lens which focuses the picture on to a mirror set in the lid, the image is then thrown direct to the viewing screen. A second screen, giving a picture 24 in. by 19 in. is also provided should a larger picture be required.

By the operation of a single switch the instrument is converted to an all-wave broadcast set. The cabinet, made from specially selected high-grade walnut, is approximately 29 in. by 23 in. by 42 in. high.

There are six main chassis units in

necessary for the operation of the receiver.

A four wave-band superheterodyne radio receiver is included in this model and incorporates several important features. It is possible to receive the radiated sound from the Alexandra Palace with or without the picture. The cabinet dimensions are approximately 39 in. by 20 in. by 33 in. high.

The receiver consists of two main chassis units:

1. Time base generator and vision unit.
2. Radio broadcast and power supply.

The superheterodyne radio receiver has five valves (including rectifier). The power pentode is capable of delivering an undistorted output of 8 watts to a large energised moving coil speaker. The receiver has a power consumption of 200 watts, and the price is 72 guineas.

EDISON SWAN ELECTRIC CO., LTD., 155, Charing Cross Road, W.C.2. Stand No. 18

Television on the Edison stand comprises a large battery of cathode-ray tubes run from a single receiver. No less than five tubes, ranging from 9 in. to 15 in. in diameter are arranged as to supply vision for five separate viewing booths. Each booth also has its own loudspeaker.

In order to ensure finest possible vision reproduction special monitoring devices have been provided. The stand is so designed as to ensure an even and regular flow of visitors.

The First Valve.—The accompanying photograph makes detailed description of the stand unnecessary, but it is in-

teresting to note that prominently displayed there is an historical collection of particular interest. This collection consists of the Fleming "thermionic" valve of 1904, surrounded by its successors, step by step, year by year, up to the present day.

Mazda Valves.—The complete range

**DO YOU REALISE HOW GOOD
TELEVISION RECEPTION IS TO-DAY,
ESPECIALLY**

BAIRD TELEVISION

**PROVE THIS BY VISITING
STAND No. 19 AT RADIOLYMPIA
(AUG. 24 TO SEPT. 3)**

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**THE NAME BAIRD WITH TELEVISION
SYNONYMOUS**

widened and unequalled research facilities provided. This has culminated in the development of the finest television receivers for domestic receiving purposes. The new range of models has been graded to meet the varying needs of a rapidly expanding viewing public and each set is the best in its class that television has to offer to-day. See them in operation at Radiolympia.

SEE TELEVISION AT ITS BEST ON STAND No. 19.

BAIRD TELEVISION LTD.

Lower Sydenham, London, S.E.26

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Telegrams: TELEVISOR, FOREST, LONDON.

RADIOGRAPHIC

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EASIER EASY PAYMENTS

WE GIVE THE BEST PART-EXCHANGE ALLOWANCES

All Receivers Carry our 100% Guarantee

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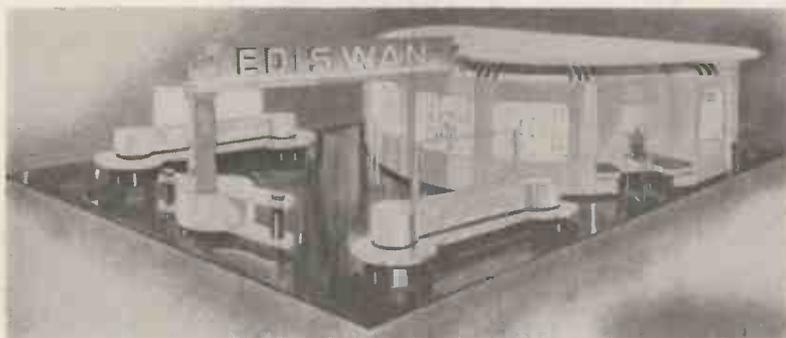
DEAN HOUSE, 2-5 DEAN ST., LONDON, W.1. Phone: GERrard 4971

66 OSBORNE ST., GLASGOW, C.1. Phone: BELL 848

SEPTEMBER, 1938

of new Mazda miniature valves for all types of mains and battery receivers, and the new Mazda economy valves for battery receivers, are shown. A selection of cathode-ray tubes ranging in size from 5 in. to 12 in. diameter are displayed and the whole is a comprehensive display of the latest contributions to radio and television from the Mazda works.

U.V. Radiation Decoration.—In addition on the Ediswan stand is a demonstration of ultra-violet radiation. Along the whole semi-circular sweep of the Television Corridor, the walls are treated with fluorescent paints and flooded with Ediswan U.V. lamps. Flashes from typical broadcast programmes are displayed forming a background for a giant clock.



A picture of the Ediswan stand at the show.
Five tubes are shown operating from one receiver.

FERRANTI LIMITED, Radio Works, Moston, Manchester.

Stand No. 14



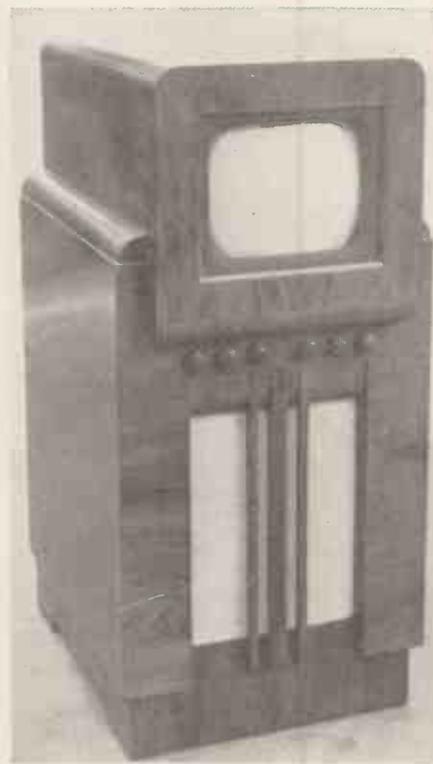
The Ferranti model T.4. Giving a picture size 10 in. by 8 in. this receiver also incorporates an all-wave broadcast set.

Two television receivers known as the T3 and T4 priced at 50 gns. and 60 gns. respectively are shown by Ferranti's.

The T4 is a combined televisor and all-wave receiver, and in addition to providing a brilliant black-and-white picture 10 in. by 8 in. viewed directly on a cathode-ray tube of special design, gives ordinary broadcast reception on three wavebands 16-52 metres; 700-560 metres and 900-2,000 metres. A special deflection system produces a perfectly defined picture of excellent brightness and fine contrast. A protective glass screen is employed and the angle of vision is 120°. The sound output is 5 watts undistorted and the frequency response is practically level from 40-10,000 cycles. A feature of the Ferranti televisor is that it will operate equally well on either concentric or balanced feeders.

The T3 is for television only and is similar to the T4 except that no ordinary broadcast set is incorporated. In both models electrostatic focusing and magnetic scanning are employed and the latest type secondary emission valves are used.

"Television and Short-wave World"
circulates in all parts of the world.



This model is the Ferranti T.3, and is very similar to their T.4, except that it is for television sound and vision only.

GENERAL ELECTRIC COMPANY LIMITED, Magnet House, Kingsway, W.C.2.

Stands Nos. 49 and 39

Handsome appearance, case, speed and accuracy of operation, outstanding performance and reliability sum up the General Electric Company's television receivers for 1939 shown on stand 49. Four models are available and the range which is most comprehensive has been planned to provide a high-grade instrument for every individual requirement.

Full technical details were not available at the time of going to press, but the new G.E.C. television receivers embody the very latest technical developments based on another year of intensive experiment and research.

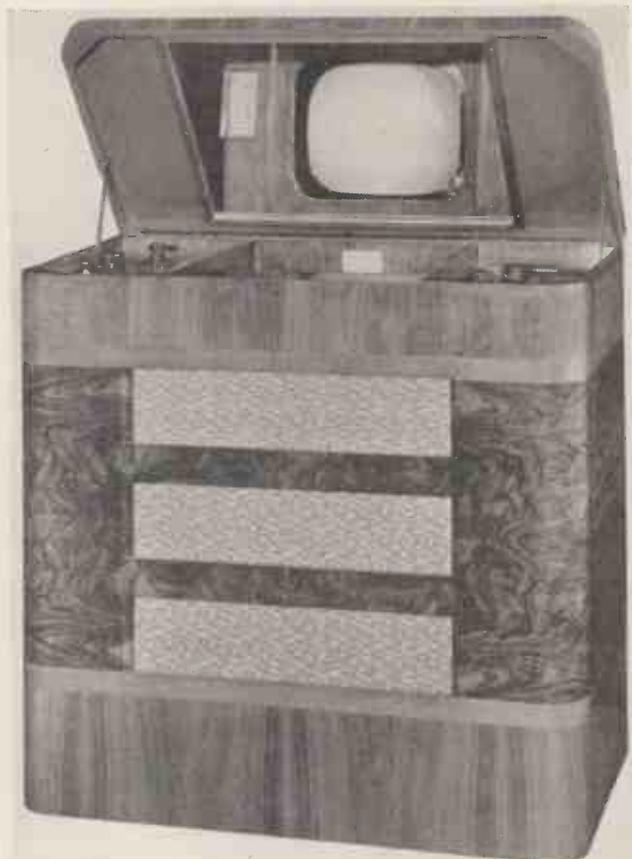
There are two de-luxe models in handsome floor cabinets of hand-polished walnut. They give large size, clear cut, rock steady pictures on silvered

mirrors, one with a screen size of 13½ in. by 11 in., the other 10 in. by 8 in. Apart from the picture size the two receivers are identical in quality and reproduction. They are simply and positively controlled, and are fine examples of high-class television receivers. Each incorporates a powerful 6-valve all-wave set of wide range and quality.

Another item in the G.E.C. range is



This model by the G.E.C. is similar in design to the other receiver illustrated, except that the picture size is somewhat smaller, being 10 in. by 8 in.



This is one of the de luxe models exhibited by the G.E.C. In addition to the sound and vision receiver, which gives a picture 13½ in. by 11 in., a powerful 6-valve all-wave set is incorporated.

a console model, for television sound and vision only, providing a picture size of 10 in. by 8 in. which is directly viewed.

A Vision Unit.—The fourth model to complete the range is a revolutionary development, bringing television within the means of every radio set owner in the television reception area. This is the vision unit, first introduced by the G.E.C. last year and now available in further improved form. Merely plugged into any A.C. radio set with a medium waveband, the G.E.C. Vision Unit gives a clear black and white picture of fine definition, the sound operating through the radio set speaker.

On the G.E.C. stand a wide selection of sound reproduction equipment is also shown, covering every requirement of public address work where high quality reproduction by microphone, record or radio is desired.

Among the Osram valve exhibits on Stand 39 is a full range and working demonstrations of the international type valves notable for their economy of operation, uniformity of quality and simplicity of fitting, effected by a self-locating base. There are also valves for power amplifiers, water-cooled transmission valves, valves for television and, in addition, a range of cathode-ray tubes.



This is the G.E.C. console model providing a picture 10 in. by 8 in.

GRAMOPHONE CO. LTD.
108, Clerkenwell Road, E.C.
Stand Nos. 47 and M.I

The Gramophone Co., Ltd. (H.M.V.), have retained three of their original models, viz., the 900, which is a combined television and all-world receiver at 80 guineas; the 901, a receiver for television sight and sound only, employing the same television equipment and control as model 900 except that a slightly modified power pack also supplies the sound receiver, price 60 guineas; and the 902, a combined television sight and sound receiver and all-world radio with automatic record changing electrical gramophone, priced at 120 guineas. This latter model employs the same equipment for television and radio reception as model 900, except that the cathode-ray tube has a 9 in. diameter screen. The screen is viewed via an optically corrected lens and 45-degree mirror.

The new models consist of a table television receiver, model 904 at 29 guineas; model 905 at 35 guineas, which is also a table type set; and a combined television and all-world radio console, which includes a superhet receiver for both sound and vision; separate power supply chassis, and a 5-valve

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three waveband sound receiver with television sound on a separate waveband. There is also a model 903 which has similar television characteristics to model 907 and is in a generally similar cabinet, but does not incorporate all-world radio, at a price of 45 guineas.

Models 904 and 905 are of similar type but different sizes, the former giving a picture 4 in. by 4¾ in., the latter 5 in. by 6¼ in. The prices are 29 guineas and 35 guineas respectively.

The H.M.V. table model 905 is a combined six-valve all-world superhet radio receiver with the television sound on a separate waveband. The vision receiver gives a sharply defined black and white picture, size, 5 in. by 6¼ in. In addition, gramophone pick-up sockets are provided to which pick-up leads may be permanently connected. The receiver is housed in a finely figured walnut cabinet.



**KOLSTER-BRANDES LTD.,
Cray Works, Sidcup, Kent.
Stand No. 41**

This firm are showing two television receivers, one of which is for television and television sound only and the other including a 5-valve superhet broadcast set.

The K.B.780 reproduces brilliant black and white pictures, size 10 in. by 8 in., on a 12-in. cathode-ray tube. The pictures are viewed directly on the cathode-ray tube mounted at the best angle for viewing. A high-fidelity moving coil speaker of very pleasing tone reproduces the accompanying

sound. Simplicity of operation is a notable feature. There are only five television controls and a volume control for sound.

The console cabinet is of contrasting figured walnut. Concealed, silent running, rubber-tyred castors enable the receiver to be moved easily from place to place. A decorative sliding blind conceals the cathode-ray tube when not in use. The dimensions of this model are 38 in. high, 21 in. wide, 21 in. deep. Nineteen valves are employed in the model K.B.780 and it operates from A.C. mains, 200-250 volts, 40-60 cycles. The price is 44 guineas, which includes installation, special television aerial and guarantee with free service for 12 months.

In addition to equipment for the reception of television with accompanying sound as in the other model, the K.B.790 incorporates a highly efficient 5-valve all-wave superhet with cathode-ray tuning indicator, giving excellent reception of long, medium and short-wave broadcast programmes from all parts of the world.

The received picture measures 10 in. by 8 in. and in this case is viewed indirectly from a distortionless metallic mirror mounted inside the cabinet lid.

The figured walnut cabinet measures 41½ in. high, 32 in. wide, and 18 in. deep. A sliding shutter obscures either the cathode-ray tube or the tuning scale of the all-wave superhet when either is not in use. Concealed, rubber-tyred castors facilitate easy movement of the complete receiver. The model K.B.790 employs 26 valves and may be operated from A.C. 200-250 volts, 40-60 cycles. The price is 55 guineas, which includes

installation, special television aerial and guarantee with free service for 12 months.

**MARCONIPHONE CO.
LTD., 210, Tottenham Court
Road, W.1**

Stand Nos. 65 and 54

The Marconiphone television programme for 1938-1939 comprises nine receivers in all at prices ranging from 29 to 200 guineas. These include:—

706. A television sound and vision and 6-valve 3-waveband radio receiver (size of picture 4 in. by 4¾ in.), price 29 guineas.

707. A television sound and vision and 6-valve 3-waveband radio receiver (size of picture 5 in. by 6¼ in.), price 35 guineas.

709. A television, sound and vision and 5-valve 3-waveband radio receiver (size of picture 6 in. by 7½ in.), price 45 guineas.

704. A television, sound and vision receiver (size of picture 6¼ in. by 7¾ in.), price 45 guineas.

702. A television, sound and vision receiver (size of picture 8 in. by 10 in.), price 60 guineas.

701. A television, sound and vision and 6-valve 4-waveband radio receiver (effective size of picture 8 in. by 10 in.), price 80 guineas.

705. A television sound and vision and 6-valve 4-waveband radio receiver



The Kolster Brandes model 790, in addition to providing a picture 10 in. by 8 in., gives reception of long, medium and short-wave broadcast programmes.



The Kolster Brandes model 780 television receiver providing a picture 10 in. by 8 in.



With this model by Marconiphone the picture size is 6 in. by 7½ in. A 5-valve radio receiver is also incorporated.

(size of picture 8 in. by 10 in.), price 80 guineas.

703. A "Mastergram" model. Television, 6-valve 4-waveband radio and automatic gramophone (size of picture 8 in. by 10 in.), price 120 guineas.

708. Large screen projection model, television with sound accompaniment and 6-valve 4-waveband radio receiver



This Marconiphone receiver provides a picture 4 in. by 4½ in. in addition to a short-wave radio set.

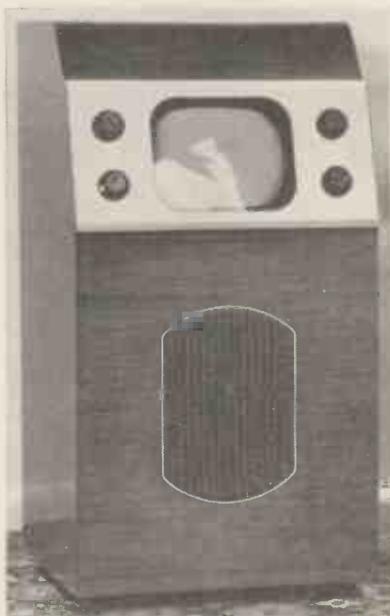
(size of picture 18 in. by 22 in.), price 200 guineas.

Of particular interest are three entirely new models (706, 707 and 709) which, though only providing small pictures, have enabled a considerable reduction of price to be made.

MURPHY RADIO LIMITED,
Broadwater Road, Welwyn
Garden City, Herts.

Stand No. 27

Murphy Radio, Ltd., are showing a new receiver for television at £30, and a combined television and all-wave set at £45. The designs, it is stated, permit of quantity production in the factory—as distinct from the virtually hand-made instruments, and to attain



This is the new Murphy receiver for sound and vision only. The picture size is 7½ in. by 6 in.

the present figures every cost except the bare materials and labour for the receivers has been pared to the limit.

The new Murphy £30 receiver is designed solely for the television transmissions from Alexandra Palace station, with their sound accompaniment. The instrument is a very neat "console" type, standing only 35 in. high by 18 in. wide and 17½ in. deep. The controls are mounted on a panel of plate glass, invisibly fixed, and with an opaque finish, which does not show annoying reflections. The glass protects the end of the cathode-ray tube (on which the television picture is seen) and it is sloped slightly backward to give the most comfortable viewing position.

The picture size, black and white, is 7½ in. wide by 6 in. deep, adequate size for comfortable viewing in the average living room.

The sensitivity of the receiver is adequate to give satisfactory reception at the outer limits of the Alexandra Palace service area, while the 5-watt sound output valve and large loudspeaker result in very good quality.

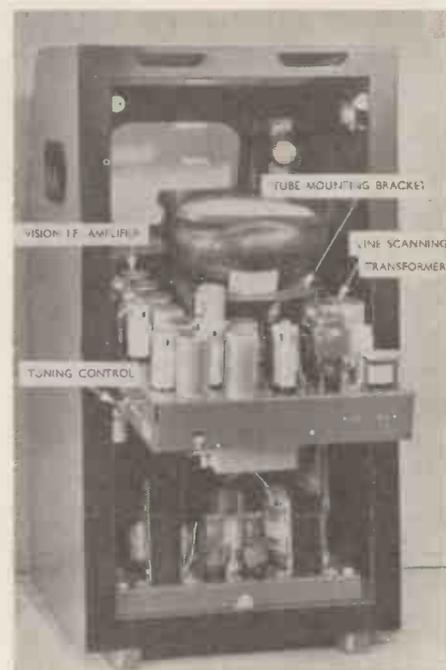
The handy compactness of the instrument is largely due to the development of a new short type of cathode-ray tube. Fifteen valves are used for the sound vision, and synchronising with three rectifiers to deliver the high voltages necessary to get brilliant pictures. By an ingenious design, the chassis can be lowered in its cabinet and is therefore accessible for service.

Picture brightness and definition are unusually high, and the main controls have been reduced to a minimum for satisfactory operation. They comprise focus, brightness and contrast controls for the picture, and a volume control (with main on-off switch) for sound. On a side panel are tuning, line synchronising and frame synchronising controls which rarely have to be touched, while screw-driver adjustments are provided for picture height and width.

The set consumes 200 watts from the A.C. mains.

Although it will be priced at £30, the 56V is a worthy "small brother" to the luxurious A42V at £65, retaining the high picture and sound quality, and absolute steadiness which distinguish the larger instrument.

Another model includes an all-wave radio receiver (£45). The television side



A rear view of the Murphy receiver showing the hinged chassis.

of this model is exactly the same as the £30 type described. The only difference

(Continued on page 550)

Now at Radiolympia



AND SHORTLY ON VIEW AT YOUR "H.M.V." DEALERS

"His Master's Voice" Television-All-world Radio

FOR ONLY
29 GNS
OR AT THE RATE OF
6/4 A WEEK



NOW, "H.M.V." bring you television combined with all-world radio at the extraordinarily low price of 29 guineas, or by hire purchase at the rate of only 6/4 a week. Like all "H.M.V." television sets, this new table model has had the advantage of being designed by the same engineers who were responsible for the transmitting apparatus at Alexandra Palace . . . Therefore, it has many refinements which enable it to reproduce B.B.C. television programmes with the finest quality definition. Its tone and all-world radio performance are of the usual high standard set by "H.M.V.". There are now six "H.M.V." television instruments for your choice; be sure you see them.

"H.M.V." TABLE TELEVISION Model 904

The chassis comprises a television receiver of the superhet type, giving a clear picture on the screen of a cathode ray tube 5" in diameter, combined with a 6-valve three waveband all-world radio receiver.

29 Gns
or by hire purchase at the rate of 6/4 a week.

Model 905. Similar in specification to Model 904, but having a cathode ray tube with a 7" diameter screen. 35 Gns

"H.M.V." ARE SHOWING TELEVISION SETS TO SUIT EVERY HOME



Model 907. Console type television receiver, having a 9" diameter cathode ray tube. The radio chassis is a three waveband 5-valve all-world superhet receiver 45 Gns



Model 901. Size of picture approximately 10" x 8". This instrument receives television sight and sound only 60 Gns



Model 900. A combined 6-valve five waveband all-world receiver and television sight and sound receiver 80 Gns



Model 902. A combined 6-valve, five waveband all-world radio receiver, television sight and sound receiver, and eight record automatic changing electric gramophone 120 Gns

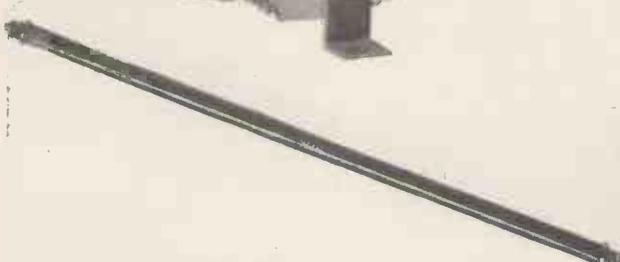
All "H.M.V." television receivers may be purchased on convenient hire purchase terms.



FOR RADIO AND TELEVISION

There is a Westinghouse Metal Rectifier to suit every rectification need. In sound and vision receiver power supplies, times bases, detection, picture shift circuits, etc., etc. The B.B.C., the G.P.O. and the principal Broadcasting stations of the world use Westinghouse. So should you if you want outstanding reliability.

You can inspect the full range of these reliable rectifiers on Stand 35, or a 3d. stamp to Dept. T. will bring you a copy of the new 1939 edition of "The All Metal Way."



Westinghouse

STAND 35

WESTINGHOUSE BRAKE & SIGNAL CO., LTD.,
82, York Way, King's Cross, London, N.I.

SEPTEMBER, 1938

A SIMPLE RECEIVER FOR TELEVISION SOUND



The complete two-valve receiver with power unit is mounted on a single chassis in this manner.

TWO VALVES ONLY :: LOUDSPEAKER VOLUME :: LOW COST

READERS living within 25 miles or so of the Alexandra Palace transmitter can receive the sound programmes that accompany the vision with quite a simple instrument. It is not necessary to use multi-valve superhets with special transformers and other components for this is unnecessarily costly and is only required when advantage is to be taken of the high fidelity programmes transmitted from Alexandra Palace.

With the normal television receiver the sound section usually has wide band I.F. transformers in order to obtain a wide frequency range. If listeners are content with quality similar to that obtained from the normal medium wave stations with a top note response of between 7,000 and 8,000 cycles then a conventional type of circuit can be used. The field

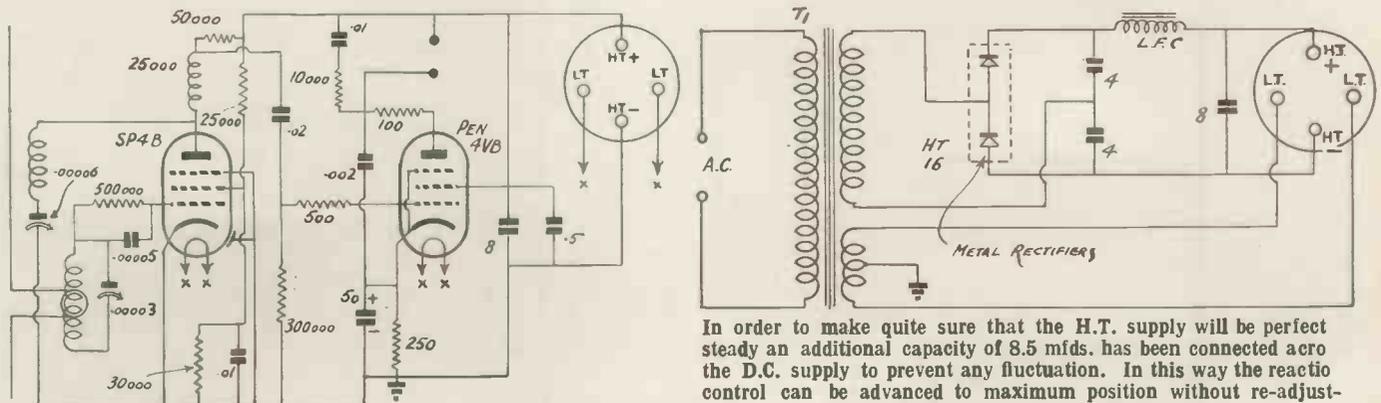
strength of the Alexandra Palace transmitter is quite high within a 25-mile area so that a 2-valve receiver with a reacting detector plus a high slope pentode valve is quite satisfactory.

This type of receiver will give good loudspeaker volume and is comparatively free from frequency drift. Modern valves with high slopes need a comparatively small input in order to provide high level output so that the simple type of super-regenerative receiver which is so commonly used on ultra-short wave loses most of its advantage.

The super-regenerative receiver which so many amateurs are using for 7-metre reception is only satisfactory when the signal input is extremely high, otherwise there is an inherent noise level which cannot be overcome. Also the quality from a

self-quenching detector is far too poor for programme reception. This does not leave a very wide choice of receivers, but fortunately the straight set with capacity controlled reaction is quite suitable for our purpose. The circuit is shown on this page from which it can be seen that a radio-frequency pentode is used as a leaky grid detector. The grid connection is taken to the top cap of the valve so reducing inter-electrode capacity. This also helps to reduce the shunt capacity between grid and earth, that is in parallel with the grid coil. In this way, a comparatively large coil can be used, so greatly increasing the efficiency of the circuit. It must be remembered that on the ultra-high frequencies, good efficiency can only be obtained when the L/C ratio is correct.

It will be noticed in this circuit



In order to make quite sure that the H.T. supply will be perfect steady an additional capacity of 8.5 mfd. has been connected across the D.C. supply to prevent any fluctuation. In this way the reacto control can be advanced to maximum position without re-adjustments having to be made.

Only trimmer condensers are needed in this receiver and once the station has been received they do not need touching.

This is the simple power pack which gives 250 volts at 60 mA. One of the condensers has to be insulated as pointed out in the text.

CAPACITY REACTION CONTROL

that the tuning condenser has a capacity of 30 mmfd., which is ample on this wavelength.

Straightforward Reinartz capa-

frequency choke in the anode circuit and a resistor of 500 ohms in series with the grid of the output pentode.

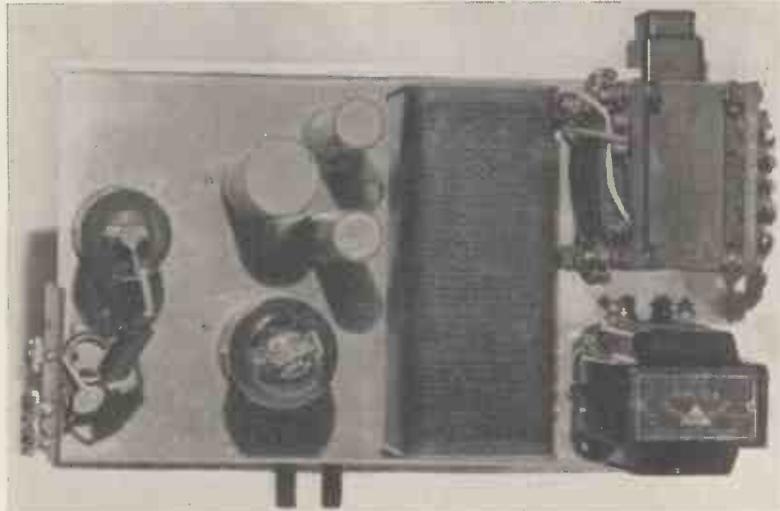
The final stage is quite straight-

dropping resistance or potentiometer network in order to obtain the screen voltage. The output pentode, an AC2/PEN, operates satisfactorily with 250 volts on both anode and screen.

The power pack is shown as a separate unit in case readers may have a suitable unit available. It is, however, mounted on the same chassis as the receiver, as shown in the illustration. The power pack consists of an input transformer with a filament winding, plus a metal rectifier which gives approximately 250 volts at 60 mA. It is used in the voltage doubler circuit with an 8-mfd. condenser in the smoothing circuit and two 4 mfd. condensers in the voltage-doubling circuit.

As a metal chassis is used it is essential that one of these condensers be isolated. As the other condenser is connected to the high voltage secondary, if it were connected to earth in the usual way, there would be a short circuit. The output from the rectifier is taken to the smoothing choke the receiver side of which has to be by-passed to earth by means of the 8-mfd. condenser. The rectifier in this circuit is an HT16, which has a maximum current output of 60 mA. The transformer, however, need only supply 240 volts as the rectifier is being used in a voltage doubling circuit. Despite the low voltage output the condensers must have a peak working value of 400 volts.

(Continued on page 544).



A plan view of both units. The upper of the two small condensers is the one to be isolated.

city control reaction is used and as this does not have to be adjusted after the correct setting has been found it does not matter if the control is slightly rough. In normal circumstances when the reaction control has to be varied for each station received this arrangement would not be suitable.

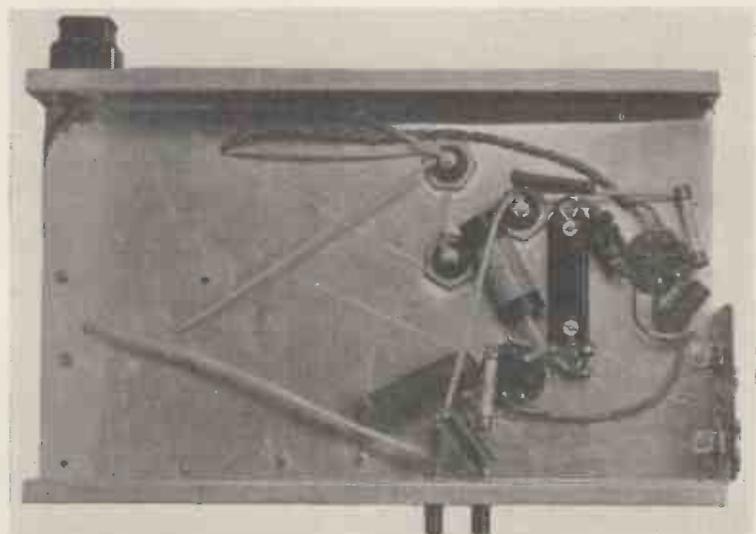
In order to obtain a reasonably high stage gain with a pentode detector the correct anode load must be obtained, so for this reason transformer coupling is ruled out. A good average value for the anode resistor is 50,000 ohms, which provides a compromise between stage gain and D.C. voltage drop.

The output from the detector valve is fed into the grid of the output pentode through a coupling condenser having the value of .02 mfd., while there is a grid resistor of 300,000 ohms. With this circuit and even a small signal there is sufficient input to the grid of the pentode to obtain an output of 2 to 3 watts. This may sound quite a high figure but it must be appreciated that the output pentode only requires 3 volts r.m.s. to be fully loaded.

Simple precautions have been taken to eliminate back coupling and R.F. in the final stage. It will be noticed that the detector valve is not decoupled as there is only one stage following. There is also a high-

forward having automatic bias obtained by means of a cathode resistor of 250 ohms shunted with a condenser of 50 mfd. In order to attenuate top note response which is unduly amplified with this pentode valve, a condenser of .002 mfd. is connected between the anode of the valve and the cathode. There is also a tone correction circuit across the loud-speaker primary to give more or less correct tonal balance.

With the output valve chosen there is no need to include any voltage



Only a very few components are mounted under the chassis as this illustration shows.

Scannings and Reflections

TELEVISION IN THE PROVINCES

ALTHOUGH no official announcement has been made, it is practically certain that very soon now a definite move towards the extension of television to the provinces will be made by the Postmaster-General's Television Advisory Committee.

The matter has been under discussion by the Advisory Committee for a considerable time and it remains to reach a decision as to what area will first be served. Birmingham, Manchester and Liverpool are the most probable and it seems likely that it will be the first of these. The possibility of using the co-axial cable is under consideration, but there is some doubt whether this cable can cope with telephone traffic and television at the same time.

Investigation is also being made as to the possibility of making one station serve two areas by erecting a transmitter in the hills of Staffordshire or Derbyshire, and also by micro-wave relay stations.

TELEVISION AND THE CINEMA

In the course of an address to cinema exhibitors at Manchester recently, Mr. M. Raymond, jun. (Baird Television), said:—

"The reaction to the arrival of television by the film industry has been of a very varied character. In some quarters it has been regarded as a menace, while others have shown great enthusiasm and keenness. However, there is no doubt that in the immediate future television will play a very important part in kinema entertainment, and no exhibitor can afford to overlook the vast field of entertainment which this new art can and will offer, not forgetting its enormous box-office value."

Regarding structural alterations to cinema theatres, he said:—"As in the early days of sound, a survey of the theatre will have to be taken. It will be necessary to determine the best position for the aerial, to take field strength measurements and

advise the best location for the equipment in the theatre.

A.P. TENNIS

A tennis club in the vicinity of Alexandra Palace has been saved from extinction due to lack of members by an influx of new members from the television staff at Alexandra Palace.

A PEOPLE'S TELEVISION SET

On the occasion of the opening of the Berlin Radio Exhibition, Dr. Goebbels announced that television reception would be given free for the public on October 1 of this year, and that plans were under way to build a cheap "people's" television receiving set. The cost of the new German television receivers is approximately £40.

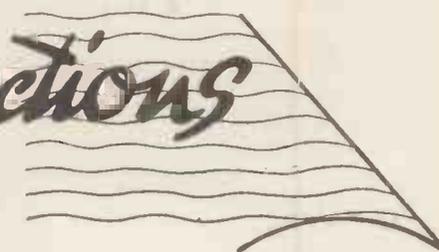
A FIRE AT A.P.

Fire broke out at Alexandra Palace, N., on August 4. The outbreak occurred in a room off the Great Hall in that section of the building open to the public. Two brigades kept it from spreading to the television section. It is evident that the risk of fire in a building of this type, which is open to the public, is very considerable.

GAUMONT-BRITISH AND TELEVISION

Mr. Isidore Ostrer, speaking of television at the eleventh annual general meeting of the Gaumont-British Picture Corporation, said:—"In regard to our television interest in Bairds, owing to the co-operation between Gaumont-British and the Baird Company, the Baird Company are in the position to instal immediately large screen television in theatres and cinemas.

"The importance of this revolutionary advance in television—where we are in a position to present to you the Test matches, the tennis matches, in fact almost everything of real interest while it is going on—is obvious. It is largely due to our vision and co-operation with the Baird Company that we are in this unique



position, and further, that Britain leads the world at the moment in cinema reception of events.

"We have asked the B.B.C. for permission to show television in our cinemas; other cinemas and theatres to have the same right. The public appreciation of films of great events is already established, and now that it is possible to see in the theatre great events while they are actually happening, the public will demand the opportunity of doing so."

TELEVISION AT RADIOLYMPIA

More than 120 mannequins will parade before the television cameras at Radiolympia in the "Forecasts of Fashion," which are to be televised from the glass-walled studio in the National Hall. The parades, which will be carried out in co-operation with the Fashion Group of Great Britain, will feature exclusive models by some of the leading British designers. Winter and spring fashions will be shown, and it is estimated that clothes to the value of £30,000 will pass through the studio between August 24 and September 3.

C. H. Middleton will be televised each morning in the second week (August 29 to September 3) with a reconstructed corner of the Television Garden, which regular viewers have so often seen at Alexandra Park.

Visitors who accept the invitation to "Come and Be Televised" will be interviewed before the cameras each morning. They will, of course, be "made up" before being televised. Interviewers will include Jasmine Bligh, Elizabeth Cowell and David Hofman, the television announcers.

Joan Miller, the "Picture Page Girl," returns to her famous switchboard for the Radiolympia presentations of this regular feature. "Picture Page" will be seen in its entirety by Radiolympia visitors on August 25 in the afternoon and evening and again on Thursday, September 1.

MORE SCANNINGS

FIRST DANCE HALL TELEVISION

Arrangements have been made for a relay in the early autumn from the Palais de Danse at Hammersmith, which can accommodate over 3,000 dancers. It was the first place of its kind selected for sound broadcasts and now it has been selected to make dance history by television. All the latest dances will be shown. A relay from the Chelsea Arts Ball on New Year's Eve is also under consideration.

TRAINING PROJECTIONISTS

Mr. Robert Finnigan, in his presidential address at the annual conference of the National Association of Theatrical and Kine Employees, stated that detailed but tentative plans on a national scale had already been made for the technical education of projectionists to deal with the demand that will arise for men able to handle television equipment in cinemas. "Trained projectionists," he said, "will be in the happy position of becoming key men under the new regime." "The News Reel," he concluded, "gives the things as they were, but there is nothing so old as yesterday's news. That is why television will stir the public's pulse and loosen its purse-strings."

THE PROMENADE CONCERTS ON THE TELEVISION WAVELENGTH

Arrangements have been made for parts of the Promenade Concerts, conducted by Sir Henry Wood in the Queen's Hall, to be transmitted from Alexandra Palace on the sound wave only by the television service. Each of the relays will last from 8.0 p.m. to approximately 9.0 p.m., depending upon the arrangement of items in each concert. The transmissions will be in addition to the evening television programmes which will normally begin at 9.0 p.m. Owners of television receivers will thus be able to take advantage of the improved quality which the high frequencies make possible.

STEREOSCOPIC TELEVISION

Zworykin has been investigating the possibilities of stereoscopic television. Two transmitting tubes are used, about the same distance apart as the average human eyes, and the conversion of these optical pictures into television signals is effected in the usual way by allowing the beam of electrons to scan the photo-electric mosaic.

Each camera analyses alternately adjacent lines of the scene under observation, and the result is that two separate and distinct electrical pictures, corresponding to that which each eye of an observer would see, are transmitted. It will be remembered that J. L. Baird carried out experiments in low-definition stereoscopic television some years ago.

THE BIRMINGHAM TELEVISION STATION

Rumour has it that the Birmingham television station might be opened more quickly than is generally imagined. In certain quarters it has been generally agreed that the reason for the delay in opening the station in the Midlands has been due to the co-axial cable from London to Birmingham not reaching a high enough standard.

The use of the cable apparently causes severe attenuation above a certain frequency which cannot be easily overcome. As the B.B.C. are unable to afford a completely new set of studios and programmes for the Birmingham area, the idea of the new station has been shelved. Schemes have been on foot, however, to relay the transmissions from Alexandra Palace by means of microwave transmitters for at least a percentage of the distance, finishing up with a short section of cable. This arrangement is apparently working out quite well, but the powers that be will neither confirm nor deny that such a scheme has even been considered. However, time will tell and we are optimistic enough to hope that the opening of the Birmingham station is not very far distant.

A VISIT FROM AMERICAN TELEVISION ENGINEERS

N.B.C. development engineer, Mr. R. N. Morris, has arrived in this country for a six weeks' stay in order to gather first-hand information about British television. He is to join N.B.C. Director of Television programmes, Mr. Thomas H. Hutchinson, who has already been in this country a week or so. They are to visit Alexandra Palace, to see the transmitters and to study studio technique. Before going back to America they are to visit the Eiffel Tower, and several companies in Germany, finishing up at the Philips Laboratory in Holland.

ARTIFICIAL AERIAL LICENSES

There is a possibility that the Post Office may stop issuing artificial aerial licenses, which have been so popular amongst British short-wave amateurs. So far nothing has been officially done about it, although a lot has been said for, and a lot against, this type of license. It is agreed that the standard of operating displayed by British amateurs is extremely high, due, to a certain extent, to the fact that most amateurs serve a probationary period with a dummy aerial. However, it cannot be denied that experimenters who cannot pass their Morse tests and do not have the necessary qualifications for a full permit often radiate after they have obtained the A.A. license. There is a very great temptation to use a completed transmitter with an elevated aerial instead of the dummy aerial, and this is the very great point against the continuance of this type of license. It should also be remembered that of all the thousands of amateurs there are in the world, we in Great Britain are the only ones who have the privilege of this intermediate license.

AMATEUR STATIONS IN TIME OF WAR

It has been decided by the G.P.O. that in time of war all amateur stations will be closed down and the apparatus either taken away and stored, or sealed. The magnitude of this undertaking will be quickly appreciated by the average amateur who generally has a considerable amount of equipment. Also with modern valves and circuits a simple single valve transmitter can quite easily be built out of scrap materials. This point, however, was raised, and the Post Office agreed that it probably would be almost impossible for all apparatus to be confiscated, but put forward the suggestion that with most of the amateurs out of the way, it would be a simple matter to locate any illicit transmissions. Also, if a very heavy penalty was imposed upon those transmitting without a permit, they think that this would be sufficient to deter amateurs from using any equipment they may be able to retain.

NEW VALVE PRICES

In an endeavour to counteract the increasing popularity of American valves the B.V.A. decided to reduce the price of most of the British valves.

AND MORE REFLECTIONS

This price reduction took effect from August 15, and in some cases amounted to as much as 10s. per valve. Generally speaking, the average drop is about 3s., which is quite an appreciable amount to constructors building television receivers. In the case of battery-operated pentodes and screen grid valves, the new price is 9s., as against 11s. Mains-operated pentodes will, in future, be 10s. 6d., with mains triodes 7s. 6d. Rectifiers of the vacuum type up to 500 volts input are now 9s. each, which is a much more reasonable price even though it is still slightly high for the amount of work entailed.

CHEAPER TELEVISION

Most of the television manufacturers have this year reduced their prices and made more flexible the hire-purchase terms. In this way television is now within the reach of the ordinary man in the street, for receivers cost less than £30, while the hire-purchase terms are approximately 6s. per week. These receivers include as many as 15 valves, plus a cathode-ray tube, so that they represent very good value for money and it is not feasible to expect any material price reduction for some time to come. Modern television receivers can be installed by the local dealer for they are, if anything, more reliable than the ordinary radio. No technical knowledge is required in operating, so that before the next twelve months are out it can confidently be expected that this country, at least so far as the London area is concerned, will be television-minded.

NEW YORK TELEVISION EXHIBITION

The National Broadcasting Co. of America have opened a permanent television exhibition in Radio City. They are showing all kinds of apparatus, while in a glass wall studio televised performances can be seen by visitors. This Exhibition is an endeavour to convince New Yorkers that television has a good entertainment value, for unless a large number of receivers are in use there cannot be any sponsored television programmes.

TELEVISION TELEPHONE

A television telephone has been patented in Washington by McLean Nicolson, of New York. The system is designed for inter-office use, but

the inventor considers that it will be possible to use the same type for long distance visual telephony on the same lines now in use in Germany. The system has a bell-shaped horn which contains a television scanner for both sending and receiving, in addition to a microphone and loud-speaker.

GERMAN TELEVISION SERVICE-

It was announced from Berlin that from October 1 there will be a television service in Germany. (The new television transmitter on top of the Amerika-Haus at the Adolf Hitler Platz will have an input of about 20 kilowatts, as compared with the 17 kilowatts used by the B.B.C. It is hoped that within a very short time that 25 per cent. of the German population will be within range of vision stations. An interesting television car has been designed and contains a complete transmitter. It differs from the B.B.C. television unit in so far as it can actually televise events while moving along, and is aptly called a roving reporter.

A MOBILE UNIT FOR THE B.B.C.

A complete mobile film unit is being purchased by the B.B.C. for television purposes. It is similar in appearance to the trucks used by the news-reel companies, consisting of a saloon car with reinforced roof on which a camera tripod can be mounted. It is intended to use this car for making short films for inclusion in full-length programmes.

FINNISH TELEVISION

As the Finnish Government are going to make arrangements for Olympic Games in 1940, they have decided to install television equipment at an early date. They are negotiating with a German firm for the installation of a television transmitter, and also for the erection of a number of television rooms in various parts of Helsingfors.

THE OXFORD UNIVERSITY EXPEDITION

Under the call sign OX7OU the Oxford University Expedition are operating a 20-and 80-metre transmitter from Greenland. Reports from short-wave listeners should be sent to Mr. Andrew Croft, Leckhampton House, Cambridge. The American Expedition to the Belgian Congo have also radio equipment operating

on the same wave bands, but with the call signs of OQ5ZZ.

TELEVISION AND AIRCRAFT DETECTION

The use of television for long range detection of aircraft is now being developed by the Radio Corporation of America, at Camden, New Jersey. The method is said to be based upon a British discovery that the metal structure of an aeroplane collects and re-radiates the ultra high frequency as used in television broadcasting. The reflected wave component affects the received image similarly to the night effect of the components reflected from the Heaviside layers, and results in the production of a shadow image on the television screen. The accidental nature of the discovery precluded the phenomenon from becoming a military secret, as its usefulness for defence purposes was not at first realised. It is possible to detect aircraft at a distance of several hundred miles and to locate its position within an area 50 miles wide and 100 miles long. The Air Ministry have ordered some television equipment for installation at strategic points along the Eastern Coast in order to obtain the first warning of the approach of aircraft.

TELEVISION AT B.H.

It is anticipated that there will be space to spare in the new extension at Broadcasting House for a studio in which television rehearsals can take place. This will help very much to relieve the congestion at Alexandra Palace, which is getting steadily worse.

Very probably some of the programmes may also emanate from B.H. and be sent to Alexandra Palace by line. At the present time many of the rehearsals are conducted in any hall that may be available in London or where a group of artists can be assembled.

TELEvised FILMS

Several full-length films have just recently been used in the Television programmes. One of the first "The Student of Prague" lasted for well over an hour, and although it was in German, being supplied with English captions, it was most enjoyable. The use of films of this kind greatly improves the programmes for they are better than the average variety programmes generally presented during the evening transmission.

RECENT AMERICAN TELEVISION DEVELOPMENTS

We are indebted to "Electronics" of New York for the following report of Papers on television read at The Institute of Radio Engineers Convention held in June at New York.

AN Iconoscope of greatly increased sensitivity was described at the Institute of Radio Engineers' Convention recently held in New York by H. Iams, G. A. Morton and V. K. Zworykin, of the R.C.A. Manufacturing Co.

This new form of television pick-up tube has a sensitivity about ten times as great as that of the conventional Iconoscope. A schematic diagram and a photograph

times as great as the charge actually produced by the photocathode in a given length of time. This results in a tenfold increase in sensitivity.

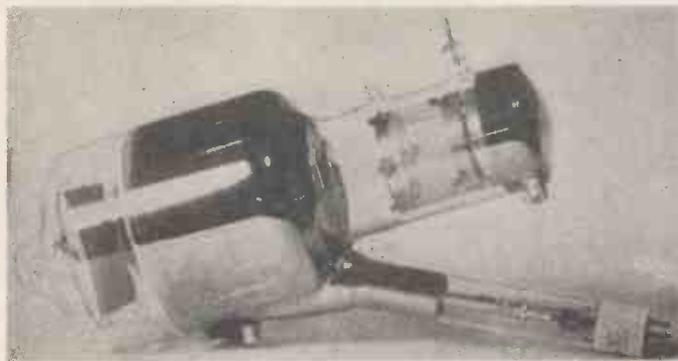
The insulated plate which retains the charge image, is scanned by a cathode-ray beam as in the conventional type, and the replacement of charge on the plate changes the potential according to the lights and shadows in each scanned line. The increased sensitivity may be used to

A New Electron Multiplier

A new type of multi-stage electron multiplier which employs electrostatic focusing in place of the previously used magnetostatic focusing was described by Dr. Zworykin and J. A. Rajchman. The electrode structure of one of the new tubes is shown. The curvature of the plates serves to direct the electrons from one stage to the next, focusing them successively on the inner surface of each plate, which has a high secondary emission ratio. One such tube, having ten stages and 200 volts per stage, gives a useful amplification of 13,000,000 times. Tubes of a larger number of stages having amplification in the hundreds of millions are feasible. One tube, employing a circular arrangement of elements, allows an amplification of several million within a tube one inch in diameter and one inch high.

Electron Tracing

The success of the new multiplying structure is due to the use of a very ingenious device for tracing the paths of electrons in different electrode configurations. A flat piece of flexible rubber sheet is pressed over metal elements which have the shape to be investigated, and the rubber sheet thereby assumes a three dimen-



Photograph of new Iconoscope. The mosaic may be seen at the extreme left. The gauze cylinder, adjacent to the photocathode, aids in focusing the electron image. The electron gun is similar to that used in modern cathode ray tubes.

of the new tube is shown on this page. The light from the scene to be televised is focused on a translucent photo-cathode. An image in electrons is thereby released from the cathode and focused by an electrostatic or magnetostatic lens on a flat plate of insulating material at the other end of the tube. This plate is treated to have a high secondary emission characteristic, and as the image of electrons hits it, the secondary emission leaves the plate with a charge deficiency whose distribution is the same as that of the lights and shadows focused on the photocathode.

Multiplying Action

As the bombardment of the image-plate continues, the charge deficiency increases in magnitude, but preserves its geometrical configuration due to the insulating properties of the plate. Consequently, the storage action characteristic of the ordinary Iconoscope is obtained.

The multiplying action of the secondary emission is such, however, that the charge stored is about 10

operate the Iconoscope with decreased levels of illumination, or with a smaller aperture in the camera, with consequent increase in the depth of focus.

The spurious signal or "shading" effect noted in the conventional Iconoscope is present in the new tube, but its extent is no greater than and in some cases considerably less than,

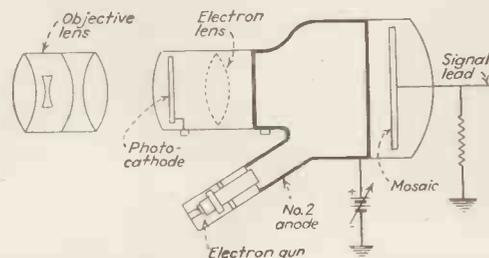


Diagram of the new Iconoscope. The mosaic, bombarded by an electron image from the illuminated photocathode, emits secondary electrons. The mosaic is scanned by a beam from the electron gun.

that of standard tubes. The image focusing system between the photocathode and the secondary emission plate is substantially the same as was described by Dr. V. K. Zworykin several years ago.

sional contour which follows the corresponding potential distribution between the elements. By placing steel balls on the rubber and tracing their paths as they roll on the hills and

(Continued on page 552)

SIMPLE EXPERIMENTS IN SUPERSONIC-WAVE LIGHT MODULATION

By J. H. Jeffree

A good deal of work has been done in recent years on supersonic-waves, and a few simple experiments on their optical effects will interest "Television" readers in view of their importance as a method of light modulation.

THE principle is as follows: A thin plate is cut from a quartz crystal in a certain direction, for instance, perpendicular to the

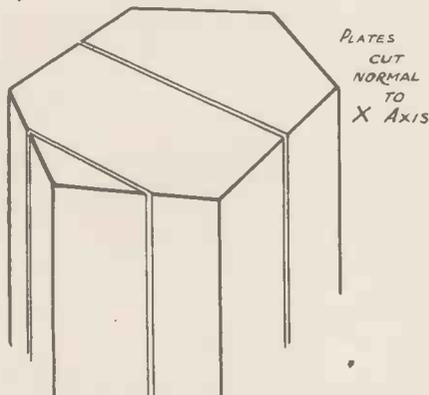


Fig. 1. Cutting quartz crystals.

electrical or "X" axis, as shown in Fig. 1. Such a plate has the property of changing its thickness when a voltage is applied to its surfaces.

If alternating voltages of the right frequency are applied, the changes set up a resonant vibration as shown in Fig. 2, both surfaces going inwards or outwards together, and the middle plane standing still. The movement is then much greater than that which a steady voltage of the same value

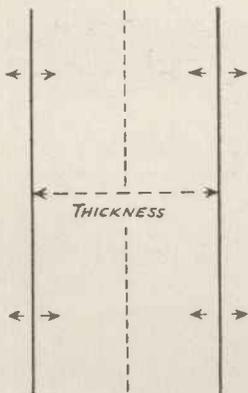


Fig. 2. Mode of Vibration of crystal.

would produce, and causes a reaction on the electrical circuit, which enables such a crystal to be used for control

of transmitters. For supersonic experiments, however, we are chiefly concerned with the waves that can be generated in a liquid in contact with such a vibrating crystal.

For this purpose the crystal can either be totally immersed in an (insulating) liquid, or stuck over a hole in the side of a cell or on the end of a tube, so that one side only is in contact with the liquid. Owing to the fact that the crystal is vibrating in resonance, it needs nothing on the other side to "push against," and actually gives a stronger effect when one side is free, so that the latter arrangement is preferable: but the former can also be perfectly well used for experiments if one has a suitable trough with flat sides. In either case the effect is, as shown in Fig. 3, that pressure waves travel away from the crystal and cause momentary local changes of density and, therefore, also of optical refractive index. If a beam of light passes through the liquid these changes, though small in themselves, can cause marked diffraction effects in it, owing to their sharp variation from point to point in the liquid.

To demonstrate them effectively, we must:—

- a. Excite the crystal at the resonance frequency.
- b. Pass light through the liquid parallel to the wave fronts.
- c. Focus the parallel beam on a screen.

Cell Construction

Any sort of flat-sided transparent cell can be used, but an open-ended type is better, such as was suggested in recent mechanical television articles. The dimensions of that cell are reproduced in Fig. 4, and it can be made of glass plates with spacers, of glued or painted wood, or ebonite or the like. A container made of a transparent synthetic resin can be bought.

The best crystal frequency is about 10 megacycles, but anything from 7 to 14 mc. will do quite well, so that a standard 7 mc. crystal can be used.

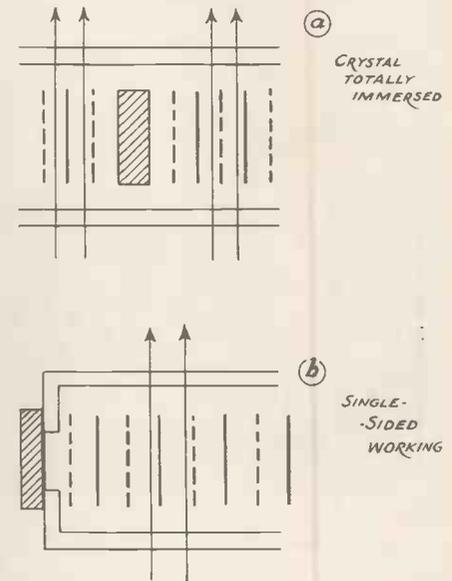


Fig. 3. Crystal-generated pressure waves and light rays.

It should be mentioned, however, that the high accuracy of grinding, needed for a good transmitter crystal, is

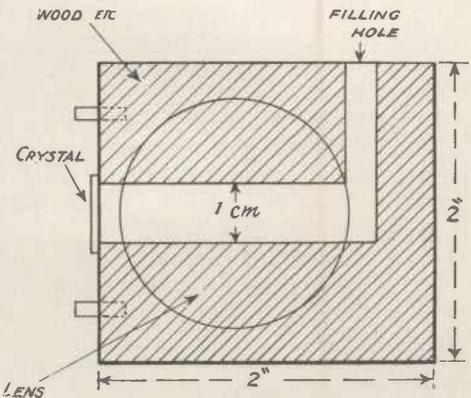


Fig. 4. Cell, with dimensions.

wasted on supersonic work, and a plate cut in the right direction (from an un-twinned crystal) and ground

to about 1/100th inch thick, is all that is really needed.

Electrodes are needed, and may be aluminium foil stuck on with seccotine. It is advisable to lay the crystal on a piece of plate glass, and smooth out excess cement by stroking with a

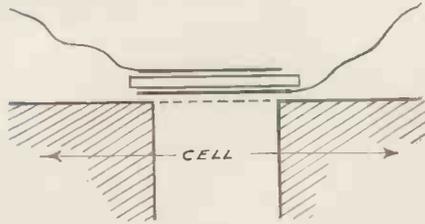


Fig. 5. Crystal electrode arrangement.

card or ruler. Strips of foil longer than the crystal are convenient, the extra lengths being for connections; they can go off in opposite directions on the two sides. On one side, the

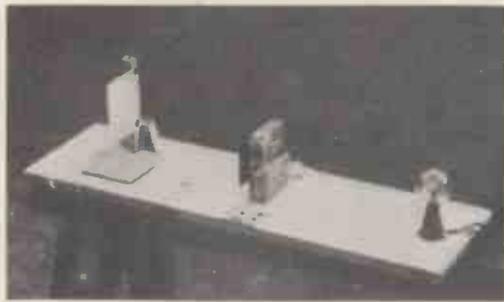


Fig. 6. Optical set-up (lamp, cell with lenses and Screen).

width can be that of the hole in the cell which it has to cover, and the other strip can be stuck down only over an area equal to that of the hole. In this way power is not wasted in making those parts of the crystal vibrate which are in contact with the cell walls; effective vibration only occurs where there is an electrode on either side, well stuck down.

As an adhesive, seccotine is suitable, because it remains a trifle damp and does not crack off. Sufficient should be used to make round the crystal a small squeezed-out ridge, which should be left. The tinfoil ends are made fast to firm connectors. (Fig. 5).

Two simple lenses are needed, one to take light from a small filament and make it parallel, for passage through the cell, the other to focus it on a screen on the other side. About 8 in. to 10 in. focus is very convenient for these, and those of 8 in. focus stuck on the mechanical television type of

cell are quite suitable. Otherwise, however, they need not be stuck on, but can merely be mounted near the cell on either side.

General Arrangement

The general arrangement is shown in Fig. 6. The lamp, with a small vertical filament (i.e., parallel to the crystal) can be a motor headlamp bulb, or anything with a single fairly straight filament not wider than about a fortieth of an inch. Lens A is at its own focal length away from this; then come the cell, lens B and, at its focal length beyond, a screen, such as a piece of card. Simple adjustable mountings, such as are shown in the picture, are convenient, and a foot or so of extra baseboard length beyond the screen would be an advantage for later experiments.

need an oscillator; it is no use trying to work from D.C. or ordinary sound or picture signals! The simple circuit of Fig. 7 is satisfactory; the thick lines are a simple oscillator, the thinner ones show how to add modulation. Any tuning condenser between .0001 mfd. and .0003 mfd. is suitable, and the coil is 10 turns, centre tapped, for a 10 mc. crystal and made by winding D.C.C. wire of something like 24 S.W.G., round the four fingers of the left hand; 5 turns, then a twist for the centre tap, and 5 turns more. The first and last half turns can be bound round the rest to secure it together, and the whole made into a close circular coil about 1½ in. diameter. There is no need for a more elaborate coil than this.

For a 7 mc. crystal use about 14 turns, and for 14 mc. crystal about 6 are suitable.

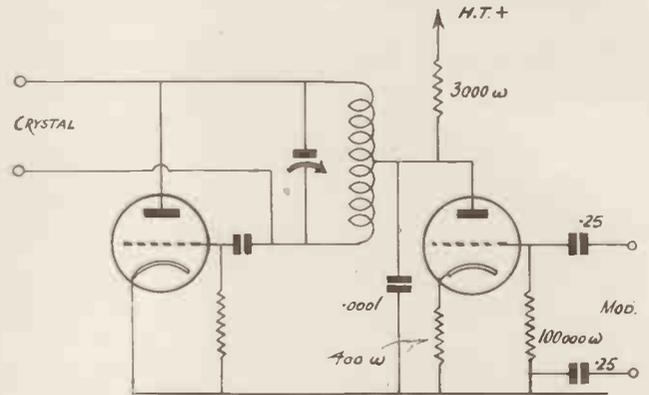


Fig. 7. Oscillator (left) and modulator (right) circuits.

The liquid in the cell may be almost anything that does not attack the materials and cements used in it, but care should be taken in experimenting with various liquids in a cell of synthetic material. Paraffin lamp oil, however, is one of the best liquids to use, and suitable for these experiments. The cell should be filled before any voltages are applied to the crystal, since it is not impossible, otherwise, to overload and crack it owing to lack of damping. For the same reason bubbles should not be permitted to lie up against the crystal face.

To avoid creeping of the paraffin, one may wipe the top of the filling hole as dry as possible, and stick down a piece of thin paper on it with seccotine, or use some kind of stopper. Leave a little air in the cell to allow for expansion.

Oscillator

For all supersonic experiments we

A small power valve is best for the oscillator, but almost anything with reasonable emission, and capable of acting as a triode, will do. For modulation experiments a mains type with 200 to 300 volts H.T. is desirable.

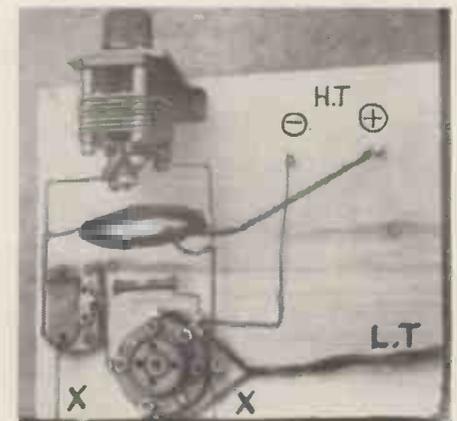


Fig. 8. Oscillator, points marked x are crystal connections.

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able, but a battery type with 100 volts will produce the simpler phenomena. Grid leak and condenser can be almost anything for the present experiments, but low values such as 25,000 ohms and 20 mmfd. will be needed for television work.

A similar valve will do for the modulator. The coil centre tap is

a poor one it is probable that the cell is at fault. Look for a short circuit, or an excess of damp cement between the crystal electrodes. If the television value of grid leak (25,000 ohms) has been used, one can try a higher value.

Oscillation having been secured with the cell connected, tune rapidly

end of the tuning range, showing which way to alter the coil. The most sensitive way to find such effects is often to remove the screen, and look through the cell at various bright and dark objects, keeping the line of sight as nearly parallel to the crystal face as possible and watching for the faintest doubling of outlines as tuning, and line of sight, are varied.

Having got the effect, it can be noted that the milliammeter shows maximum current at correct tuning, indicating that at resonance the crystal draws most power from the circuit. Now the phenomena of fringe formation can be studied.

Fringe Phenomena

Each fringe, like the centre image, is an image of the filament, but the fringes are slightly coloured at the edges (apart from colour aberrations, due to the use of uncorrected lenses). The outer edges are redder, the inner blue. Well off tune, there is a single faint fringe each side, nearer resonance a second pair appears, then a third. Note that they are equally spaced from each other, and that the phenomena is *not* one of actual movement of the light (though it can give that impression), but of the successive brightening up of fringes further from the centre. There is, however, a slight change of spacing during tuning, the separation of fringes growing greater with increasing frequency. The *spacing* depends on *frequency*, the *brightness* distribution on nearness to resonance, that is, on the *effective power*.

As the fringes increase, the centre image darkens, becoming brownish. This means that blue light is being thrown out of it, into the fringes, more readily than red. With enough power, however, after darkening to a certain point at which it nearly disappears, it begins to brighten up again, and is then bluish. This means that there is a point, for any particular colour, at which maximum darkening occurs, and it occurs sooner for blue than red. Theoretically there then follows a whole series of faint and decreasing maxima and minima for each colour, but in practice one hardly sees more than the first. Also, however, one can notice that the first fringe on each side now pass through a dark minimum, and (with enough voltage) the second fringes after them. The minimum of the

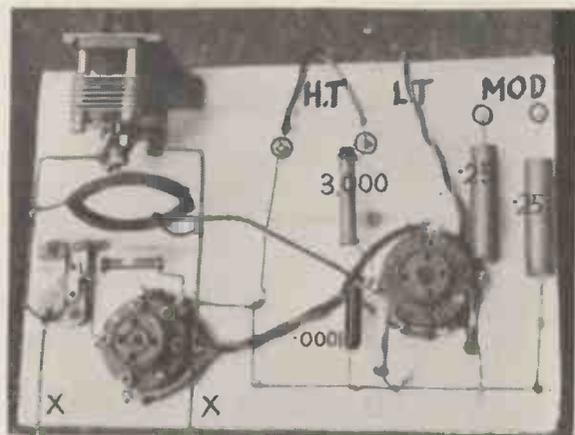


Fig. 9. Modulated oscillator. Points marked x show crystal connections.

then to be earthed for H.F. by a small condenser—about .0001 for television work—and there is no harm in including this in the simple oscillator from the start. For safety in applying all sorts of modulation, condensers have been included in both input leads. Fig. 8 shows the simple oscillator, Fig. 9, with modulation added.

While there are better circuits for television work, this one is perhaps the simplest and gives a positive picture with the sort of arrangement suggested in recent articles. This is the justification for giving component values more suited to television than to the simple experiments of this article.

Inclusion of a milliammeter in the H.T. lead is advantageous for checking behaviour of the oscillator.

Getting the Effects

Now connect up the filled cell across the oscillator tuned circuit, remove the modulator valve, if any, and switch on the light and the oscillator. First, check whether it is oscillating. The milliammeter will show changes on tuning if it is, and a screwdriver across the tuned circuit will draw sparks. If not switch off and disconnect the cell; if oscillation then occurs, one can try connecting the cell across the half tuned circuit only (centre tap—one end) on the idea that the damping may be a bit too great for the valve: but unless the latter is

through the range, and look for any movement in the liquid, spreading of the filament image or sharp maximum in H.T. milliamps. Having obtained such, leave the tuning there and try, by slightly rotating the cell right and left, to get a symmetrical fringe formation of maximum amount on either side of the filament image. This done, the tuning can also be adjusted for maximum effect.

If, in spite of the presence of oscillation nothing can be seen, the tuning may be quite wrong. In that case a faint effect may be found at one

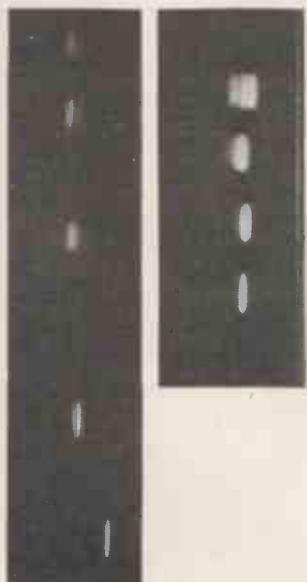


Fig. 10. Fringe formations A varying power, B varying slant.

(Continued on page 541.)

HARD VALVE SCANNING CIRCUITS—II

In this article, which is a continuation of that in last month's issue, G. Parr describes two more types of circuits and gives some notes on the output stage of the scanning circuit.

IN the hard valve circuits, described in last month's issue, two valves were used, one to act as the discharge valve and the other as a triggering valve to initiate the discharge.

It is possible to construct a single-valve discharge circuit in which, given the right conditions, the valve will automatically discharge the condenser in the same manner as a thyratron. To do this, the grid and

more positive, until the condenser is rapidly discharged and the valve ceases to conduct. The bias is then restored and the charging cycle recommences.

For this circuit to operate satisfactorily, several precautions have to be taken. The polarity of the transformer winding must obviously be such that the grid is driven positive by the discharge current or the valve will not work. When the discharge current is flowing, the valve must be prevented from oscillating continuously. This condition is usually obtained when the charging condenser is of a high value and the transformer winding is undamped. The valve will then tend to oscillate at the natural frequency of the transformer during the charging time of the condenser. To prevent this, a damping resistance R^2 is connected across either the primary or the secondary of the transformer, and adjusted until a single pulse of current is obtained. If the resistance is too high there is a tendency for one or two damped oscillations to occur during the cycle.

Synchronising of the circuit to the television signal is best done by the addition of another winding tightly coupled to the secondary winding of the transformer. In an experimental circuit tried by the writer the following values were used:—

C. 0.5 mfd. R. 250,000 ohms
C² 25 mfd. R² 50,000 ohms variable.

The transformer was a 1:1 ratio Telsen driver transformer, the damping resistance being connected across the primary side.

With a 6C5 triode as the discharge valve, the bias resistance should be 10,000 ohms variable. The speed is controlled by R and the amplitude by R², and the circuit gives an excellent saw-tooth wave on 350 v. H.T. which can be amplified in the usual way.

Squegger Circuit

The squegger circuit, which was first described in a paper by Appleton, Watson-Watt, and Herd* is, in some respects, similar to the single valve circuit just described, but in this case

the valve is allowed to oscillate continuously with pauses of quiescence ("squegging").

The principle is shown in the diagram of Fig. 2a. The anode and grid circuits are coupled as before, but in the grid circuit is included the condenser C and the leak R. When the valve is switched on it tends to oscillate if the coupling between the coils is sufficiently tight, the frequency of the oscillation depending on the coil constants. As soon as oscillations commence, the condenser C is charged and the potential rises slowly. The grid of the valve thus becomes more and more negative to the cathode until the grid bias is sufficient to stop the flow of anode current and the oscillations cease abruptly. The condenser C then begins to discharge through the resistance R at a rate determined by the time constant of C and R, until the grid potential has fallen sufficiently to allow oscillations to commence again.

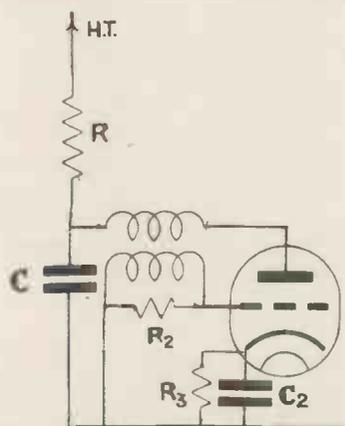


Fig. 1. A single-valve discharge circuit with anode and grid coupling.

anode circuits are coupled together as though the valve were intended for an oscillator, but the constants of the circuit are so arranged that it is prevented from oscillating continuously.

The arrangement is shown in Fig. 1. The grid is connected to the secondary winding of a transformer, the primary of which is in the condenser discharge circuit. The condenser C is charged through a resistance in the usual way. The valve is biased beyond the cut-off point by a self-bias resistance and condenser C² which serves as a reservoir to maintain the bias potential.

Assuming that steady conditions are established, the condenser charges until its potential is sufficient to start the flow of anode current through the valve. The initial current through the transformer winding induces a potential on the grid which reduces the bias still further. The current increases, the grid becomes

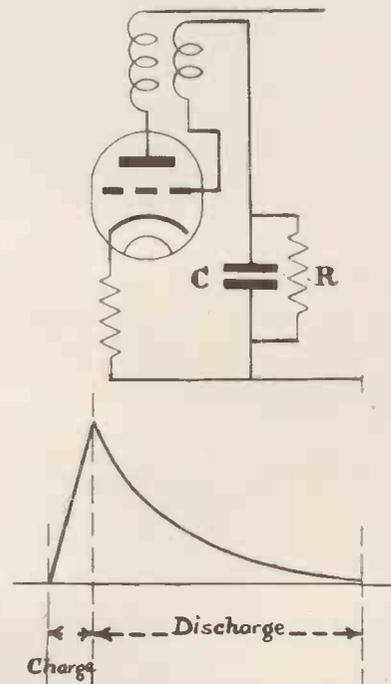


Fig. 2. (a) 'Squegger' circuit in which the condenser C is charged during oscillation and discharges slowly. (b) The discharge curve is exponential when R is used across the condenser.

* Proc. Royal Soc. 1926 (A) 111,165.

AMERICAN SCANNING CIRCUITS

If we consider the changes in potential across C we find that the potential rises rapidly during the oscillation period, and then falls more slowly (Fig. 2b). The shape of the potential curve with a plain resistance is exponential, but it can be straightened into the usual saw-tooth by the use of a pentode instead of the discharge resistance. It will be noted that the action of this circuit is the reverse of the familiar charging circuit—the condenser rises rapidly in potential and then discharges slowly.

The squegger circuit is capable of a wide range of speed with a pentode discharge valve of which the screen is varied to alter the rate of discharge and is a reliable oscillator, although it is sometimes difficult to adjust for optimum conditions.

Oscillator Controlled Circuit

Although more complicated than any of the foregoing circuits, oscillator driven circuits are popular in American television practice, and a typical one is described in Zworykin's paper before the Institution of Electrical Engineers.†

The principle of the circuit is the use of a separate oscillator to operate the discharge valve by applying a peak potential to the grid at controlled intervals. A simple form of circuit is shown in Fig. 3. The condenser C is charged through a pentode in the usual way and the discharge valve V is connected across it. The grid of the discharge valve is connected to an oscillator of the dynatron or Hartley type. To ensure a sharp peak of potential on the grid of the discharge valve the oscillator valve operates as a "class C," the anode current rising in pulses of short duration. The sweep frequency is governed by the interval between the peaks of current from the oscillator, and these must last for a sufficient length of time to enable the condenser to be completely discharged. The adjustment of the circuit is critical, and it is doubtful whether the results obtained warrant the extra complexity so far as the experimenter is concerned.

Output Amplifiers

When resistances are used in the charging circuit of the time base the discharge potential must necessarily be kept low to preserve the linearity

of the charge. This means that the amplifier feeding the deflector plates must develop sufficient voltage across its anode load to produce a full deflection of the beam with a moderate input. The peak voltage across the amplifier will be high if the larger sizes of tube are used, and it is not uncommon to reach a value of 700 to 1,000 volts under certain conditions. This imposes a considerable strain on the insulation of the valve, and special valves are usually designed for the output stage. The Mazda AC/P.4, for example, has the anode connected

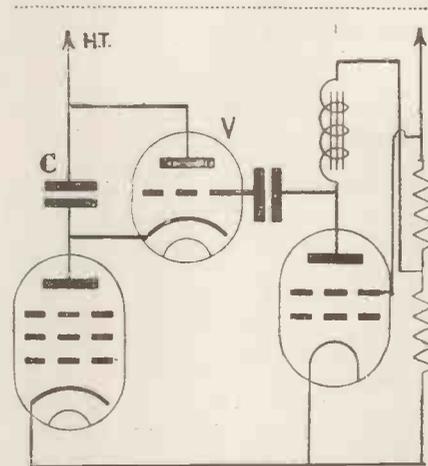


Fig. 3. A discharge valve (V) driven from an oscillator. Minor details have been omitted in the circuit, which is only diagrammatic.

to the top terminal and is rated to give 2,000 v. output with an H.T. voltage of 1,200.

With smaller amplitudes of deflection it is possible to use a single-valve amplifier following the discharge valve being applied directly to one of the deflector plates and the output of the amplifier to the other. This means that the condenser potential must be equal to half the peak-peak deflecting voltage, and there is a tendency for the charging curve to become non-linear if this value is high. An ingenious method of keeping the deflection linear has been devised by Bedford,‡ and is used in the Cossor receivers.

The curvature of the amplifying valve characteristic is deliberately designed to counteract the curvature in the charging potential of the condenser, so that when the potential is amplified it is substantially straight. This enables a single valve to be used

to produce a large deflection with moderate voltages, and is more economical than the usual method of two push-pull valves.

"Simple Experiments in Supersonic-wave Light Modulation."

(Continued from page 539)

second fringes, however, will be markedly coloured.

To see these effects at their best one should focus the images carefully, and also stop out all except a small part of the cell aperture, about a quarter inch square or so, to get good definition and a comfortable brightness. Fig. 10 shows some of them.

By turning the cell slightly, leaving the tuning set for maximum effect, one can see the effect of skewing the waves relative to the light. The maximum fringe brightness moves to one side, and the central image brightens; the fringes then fade out, to nearly zero, and on further skewing show a slight re-appearance. Again, theoretically, one could get an unlimited series of ever fainter maxima and minima, with sufficient power.

The Co-axial Cable

Reports have received wide publicity to the effect that the co-axial cable between London and Birmingham is "an expensive failure." This is a perversion of the truth. In fact no attempt has been made to televise pictures from London to Birmingham by this Post Office cable because it was realised from the start that it had not reached the necessary technical standards.

But on the other hand it is practically certain that the first provincial television station will be in Birmingham. It is understood on the highest authority that the Post Office now has under consideration the use of an ultra-short wave link between London and Birmingham. This would be effected in three hops of about thirty miles each, relay points being established at each of the intermediate stages. The fact that the B.B.C. has a second mobile unit available will make an early experiment on these lines practicable. This method, it is held, would be much less expensive.

† J.I.E.E. Vol. 73, p. 437.

‡ Jour. Tel. Soc., Vol. 2, p. 228.

TELEVISION AT THE BERLIN RADIO EXHIBITION-1938

By E. H. Traub

This is the first part of a special report of German developments. The second part will appear in next month's issue.

THIS year's Berlin Radio Exhibition, which opened on August 5, was of outstanding interest to the "television world" as this year

hibition was housed in one of the many halls surrounding the famous Funkturm, which go to make up the whole Exhibition. The television hall itself was very nearly the size of the Grand Hall at Olympia.

Whilst the show did not reveal any fundamentally new systems or apparatus, there were nevertheless many exhibits of outstanding interest. Moreover, it should be emphasised at the outset that all pictures were on the new 441 line interlaced standard, and that the general quality of reception was amazingly high.

The following firms took part in the show: Fernseh A.G.; Telefunken, Loewe, Lorenz, Tekade, and the Research Institute of the German P.O. (Reichspost).

Fernseh A.G.

There is not a shadow of doubt that the most outstanding exhibits in small and big receivers as well as in

transmitters were those of Fernseh, A.G. It is truly amazing how this company has mastered all the various phases of television transmission and reception. The two technical heads, Dr. Möller and Dr. Schubert and their staff must be congratulated on this fine achievement. I have difficulty in finding sufficient superlatives to express my admiration for their work.

The most important exhibit of this company was their big-screen picture, about 10 ft. by 12 ft. in size, projected from a primary picture about 4 in. by 5 in. The projection C.R. tube had 60,000-80,000 volts on its anode! The chief reason for the success of this picture must be attributed to a new type of front projection screen which concentrates the light into a strictly limited but adequate angle of viewing. This screen gives an increase of light of 15 times compared with an ordinary cinema screen. Whilst precise details of

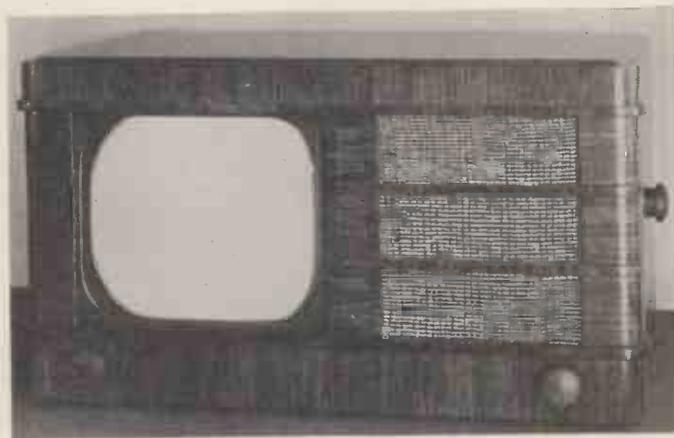


The Fernseh Home Receiver with 16-in. cathode-ray tube indirectly viewed.

will definitely mark the introduction of commercial television in Germany, after some 12 years of development.

The television section of the Exhi-

Right.—The Fernseh small and compact Home Receiver



Left.—The new small Telefunken Home Receiver with side removed showing interior arrangements.



this screen are still secret, it can be stated that the screen contains some two million lenticular elements. This screen can, of course, be used with any type of television projector and will also find application in the cinema, particularly in connection with colour films.

The picture had a brightness of 5 foot candles (50 lux). In my opinion this picture is the best television ever shown in public. In all respects, size, brightness and definition, and

half tones, it was practically equivalent to a cinema picture which, after all, is the best standard for comparison for television pictures. The amazing definition, moreover, proves that recent statements regarding the necessity of 800-1,000 lines for big screen television are sheer moonshine.

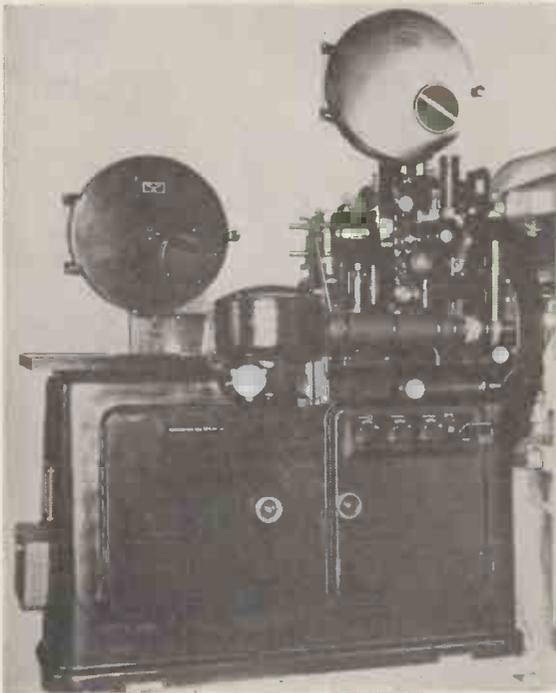
ness was higher! This, by the way, is one of the sets which will be available to the German public after the 1st of October. No prices have been announced yet, but I understand that this set will cost £35-£40.

Another model which will probably also appear on the market was of the

ground, was placed in the lid of the set. In use the lid was opened to a position about 10° from the vertical.

Transmission

Several transmitters were also shown working. No doubt the most remarkable of them was the 441 line

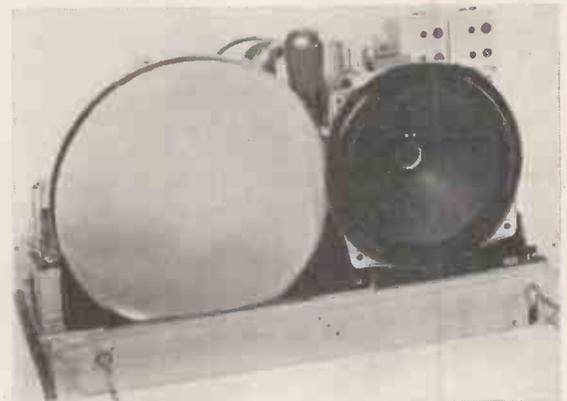


The next surprise item of Fernseh, A.G., was their small home receiver giving a picture 8 in. by 9½ in. on an 11 in. tube. In spite of this "normal" picture size, the receiver is only 14 in. deep and yet the picture is viewed directly—without the use of mirrors. As can be seen by the photograph, the picture, and the speaker are side by side. Only two controls are fitted, one for picture contrast, the other for sound volume. The receiver also contains a straight set for sound reception, not only of television sound, but also of the local "regional" medium-wave station and the "national" long-wave station. The selection of these stations is made by means of a rotary switch at the side of the set. The set is rather smaller than the average radio receiver, yet it contains about a dozen valves and an 11 in. C.R. tube. Truly a wonderful feat. The quality of the picture has not in any way been sacrificed to compactness. In fact, my impression was that the definition on the sets on view was considerably better than that of average British sets, and the bright-

The Fernseh 441-line disc transmitter for films, slides or spotlight transmission of persons.



The home cathode-ray tube projection receiver by Fernseh giving a picture 13 in. by 16 in.



Chassis of the Fernseh compact Home Receiver.

more conventional console type with mirror viewing. This model has a 16 in. diameter tube giving an excellent picture 10½ in. by 13 in. approximately. This model can be supplied with all-wave radio or the fixed 3-station system fitted to the smaller set. It is understood that these sets use both magnetic scanning and focusing.

Also shown was a cathode-ray projection receiver for home use, giving a picture 14 in. by 16 in. approximately, which struck one as being a little on the small side for a projector. Front projection was again used. The screen, which was a concave mirror with the front surface

disc transmitter, which not only transmits films but also lantern slides, and can be used as a spotlight transmitter for semi-"close-ups." All three functions are performed simultaneously and with a single scanning disc, rotating at 10,500 r.p.m. No arc lamps are used, but ordinary filament lamps of 900-watt consumption. The construction of this transmitter must rank as one of the outstanding feats of precision engineering of our time. Again my impression was that the pictures received from it were of extraordinary high definition such as we have never witnessed before. The pictures were shown on some special

demonstration receivers, using C.R. tubes 20 in. in diameter. Inciden-



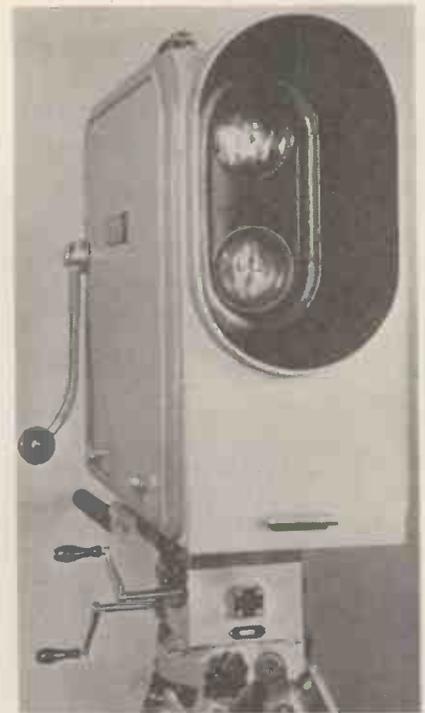
The Fernseh big screen cathode-ray projector giving a picture 10 ft. by 12 ft.

tally, these tubes had screens which were perfectly black and white, and of enormous brightness.

A number of film transmitters using Farnsworth image dissectors were shown, which also gave excellent pictures, and quite free from shading errors; these transmitters are very simple in construction and quite compact. Filament lamps are again used at light source.

Some fine Iconoscope cameras were shown, in which the problems of the camera man have been studied. The view-finder, for instance, shows the image the right way up, and a depth of focus scale is fitted at the back.

Some further particulars of German developments will be given next month in a second article.



The Fernseh Iconoscope camera.

"SIMPLE RECEIVERS FOR TELEVISION SOUND."

(Continued from page 532)

How the receiver is constructed can be seen from the illustration. The small bakelite panel is used to hold the grid and oscillator coils and the three trimmer condensers. The grid coil can be mounted directly across the 30 mmfd. condenser while the reaction winding made of flexible wire is wound around the centre of the grid coil. Construct the grid coil of four complete turns of 16 gauge wire, $\frac{3}{8}$ in. diameter and spaced approximately the gauge of the wire. Between three and four turns of flexible wire bunched wound around the grid coil will serve for reaction.

A further single turn coil has to be looped around the earthy end of the grid coil and connected either to a di-pole aerial or to an ordinary aerial with a ground connection. In this way there is no need for aerial and earth terminals although these can be used in order to make the circuit arrangement more rigid.

Unless the detector valve is fed with the correct screen voltage, it may be difficult to obtain sufficient oscillation. With the power pack recommended correct screen voltage is obtained when the screen resistance network has 25,000 ohms in the high voltage side and 30,000 ohms in the

low voltage side. The screen is also by-passed to earth by .01 mfd. condenser. Should the power pack deliver a higher voltage than it will be necessary to increase the value of the upper resistor in order to reduce the voltage. Alternatively a variable

tuned in there will be the conventional chirp. If, however, there is no trace of oscillation try the effect of reversing the connections to the reaction coil. Should this not have the desired effect revert to the original connections but increase the number of turns until oscillation is obtained. The Alexandra Palace transmitter is then tuned in and the reaction condenser slackened off until oscillation just stops. This receiver is then in its most sensitive condition.

During these tests there is no need to have the aerial connected. If the aerial is a long one, when it is connected to the receiver the damping will probably cause the circuit to go out of oscillation, in which case, loosen the coupling between aerial and coil. Instead of having one full coupling turn of flexible wire, use a stiff wire and arrange for this to be fixed away from the grid coil. The position should be found which gives maximum volume but which does not cause the receiver to stop oscillating. Once the station has been tuned in there should not be any further need for retuning. There will be slight frequency drift but if the tuning is left alone, when the valve reaches normal working temperature it will generally be found that the station is correctly tuned in.

The following components are recommended for use in this circuit.

- 3—30 mmfd. trimmers with ceramic bases (Bulgin).
- 1—.0005 mmfd. tubular condenser (Dubilier).
- 2—.01 mfd. tubular condensers (Dubilier).
- 1—.02 mfd. tubular condenser (Dubilier).
- 1—.02 tubular condenser (Dubilier).
- 2—4-mfd. type 400-volt working (Dubilier).
- 1—8-mfd. type electrolytic 450-volt working (Dubilier).
- 1—500,000 ohm $\frac{1}{2}$ -watt resistor (Bulgin).
- 1—30,000-ohm type $\frac{1}{2}$ -watt resistor (Bulgin).
- 1—25,000-ohm type $\frac{1}{2}$ -watt resistor (Bulgin).
- 1—50,000-ohm type 1-watt resistors (Dubilier).
- 1—250-ohm type 1-watt resistor (Dubilier).
- 1—100-ohm type 1-watt resistor (Dubilier).
- 1—10,000-ohm type 1-watt resistor (Dubilier).
- 1—500-ohm type $\frac{1}{2}$ -watt resistor (Bulgin).
- 1—300,000-ohm type $\frac{1}{2}$ -watt resistor (Bulgin).
- 2—7-pin chassis type valve holders (Clix).
- 1 Mains transformer giving 240 volts 100 mA. and 4 volts CT. at 3 amp. (Premier).
- 1—50 mA. smoothing choke (Varley).
- 1 HT16 metal rectifier (Westinghouse).
- 1 Two-way loudspeaker connector (Belling & Lee).
- 1 ACS2/PEN (Mazda).
- 1 AC2/PEN (Mazda).

resistor of 100,000 ohms across the entire power supply could be used to advantage.

Before putting the receiver to work oscillation must be obtained. The reaction condenser should be screwed down hard and then if the circuit is oscillating, when a station is

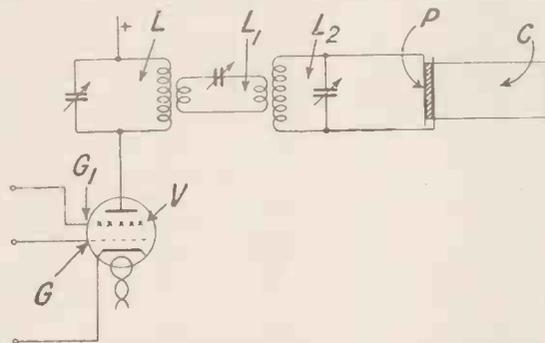
RECENT TELEVISION DEVELOPMENTS

A RECORD OF PATENTS AND PROGRESS *Specially Compiled for this Journal*

Patentees: Scophony Ltd., J. Sieger and J. H. Jeffree :: O. von Bronk :: Fernseh Akt. :: Cie pour la fabrication des Compteurs et Materiels d'Usines à Gaz :: Telefunken Ges fur Drahtlose Telegraphie m.b.h. :: W. E. Benham :: Marconi's Wireless Telegraph Co., Ltd., D. L. Plaistowe and D. J. Fewings

Light-modulating Devices (Patent No. 482,665.)

RELATES to means for modulating a beam of light by passing it through a "liquid cell" which is subjected to high-frequency



Liquid light-modulating device. Patent No. 482,665.

mechanical waves produced by means of a piezo-electric crystal.

The piezo-electric crystal P, as shown in the figure, is mounted at one end of a tube or "cell" C containing petrol or other suitable liquid. The frequency of the crystal is usually equal to the incoming carrier-wave, but since the band of signals to be handled is at least one megacycle in width, it is necessary to adapt the input circuit accordingly.

The incoming signals, varying from zero to one megacycle, are applied to the grid G of the valve V, whilst local oscillations of 10 megacycles are applied to the second grid G₁. The output from the valve is fed to the crystal through three tuned circuits marked L, L₁, L₂, which are tightly coupled together to give a double-humped resonance curve, with one "peak" at 9 megacycles and another "peak" at 11 megacycles. This provides a two-megacycle band-pass input to the crystal.

The ray of light to be modulated is passed through the light cell C in a direction at right-angles to its length. —Scophony, Ltd., J. Sieger and J. H. Jeffree.

A "Stationary" Glass Scanner (Patent No. 484,706.)

A photographic film F is scanned by light which has passed through a stack P₁, P₂ . . . of glass plates of different lengths. The light takes

across the film at "framing" speed. The successive flashes energise the photo-electric cells C to produce signalling currents.

A similar scanning arrangement is used for reception, as shown in

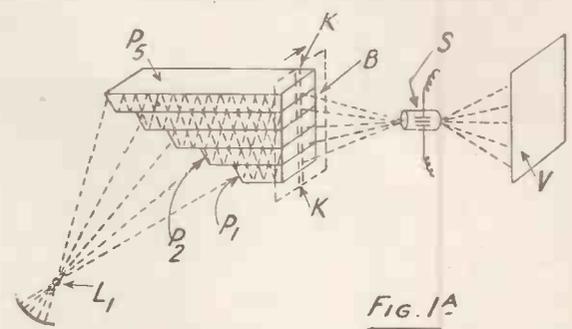


Fig. 1A

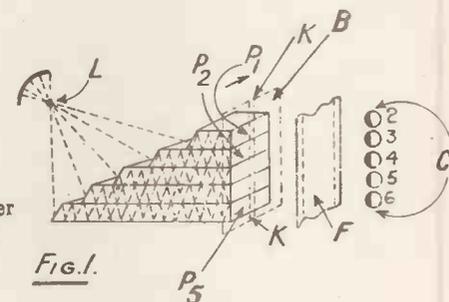


Fig. 1.

"Stationary" glass scanner
Patent No. 484,706.

a slightly longer time to pass through one plate than the other, and therefore emerges, not simultaneously, but as a series of rays which follow each other in time. To increase the "interval," each ray is subjected to a series of internal reflections, as indicated by the dotted lines, so as to give it a longer traverse than if it passed through the glass directly. This permits a perceptible time-delay to be obtained from a plate of comparatively small size.

The lamp L is interrupted or "flashed" at rapid intervals, corresponding to the "line" frequency. Each flash, after it has been broken up into shorter flashes by the plates P₁, P₂ . . . , passes through a slot K in a screen B, which moves

Fig. 1A, except that the ray which passes through the shortest glass at the transmitter is now passed through the longest one, the whole sequence being similarly reversed. The lamp L₁ is flashed at the same speed as the lamp L used for transmission. The supply current for the lamp is also used to control a shutter S which throws the signals on to the viewing screen V.—O. Von Bronk.

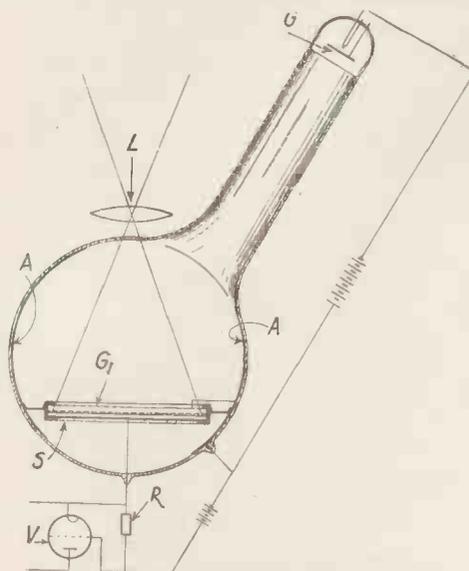
Television Transmitters

(Patent No. 484,913.)

Relates to the type of cathode-ray tube in which the picture to be televised is projected through a lens L on to a mosaic-cell screen S which is then scanned by the electron stream from the gun G of the tube.

In order to increase the acceleration potential on the scanning stream a finely-meshed grid G is mounted close to the screen and is connected to the highly-positive anode coating A of the tube. This serves to collect the electrons emitted by the screens, without disturbing the accurate scanning movements of the electron stream.

In constructing the mosaic screen, the wire-mesh grid G₁ is first placed



Mosaic screen pick-up tube. Patent No. 484,913.

in position, and the photo-sensitive layer of silver and caesium is then deposited on the screen by evaporation through the meshes of the grid. This serves to separate the layer into a mosaic of elementary areas, corresponding to the interstices of the meshwork, and also ensures that there is no loss in the photo-electric effect produced by the light from the lens L. The signal currents developed across the resistance R are passed through an amplifying valve V.—*Fernseh Akt.*

Cathode-ray Receivers
(Patent No. 485,412.)

The drawing shows a cathode-ray tube combined in the same glass envelope with an electron multiplier, in order to increase the brilliance of the received picture. The first cathode C of the combination may be of the indirectly-heated type, energised from a battery B, or it may be of the photo-electric type and activated by a ray of light from a source S.

In either case the electrons originally liberated are made to impact against a series of target electrodes T₁, T₂, where secondary emission takes place. The last target T₃ is

the source of the scanning stream which passes through the vertical limb of the cathode-ray tube.

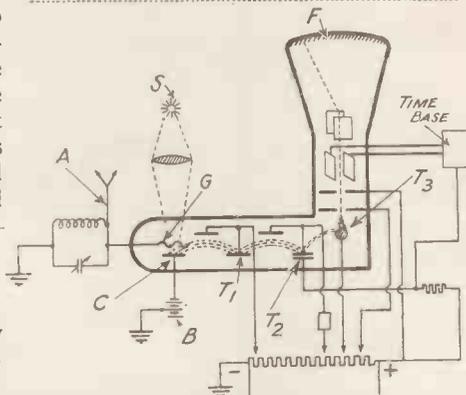
Television signals received by the aerial A are applied to the control grid G, where their effect upon the electron stream reaching the fluorescent screen F is emphasised by the intervening amplification produced by the target electrodes T₁, T₂, T₃.—*Cie. pour la Fabrication des Compteurs et Materiels d'Usines à Gaz.*

Cathode-ray Transmitters
(Patent No. 485,453.)

An optical image of the picture to be televised is first projected on to a photo-electric screen, and the stream of electrons so produced is focused on to a second film or screen in the same tube, so as to produce an "electric" image. The latter is then scanned to develop signalling voltages.

The second screen consists of a thin film of metal oxide or sulphide. This is only semi-conducting, and so allows the formation of individual electric charges resembling the original light-and-shade effects of the original picture. When the semi-conducting screen is scanned by an electron stream, secondary emission takes place, the intensity of the emission varying from point to point with the value of the individual electric charges.

The secondary electrons so liberated are collected on an adjacent electrode, and form the basis of the signalling currents.—*Telefunken Ges Fur Drahtlose Telegraphie m.b.h.*



Combined cathode-ray tube and electron multiplier. Patent No. 485,412.

Television Sets
(Patent No. 485,653.)

In order to reduce the number of valves used in a television receiver, the signals are applied to the time-base unit directly, after they have passed through the first rectifier stage, the usual separating valve being omitted.

The discharge valve of the time-base unit is normally biased to the cut-off point, and the signals from the rectifier are applied to it in such phase that the picture signals are negative and the synchronising impulses positive. The former, therefore, have no effect on the valve, whilst the latter make the valve conductive so that it discharges the condenser used to produce the saw-toothed scanning oscillations.—*W. E. Benham.*

Time-base Circuits
(Patent No. 486,041.)

The charge and discharge of a condenser used to generate scanning oscillations is controlled by the deflection of the electron stream through a valve of the cathode-ray type. During the charging-up period, the electron stream falls on to one anode of the valve, but when the condenser voltage reaches a certain value, the stream is deflected to one side, so that it falls on to a second anode.

In this latter position the stream opens up a discharge path for the condenser, thus producing the "fly-back" stroke. When the condenser voltage falls, the electron stream reverts to its original position and the charging-up of the condenser commences again.

The deflection of the electron stream to the critical point where the main condenser begins to discharge is controlled by the application of a synchronising impulse, which need only be of small amplitude owing to the sensitive response of the electron stream in a valve of this type.—*Marconi's Wireless Telegraph Co., Ltd., D. L. Plaistowe, and D. J. Fewings.*

Summary of Other Television Patents

(Patent No. 483,385.)

Television receiver utilising an electron scanning device utilising a light-sensitive cell subjected to high-frequency oscillations from a piezo-electric crystal.—*E. Traub.*

(Patent No. 483,679.)

All-metal cathode-ray tube with a fused-in glass viewing-screen.—*A. Castellani and "Sajar."*

A TWO-VALVE RECEIVER FOR TELEVISION SOUND

On page 531 of this issue a circuit is given for a two-valve receiver for television sound in which an error appears. It should be noted that the moving plates of the .00003 mfd. condenser should be connected to earth.

Telegossip

A Causerie of Fact, Comment and Criticism

By L. Marsland Gander

IN television trade circles I hear considerable controversy over the wisdom of giving publicity to news of long distance reception, coupled with a debate over the claims and counter claims. Does it help television, I am asked, to report reception of the Eiffel Tower at a distance of 180 miles on an extra special set in an unusually favourable situation?

Does it tend to make false impressions in the public mind and increase their uncertainties regarding television when they discover snags? A television enthusiast writes to me: "Certain hilltops over 100 miles from Alexandra Palace may, under conditions of complete freedom from interference get passable pictures—but the implication that the reliable range is much more than 30 miles is simply not true. I am over 30 miles from A.P. here (Sevenoaks) but then I am 600 feet high and in a quiet road . . ."

Now while I am inclined to agree that excessive optimism regarding the range of television is undesirable, there is no justification for rushing to the other extreme. I had an experience the other week-end which was a revelation. When visiting Angmering in Sussex I noticed a television aerial of the reflector type attached to the chimney stack of a new villa built facing the sea *and at sea-level*. The summit of the aerial was only about 70 feet from the ground.

I could not resist the temptation to investigate. The owner of the house, when rung up on the telephone, hospitably invited me to see a demonstration of the 9 o'clock transmission there and then. When I duly arrived I found that mine host was not in any sense a television expert but simply an ordinary viewer. Nor was there anybody in the house who could claim expert knowledge of the set and its workings. He simply switched on and the familiar geometrical diagram appeared on the screen. Then for half-an-hour we watched a cabaret programme and a news reel. The reception made favourable comparison with the pictures I receive in Barnes, nine miles from the transmitter; yet there we were at a distance of sixty miles as the crow flies.

The extraordinary part about this feat of reception was that the ultra-short waves must have hopped over

both the North and the South Downs. Glancing at the map one notices that Box Hill is also roughly in the line of fire. True this particular dwelling is situated far from possible sources of interference, but in all other respects the reception seemed to provide the complete answer to my friend. Only once was the picture seriously upset, and then when some visitors arrived at the door by motor-car, with the usual devastating result on the screen.

I may add that the audience watched the pictures quite happily till a demonstration of leather work began in the A.P. studio. Then mine host switched on the electric lights and suggested a game of cards.

The Programmes

Which brings me to the second point constantly under discussion in television circles just now. Has the B.B.C. discovered the ideal vision programme and is it using programme time to the best advantage? Again I quote the opinions of others. I held a television seance the other night at home. Afterwards I asked one of the visitors, a keen listener, what he thought of the programmes (we had been seeing televariety). "Half the time I wasn't looking at the screen, and I could appreciate the programme just as well," he remarked.

Poor Gerald Cock! This sort of criticism is so crushing and so unhelpful. Yet the truth must be faced. For one reason or another the studio shows are the least acceptable of all the B.B.C. television programme activities. In my own view the most successful and the most entertaining pictures of the past month were those of the Women's European Diving Championships from Wembley Pool. Why? Because they were topical, actual, competitive, the embodiment of physical skill and graceful movement, and because they made beautiful action pictures, seen in close-up. Unlike so many others, this programme was one you could NOT appreciate with eyes closed.

So what? The B.B.C. has just acquired a new mobile film unit and by the time these words are in print will have also taken over the second of its £20,000 mobile television units. This is a clear indication of the line of future development. The B.B.C.

must, and no doubt will, go out into the open more and more. The new film unit consists of a saloon car equipped with a movie camera and sound head. The car has a specially reinforced roof on which the camera tripod may be mounted.

It is stated semi-officially that the uses to which this car will be put, under the direction of Major Barbrook, relate chiefly to radio drama. Short sections of film will be introduced as illustrations when they can usefully add to the realism of a play. Shorts and documentary films will also be made. There will be no competition, we are told, with the news reel companies or with the film studios.

But I find it extremely hard to believe that the work of the film unit will always be so strictly circumscribed.

That Major Barbrook and Company will spend the years to come in merely filming snatches of town and country scenery to wedge in here and there between studio performances is inconceivable.

The New Receivers

Manufacturers are building great hopes on "Teleolympia" and the new, cheap television plus all-wave radio sets. I have been trying to take a sort of private census of the number of television sets at present in use. As a result I estimate the figure at between 3,500 and 5,000. Judged by the millions of radio sets, this total may not sound particularly impressive, yet it is not negligible. With £30 sets on the market the audience should soon be trebled and quadrupled.

Certainly the position does not warrant the uncomplimentary remarks which I have just been reading in the German paper *Voelkischer Beobachter*, made by the head of the radio department in the German Post Ministry. Television, he says, was made available to the English public last year, when technical development had not reached maturity. As a result "there has been much dissatisfaction among the small number of viewers." Germany, by going slow and awaiting technical advances, has avoided the possibility of a setback such as that experienced in Britain.



H. W. STEWART
G2CY

HUMOUR, so far as we can ascertain, is not altogether unknown in the radio amateur world, and we can imagine the array of facial contours shown below coming in for perhaps more than a fair share. However, we ask you to take the mournful expressions as mere indication of a general dislike for the photographer—N.O.'s grin (the exception) due to his private thoughts on life in general. These expressions mask the happiest men you could wish to find—happy in the fact that their business is literally their hobby—your hobby. Every one of them, from the time that they left school, have been engaged wholeheartedly in ham radio, and to-day their early dreams are coming true. Think of it—a life spent amongst the pick of components, receivers and transmitters. Visitors from all over the British Isles—from all over the world—making Webb's their meeting point and the place for discussion and solution of many a problem.

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H. R. ADAMS
G2NO

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From August 1st, SOLE RIGHTS TO IMPORT AND DISTRIBUTE HALLICRAFTER products, together with SOLE RIGHTS to use REGISTERED TRADE MARK "HALLICRAFTER" in Great Britain, have been granted to Webb's Radio. Webb's will continue to distribute through the normal channels. To assure that you buy the latest SPECIAL EXPORT MODELS ask Webb's for the name of your nearest authorised dealer.



THE SKY CHAMPION

Hallcrafters are manufacturing the finest range of specialized receivers for short wave work in the world—their latest models include the now famous Sky Champion illustrated on the left of this paragraph. This is an eight valve receiver covering continuously the wave band from 6.8. to 550 metres. It incorporates every known device for flexible control of a truly sensitive, almost laboratory class of receiver. Entire instrument complete with a built-in Loud Speaker, Beat Frequency Oscillator, Separate Vernier Band Spread Dial, and suitable for operation on mains supply voltages from 110 to 250 volts A.C. is priced at £15. 0. 0. Hire purchase facilities of course, available. (Note—the price of this instrument will be increased early in September to 15 guineas.)

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The new five valve Sky Buddy, complete with speaker, at £9. 0. 0. Eight valve super Skyrider, Crystal Gate Model, at £32. 0. 0. The Sky Challenger II, which is fitted with the Image Rejector patterned by Hallcrafters, at £25. 0 0.

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A range of keys just released by McElroy comprise four models which are bound to prove popular. They are all similar to photograph, and only vary in finish and detail. The De Luxe model, chromium plate... .. 15/- Professional model, in lacquered brass... .. 12/- Commercial model, in black and chrome 8/6 And the Amateur model, cadmium plate 6/6



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For truly Webb's depots at both London and Birmingham have become the recognised meeting places for amateurs at large. Visitors know that besides inspecting most modern equipment they can discuss their individual problems with "Dyed in the wool" transmitting members of the staff. At London G2CY, G6VA and G2NO comprise a team which, from experience gathered in every instance from the days of 1,000 metres and Billi-condensers (when there were literally no short waves), will welcome discussion of your own individual problems. George Brown, G5BJ, whose long experience in commercial production and design of short wave equipment, added to his fame as a leading light in the D.X. world, provides, with the enthusiastic assistance of George Hart, a similar meeting place for Midland "hams." Ted McElroy, WIJYN, is now permanently attached as resident American buyer in Boston, U.S.A., to Webb's staff, and maintains his reputation as the world's champion high speed telegraphist with real high speed despatch of those orders cabled on your behalf marked "Urgent Delivery."



E. J. PICKARD
G6VA



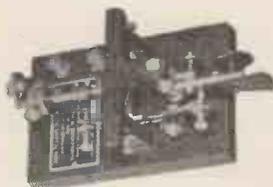
T. R. McELROY
WIJYN



BROWN'S FAMOUS HEADPHONES

All "Old Timers" will be familiar with certain headphones manufactured by S G. Brown, employing an adjustable reed type of diaphragm. These and all other types of Brown's headphones are carried in stock at Webb's. The type "A" Adjustable Reed available in any resistance from stock, 50/-.
Type "D," 35/-.
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McELROY AUTOMATIC "BUG" KEYS



A complete range of three semi-automatic morse keys is available. The standard model and the most popular illustrated on the left is mounted on a heavy cast base, with chromium plated lever and terminals. Speed can be adjusted from 5 to 70 w.p.m. Price 27/6.

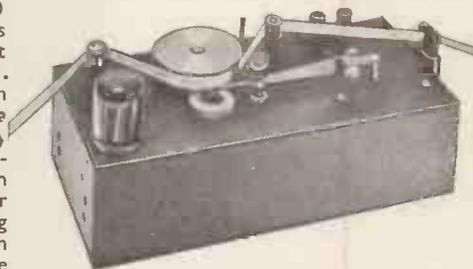
A De Luxe Model of the Standard Key, extra heavy terminals and contacts, patent dot stabilizer and phone switch, 37/6.

A lightweight Junior Key of typical McElroy standards, 17/6. Send for copies of the pamphlets issued by McElroy on Hints for learning Morse Code.

NEW McELROY MORSE RECORDER

A complete mains operated recorder which may be attached to the output of any receiver capable of receiving morse code. Requires an input of approximately two watts. Will produce any kind of slip, and will record at speeds up to 300 w.p.m.

It is a magnificently designed and produced instrument, supplied complete for 110 or 230 volt mains operation, list price, £8. 0. 0. Coincident with this release is a new McElroy morse codetransmitter, which may be used for reproducing the tape made on the above



machine. Speed can be varied from 5 to 100 w.p.m. This automatic transmitter also priced at £8. 0. 0. A third item of interest—new tape puller for use with either of the above instruments, £3. 7. 6.

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TELEOLYMPIA REPORT

(Continued from
page 528)

is that the audio frequency amplifier stages and loudspeaker are common with those of the radio set.

The radio side is virtually a standard Murphy console receiver, designed largely for high quality reproduction, with special attention devoted to the loudspeaker, and acoustic construction of the cabinet. The output is 6 watts.

All-wave reception is provided by a high-gain super-het circuit, with a three-colour, three waveband station name scale, slow motion tuning being included to simplify operation on short-waves.

PHILIPS LAMPS LIMITED, 145, Charing Cross Road, W.C.2. Stand No. 51

Philips Lamps have further developed the cathode-ray projection receiver which they introduced last year. Important improvements have now resulted in a large projected picture (size 18 in.



This television receiver by Philips employs their picture projection system. The actual size of the picture is 18 in. by 14½ in. Also incorporated is a press button tuning broadcast receiver.

by 14½ in.) of such brilliance and definition that it can be viewed in comfort and under normal conditions. The television image is produced on the end of a small cathode-ray tube, and is sufficiently brilliant to be enlarged from

2 in. to 18 in. wide by means of a high quality anastigmatic f/1.9 lens. The projected picture is reflected from a mirror in the lid of the cabinet on to a flat etched glass screen, the etched surface being protected from dust and dirt by enclosure between two sheets of glass.

The projection screen automatically rises into its correct position when the lid of the cabinet is lifted. A slow motion device prevents damage to the glass screen and mirror by too rapid closing of the lid.

The Mullard 4 in. diameter projection type cathode-ray tube operates from a 25,000-volt supply.

Focusing and deflection in line and frame directions are entirely magnetic.

The tube is completely screened magnetically and is mounted with the projection lens in gimbals to facilitate optical centring of the picture on the projection screen.

Extra high tension equipment.—The 25,000-volt supply for the operation of the cathode-ray tube is obtained from a voltage doubling rectifier unit using two Mullard 1878 H.T. rectifiers. A rare gas discharge tube connected across the supply to the first anode of the cathode-ray tube prevents excessive voltage developing and damaging the cathode-ray tube.

The whole E.H.T. equipment is contained in an earthed steel case with interlocked switches and an earthing device on the door. Opening the door breaks the supply to the rectifier and automatically earths the E.H.T. terminals, thus making the equipment completely shock proof.

The television and broadcast equipment consists of five units:—

1. Vision and sound receiver with synchronising separator.
2. Frame and line time bases and H.T. supply.
3. E.H.T. equipment.
4. Projection assembly containing the cathode-ray tube.
5. Broadcast chassis type 753A.

The four television units are bolted to a steel framework which can be removed bodily for inspection and worked in complete safety outside the cabinet. The controls are extended by Bowden cables to the control positions on the cabinet.

Circuit.—The aerial feeds into a tuned aerial transformer connected to the grid of a radio frequency amplifier using a TSP4 valve.

Separate frequency changers for sound and vision are employed with a push-pull oscillator section using an oscillator frequency of 31.8 mc.

The vision I.F. at 13.2 mc. is amplified by four TSP4 stages using single side band working; it is then passed to a small television diode type T4D and

an R.C. coupled video frequency output stage using a Pen A4 valve. The D.C. component is replaced by passing the output to a further T4D diode before the cathode-ray tube.

The sound I.F. at 9.7 mc. is amplified by a TSP4 stage and passed to a T4D diode, which also applies A.V.C. to the I.F. stage. The audio frequency is then connected to the pick-up sockets of the broadcast receiver, type 753A.

Twin speakers are incorporated.

Time Bases.—The frame scan is obtained from a 2-valve circuit using a gas triode and pentode output.

The line scan uses a 3-valve circuit with a gas triode and two power pentodes in parallel in the output stage. In addition, a rectifier is used in conjunction with the line frequency output transformer to obtain a rapid return trace.

Safety relay circuits are connected across the line and frame deflection coils of the cathode-ray tube. Should either of the scans fail from any cause, the voltage on the grid of the appropriate gas triode will fall and the relay in its anode circuit will open the supply to the E.H.T. transformer, thus cutting off the E.H.T. to the cathode-ray tube and preventing damage to the fluorescent screen.

In addition to reception of the television programmes, normal broadcast reception is afforded by a high-fidelity all-wave receiving unit.

PYE LIMITED, Radio Works, Cambridge. Stand No. 31

Several new television receivers are shown by Pye, Ltd., Model 815 is an A.C. mains operated table model. The cathode-ray tube has been arranged to permit direct viewing of the television image at as great a viewing angle as possible.

It is fitted with two major controls and five minor controls. The five minor controls are pre-set and normally the user will only have to operate the two major controls. The power consumption is 150 watts; the cabinet size, 19 in. by 17 in. by 14 in., and the picture size 7½ in. by 5¼ in.

There are 13 valves, 2 rectifiers, 3 diodes and, of course, the cathode-ray tube.

A new form of construction is introduced on the radio side. In the place of separate units for sound and vision channels, they are combined on one compact chassis. Special layout and screening cans combine with the new "E" series valves to attain compactness with high efficiency. Square "click on" type cans overcome the

difficulties experienced with that type of can requiring bonding links. Inter-unit wiring is also considerably reduced.

Television Receiver Model 817.—The Pye 817 model television receiver has been developed to provide a means for owners of radio receivers to supplement their existing radio equipment in the simplest and most inexpensive manner, so that they may receive and enjoy the television programmes. The model 817 receiver can be used in conjunction with any existing radio receiver where A.C. mains are available.

The cabinet size is 16 in. by 13 in. by 12 in.; the power consumption 110 watts and the picture size 4 in. by 3½ in. Eight valves, 2 rectifiers and 1 cathode-ray tube are employed. The cathode-ray tube is a new type "Cathodeon" specially developed for this receiver.

The power unit lies directly beneath the cathode-ray tube and supplies all the power necessary for the operation of the teleceiver.

The H.T. supply for the time base, vision unit, and sound unit is obtained from one indirectly heated rectifier.

A common L.T. winding of 6.3 volts supplies the heaters of all valves.

The cathode-ray tube is statically focused and magnetically scanned. It is inserted from the front end of the

chassis and held in place by a rubber retainer. The focusing potential is derived from a potentiometer across the E.H.T. supply and is about 900 volts. The first anode volts are derived from a potentiometer across the H.T. supply and should be about 100 volts.

Pye Television Receiver Model 838.—The 838 model television receiver includes an 815 television receiver assembly and console radio receiver assembly. A Garrard automatic record-changer unit is also fitted.

The power consumption is 200 watts; the cabinet size, 36 in. by 33 in. by 18 in., and the picture size 7½ in. by 5¾ in.

Pye Television Receiver Model 819.—The Pye television receiver model 819 is comprised of an 817 television receiver assembly and a press-button superheterodyne receiver assembly.

**RADIO GRAMOPHONE DEVELOPMENT CO. LTD.,
Globe Works, Newtown Row
Birmingham, 6. Stand No. 36**

The Radio Gramophone Development Company are continuing their model 382 sound and vision receiver at 75 guineas and have also produced the same model with a radio chassis combined, employing a push-button all-wave receiver.

Another R.G.D. product is a combined television radio-gramophone including an 11-valve all-wave push-button receiver.

The television receiver, model 382, is a 29-valve sound and vision receiver. The picture size is 10 in. by 8 in. The sound receiver is designed to give the best possible reproduction at a maximum output of 3½ watts.

The vision and sound receiver unit comprises a 14-valve superhet. circuit and H.F. stage, triode hexode frequency changer, two-channel I.F. amplifier, one having a band width of 4 megacycles for vision, the other having a band width of 10 kc. for high-fidelity.

An Ediswan type 12H cathode-ray tube is used with electrostatic scanning of both frame and line. The time base and sync. separator unit uses two Thyatron generators for line and frame hold, followed by a push-pull amplifier feeding the frame and line-deflecting plates of the cathode-ray tube. Four valves are used in the sync. separator circuit.

The R.G.D. model 371 is a combined television receiver and radio gramophone and consists of a 35-valve television sound and vision receiver, all-wave broadcast sound receiver, and automatic electric gramophone. The picture size is 9½ in. by 7½ in.

SCOPHONY LIMITED, Thornwood Lodge, Campden Hill, W.8.

Stand No. 22

Scophony receivers are of particular interest for they are the only type at the Exhibition employing a mechanical-optical system. Those responsible for the development of the Scophony receivers started with the premise that nothing smaller than a picture corresponding in size, brilliance and definition to that of the home cinema as it is known to-day, would ultimately be satisfactory, and the home receiver, developed by the Scophony engineers, and based on Scophony optical-mechanical methods, is practically an equivalent.

Two receivers are shown—one the home type giving a picture 24 in. by 20 in. (approximately), and the other a junior public viewing projector for projecting a picture 6 ft. by 5 ft. The home receiver gives a bluish black and white picture on a flat screen with picture projected from the rear. Operating voltages are low, in fact not in excess of those in an ordinary broadcast receiver. The light source is a super-pressure mercury lamp—the light source with the greatest known intrinsic brilliancy.

The home receiver incorporates:—

(1) The Scophony supersonic light relay which makes it possible to employ, in this type of receiver, nearly 200 elements of the picture simultaneously, with a resultant increase in the light available.

(2) The special optical invention of

focusing in two distinct focal planes (split focus) which makes it possible to

reduce the size of moving parts whilst retaining the fullest amount of light.

Junior Public Viewing Projector.—

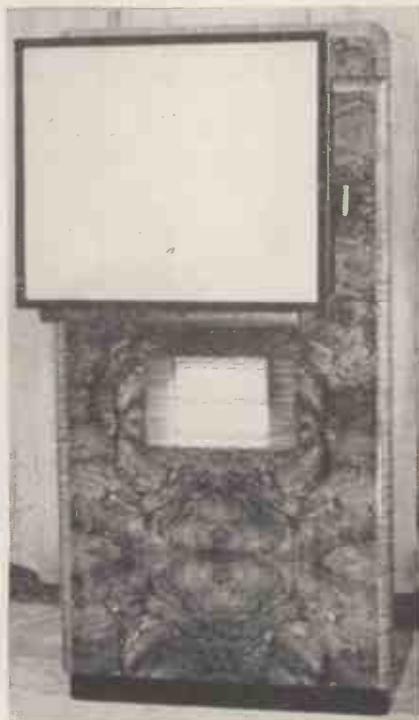
The public viewing projector type of receiver is based upon the same technical principles as the Home Receiver, and has been specially developed for use in cinemas, clubs, schools, etc. Dependent upon the architectural conditions of the place, the picture can be satisfactorily viewed by audiences of 500-750 at a time.

The picture size is 6 ft. by 5 ft. of a black and white colour cinema screen effect. The screen is flat and the picture is projected from the rear. The voltages do not exceed those used in a small cinema. Either a standard cinema arc or a super pressure mercury lamp is used as a light source.

The brightness of the screen is adequate to permit complying with L.C.C. regulations regarding illumination of gangways and passages.

The Scophony public hall television projector resembles in appearance a standard cinema film projector, with a separate rack for amplifiers and power supplies. The apparatus is a type that can easily be handled by any cinema operator.

Scophony are also showing a television transmitter Master Generator for synchronising signals. Modern high definition television requires very accurate synchronising signals. This is



The Scophony home receiver providing a picture 24 in. by 20 in.

achieved in the case of the Scopphony master generator by using a method of compensation for any possible inaccuracies.

The Scopphony master frequency generator produces the line frequency required coupled to the frequency of the mains. It consists essentially of an electrostatic generator so constructed that the signal generated has a minimum rate of change of frequency under all conditions.

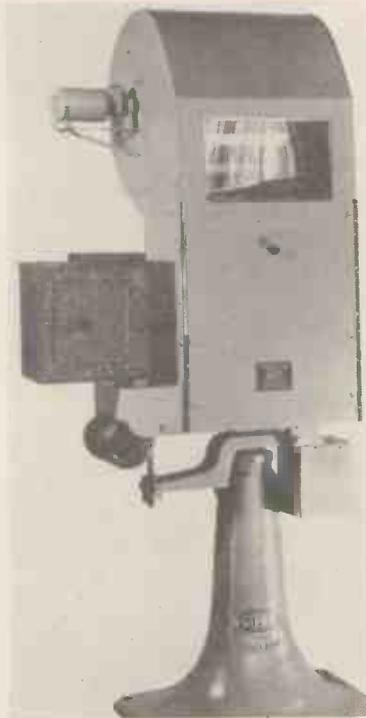
The rest of the Scopphony synchronising equipment controlled by the master generator provides all the synchronising signals required.

The Scopphony Film Transmitter.—Scopphony have also developed a transmitter, using optical-mechanical methods. It is a universal transmitter as it can be used for any practical number of lines and for interlaced or sequential type of scanning, with 25 or 50 frames per second.

The transmitter employs two scanners, a high speed scanner in the horizontal direction, and a slow speed scanner in the vertical direction. The horizontal or line scanner is synchronised from the Scopphony synchronising equipment for any given television standard. The vertical scanner is driven from the mains frequency. The film moves continuously at normal film speed.

The picture current of the transmitter strictly corresponds in its amplitude to the shade variations of the picture details. Additional corrections are not required.

Either a high pressure mercury lamp or an arc lamp may be used as a light source.



This illustration shows the Scopphony Junior Public Viewing Projector. Similar in appearance to a standard cinema film projector, it gives a picture size 6 ft. by 5 ft.

the length of the scale available for the reproduction of half-tones, but it has a marked effect upon the sharpness of the image which is analogous to good optical focus in the case of a projected picture.

Silver Sensitisation

The sensitivity and picture signal of Iconoscopes have been increased recently by a factor of two or three times according to R. D. Janes and W. H. Hickok. The spectral response of the newer tubes more closely resembles that of the eye and may be controlled by processing. "Dark spot" has been diminished by the use of a cylindrical envelope. The increase in sensitivity and picture signal output of the Iconoscope arises from the use of an extra sensitising process called "silver sensitisation." This extra sensitisation also serves to give a spectral response closer to

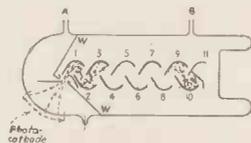


Diagram of ten stage electron multiplier using electrostatic fields only, described by V. K. Zworykin.

"RECENT AMERICAN DEVELOPMENTS."

(Continued from page 536)

valleys of the contour, it has been possible to predict accurately the focusing effect of different electrode shapes and separations.

Better Contrast

One television problem is to obtain an image with adequate contrast, for although a relatively low contrast range may suffice for the transmission of intelligence, a much greater contrast range is essential for the reproduction of clear, lifelike images.

Factors harmful to contrast are well known and may be studied in a variety of ways. In the belief that the reaction of the observer is the ultimate criterion for judging the perfection of the image, R. R. Law, R.C.A. Radiotron, began an investigation of contrast with a series of viewing tests designed to determine the relative psychological effects of the various factors harmful to contrast. On the basis of these tests it

was definitely concluded that halation is far more detrimental to image quality than screen curvature or bulb-wall reflections.

Experimental evaluation of the relative importance of the individual factors harmful to contrast lead to the same conclusion. For example, in reproducing a small dark spot on a bright field with a conventional sprayed screen cathode-ray tube the limiting value of contrast ratio as determined by each of the individual factors is approximately as follows:

Halation	6
Normal reflection ...	60
Curvature of screen ...	70
Bulb-wall reflection ...	200

Halation may be reduced several fold by introducing a light absorbing layer on the tube screen. According to this analysis a 10 to 20 per cent. absorption layer should give a 3- to 6-fold reduction in halation.

Cathode-ray tubes, the authors state, made in accordance with these principles give greatly improved contrast. Not only does reduction of halation substantially double or triple

that of the eye. The resolution is also somewhat improved.

For tubes which are used for viewing actual scenes in the studio, a further sensitisation process is used to give the walls of the envelope a high photo-sensitivity. When light from a small lamp is allowed to fall on the sensitised walls without striking the mosaic, another gain in sensitivity and signal output is achieved. The advantageous effect of this "back lighting" method was first discovered by engineers of Electrical and Musical Industries, Ltd. In the studio, the gain from the extra sensitisation and the use of the "back lighting" can be employed either to reduce the illumination on the scene or to increase the depth of field of the scene.

In Iconoscopes for transmission of film, photo-sensitive walls are disadvantageous because of signals introduced by the intermittent illumination of the film. Iconoscopes for film transmission are, therefore, designed so that the extra sensitisation process does not sensitise the walls of the tube envelopes. In these tubes, the extra sensitisation process improves the signal-to-dark-spot ratio.

Our Readers' Views

Correspondence is invited. The Editor does not necessarily agree with views expressed by readers which are published on this page.

The Problem of Sales

SIR,

I have just read your August editorial with regard to the poor demand for television receivers.

There may be ten thousand people in the service area who could afford a receiver, but do they want one? Take the case of Lady X. She is not going to spend part of her evenings watching a screen, however large, or however good the entertainment when all she has to do is to call for her car and be driven to a show, a bridge party, or dinner with her friends. Probably if you were to see her broadcast receiver, you would find that it was a ten-year-old portable. She has practically all her time occupied and cannot be bothered with the radio except for the news.

The case of working-class people is different. The radio is practically their only pleasure, except for an occasional visit to the cinema. If their receiver requires service, there is a row until it is put right. It is my experience that the most modern broadcast receivers are in the hands of working-class people. These are the people who like to change their set every three or four years and are the class of people who must be catered for with television.

ROBERT C. BELL

(Service Engineer, Ambleside).

Provincial Keeness

SIR,

I found your Editorial in the August issue interesting reading. The absence of general interest in television viewed as I see it now—from a provincial standpoint—is due, first and chiefly, to the impossibility of "getting it"; the limited service area makes it hopeless for the potential viewer in the larger provincial cities.

If this first reason is dispelled by future development then the price question forms the second stumbling block—or to put the matter simply: "We can't get it and if we could, it costs too much."

After many years in the London area—for the past year or so I have been living in a large west country town among a group of moderately wealthy middle-class people and I

have obtained an angle on their outlook on many such problems.

My immediate associates are some thirty or more well educated, well paid, professional and technical people all more or less experts in their own line—they are just the class to whom television should appeal. (They have run the whole gamut of radio development from the early days; they buy new sets every year, not counting a few extra pounds to obtain the latest thing in radio apparatus, and obviously they should be potential television purchasers. They are nearly all car owners and quite a number are keen amateur cinematographers, but, strange as it may seem, not one of them knows, or cares to find out, the merest ABC of television.

Nevertheless, I feel sure that such people (and there must be many others like them) would acquire, very quickly, the interest if it came within their reach.

If there was a prospect of getting a reasonable result at the cost of, say, £20 to £25, I am certain there would be a big market in the provinces. I say, "in the provinces," as distinct from the London area with intent, for that shows to my mind the crux of the whole question, i.e., the folly of the present attitude of those responsible for television development in catering exclusively for the wealthy Londoner.

There are in the present service area from Alexandra Palace, many hundreds, perhaps thousands, to whom £100 is a small matter, and television receivers giving excellent results are within their reach (in no sense is it a risky experiment as it used to be) but, this is what the trade do not seem to realise—they, the wealthy Londoners, are the very people who can afford to go, any day, any night, to the best shows, theatre, cabaret, concert, dance or sporting shows, which London presents. How can they get enthusiastic about staying indoors viewing a small picture of probably an indifferent or uninteresting television programme when a telephone booking and a short journey will take them to any show they please to patronise? In other words, the actual show will attract every time.

But in the Provinces the whole situation is different. The typical people I have mentioned before have the choice of two theatres (touring shows) and a large number of cinemas and these latter being easiest and cheapest, Mr. and Mrs. Provincial go to the pictures—offer them television or some really good show and they will seize it eagerly.

How it is to be done—how the great difficulties of general television transmission are to be surmounted—I do not know. As a step off in the direction of stimulating interest, something in the nature of travelling television transmitters might be possible. Anyhow, give the provincials a chance of sampling television and they will "bite." I am certain, that so long as television only comes within the reach of the comparatively wealthy in London, so long will it remain stagnant.

F.A.S. (Bristol).

Futile Demonstrations

SIR,

The answer to your question:—"Can any reader provide the real answer to the problem of the poor demand?" is that in numerous instances where television sets are being exhibited the results are so bad, due almost entirely to the failure of the operator who is working the set, that the viewers go away with a very bad impression. They then pass the opinion on to their friends, who also agree that the picture they saw was erratic and continually being altered by the operator.

And so it goes from one to another, in the train, in the bus, in the office and so on. I shall not mind in the least if you disagree with this answer to your question. I am still convinced that this is the correct one.

In conclusion, I would add that in every single instance amongst the many friends who have been invited into my house for an evening's entertainment by "television" they have all agreed that this wonder of wireless has undoubtedly come into its own, and that before long they will certainly possess a set.

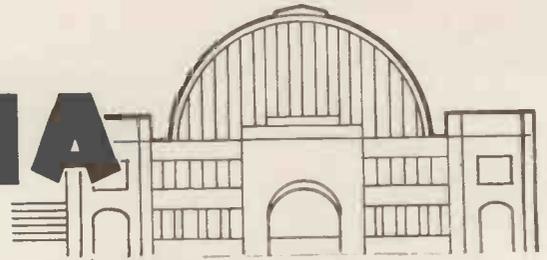
I go so far as to say that there are not many people yet who really know what they are doing when they fiddle with the various control knobs of a television set.

This is the problem that will need to be overcome if lots of television sets are to be sold to the hosts of people who are definitely interested but not yet convinced.

F. S. LEPPARD (Slough).

RADIOLYMPIA

SHORT WAVES 1938-9



The new short-wave components and receivers to be seen at Radiolympia are discussed in this report. Full information is also given about all new short-wave equipment.

SHORT-WAVE receivers, components and valves suitable for use in short-wave transmitting and receiving apparatus are the high-spots of the 1938-9 season. In all the years that a radio show has been held, short-waves



No experimenter should be without accurate test equipment. This Universal Avometer tests voltage, capacity and resistance, etc., with great accuracy.

and short-wave equipment have never been of primary importance, owing to the comparatively small market in this country. British manufacturers have now discovered that there is an increasing market for good short-wave apparatus, and although last year at Radiolympia many manufacturers were showing short-wave components, there was not the assortment the British amateur required.

This season British manufacturers have produced sufficient components and receivers for British amateurs to obtain all of their equipment in this country. Several manufacturers are producing little else than short-wave equipment of a specialised type, while there are a number of reliable importers of products which are very greatly in demand.

Even valve makers have come into line in producing valves which are equal in performance and in many cases better than the best of the American

transmitting types. British receiving valves are immeasurably superior to their so-called American equivalents, particularly with high gain R.F. pentodes produced for use in television receivers

Amateur constructors will be able to build sensitive high gain receivers with the minimum number of valves. The Mullard Company have produced a complete range of valves in their "E" series which are ideal for use in communication receivers owing to their amazingly low noise level. In the same range are output pentodes giving a very high speech wattage for extremely low grid inputs.

Efficient switch coils for use in multi-wave transmitters have been introduced by Premier, together with a large number of other interesting and highly efficient components. Ceramic coil forms and valve holders will this season be in general use. Importers such as Webbs Radio have large stocks of American ceramic materials in addition to a comprehensive range of components of their own manufacture.

Test equipment also figures very largely amongst the important developments of the 1938-9 season, and it is hoped that all these developments will enable the British amateurs to improve the efficiency of their stations by discarding the old materials in favour of

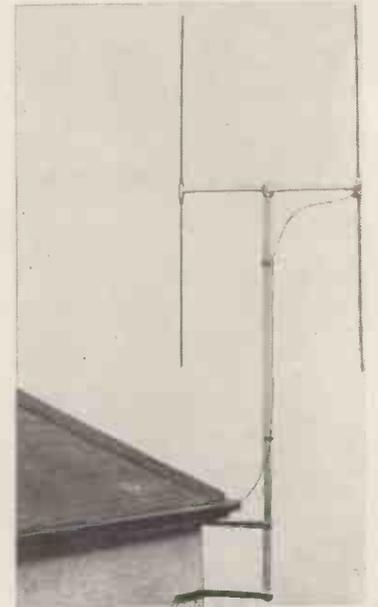


The new Belling-Lee coupling for coaxial cable.

valves, circuits and components more suited to ultra-high frequency working.

The following information regarding the components and equipment available to British experimenters, is but a small selection of what is actually available and amateurs are recommended to get in touch with the various manufacturers concerned for full information which they will be only too glad to supply. Any amateur wishing

to save postage can send all requests for catalogues to this office in one envelope and we will undertake to forward on his



This is one of the most simple types of Belling-Lee Television aerial.

requests to the proper quarter. Merely mention which catalogues are required and we will do the rest.

A. C. S. Radio, Ltd., 16 Grays Inn Road, London, W.C.1.—In view of the increasing interest in ultra-high frequency working and the need for some simple means of obtaining reception from Alexandra Palace this company have introduced a most interesting self-contained short-wave convertor. It has been designed for amateur use and covers broadly between 5 and 10 metres. However, as it includes its own power supply and is not limited to amateur wave bands, it makes an ideal unit for use with almost any type of A.C. operated receiver. This convertor called the DB-20 is priced at £13 15s. and is certainly the most simple way of listening to the ultra-high frequencies. They also have and can demonstrate practically every well-known American and British communication receiver and have equipment installed to line up and check the performance of multi-valve receivers.

A.C.S. Radio Ltd.

Anglo-American

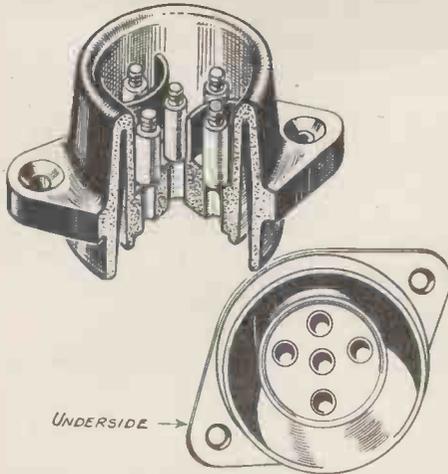
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AVO

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Bulgin

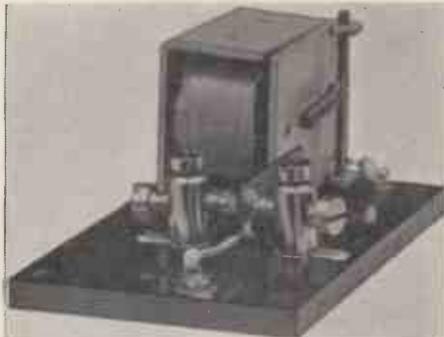
It is not always realised that some of the larger American sets are shaken up before they reach this country, so in



A high-tension valve holder for 12,000 volt use. A Belling-Lee product.

order to obtain the maximum results they have to be re-aligned and generally overhauled.

Anglo-American Radio, Ltd., Albion House, New Oxford Street, W.C.1.—Every manufacturer of importance will be making a receiver to include some sort of press button or semi-automatic tuning. This is all very well for those who intend to purchase a new receiver, but rather unfortunate for those who last year purchased a good set and find



Bulgins' new relay type R.C.11 for mains or battery operation. Price, 6/-.

that they are debarred from this most interesting and useful refinement. In order to overcome this difficulty, Anglo-American Radio, Ltd., are selling a press-button tuning unit suitable for seven station operation, which can be added to almost any existing commercial or home-built receiver, merely by connecting three wires. Full instructions are given with the unit and no technical knowledge is required. For those who like large receivers they have an all-waver covering from 6.8 metres to 2,140 metres using 12 valves. The

model number is 512 and the price of the chassis including valves is 25 guineas.

Automatic Coil Winder and Electrical Equipment Co., Winder House, Douglas Street, London, S.W.1.—The Avo oscillators and equipment made by this company are well-known amongst manufacturers, service agents and constructors generally. Their latest achievement is an all-wave oscillator with six separate coils covering 100 kc. to 30 mc. The dial is directly calibrated in frequencies on all ranges. The maximum R.F. output is 1 volt, while a comprehensive attenuation system is provided consisting of a 4-position step attenuator and continuously variable slide wire. A separate L.F. oscillator valve provides internal modulation at 400 cycles to a depth of 30 per cent. The price of this oscillator is 9 guineas. Another interesting meter is the 46 range Universal Avometer. It is priced at 16 guineas and will read D.C. current, D.C. voltage, A.C. current, A.C. voltage, resistance, capacity, power and will also give a decibel level. This is perhaps one of the most comprehensive test sets obtainable in this country. Stand 21.

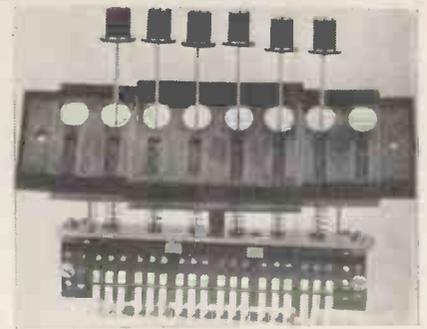
Belling and Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.—Owing to the fact that constructors are now alive to the advantages of noise suppression equipment, this company have been able to make drastic reductions in many of their prices. They have also a large number of most interesting aerials, not only of the noise suppression type, but of the spike variety which can be fitted to a chimney stake with or without a mast. These spike aerials vary in price from 42s. and can be used with or without noise suppression equipment. They give good all-round reception and are particularly effective on ultra-short waves.

The new Belling Lee anti-interference aerial is suitable for operation between 10 and 2,000 metres. It is priced at 37s. 6d., a very reasonable figure. It appears that there is very little chance of legislation being introduced to interference to radio. This means that the only solution is an anti-interference aerial.

The Belling Lee multi-connectors are widely used in television receivers but amateurs will find that they can be used to advantage in transmitting equipment where high voltages have to be transferred from one chassis to another. They are also suitable for inter-connecting a multi-valve receiver with a separate power supply unit. These plugs and sockets are available with 10 connections for 3s. 9d. or five connections 2s. 9d. Stands 4 and 5.

S. G. Brown, Ltd., Victoria Road,

North Acton, London, W.3.—The Brown type "A" reed headphones have been universally popular since the early days of broadcasting. (This company



The cheapest press-button tuner for amateur use. It can be used in almost any type of receiver. Made by Bulgins of Barking.

are still producing a complete range of highly efficient headphones, including types A, D and E. Short-wave listeners who wish to make the most of their receivers on weak signals will be well advised to consider using a pair of these headphones.



Some of Bulgins' popular ceramic insulators and a low-loss extension rod.

A. F. Bulgin and Co., Ltd., Abbey Road, Barking, Essex.—To constructors who wish to build the best possible receiver the name of Bulgin is synonymous with high grade components. Bulgin have for many years produced many hundreds of specialised components suitable for constructors and short-wave transmitting experimenters. This year they have surpassed themselves with a special 124-page catalogue full of interesting items. They have a press button tuner of a unique type in either 6 or 8 way models, complete with bakelite escutcheon. The 6-way tuner costs 8s. 6d., so that it is the cheapest unit of its kind available to constructors. With this unit any experimenter can build himself an up-to-the-minute press button tuning set, which at one time was considered beyond the capabilities of the average home constructor.

Belling-Lee

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Brown

B.T.S.



Burndept

Bulgin switches are already well-known, but this season they have introduced a complete range, up to 12-way, of midget rotary switches. These are priced at 2s. 6d. and have a very positive but smooth action. For transmitting use they have an H.F. choke which will carry 1,000 mA, and is priced at 5s. 9d. It is insulated to withstand 10,000 volts between windings and chassis.

Constructors have discovered that it is not at all difficult to build television receivers provided suitable components are available. Bulgin have produced H.F. and I.F. transformers

which will give the required band width of 3 mcs. in addition to a special television aerial unit. The H.F. transformer is priced at 5s., the I.F. transformer at 6s., and the aerial unit at 5s. 9d. For the first time in the Bulgin range there are low loss variable short wave condensers of varying capacity from 15 mfd. to 160 mfd. They are widely spaced and are suitable for operation up to 300 volts, so being ideal for use in low power transmitting equipment and in the average crystal oscillator stage.



This type of Bulgin power resistor is most useful for obtaining screen voltages for transmitting valves of the 6L6 class.

In order to obtain stable screen voltages, particularly with high slope tetrode valves, it is essential to use a low resistance network across the H.T. supply. In the Bulgin range

there are suitable resistors from 10 watts up to 60 watts in most values of resistance. An electro-magnetic relay suitable for 2-volt 1-amp. operation or 250-volt 10 mA operation is suitable for use in transmitting equipment. The internal resistance is 7,000 ohms to 7,500 ohms approximately, and this interesting relay is priced at 6s. The contacts are wide, so that it is applicable for short-wave working. We strongly advise constructors to obtain a catalogue from this company either from their head office or their show-



Dubilier have introduced this new ceramic twin condenser. It is ideal in balancing circuits. rooms at 64 Holborn Viaduct, London, E.C.1. Stand 72.

British Television Supplies, Ltd., Faraday House, 8-10 Charing Cross Road, London, W.C.2.—For some considerable time this company have been concentrating on the production of high grade communication type receivers for amateur and general short-wave use. They have designed what is now a most popular receiver in the Trophy 5, which has a continuous coverage from 10 to 550 metres with band spreading, beat-frequency oscillator, A.V.C. switch, and 'phone jack, etc., all complete in a metal case for £9. This receiver has been used in at least two record breaking attempts. A smaller version of this receiver is the Trophy 3, which although not intended for communication purposes is extremely effective for bringing in long distance short-wave broadcasters. The A.C. model is priced at 6 guineas, and the Battery model at £5 15s., less batteries.

B.T.S. also have a very complete range of components suitable for amateur use, including some most effective plug-in coils of a new design. These have a self-locking device so that the coil always makes perfect contact.

Burndept, Ltd., Light Gun Factory, Erith, Kent.—There are a number of amateurs who for many reasons are unable to purchase a separate short-

wave receiver and have to rely on a good all-waver for experimental use and entertainment. In such circumstances it is advisable to have a multi-valve instrument. A suitable set for such a purpose is the Burndept model 290, which is priced at 13 guineas. It



A rotary converter for use with television receivers. It is a product of the Electro-Dynamic Construction Co., Ltd.

is a 9 valve all-wave superhet with practically continuous coverage from 13.5 to 2,000 metres, with an audio output of 18 watts. Stand 43.

A. C. Cossor, Ltd., Highbury Grove, London, N.5.—An ingenious automatic tuning system has been fitted to the new Cossor 5-valve superhet receiver. This Teledial tuning is so arranged that ten stations can be accurately tuned by merely operating a dial similar to that used on an automatic telephone. The receiver is priced at 10 guineas. At 11½ guineas they have a 6-valve all-waver with Teledial tuning so arranged to provide eight pre-set tuned stations. The highlight of the Cossor range is a 5-valve all-wave superhet radiogramophone with a 10 in. moving coil loudspeaker. This instrument is priced at 16 guineas; and will probably be as good value for money as any in the 1938-9 range of radiogramophones. Stand 42.

British Mechanical Productions, Ltd., 79a, Rochester Row, London, S.W.1.—



One of Ferranti's new receivers which is suitable for A.C. or D.C. working.



Here is a new Cossor receiver with their Teledial.

Cossor



Clix

Dubilier

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Ediswan

The Clix switch plug unit has a multitude of uses, such as for loudspeaker switching, radio to gramophone change-over, aerial earth and wave-change switching and also for wave-change and battery switching. This plug unit is fully described in a small booklet issued by this company which can be obtained



A fine 8-valve all-wave high quality receiver produced by G.E.C.

free by mentioning *Television*. Normally it is priced at 3d.

Clix are producing this year a very complete range of plugs, sockets and terminals of every kind, also valve holders, of the low-loss type and chassis mounting strips. Experimenters will also be interested in their plug adaptors, which are of the 5-amp. type and suitable for all kinds of sockets.

The Dubilier Condenser Co., (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.—Many new and interesting developments in condensers and resistances to meet the most up-to-date requirements of radio and television are being made available by

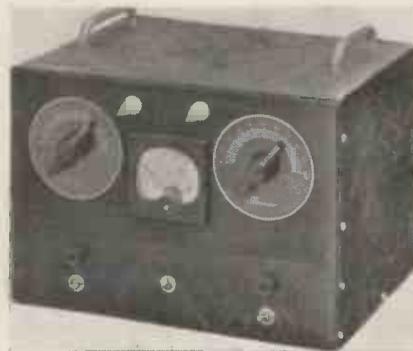


The H.M.V. receiver model 657 has motor assisted press-button tuning. It also has an outstanding short-wave performance.

this company. There is a new range of trimmer condensers, including small size single capacity metallised mica

trimmers in two sizes of 5/20 mmfd. and 5/40 mmfd. There is also a range of ceramic condensers in disc cup and tube shapes, with capacities of 5 to 1,000 mmfd. Surge limiting wet electrolytic condensers of a new design arranged for one hole fixing and inverted mounting have been produced for use in receivers where there is likely to be surge voltage during the heating-up period. They are available in ranges from 8 mfd. to 32 mfd. at normal voltages of 350 to 450 D.C. Stand 69.

Edison Swan Electric Co., Ltd. 155 Charing Cross Road, London, W.C.2.—The most important development of this company with regard to amateurs is the introduction of a special transmitting valve designed for amateur use. This valve the, E.S.W.20, is suitable for use down to 2½ metres, and can be used at 5 metres with maximum input. It is designed for 800 volts on the anode, a 7.5 volt heater, and has a 4-pin UX type base. It is priced at 17s. 6d., and transmitting amateurs can obtain full particulars from this company, including very complete operat-



Premier's 10-watt all-band transmitter for phone or C.W. operation, priced at 10 gns.

ing data and transmitting circuits. Numerous valves of the high slope type are available, and although these have been designed for use in television receivers, the RF pentodes are ideal in communication receivers.—Stand 18.

Ever Ready Radio, Ltd., Eley's Estate, Angel Road, Edmonton, London, N.18.—It is anticipated that one of the most interesting instruments this season will be the Ever Ready gramophone with a three-band chassis for £16 19s. 6d. This receiver is for A.C. mains operation, and on medium waves covers 15 to 52 metres. They are also showing a type 5041 portable receiver for £6 19s. 6d. complete with battery. With this model is a frame aerial built in to the side of the cabinet,

and as automatic grid bias is included, only needs one dry battery. Total current consumption has been kept down to a very low figure so that a long life from the battery can be expected. This type of receiver is most popular for motor-cars, where it will perform very creditably despite the steel bodies of the average motor-car.

Ericsson Telephones, Ltd., 22, Lincoln Inn Fields, London, W.C.2.—This company are continuing the manufac-



One of H.M.V.'s most popular models the 650 priced at 19 gns. It tunes to under 5 metres.

ture of highly sensitive headphones for communication purposes. They have been developed primarily for Government service use where maximum volume is essential. Ericsson headphones are available in resistances of 120, 2,000 and 4,000 ohms, but amateurs generally purchase those having a resistance of 4,000 ohms. They are priced at 15s.



An A.C. receiver from New Times Sales. It has four valves and band spread tuning. The price of the kit is 75/-.

and are probably one of the most popular headphones used by amateurs at the present time.

Ever Ready

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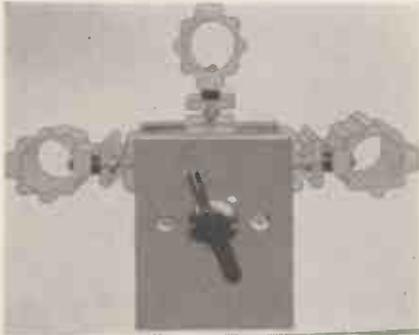
Ericsson

Erie



Electro-Dynamic

Erie Resistor, Ltd., Carlisle Road, The Hyde, London, N.W.9.—With modern high sensitivity receivers, it is essential that every resistor be depend-



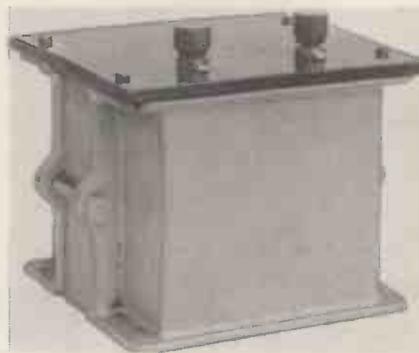
This coils unit can be used in a transmitter for three-wave band operation. Ceramic coils are included in the price of 27/6. Made by Premier.

able and free from noise, even in adverse conditions. We have used Erie resistors for many years in most of our constructional designs for the reason that they are utterly dependable and will stand a very high temporary overload. A new type of vitreous enamelled wire wound resistor has been produced in which the resistance wire used has a melting point of 2,714° F. The coating is resistant to acids and will withstand a temperature of 1,000° F. without softening or burning. Erie volume controls are available in ranges from 3,000 to 5 megohms, and have a minimum resistance at hop-off of .1 per cent., and a maximum resistance at end hop-off of 1 per cent. Erie have also produced a range of silver mica condensers in which both condensers are formed of silver plates intimately bonded to a high-grade ruby mica. Power factor throughout the radio-frequency spectrum up to 5 Mc. varies from .01 per cent. to .04 per cent. with a leakage resistance in excess of 10,000 ohms. The waxes used to seal these silver mica condensers limit their operating temperature to about 160 Centigrade. They are conservatively rated at 500 volts D.C., and are tested at 1,150 volts RMS 60 cycle A.C.

Electro-Dynamic Construction, Co., Ltd., St. Mary Cray, Kent.—Amateurs on Field Days are bound to use rotary convertors fed from accumulators in order to obtain a reasonable power supply. This company have always been noted for their small convertors, which are supplied with a very complete noise filter. They have now improved this popular radio type of rotary convertor to meet the additional problems inherent to television as compared with radio, particularly as re-

gards voltage regulation. Special precautions have been taken to eliminate interference to a very high degree, so that these convertors are now suitable for multi-valve television and the more conventional short-wave receivers.

Ferranti, Ltd., Moston, Manchester, 10.—Two all-wave superhets have just recently been released by Ferranti and styled 513 AM. and 512 AM. The 513 AM. is housed in a walnut cabinet and is suitable for D.C. or A.C. supply. A five-valve seven-stage superhet circuit is included with a special neutralised convertor stage in order to give a high degree of sensitivity on all bands. The intermediate frequency is 450 cycles, so reducing second channel interference on short waves. The 512 AM. is in a



Another Premier product for amateurs. A choke which will not rattle when used in a modulation circuit.

moulded cabinet and has a slightly reduced specification, but the price is only 12 guineas. The star receiver in the range is the 617 PB, which is an 8-stage push-button all-wave receiver with a

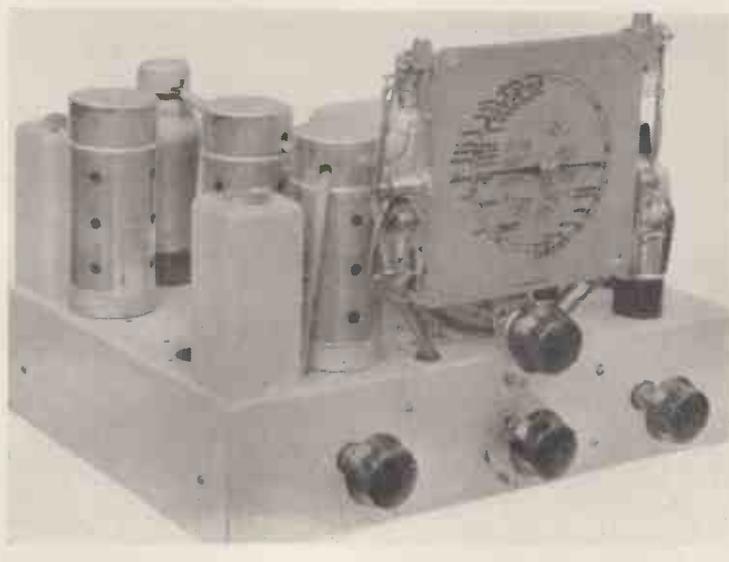
push-pull output stage giving 6 watts. For those who are confined to D.C. mains the 513 AM. is a most satisfactory instrument. This retails at 13½



These meters are very cheap and are available in all ranges. Premier will supply further details.

guineas and has a very high degree of sensitivity and selectivity. There is also a very large range of quality iron cored components and a comprehensive range of meters. Stand 14.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—The cheapest mains-operated receiver offered by this company is a 5-valve A.C. superhet at £7 19s. 6d., while there is an all-wave receiver with a fundamentally similar circuit for 9½ guineas. For those who need a press-button tuned receiver, the model A.C. Touchtune-5 at 12½ guineas represents extremely good value for money. The same chassis is available in radiogramophone form for 23 guineas. One of the most ambitious receivers in the range is the all-wave



Although this 8-valve B.T.S. chassis only costs 12 guineas it tunes down to 10 metres and has a good performance on that wavelength. A 9-valve model costs £14-14-0

Ferranti

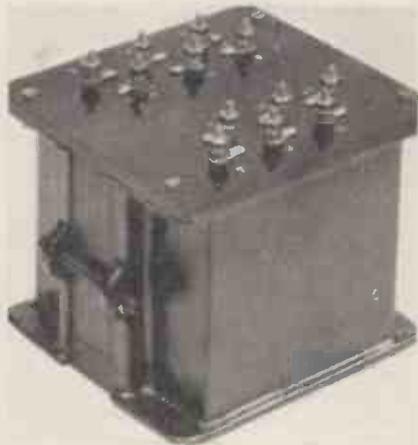


G.E.C.

Hivac

super 10 which tunes from 11 to 2,100 metres and is priced at 29 guineas. Beam power tetrodes in the output stage provide 15 watts of undistorted output.

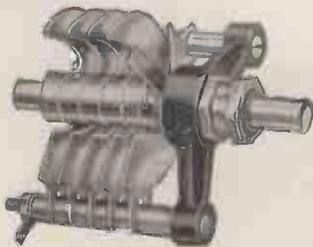
Continuing their policy of providing



One of the new Premier modulation transformers which will match any load between 500 ohms and 18,000 ohms on both primary and secondary.

valves suitable for use by amateurs, G.E.C. have introduced a completely new range. For those interested in low-power work there is the PT7, a pentode with a 2.0 volt .3 A heater designed for a maximum H.T. of 240 volts. The price of this valve is 20s. Also in this class is the DET9 a transmitting triode with a 2.0 volt filament designed for 250-volt working. This valve is priced at 19s., and has an anode dissipation of 3.75 watts. A tetrode designated the KT8 is also a very new valve being suitable for an anode dissipation of 25 watts. It has a 6.3-volt heater and will stand 600 volts on the anode. This should be a most useful valve when used as a crystal oscillator, doubler or even for power amplification. It is considerably cheaper than its American counterpart the RK-39.

The DET10 transmitting triode is a very good valve in its class and priced at £1 15s. This triode is rated for 15-



This is a new design in miniature wide-gap transmitting condensers and is the Eddystone type 1094.

watts dissipation and 600 volts on the anode. The heater is 6 volts at 1 A.

For higher power use is the ACT5, an air-cooled triode suitable for an anode voltage of 1,500 with a dissipation of 15 watts. It has a 6-volt heater and is suitable for ultra-short wave operation.

A valve which will operate with maximum input down to almost 1-metre is the ACT6, another air-cooled triode, but suitable for an input of 75 watts at 1,500 volts. The price of this valve is £7 15s., but it is good value for money as it is conservatively rated.

We advise short-wave amateurs to obtain further details of these new valves from the G.E.C. stands 39 and 49.

The High Vacuum Valve Co., Ltd.
111/117 Farringdon Road, London, E.C.1.—No less than 60 valves, including short wave battery, mains and midget types are available from Hivac this season. The short-wave types with



A cheap transmitter supplied by Webbs Radio. It is steel and can be had from 31 ins. high.

low loss bases and top cap grid connections are well known to constructors, but a brand new valve is the HVU1, which is a high voltage half-wave rectifier retailing at 15s. 6d. It will deliver up to 3,000 volts at 3 mA. The Y230 is a five-pin output tetrode and retailed at 9s. 6d., while the VP215C is a 2-volt variable mu H.F. pentode, which operates with 150 volts on both anode and screen. This valve also costs 9s. 6d. For experimenters Hivac have produced two cathode-ray tubes. The first is the CR3 which retails at 2 guineas, has a seven-pin base and a 3 in. screen. The second, the CR3A, has a 9-pin base, in which all electrodes are brought out to independent pins, while the screen is suitable for photographic work and for experimental

television. Hivac midget valves are non-microphonic in use and are ideal for inclusion in high gain amplifiers or for following crystal microphones where a low noise level is required. These valves are available in all types. Stand 103.

His Master's Voice, Clerkenwell Road, London, E.C.1.—In order to look after the requirements of the large



By means of this Eddystone extension coupler condensers and similar components can be operated at an angle of 90-degrees.

number of enthusiastic constructors who wish to make the most of their gramophone records, H.M.V. have introduced a hyper-sensitive pick-up. The pick-up gives a substantially level response from 50 to 8,000 cycles per second, and as the weight on the record at the needle point is only 1¼ ounces the life of a record is more than eight times as great as when the conventional type of pick-up is used. There is complete absence of mechanical vibration while, despite the high frequencies covered, needle scratch is almost unnoticeable. Due to the general reduction of mass of all the parts the whole of the mechanical energy taken by the stylus point through its motion composed by the record groove, is transmitted to the armature for conversion into electromagnetic energy without any mechanical radiation from the stylus shank or the body of the pick-up. This reduces the mechanical rattle and there is no need to have the lid closed when the pick-up is in use. Television technique has been used in the design of their new radio receivers so that frequency drift on short waves has been eliminated. An extremely effective receiver is the model 650, a 10-valve super-het, priced



The Eddystone Frequentite former for high-power transmitters.

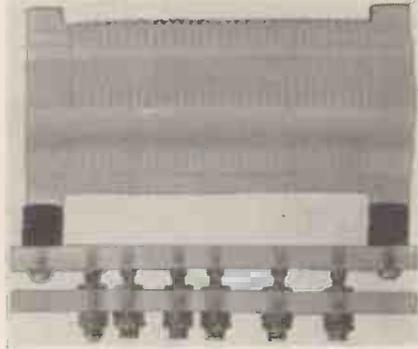
H.M.V.

Solon

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Murphy

at 19 guineas, which tunes from 4.85 metres upwards. The model 656 is also an interesting one for it is a 6-valve circuit with four tuning ranges from 13 metres and has an output of 3.25 watts.



This ceramic coil form with low base and socket is priced at 3/-. It is one of a large range of Premier amateur products.

It is priced at 14 guineas. Other interesting receivers in this range include an AC/DC table receiver for 11½ guineas, a 4-valve battery superhet for 11 guineas, a transportable 6 at 12½ guineas and a light-weight portable with two tuning ranges and an output of 180 mW, priced for 8 guineas. For those who wish to convert their radio receiver into a radiogramophone, there is a new record player suitable for any A.C. voltage between 100 and 130 and 200 to 250 for 39s. 6d. Stand 47.

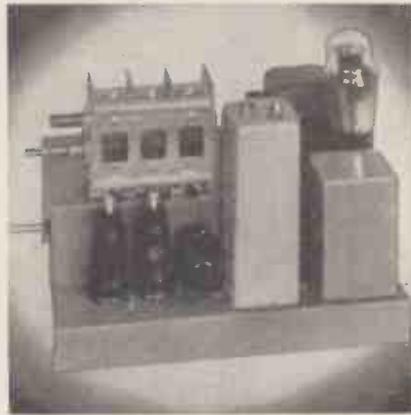
W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.—Over 15 hours' good soldering for 1d. is possible with the Solon electric soldering iron. This iron is most suitable for amateurs for the heat is concentrated in the point. When building receivers this is a most important feature and helps very considerably when wiring. The Solon iron with solder, flex and lamp adapter is priced at 8s. 6d. and should at any time there be a breakdown separate parts can be obtained from the makers.

Jackson Bros. (London), Ltd., 72 St. Thomas's Street, London Bridge, S.E.1.—It is considered rather difficult for constructors to build an all-wave receiver without special equipment but by including a tuning heart in which part of the receiver is already wired, most of the difficulties are overcome. Jackson Bros have a most effective all-wave tuner, which includes the coils for detector and oscillator, with associated tuning condensers so that it is a comparatively simple matter to add on the balance of the receiver. The very popular JB short-wave condensers are still available this year varying in size

from 50 mmfd. to 250 mmfd. at a single price of 5s. 9d. each.

New Time Sales Company, 56 Ludgate Hill, London, E.C.4.—New Time Sales are offering two very interesting kit sets which constructors can build into 3- or 4-valve receivers. Six-pin self-locating coils are employed to cover 9.5 to 2,000 metres while American type valves are utilised in three stages. Both kits are supplied with drilled steel chassis and high grade components. The 3- and 4-valve models are listed at £1 12s. 6d. and £2 2s. 0d. respectively. A special catalogue has been produced giving full details of the N.T.S. bargains, which include a short-wave kit for 25s., a 2-valve receiver for 32s. 6d., a 3-valver for 37s. 6d., and a DX receiver for 75s. for A.C. operation.

Murphy Radio, Ltd. Welwyn Garden City, Herts.—It is good news to know that Murphy have produced a receiver which will appeal to those interested in



The famous R.M.E. expander for ultra-short wave operation. Price, £13 15s.

short-wave reception. Their model 47 has been modified to include a wave range between 50 and 200 metres so that it includes the 80 and 160 metres amateur bands. This receiver is battery operated and is priced at £11 10s. and it includes Q.P.P. output so giving more than the normal volume level. At £9 19s. 0d. their model 46 is the cheapest receiver in the range for mains operation. It is an all-waver covering 16.7-50 metres and, of course, the usual medium and long-wave ranges. A DC/AC version is also available for £9 15s. 0d. Stand 27.

Mullard Wireless Service Co., Ltd., Mullard House, 225 Tottenham Court Road, London, W.1.—The products of this company can be split into three sections—radio receivers, valves and tubes, and television. (The range of

radio receivers is extremely comprehensive varying from a three-valve battery set at 6½ guineas up to the MASS, a 5-valve all-wave superhet, for 15 guineas. Mullard receivers this year have an exceptionally fine short-wave performance due primarily to the use of one of the new noiseless pentodes of the Red "E" series. One of the most popular sets is going to be the MAS 15 5-valve all-wave superhet at 10 guineas, which includes this new pentode, cathode-ray tuning indicator and tone diffuser. For D.C. operation a converter unit is available but the price of the receiver is increased to 10½ guineas. Press-button tuning does, of course, figure very largely in the Mullard designs, and the most outstanding receiver is a 4-valve all-wave console in which provision has been made for press-button tuning to cover six stations. This receiver is 14 guineas, which is an extraordinarily low price for a console type instrument.

Amateurs will be interested in a very complete range of transmitting valves specially designed for low power service, at prices comparable with American valves in a similar category. In addition, Mullard are in a position to supply a considerable amount of data as to how to operate these small transmitting valves to the best advantage. Stands 29, 30, 99.

Premier Supply Stores, Ltd., Jubilee Works, 165 Lower Clapton Road, London, E.5.—Amateurs will be able to obtain components and receivers of all kinds from this company, who are specialising in the future in amateur needs. Prices are low, while the quality of the components and receivers are such that they are fully up to the



One of the new W.B. Stentorians with special coils. This is one of the most popular P.M. speakers used by S.W. listeners.

Mullard

::

Premier

Be guided by the expert
use

THESE instruments put into the hands of every radio experimenter and keen amateur the same precision testing facilities which the radio engineer has learned to expect of 'AVO' instruments. The outcome of many years' experience in the manufacture and design of electrical test apparatus, they combine high accuracy with maximum utility and are available at a truly moderate cost.

STAND
21
RADIOLYMPIA



A VALUABLE BOOK

A new and enlarged edition entirely re-written in the light of present day knowledge. It takes the reader in easy stages through the whole routine of testing modern receivers, and clearly explains the causes of faults in receiving and amplifying apparatus. It also shows how to use effectively all radio instruments. 150 pages with numerous diagrams and graphs.

Price 2/6 (Post free 2/10)

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'AVO' ELECTRICAL MEASURING INSTRUMENTS
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The D.C. AVOMINOR
Electrical Measuring Instrument

An accurate 13-range moving-coil instrument for all normal radio tests, including H.T., L.T., and G.B. Batteries, D.C. Mains and Eliminator Voltages; Valves and valve circuits, etc.

CURRENT		VOLTAGE	
0- 6 milliamps		0- 6 v.	0-240 v.
0- 30 "		0- 12 v.	0-300 v.
0-120 "		0-120 v.	0-600 v.
RESISTANCE			
0- 10,000 ohms			
0- 60,000 "			
0-1,200,000 "			
0-3 megohms			

Complete in case with instruction booklet, leads and interchangeable testing prods and crocodile clips. **45/-**

The UNIVERSAL AVOMINOR
Electrical Measuring Instrument

A 22-range precision moving-coil instrument for all A.C. and D.C. testing. All readings direct. Total resistance of meter 200,000 ohms.

D.C. VOLTS		MILLIAMPS.	
0- 75 millivolts		0- 2.5 milliamps	
0- 5 volts		0- 5 "	
0- 25 "		0- 25 "	
0-100 "		0-100 "	
0-250 "		0-500 "	
0-500 "			
A.C. VOLTS		RESISTANCE	
0- 5 volts		0- 20,000 ohms	
0- 25 "		0-100,000 "	
0-100 "		0-500,000 "	
0-250 "		0- 2 megohms	
0-500 "		0- 5 "	
		0-10 "	

Complete with instruction booklet, leads, interchangeable testing prods and crocodile clips. **£5 10s.**
(Leather Case 10/-)

The AVODAPTER
Valve Testing Holder

Simplifies valve testing. Enables all valves to be tested under working conditions outside the set. Eliminates the need for severing connections and groping about inside the set. Instantly adaptable for 4-pin, 5-pin and 7-pin valves. **27/6**

9-pin Avo Coupler. An attachment for rendering the AvoDapter sui table for 9-pin valves. **12/6**

Write for fully descriptive
Literature on 'AVO'
instruments

DEFERRED TERMS IF DESIRED

Pilot

::

Peto-Scott

::

Q.C.C.

standard required by Government services. The most popular receiver in a comprehensive range is a 5-valve Communication type super-het with elec-



The new McElroy tape puller price 67/6 handled by Webbs Radio.

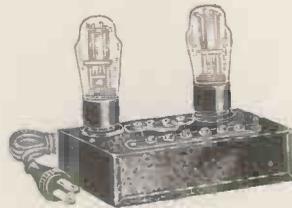
trical band spread covering 12 to 2,000 metres without gaps. This receiver is in a steel cabinet, and includes all refinements such as phone jack, BFO switch, and has a separate 10-in. moving coil loudspeaker in its own cabinet. The price of this excellent receiver is £8 8s. complete with speaker.

Transmitters of all kinds are to be featured and these include a 5-metre transceiver for £10, a 10-watt multi-band phone transmitter for 10 guineas, and other complete phone and C.W. transmitters in rack construction for 25, 50, 150 and 350-watt inputs. The largest transmitter with 350 watts input on both C.W. and phone is priced at £175 and includes a separate exciter, and a second rack for the numerous power packs. This is a miniature broadcasting station and is similar to those supplied to Colonial departments. Other interesting items include a switched coil unit with three coils suitable for transmitting use at 275. 6d., and a larger version for high power operation at 33s. 6d. A catalogue is available giving the complete details of all Premier amateur components, but in addition there are now a number of mains transformers in cast steel cases and also low frequency chokes which are guaranteed rattleproof even under conditions of maximum modulation. A new range of meters of a very modern type are also available in all ranges from 500 microamperes, while ceramic coils already threaded and complete with low loss base, are priced at 4s. 6d. for the small size and 6s. 6d. for a larger version.

Transmitting condensers up to 250 mmfds., in single or double spacing, feed through insulators for as little as 4d. each, inexpensive microphones, including transverse current, moving coil and crystal types, high impedance transmitting chokes and valves of every kind are also available from

stock. Premier's are making a very big point this year of maintaining large stocks so that constructors can obtain deliveries without delay. Premier are being shown by Morris & Co. (Radio), Ltd. Stand 74.

Pilot Radio, Ltd., 87 Park Royal Road, London, N.W.10.—The first receiver to be released in the Pilot range is a battery operated all-wave superhet, type B43 priced at 9 guineas. This receiver is of unique design and uses the latest British octal base valves. An all-wave receiver for A.C. mains operation, type 53, is priced at 10½ guineas, or 11 guineas for a universal model. Press-button tuning is included in the model BT 530, which is also a 5-valve all-waver, priced at 12 guineas. Piano-tuning is the high spot of the Pilot range, and is included in the model PT36, a 6-valve all-wave receiver priced at 14 guineas. For those who prefer multi-valve receivers with a high output there is the model U385, an 8-valver with push-pull output giving 7 watts of really good quality. This excellent receiver costs only 15 guineas. One of the most sensitive receivers available at the present time, U106, which includes a 10-valve radio chas-



The 2-valve McElroy oscillator priced at 32/6.

sis, and has a non-stop coverage from 4.5 metres upwards. The short-wave performance of this receiver is exceptional, and the output stage delivers 14 watts. All refinements are included, such as bass expander and treble control. Price is 25 guineas. Stand 37.

Peto-Scott, Ltd., Pilot House, Church Street, Stoke Newington, London, N.16.—The Peto-Scott slogan "Everything for Radio" is very true when one examines the range of components and receivers now available from this company. Amateurs who need a good slow-motion dial should take the first opportunity of examining the new Peto-Scott geared mechanical band-spread dial. It has a coverage of approximately 8 feet and can be used with any ¼ in. spindle condenser. It is priced at 12s. 6d. and is ideal for use on communication receivers and frequency meters. Divisions of 1 part in 80° can quite easily be read on a full vision scale. They also have a complete

range of push-button all-wave receivers plus a communication receiver tuning from 10 to 2,000 metres. Peto-Scott are distributors for the B.T.S. Company, and are handling their range of short-wave and communication receivers.

Quartz Crystal Co., Ltd., 63-7 Kingston Road, New Malden, Surrey.—This company have a complete range of the well-known National products and can supply quartz crystals of every type. They are already known amongst amateurs, but it is not appreciated just how wide are the activities of this company. Catalogue is available, 1½d. post free, on mentioning TELEVISION AND SHORT-WAVE WORLD, and this is well worth obtaining for reference purposes.

Radiographic, Ltd., Dean House, Dean Street, London, W.1.—The new Meissner products are available from this company including the very popular all-wave tuning heart, which enables constructors to build a complete all-wave receiver with a coverage from 5 metres upwards. They also have a most interesting crystal microphone costing 39s. 6d. which has a comparatively high output and built by one of the leading American manufacturers. Hytron valves are also available and these are ideal for amateur use. The average price is low even though the valves are conservatively rated. Communication and short-wave receivers of every kind are available from this company, mainly from stock, and all receivers are carefully checked and re-lined in order to provide maximum results.

Radiomart (Birmingham), Ltd., 44 Holloway Head, Birmingham, 1.—A complete transmitter of modern design is available from G5N1 and despite its extremely low price has proved to be highly satisfactory. It uses type 46 valves in the final stage and can be adjusted for varying inputs. It is designated the RF-60. A larger version,



Another W.B. product. A coffee table with built-in speaker and remote control.

Radiographic

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Raymart

NOW READY

Premier 1938 New enlarged Illustrated Catalogue, Handbook and Valve Manual! Send 6d. in stamps for 90 pages of Valve Data, Technical Articles, Circuits and Premier 1938 Radio.

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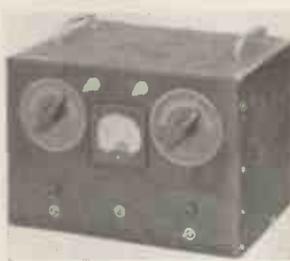
SEE THE NEW PREMIER COMMUNICATION RECEIVER AT OLYMPIA !

Complete coverage from 12 to 2,000 metres in 5 Bands I (25 megacycles to 150 kilocycles.)

- Electrical Band-spread.
- Beat-Frequency Oscillator.
- Phone-Jack, Send-Receive Switch.
- Latest type International Octal Valves for 200-250 volts A.C.
- Built into black-crackle finish steel case.
- Complete with 10½-in. moving-coil speaker in separate steel cabinet to match.

£8 . 8 . 0

STAND No. 74



A 6L6 is used as a modulated oscillator in a Tritet circuit, allowing a fundamental and second harmonic operation, without coil changing, from any one Xtal. A 6C5 speech amplifier is R.C. coupled to a 6L6 modulator, giving approx. 9-10 watts audio. A 400-volt power supply with generous smoothing gives completely hum-free output.

Housed in steel cabinet, in black crackle finish, 12in. x 9 in. x 8 in.

Complete with Xtal and Coils for 7 and 14 mc. operation.

Write to G2HK for full details £10 . 10 . 0

THE NEW PREMIER 10-15 WATT ALL-BAND TRANSMITTER

Designed by G2HK to meet the demand for a really compact self-contained T.X., which can be used for 'Phone or C.W. on all bands.

Triodes, Tetrodes or Pentodes operating under Class "A," "B," "BC" and "C" conditions either Single or Push-Pull.

Totally enclosed in cast cases with engraved Panel, and full instructions. Ratings are based on R.F. inputs.

50 watt, 17/6. 150 watt, 29/6. 300 watt, 49/6.

A new range of "Matchmaker" Universal Output Transformers which are designed to match any output valves to any speaker impedance are now ready.

THE NEW PREMIER MATCHMAKER UNIVERSAL MODULATION TRANSFORMERS

Will match any modulator to any R.F. Secondary Load. Triodes, Tetrodes, and Pentodes Class A. Single or Push-Pull Class "AB1" and "B" in Push-Pull or 500 ohm line input, can easily be matched to any of the following Radio Frequency final stages requiring modulation.

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Totally enclosed in cast cases with engraved Panel, and full instructions. Ratings are based on R.F. inputs.

50 watt, 17/6. 150 watt, 29/6. 300 watt, 49/6.

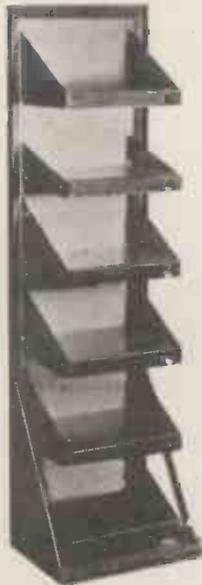
A new range of "Matchmaker" Universal Output Transformers which are designed to match any output valves to any speaker impedance are now ready.

Write for details.

SEE THE NEW PREMIER PRODUCTS ON MORRIS & Co. (RADIO) LTD.

STAND No. 74 AT RADIOLYMPIA

G2HK, G5MG and G8BV WILL BE PLEASED TO SEE YOU!



THE PREMIER STANDARD RELAY RACK

This piece of amateur equipment is typical of the thoroughness with which we are tackling the needs of the British amateur.

The two racks are constructed of 1½ ins. x 1½ ins. x 3/16ths in. steel angle with panels and chassis cut from 16 gauge steel.

The panels are finished in black crackle and the chassis and frame in eggshell black finish.

Price: —

67-in. Rack only	...	30/-
39-in. " "	...	22/6
10½-in. panels	...	4/6
7-in. Panels	...	3/-
3½-in. Panels	...	1/6
Chassis and Brackets	...	5/6

A 10-in. Panel and Chassis and two brackets cost 10/-, and a complete 67-in. rack, with five 10½-in. panels, one 7-in. panel, and one 3-in. meter panel, 6 chassis and 6 pairs of brackets, with all bolts, etc.

Price £4 . 10 . 0 Carriage Forward

A complete 39-in. rack, with three 10½-in. panels and a 3-in. meter panel, with three chassis, bolts and brackets.

Price £2 . 14 . 0 Carriage Forward

NEW PREMIER 1938, S.W. 59.3 KIT.

14 to 170 meters Pentode H.F., Detector and Pentode Output. Complete Kit of Parts with 3 matched valves 59/6 Metal Cabinet 7/6 extra.

SHORT WAVE CONDENSERS

TROLITUL insulation. Certified superior to ceramic. All-brass construction. Easily ganged.

15 m.mfd.	1/6	100 m.mfd.	2/-
25 m.mfd.	1/9	160 m.mfd.	2/3
40 m.mfd.	1/9	250 m.mfd.	2/6



All-brass slow-motion Condensers, 150 m.mfd., Tuning, 4/3; Reaction, 3/9
Double-Spaced Transmitting Types. 15 m.mfd. 2/9; 40 m.mfd. 3/6; 160 m.mfd. 4/6.

VALVES AMERICAN VALVES.

We hold the largest stocks of U.S.A. tubes in this country and are sold British Distributors for TRIAD High-Grade American Valves. All Conceivable types in stock. Standard types, 5/6 each. All the new Metal-Class Octal Base tubes at 6/6 each, 210 and 250, 8/6 each.

EUROPA MAINS VALVES 4 v. A.C. Types A.C./HI., A.C./L., A.C./S.G., A.C./V.M.S.G., A.C./H.P., A.C./V.H.P., A.C./P., and 1 watt D.H. Pentodes, all 4/6 each. A.C./Pens., I.H., 5/6; A.C./P.X.4, 6/6; Oct. Freq. changers, 8/6; Double Diode Triodes, 7/6; Triode H. ex. Freq. Ch., 8/6; Tri. Grid. Pen., 10/6; 3½ watt I.H. Triode, 7/6.

UNIVERSAL TYPES, 20 v. .18 amps., S.G., Var-Mu., S.G., Power, H.F., Pen., Var.-Mu. H.F. Pen., 4/6 each. 13 v. .2 amps. gen. Purpose Triodes, 5/6; H.F. Pens. and Var.-Mu. H.F. Pens., Double Diode Triodes, Oct. Freq. Changers, 7/6 each. Full-Wave and Half-Wave Rectifiers, 5/9 each.

BATTERY VALVES, 2 volts, H.F., L.F., 2/3. Power, Super-Power, 2/9. Var.-Mu.-S.g., 4-or-5-Pin Pentodes, H.F. Pens., V.-Mu.-H.F. Pens., 5/- Class B, 5/- Freq. Changers, 7/6.

NEW TAYLOR TUBES

T.40. TZ.40. NOW IN STOCK. Price 24/- each. Prices now reduced on 866 Rectifier, now 10/-; 866 Junior, 7/6; T55, 45/-; 203Z, 52/6; 745, 65/-; T.20 and TZ.20, 17/6 each.

Stratton

::

Sound Sales

the RF-100 has just been released. An interesting item in the Raymart range is a mains transformer providing 750 volts at 200 mA. with several tapings and priced at 25s. They can also supply chassis and cabinets of all kinds at competitive prices. Their short-wave condensers suitable for both receiving and transmitting (the transmitting type having .07 in. spacing) vary in price from 1s. 4d. to 3s. 6d. Amateurs who require additional selectivity can obtain a valuable selectivity IF kit for 15s., in which the selectivity of the receiver by means of a switch can be changed from 9 kc up to 2 kc.

Stratton and Co., Ltd., Eddystone Works, Bromsgrove Street, Birmingham, 5.—The components of this company are better known under the trade name of Eddystone. Short-wave equipment of the highest grade and suitable for every amateur purpose is now available from stock. Their range has been vastly increased and now includes low-loss Frequentite formers, steel transmitting racks, a slow motion driving head for 3s., air-tuned IF transformer at 8s. 9d., short-wave air-spaced trimmers having a capacity variation of between 1 mmfd. to 30 mmfd. at 1s. 3d., and a multitude of dials. There is for example the dual-speed full vision dial at 8s. 9d., a precision instrument drive for 6s. 9d., and miniature dials at 2s., which are ideal for amateur use. Instrument knobs are also available from 9d. An ingenious flexible drive, type 1,096 enables condensers and similar components to be operated at an angle of 90 degrees to the control knob. In this way constructors can build equipment with a symmetrical panel, but



This gramophone attachment made by H.M.V. is priced at 39/6.

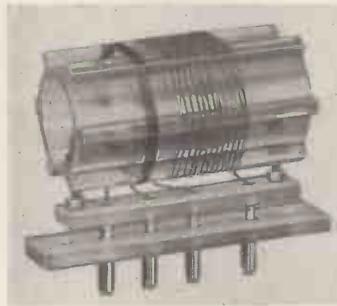
with the components in the most suitable positions.

Amongst the transmitting condensers is one of all brass construction having a maximum capacity of 65 mmfd. The price is 16s. 6d. A two-section condenser type 1081 is priced at 17s. 6d.,

while a high-power condenser of either the single capacity or split stator type cost 35s. and 36s. respectively.

For those who are interested in ultra-short wave reception there is a complete range of plug-in coils covering from 4 to 10 metres. These coils are in addition to the 4 pin and 6 pin which tune between 9 and 2,000 metres. Stand 77.

Sound Sales, Ltd., Marlborough Road, Upper Holloway, London, N.19.—Quality amplifiers of all kinds are the most important items produced by this company. They have a push-pull quality amplifier suitable for 4-12 watt output, priced at £18 10s., a 4-6 watt amplifier at £10 and 14 watt public address system for £22 10s. In addition



These low-loss short-wave coils are handled by Webb's Radio and are also suitable for ultra-short wave work.

to sound equipment, Sound Sales manufacture tuning units, all-wave receivers, a 4-band tuner and some exceptionally fine IF transformers. Their LF chokes and mains transformers are really well known as being entirely satisfactory for amateur use, while the chokes are always suitable for use in modulation circuits. Their variable selectivity IF transformer is priced at 10s.

Telegraph Construction and Maintenance Co., Ltd., Telcon Works, Greenwich, London, S.E.—Co-axial cable suitable for amateur use is now being manufactured by Telcon. The cable is extremely light and has very low attenuation figures. It can be used with a considerable number of amateur aerials and is excellent for feeding an end fed aerial at a long distance from the transmitter. Its primary use is for television, but amateurs have been quick to realise the advantages of this co-axial cable on short waves generally. Stand 78.

Tungram Electric Lamp Works (G.B.) Ltd., 82-4, Theobalds Road, London, W.C.1.—A complete range of valves in the "E" series including a double pentode have recently been introduced. This double pentode gives 5.4 speech watts

with a total current consumption 33 mA. For use in multi-valve receivers and television amplifiers is a new valve called the E.F.8, which has a negligible noise level, but provides an extremely high gain when correctly used. Amateurs who have appreciated the characteristics of the OS-12 500, a transmitting RF pentode, with ceramic base and 12-volt heater, will be glad to know that a similar valve with a 6-volt heater has been introduced and designated the OS-12/501. A 50-watt triode for ultra-high frequency use down to 1 metre called the OQQ-50/500 is now available and has low inter-electrode capacity. Stand 20.

Whiteley Electrical Radio Co., Ltd., Mansfield, Notts.—In addition to numerous loudspeakers, W.B. are featuring this season public address loudspeakers and amplifiers, relay cabinet speakers, valve holders, switches and a complete range of Stentorian chassis loudspeakers. Most of the W.B. loudspeakers have a switched input transformer so that it can be used with any type of output valve. An innovation of this company is a coffee table with a built-in loudspeaker and Long Arm remote control. They also have a pendant cabinet which can be hung from the wall and is so arranged that the cabinet front slopes at the correct angle. Stand 26.

Webb's Radio, Ltd., 14 Soho Street, London, W.1.—One of the most popular suppliers of short-wave equipment are Webb's Radio, who carry large stocks of every component amateurs are likely to require. They have just introduced a 56-page catalogue which is free and should be obtained by every amateur for reference purposes. It covers and gives full information of a large number of communication receivers, valves and components.

An interesting item they are featuring this season is an automatic CW recorder, which is complete and sells for approximately £8. They also have an automatic CW sender and a whole host of inexpensive precision morse keys. Communication receivers vary from the Sky Buddy, a 5-valver at £9, up to a two-channel receiver costing £180. A most popular set suitable for the most stringent amateur use is the Sky Champion, an 8-valve communication set with built-in speaker priced at £15.

Inexpensive transmitting racks are also available with panels and suitable chassis. They also have a range of ultra low-loss short-wave coils and formers and a complete range of threaded ceramic formers. Inexpensive quartz crystals of all frequencies are available, while Eddystone components are handled and can be obtained from

(Continued on page 582)

Tungram

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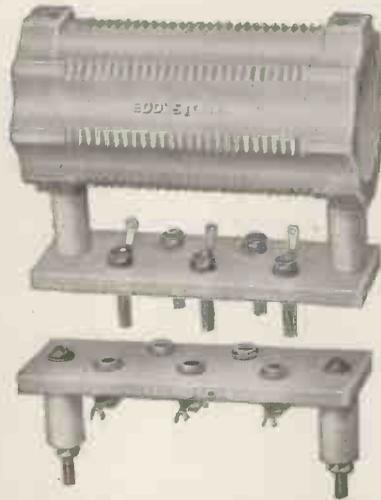
Webb's Radio

Fine Quality Components



FLEXIBLE COUPLING UNIT.
Cat. No. 1096.

For front panel control of awkwardly placed components. Will drive through 90 deg. perfectly. One hole fixing. For $\frac{1}{4}$ " Spindle. Price 3/6



FREQUENTITE LOW LOSS FORMER
Cat. No. 1090.
Ideal for Amateur transmitters. Former size 5" x 2 $\frac{1}{2}$ ", spiral grooves take 26 turns of wire up to 12 gauge. Winding data supplied with former. Price 4/-

FREQUENTITE SUB-BASE.

Cat. No. 1091.
For mounting former No. 1090. Can be used as base for self-supporting inductances. Power plugs ensure positive contact. Price 3/6
FREQUENTITE BASE. Cat. No. 1092.
For mounting former with sub-base. Heavy-duty power sockets for sound electrical connection to former. Price 3/9



SLOW MOTION DRIVING HEAD.
Cat. No. 1012.
Very useful for Transceivers and Ultra Short Wave Receivers. With 9-1 reduction ratio; pointer moving through 180 deg. Price 3/-

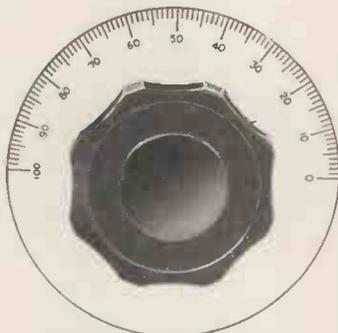


FREQUENTITE PILLAR INSULATORS

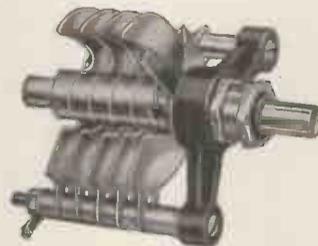
For transmitting and laboratory work. Ideal for mounting inductances, formers, meters, etc. Tested to breakdown voltage of 30,000 volts. Highly suitable for outdoor insulation. Cat. No. 1049 (wing-nut fitting) Price 1/6
Cat. No. 1095 (2BA Plug and Socket fitting) Price 1/8



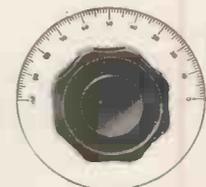
NEUTRALISING CONDENSER
Cat. No. 1088.
For H.F. circuits using low-capacity triodes. Maximum voltage 2,000 volts D.C. Capacity variation 1-8 mmfd. Frequentite pillar insulator mounting, insulated adjusting knob. Price 6/6



POPULAR TYPE DIAL.
Direct Drive. Cat. No. 1098.
The 4 in. Scale is satin finish aluminium with clearly marked divisions. It is fitted with a 2 $\frac{1}{2}$ in. knob for $\frac{1}{4}$ in. spindles. Price 4/6



HIGH-VOLTAGE MICRODENSER.
Highly efficient. Soldered brass vanes. Constantly maintained capacity; very low minimum 3 mmfd. DL9 insulation. $\frac{1}{2}$ " spindle extended for ganging. Peak flash over voltage 3,500 volts Easy to gang—capacity matched within 1 per cent. Cat. No. 1094. 18 mmfd. Price 3/9



MINIATURE POPULAR TYPE DIAL.
Direct Drive. Cat. No. 1099.
The 2 $\frac{1}{2}$ in. Scale is satin finish aluminium with clearly marked divisions. It is fitted with 1 $\frac{1}{8}$ in. knob for $\frac{1}{4}$ in. spindles. Price 2/-

1939 SHORT WAVE MANUAL NOW ON SALE PRICE 1/-

EDDYSTONE SHORT WAVE COMPONENTS

STRATTON & CO., LTD., Bromsgrove St., BIRMINGHAM.

London Service: Webbs Radio, 14, Soho St., W.1

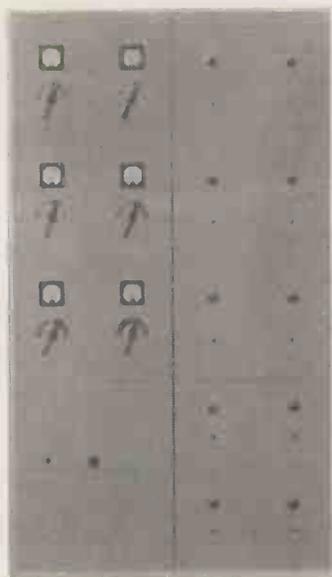
Visit our Stand No. 77, Radiolympia

With the Amateurs

By G5ZJ

IF amateurs take advantage of the numerous new components and equipment that have been produced specially for their benefit this year, then before very long the average transmitting station should assume a commercial appearance.

I have been fortunate enough to be able to handle a very big percentage of the special short-wave components that are on show at Olympia and which are now available from stock. The average manufacturer has paid the amateur fraternity as a whole the very



British amateurs will shortly be hearing XZ2JB who has just purchased this 350-watt transmitter. It has T55's in the final and class-B modulation.

big compliment that they will appreciate high quality components of the type in commercial use.

Switched Coils

I have in mind a switched coil unit with ceramic switching and three coil forms arranged so that a transmitter can be built for three wave-band operation. There are sufficient switch contacts for a centre tapped coil to be changed over complete with link coupled winding. Any amateur who uses this arrangement will be able to make a most effective transmitter having a high degree of efficiency on three wavelengths. There will not be any need for juggling with condenser values for these can be made part and parcel of the coil unit.

Crystal Holders

As variable frequency crystals are not looked upon with favour by the licens-

Some interesting news about short-wave equipment shortly to be available to amateurs is discussed in this article.

ing authorities at least two manufacturers have produced a four-way crystal holder complete with switch so that four frequencies can be obtained as required. This enables amateurs to change frequency quite easily but at the same time to know exactly on what frequency they are transmitting.

Building a super-het receiver is a problem, and for this reason amateurs who would like to build and have considered the work beyond their capabilities have purchased a communication type receiver which perhaps does not always do what it should. In order to overcome this set building problem, tuning units are now available covering amateur bands from 10 to 160 metres, or with general coverage from 10 to 2,000 metres. Generally speaking these coil units consist of a detector oscillator and radio-frequency stage all wired up to an appropriate condenser bank to which is added, or can be added, a band spreading arrangement. To complete the receiver all the constructor has to do is to add the intermediate-frequency stage, second detector and final amplifier. Boiled down the constructional work is not more difficult than building a conventional three or four valve receiver. Even refinements such as a signal strength meter can be included for two manufacturers so far have produced an R meter calibrated in arbitrary R units. These meters can be added to almost any superhet receiver.

British valve makers are very proud of the valves developed finally for use in the radio frequency and intermediate-frequency stages of television receivers. These valves have a high mutual conductance and in many instances in addition to providing an extremely high stage gain, actually decrease the existing noise level of the receiver. These valves are now generally available, and amateurs will soon appreciate that one of the new television pentodes in a short-wave receiver is almost as good as two RF stages with the ordinary type of RF pentode. American valve makers have tried very hard to reproduce valves having similar characteristics, but so far, despite the fact that they have introduced three distinct types with steep slopes they still do not compare with the British counterparts.

The Mullard "E" series of valves which as yet are not too well known amongst amateurs, deserves particular attention for I am sure that many amateurs like myself will very soon discard the older pattern pentodes in favour of those in the "E" series. I am quite convinced that the average

amateur with a reasonable technical knowledge can build for himself a communication set equal in performance to many commercial instruments. The constructor also has the advantage that he can add all the new refinements which he finds essential.

Low Current Valves

Very little attention is paid these days to the requirements of those who are limited to battery operated valves. I am very pleased to notice that the Ediswan Company have produced an entirely new range of battery valves with a filament current of only 50 mA, which is even better than the early type of 60 mA valves which were so popular. The new type, however, have a very high degree of efficiency, which could not be said for the old .06 filament valves, while there is a very considerable saving in space owing to the fact that they are extremely small in size. While talking about Ediswan valves they also have two of these new high slope pentodes designated the SP41 and SP42.

Low-power Pentodes

The Mullard Company who just recently began to take a serious interest in amateur transmitters have produced a comprehensive range of low-power

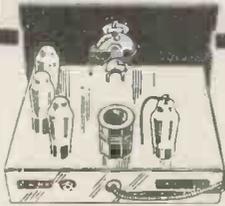


This Mullard pentode the PZ1-35 with 1-watt of excitation will provide a carrier power of 10-watts at 15 metres.

SEPTEMBER, 1938

SHORT-WAVE GEAR FOR DISCRIMINATING PURCHASERS

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- Inexpensive



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For building alternatively, 8 Short-Wave receivers—any one available as a separate kit—but it's cheaper to buy the ALL-IN-KIT. Described fully in the Peto-Scott "Short Wave Experimenter" booklet post free on request.

Complete Kit **£5-15-0**

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Features :—Covers four waveranges. Band 1, 10-25 ; band 2, 25-65 ; band 3, 200-550 ; band 4, 800-2,000 metres. Large illuminated metre and station-name scale. Highly efficient 6-valve circuit for A.C. mains, with triode hexode frequency changer, I.F. Amplifier and Double diode output Pentode. Output 3 Watts. A.V.C. and B.F.O. switches. Tone, R.F. and A.F. gain controls. High fidelity speaker. Phone jack. Pleasing black crinkle metal cabinet.

The numerous compliments paid by highest technical authorities confirm the reasons for the enormous popularity of the D.P. Communication Receiver. *Wireless World* sums up the advantages of possessing this set by stating further that "... the features appeal to the short wave receiving and transmitting amateur, but the scope is not confined to his special requirements. For long-distance short wave reception the pleasure derived is enhanced by the knowledge that users have at their command all the auxiliary services of a professional Communication Receiver—denied by the conventional all-wave set—and in addition medium and long wave reception is provided for, with quality reproduction."

Terms 21/- Deposit and 12 monthly payments of 20/3 or Deposit 21/- and 18 monthly payments of 14/3. Available in chassis form.

1 1/2 GNS

TROPHY SHORT-WAVE COMMUNICATION RECEIVERS



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- R.F. on all bands.
- Separate Oscillator.
- Beat Frequency Oscillator with separate Pitch Control.
- A.V.C. and B.F.O. on-off switches.
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British valves with American characteristics are used throughout with 6L6 as frequency changer, 6K7G as IF amplifier, 6B8C 2nd detector, AVC and audio amplifier, 6F6 output pentode. Self-contained smoothing circuit. Pleasing metal cabinet, size 17 1/2" long x 9 1/2" x 12" deep. For A.C. mains 200/240 volts, 40/100 cycles. Guaranteed, fully tested. Cash or C.O.D., 12gns. or 18/- down and 15 monthly payments of 18/-. **12 GNS.**

TROPHY 5 (Illustrated above) This popular 5-valve A.C. junior communication receiver has a continuous wave-range of 10-550 metres. Mechanical Bandsreading is employed giving an equivalent of eight-foot scale length. Alternative scale available calibrated in kc. or metres. Single wire or double aerial can be used without alteration. AVC and BFO on-off switches. Built-in speaker. Phone jack. Pleasing metal cabinet. Guaranteed, fully tested. Cash £9 or C.O.D. £9 or 10/9 down and 18 monthly payments of 10/9. **£9**

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TRANSVERSE CURRENT MIKE. Rice pattern. Wire-mesh protected diaphragm, 540 ohms impedance. Sensitive sprung on attractive neat bakelite table stand with separate bakelite case housing matching transformer and 9 v. battery. Price complete, 25/- or 2/6 down and 11 monthly payments of 2/6. Chromium-plated telescopic floor-stand model, 42/- or 2/6 down and 11 monthly payments of 4/-. Mr. K. Jowers, short wave Editor of this Journal, preferred a Peto-Scott 25/- mike to his original, costing £16.

AMPLIFIERS. 6-7 Watt Model for A.C. Mains. Effective sound-range 500 feet. Ideal for home, club and sports meetings and all P.A. work. Assembled and fully tested, ready for immediate attachment to Microphone or Gramophone Pick-up, complete with 4 valves. List value £6 10s. 0d. Special Price £3 10s. 0d. or 5/- down and 11 monthly payments of 6/9.

BATTERY 4-WATT AMPLIFIER. Efficient 4-valve class "B" output battery amplifier for use with microphone or gramophone or by plug attachment for use as booster for existing battery sets. Fully tested, complete with valves 55/- or 5/- down and 11 monthly payments of 5/4.

SPECIAL OFFERS. P.M. speakers, well-known makes, 8 in. cone, for power or pentode, 12/6 each. Energised Rola type, 2,500 ohms pentode output, 10/6 each.

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News of the Radio Clubs

transmitting valves in both the pentode and triode types. A valve which instantly comes to mind is the PZ1-35, a pentode for use down to 15 metres. At this wavelength with suppressor modulation it will stand an anode voltage of 800 and will provide a carrier power of 10 watts. It needs only 1 watt of excitation and negligible modulation power. This is an excellent valve for multi-wave transmitters. There is also the PVO5-15, another pentode which as a class-C RF amplifier at 15 metres will stand 500 volts on the anode, provide 15 watts of carrier and requires 0.9 watt drives.

A valve which is very popular amongst those who are still faithful to triodes is the TZ05-20 which, in its original form, was the T25D. With 300 volts on the anode at 10 metres it provides approximately 15 watts of carrier with about 2 watts of excitation. It is possible to obtain an efficiency of 65 per cent. at 20 metres. The TY1-50 is another interesting valve being a triode of the low C type which will operate quite comfortably down to 1 metre. At 15 metres as a class C amplifier the output power is 75 watts with a drive of only 4.5 watts.

How many amateurs would like a nice 350-watt transmitter with so much reserve of power that almost every stage can be badly mistuned without there being any appreciable drop in carrier power? A transmitter of this type has just been bought by the well-known amateur XZ2JB, who operates from Rangoon, Burma. It was built by the Premier Supply Stores and I went along and inspected it on the day it was being shipped to Rangoon. This transmitter, built on two separate racks, has a pair of T55's in the final. The line up actually is 6L6G as a separate bench operated exciter, T20, T55, T55 and push-pull T55's. It is modulated by a pair of TZ40's in class B while the complete valve line-up is 6J7, 6J7, 6N7, 6F8, 6C5, push-pull 6C5's, push-pull 6A3's and push-pull TZ40's. The gain from this amplifier is so high that full modulation is possible by speaking quite normally in any part of quite a large room. It has low and high gain input channels and a volume level indicator. The whole transmitter is finished in grey, while plug-in coils are used throughout.

The Q Aerial

One of the most popular aerials is the Johnson Q, which in its half-wave form has been used with such success. There is, however, a common fallacy that to increase the broadside radiation of this aerial all one has to do is to add two further half-sections. This is all very well in theory but the Q bars will not be suitable in their present form for

matching up the centre impedance of this aerial to a normal 600-ohm line. I have had quite a long letter to this effect from L. W. Olander, chief engineer of the Johnson Company. He tells me that a three section in phase Johnson Q has a centre resistance of 330 ohms, which means that the Q section would have to have a very large gap in order to couple a 600-ohm line to a 330-ohm aerial. The solution of the problem, however, is to use a 70-ohm line, which can be matched by means of the Q bars to the aerial impedance. The gain of such a system is between 5 and 6 dB in two directions, which seems to me to be an excellent arrangement for those who can erect the aerial in the correct line.

A very good investment I made just recently was to spend 1/s. 6d. on a small blow lamp. This was purchased



The PVI-35 one of the most popular pentodes in the new Mullard range of transmitting valves designed for amateur use.

principally for soldering and produces in 15 seconds a flame of 2,550 degrees F. It can be used for brazing, and melting of brass or copper, etc., and is simple to handle. It functions equally well on petrol, alcohol or methylated spirits and will, with one filling, last almost an hour. This soldering lamp called the Ricofor has no working parts such as a pump, as in the older type

of blow-lamp and all one has to do is to apply a match and wait 15 seconds. A very concentrated flame is obtained similar to that in a welder. It is a most useful accessory in a workshop and only measures 8 by 2 by 1 inch. It is made by the Stanhay Company and full information can be obtained from Parr's, Ltd., Craven House, Kingsway, London, W.C.2.

5-Metre

Tests

David Mitchell, who operates G6WA, has arranged another series of 5 metre tests from Snowdon. These tests are dated September 9, 10 and 11, the last two dates being arranged to coincide with the GW 5-metre trophy contest. Times for operations are as follows:—

Friday, Sept. 9, 19.30 to 22.30 BST.

Saturday, Sept. 10, 12.00 to 23.30 BST.

Sunday Sept. 11, 09.30 to 20.00 BST.

Special times have been set aside for C.W transmission only and these are:—

Friday, Sept. 9, 20.30 to 21.30 BST.

Saturday, Sept. 10, 14.30 to 15.30 BST.

Sunday, Sept. 11, 14.30 to 15.30 BST.

Schedules for stations of 80 miles from Snowdon are required while all reception reports will be acknowledged. One of the aerials used is to be a bi-directional beam array, consisting of 8 vertically stacked di-poles fed in phase. This aerial will be directed along a line drawn between Sligo, IFS, to South Foreland, Kent, and should effectively cover Dublin, Shrewsbury, Wolverhampton, Birmingham and Coventry. GW6AA will be pleased to listen for any station on the 112 or 224 mc and will reply on 56 mc. For CW operation a straight acorn valve receiver and a superhet will be used, with super regenerative receivers on phone and ICW.

The Sussex Short Wave and Television Club.—An extraordinary meeting of this Society was held recently at East Ashling, when Mr. R. F. Hansford presided. Over 80 per cent. of the members attended and it was decided that the name of the society be changed to the Sussex Short-Wave and Television Club. The president for the coming year is Gerald Marcuse, and the chairman Mr. R. F. Hansford. Further information about this society can be obtained from the secretaries, Mr. C. J. Rockall, Aubretia, Seaford Road, Rustington, or Mr. E. C. Cosh, of Anslyn, Mill Road, Angmering.

Gloucester Radio Club.—This society, founded early in 1937, has had an excellent series of lectures which have all been well attended. They have also arranged field days, and direction finding contests. Readers are invited to get in touch with the Honorary Secretary, Geoffrey G. E. Lewis, of 30 Kitchener Avenue, Gloucester, for full information as to membership.

McGRAW - HILL

BOOKS FOR RADIO MEN

Electron Optics in Television

With Theory and Application of Television Cathode-Ray Tube.

By I. G. Maloff and D. W. Epstein.

299 pages, 9×6, illustrated, 21/- net.

IN this book the authors develop the theory of electron optics from its fundamentals and cover its application in the design of the television cathode-ray tube, including an account of that part of the subject with which the authors have had first-hand experience at the Research Laboratories of the R.C.A. Manufacturing Company.

From the book the reader should get an understanding of electron optics and be able to use electron optics in various problems of pure and applied physics. He also should get the basic principles of the design of television cathode-ray tubes and associated circuits. Most of the material has never appeared in book form and some of it has not been published previously.

Engineering Electronics

By Donald G. Fink,
Managing Editor "Electronics."

358 pages, 9×6, 217 illustrations, 21/- net.

SPECIAL FEATURES INCLUDE

- 1—A clear understanding and a working knowledge of electron physics.
- 2—A sound description of the engineering characteristics of all types of electron tubes.
- 3—An understanding and a comprehensive working knowledge of the application of these characteristics to electronic circuit design.
- 4—Gives descriptions of as many practical applications of electron circuits as could be included in one volume. These circuits have to do with power transformation, electrical communication, and industrial control and measurement problems.
- 5—In order to help the student in obtaining a working ability in the subject about one hundred problems of a strictly practical nature are included. Graphical and tubular methods of presentation are used freely and the book is written in a simple and descriptive style.

Radio Frequency Electrical Measurements

By Hugh A. Brown.

Associate Professor of Electrical Engineering,
University of Illinois.

384 pages, 9×6, illustrated, 24/- net.

THIS combined laboratory textbook and manual for the student and practising electrical and radio engineer explains physical principles and procedures for making quantitative measurements.

The revision reflects both the improved available testing equipment and advanced knowledge in the matter of applied principles and measuring technique which have reached the service stage since the publication of the first edition.

Sections on measurements of coil resistance, antenna resistance, condenser loss resistance, frequency by approximate and precision methods, vacuum tube parammeters and performance, receiving set performance, have all been revised in the light of this advanced knowledge.

Fundamentals of Radio

By Frederick Emmons Terman

Professor of Electrical Engineering, Stanford University

458 pages, 9×6, illustrated, 21/- net.

CHAPTER HEADINGS

- | | |
|--|---|
| Preface | Sources of Power for Operating Vacuum Tubes |
| The Fundamental Components of a Radio System | Radio Transmitters |
| Circuit Elements | Radio Receivers |
| Resonant Circuits and Circuit Analysis | Propagation of Radio Waves |
| Fundamental Properties of Vacuum Tubes | Antennas |
| Vacuum-Tube Amplifiers | Radio Aids to Navigation |
| Power Amplifiers | Television |
| Vacuum-Tube Oscillators | Acoustics |
| Modulation | Appendix |
| Vacuum-Tube Detectors | Index |

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The 15-watt C.W. Transmitter

The first part of this article was published in the July issue, but for the benefit of readers who require information on the sub-chassis lay-out we are giving this additional information.

AS so many readers have written to me regarding small points in the design of the 15-watt C.W. transmitter, I have decided to reply to all of these queries in this article.

Most readers appear to have found difficulty in arriving at a satisfactory layout for the components despite the

pick-up. Incidentally the screened cable is earthed at both ends.

The next component of interest is VS₃, which is in the centre of the chassis and is close to the microphone transformer. On the extreme right is VC₂, which is very close to the anode circuit of V₁, while the pre-set cathode

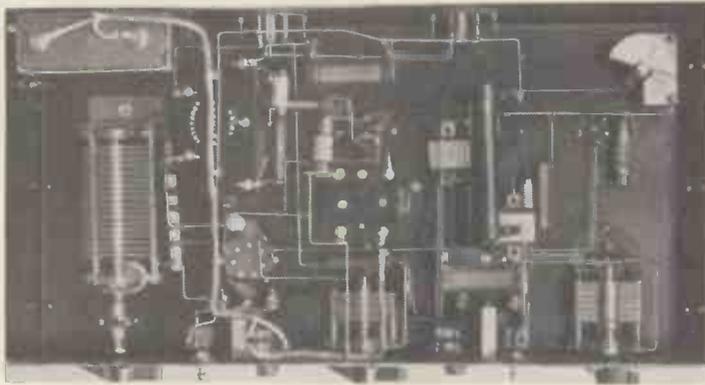
this reason, I strongly advise readers to use heavy gauge connection wire. No. 16 gauge is about the thinnest I recommend, while if a good hot iron is available, try and use 12-gauge wire.

That, I believe, covers all the points readers have raised regarding the building of the transmitter, but should constructors have any other difficulties, I shall be glad to answer any queries they may have.

When designing this transmitter I assumed that most amateurs would have a suitable power supply circuit available. However, it appears that many of the newly licensed experimenters have no power unit of a suitable type. At the bottom of this page is illustrated a compact power unit which is ideal for this transmitter. As can be seen it is mounted on a narrow metal chassis and consists of a transformer with one high voltage and three low-voltage secondaries, full wave rectifying valve, a 200 mA. choke, two smoothing condensers and a two way terminal block.

The switch which can be seen on the front edge of the chassis is connected between earth and the centre point of the high voltage winding. It is used for stand-by operation and merely connects or disconnects as required the high voltage to the anodes of the three valves without disturbing the heater windings. It will be realised that the power pack cannot be switched off at the mains because should it be necessary to switch on in a hurry there will be a time lag of at least one minute for the valve heater to reach the correct temperature. —G2HK.

The underside of the chassis is wired in this manner from which it can be seen that the components are well spaced and are simple to wire.



fact that these should be interconnected in the wiring whenever possible.

A sub-chassis illustration is shown on this page. On the left can be seen the main tank condenser VC₄ which is mounted on two stand-off insulators. The drive is taken through the front lip of the chassis via a flexible coupler. In this way, there is no need to insulate the spindle from the metal chassis.

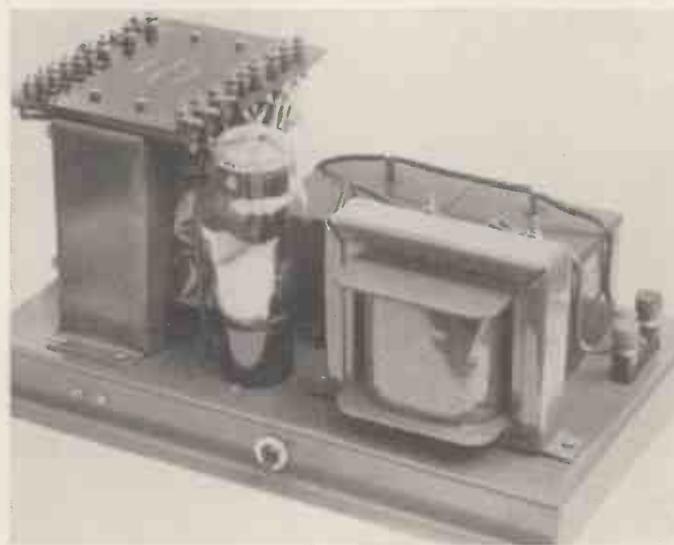
Slightly to the left of this condenser can be seen, T₁, the modulation transformer which is connected in series with the suppressor grid of V₂. The primary of this transformer is in the anode circuit of V₃, which is between T₁ and T₂. The transformer T₂, which can be seen in the centre of the chassis, is, of course, the microphone input transformer and this is the component which appears to have caused most difficulty.

In the design of this transmitter I found it was almost impossible to arrive at a layout so that the microphone input circuit was interconnected by short leads. However, I finally decided that it was better to have the microphone transformer close to the grid of the valve and to have a long microphone lead than to fix the microphone transformer close to the input jack, which would mean a long grid lead. For this reason, the microphone transformer is as close as possible to V₃, while the microphone battery is in the left-hand corner of the chassis, and held in position by an aluminium clip. The two leads from this battery are in shielded metal cable so reducing hum

condenser is mounted through the top of the chassis and can be seen in the top right-hand corner. VC₁, 2 and 3 are all very carefully insulated from the panel by means of Trolitule strips.

On the back lip of the chassis can be seen two valve holders. These are for the power supply circuits, one taking the low-voltage heater windings and the other the H.T. supply. Grid bias connections are made via long leads through a bushed hole on the chassis.

The various resistors are actually mounted in the wiring for it so happens they are of the correct length to fit between the various components. For



This is a suggested power pack of conventional design with a 500 volt-transformer, 200 mA. smoothing choke, a 5Z3 rectifying valve and two 4-mfd. condensers.

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The Short-wave Radio World

A STABLE ELECTRON COUPLED OSCILLATOR

IN the current issue of the American publication QST is an excellent description of an ECO unit designed by W9JID. This oscillator was apparently developed during the course of design work in connection with the construction of a commercial transmitter. It has proved to be superior in stability to the commonly used single valve arrangement, while the use of valves such as the 6L6G permits of appreciably greater power output than is normally obtained from a conventional oscillator.

The circuit arrangement is shown in Fig. 1 from which it can be seen that a 260 mmfd. condenser provides the essential high capacity in the grid-screen

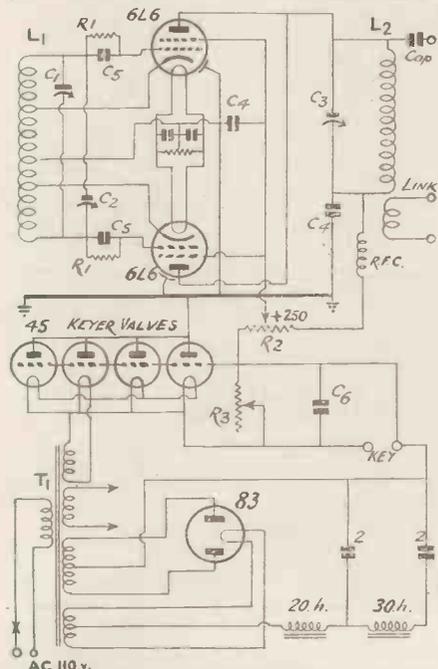


Fig. 1. W9JID developed this ECO circuit and recommends the use of a valve keying circuit as shown.

circuit. A 25 mmfd. in parallel with this permits a change in frequency of about 50 kc. without change in the setting of the main tuning condenser. Since the oscillator is built up as a separate unit and installed on the operating table this small change in frequency is all that can be used because a wider variation makes it necessary for the remainder of the transmitter to be re-adjusted. In the course of adjustment it will be found that best stability is obtained with a small amount of excitation, therefore the cathode tap is placed very close to the centre tap of the coil. Although 6L6's have proved to be quite satisfactory further developments have shown that the RK40's are extremely good oscillators. It will be noticed that a valve keying arrangement is included

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

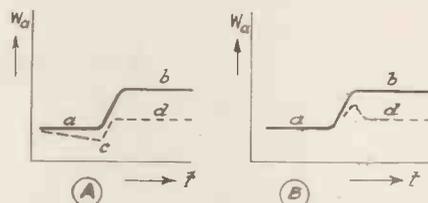
in this circuit. The system is highly recommended and will provide absolutely clickless keying even when worked break-in close to the operating frequency. Four type 45 valves are used in the keying circuit, but if a greater output is required additional valves can be wired in parallel. In order to obtain good voltage regulation choke input is used.

VOLUME EXPANSION IN RECEIVING SETS

The problem of volume expansion has been very fully discussed in the Philips Bulletin No. 39, and we have extracted some of this owing to its interest to those keen on making the most of their gramophone records.

It is a well-known fact that the volume range of music as recorded on gramophone records, or modulated on the carrier wave of a radio transmitter is for various reasons reduced to a small compass. In the first instance, the smallest amplitude that can be recorded on a gramophone disc, a film or a carrier wave must be greater than the noise level. For the gramophone record the highest amplitude is limited by the width of the sound groove and for a carrier wave by the hundred per cent. modulation.

It would be a mere coincidence if this expansion range exactly corresponded to the contrasts in the original music or speech which it rarely does. The available contrast range of a gramophone record or of a radio transmitter is not



Figs. 2a. and 2b. Graph illustrating the movement from a soft to a loud passage of music.

sufficient to enable the original music or speech to be transmitted in a perfectly natural state. For this reason the extreme limits of volume are to some extent attenuated in the low-frequency amplifier which precedes the disc cutting apparatus or the modulator valve. This may be effected either automatically or by manual control. In the latter case there will be an arbitrary factor in the execution and consequently the original music is likely to be reproduced in a different form.

The reason for volume expansion is

to restore to music the original richness of contrast which it possesses before volume compass is reduced. In this connection it is advisable to consider the delays occurring in both transmitter and receiver for these delays are added together. In the case of a hand controlled transmitter a skilful musical expert can eliminate the delay at the transmitter end. Another and perhaps more serious drawback is that the reproduction of an automatically controlled transmission by a non-automatically controlled receiver is by no means irreproachable. This can be seen from the graphs. Graph 2A represents the amount at which the volume of music in the transmission would necessarily increase from *a* to *b*, the rise of volume so

being— $\frac{b}{a}$. If the transmitter is unable to

handle volume *b* it is usual in the case of manual monitoring for *a* to be gradually attenuated to *c* as shown by the dotted curve after which a rise to *d* is possible. Obviously this method is only suitable when the control is operated by a musical expert. After control down to *c* has first been effected the full rise of volume may be permitted. If a decrease of music volume were expected at *a* it will be necessary to begin with a gradual rise.

The effect of automatic control is illustrated in Graph 2b. The volume level *b* is again reduced to *d*, but owing to inertia of the system the level *d* is first exceeded. This fact is very disturbing in the case of reception without accentuation of contrasts. It will, however, be noticed that a system as in Fig. 2a enables greater contrast to be

realised for the ratio $\frac{d}{c}$ in Fig. 2a has

a greater value than the ratio $\frac{a}{b}$ in

Fig. 2b.

One cause of delay in the application of volume expansion is the greater output energy required at the receiving end. In order to obtain natural reproduction of an orchestral performance it

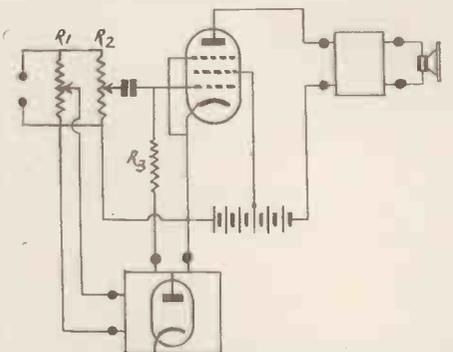


Fig. 3. Theoretical circuit of an experimental volume expander.



STABLE VOLTAGE

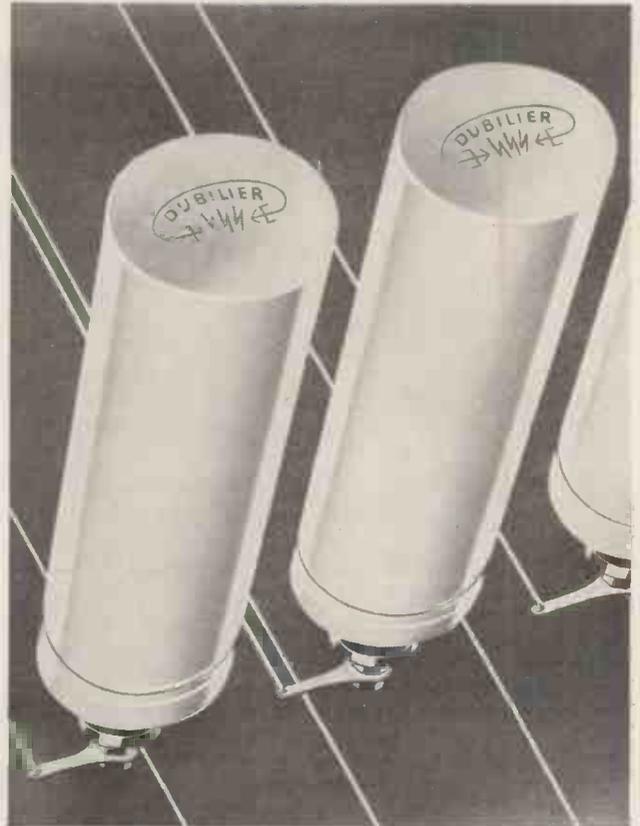
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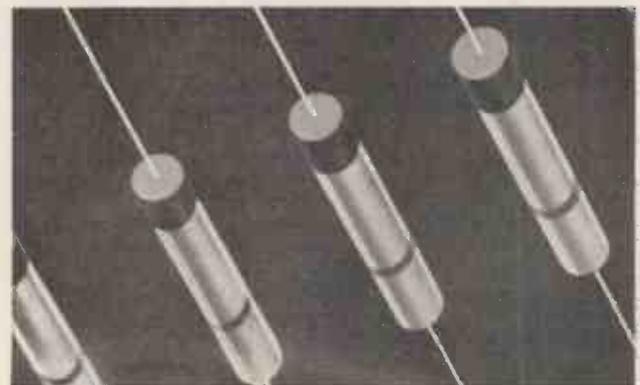
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Volume Expansion

is necessary to use a higher wattage. If the level of the entire performance is reduced below a certain value the soft passages in the music will be far too faint in comparison with the background noise.

contrast is of the order of 25 dB, whilst for very good records and radio transmitters it is about 40 to 45 dB.

An obvious remedy is to use a pentode of variable conductance to bring about the necessary variation in ampli-

a control voltage range of about 35 volts.

In the recommended circuit the degree of volume expansion is not controlled before the detector by a volume control, but is left until after this valve. The maximum D.C. voltage obtained with an input signal from V_1 of 0.5 volts RMS is 60 volts. On the buffer condenser C_2 there is inevitably a small ripple voltage of the frequency applied, since this condenser may not be too large on account of the sluggish action entailed. On the other hand, as it is undesirable to apply this ripple voltage to the low-frequency amplifier a smoothing filter has been provided. This filter consists of a resistance and a condenser. The automatic control is naturally retarded for which reason the product RC should not exceed 0.1. When taking as a basis an output of 25 watts it was found that the conductance of the control pentode must be capable of varying by 100. It was also suggested effecting control between 3 and 300 microamperes per volt corresponding to a negative grid bias range -44 down to -10 volts.

The cathode voltage of the AF3 should therefore be 44 volts when no signal is present.

Reference to Fig. 5 will give some idea as to what can be achieved by using the AF3 as a volume expander.

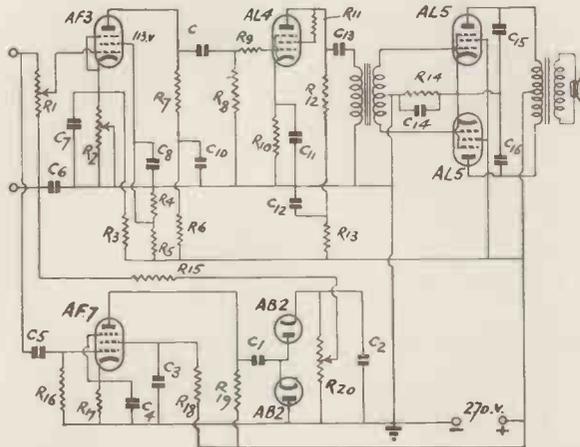


Fig. 4. Circuit of an LF amplifier giving 15 watts and including volume expansion.

The mean volume of a powerful orchestra is about 80 dB higher than notes located on the threshold of audibility. On an average, the peaks are 10 dB higher than the mean value mentioned, but occasionally there are peaks about 30 dB higher than the mean volume. Existing data regarding the human ear indicates that this is rather a high estimate, but all these figures are to be regarded as rough approximations.

As a matter of interest the mean volume mentioned corresponds to a loudspeaker input of about 250 milliwatts in a room of moderate size. For undistorted reproduction of the largest peaks, which are 30 dB higher, a speaker input of 250 watts would be required.

The maximum speaker input of an ordinary radio set at the present time is rarely in excess of 25 watts. As already mentioned the most pronounced peaks in the orchestral transmission are 30 dB higher than the mean volume, while the softest passages correspond to a volume of 40 dB below this level. If this latter level is reproduced with natural volume and the peaks 10 dB less strongly because of the limited power output the range covered will be 60 dB. On the other hand if the mean volume is taken as a standard and the range compressed by 10 dB in an upward direction, the contrast in the downward direction will automatically be diminished by a somewhat greater amount than 10 dB.

The original distribution of plus 30 dB and minus 40 dB will then be altered to approximately plus 20 dB and minus 30 dB and a total volume range of 50 dB. For gramophone records of average quality the greatest

modification. A suitable circuit is shown in Fig. 3. In this arrangement the signal of the pick-up or of the detector diodes is applied via a volume control to a variable-mu pentode and then passed on to a power valve. The volume control enables the amplifier to be adapted to more or less sensitive pick-ups or to transmitters of greater or lower power. The variable-mu pentode receives a fixed negative bias and an additional bias depending on the input signal. The latter bias can after amplification of the input signal be produced by means of rectification, such rectification being directed so that the bias of the pentode becomes more positive when the signal strength increases. The degree of volume expansion can then be adjusted by means of R_1 .

It has already been pointed out that the speech amplifier giving between 15 and 25 watts output is required for perfect reproduction. In Fig. 4 is shown an experimental circuit using two pentodes in push-pull class AB₁, that is operating without grid current. This amplifier can deliver a speech output of about 15 watts, with a grid signal of 0.1 volts R.M.S. on the grid of the AF3. This valve is not sufficiently large completely to modulate the power stage. For this reason, an intermediate amplifier has been included which in any case is necessary on account of the high internal resistance of the AF3 which is not suited for transformer coupling.

Also in Fig 4 is shown a suggested control for producing the control voltage of the AF3. It has already been suggested that the amplification must be varied by a factor of 100. It follows from the conductance characteristics of the AF3 that this factor corresponds to

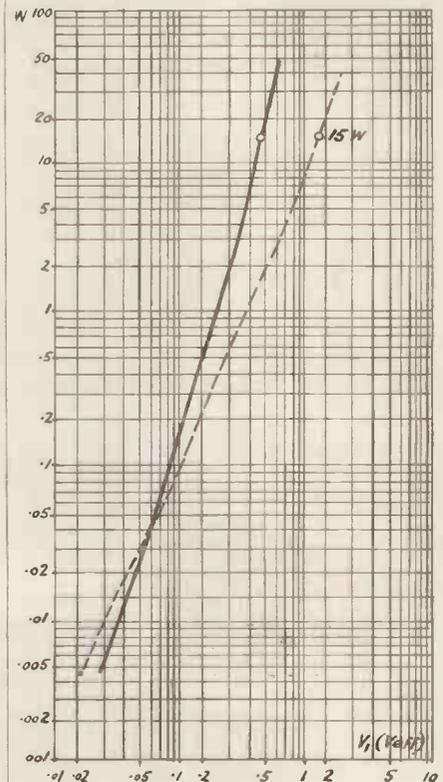


Fig. 5. These curves show the operation of the volume expander.

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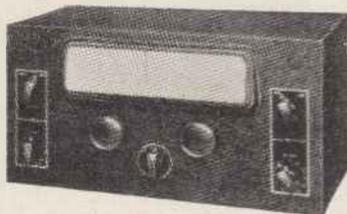
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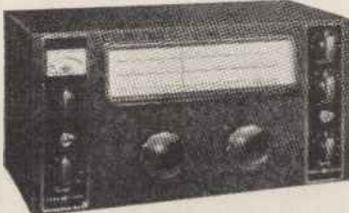


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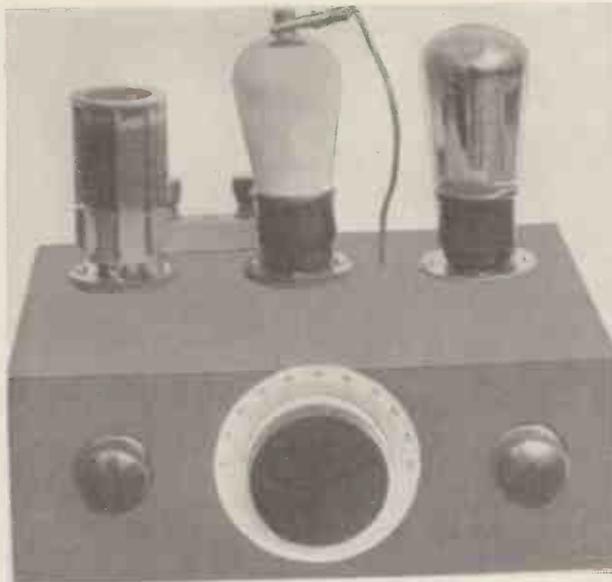
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The Beginner's 2-Valve Receiver

By G5ZJ.

Readers who constructed the single valve receiver described in the August issue will be interested in this two-valve version of the same receiver. It has been built for those who need the simplest set to provide loudspeaker reception on short waves.

IN the August issue I described the construction of the simplest short-wave receiver. It was intended for the absolute beginner who had not had any previous experience as to how to build a receiver for the reception of wavelengths of 200 metres and under. It must be clearly understood that although the single valve receiver will pick up transmissions from all parts of the world under favourable conditions even with a good aerial it cannot provide reliable loudspeaker volume, and for this reason it is always important to use a sensitive pair of headphones.

L.F. Amplification

The single valve receiver is primarily a detector plus a tuning circuit and only provides a very small degree of amplification. In order to increase the volume of such a receiver additional valves have to be added. By adding a low-frequency amplifier, volume output should be sufficient to comfortably work a loudspeaker, but if greater range is required in addition to increased volume then a stage of radio-frequency amplification must be used in front of the detector. For this reason the most popular simple short-wave receiver usually consists of a radio-frequency amplifier, detector and low-frequency amplifier in order to obtain long range with good volume.

In this article I propose to show how to add a low-frequency amplifier in order to increase the volume of stations already received, but before doing so there are a number of queries which readers have raised which appear to be of general interest so for this reason I am going to clear up a few points about the single valve receiver described in the August issue.

The most common difficulty appears to be lack of oscillation which is quite easily understandable when the receiver is being used by an inexperienced con-

structor. Reaction is controlled by the condenser VC4, and the variable resistance VR1. It should be possible with VC4 at maximum capacity to obtain uncontrolled reaction, but it will be noted that if VC3 is at maximum capacity and the aerial is a long one there may be trouble in obtaining reaction of any kind. Many readers may use an ordinary broadcast aerial with the receiver and this very heavily damps the detector valve, so making it almost impossible for oscillation to be obtained.

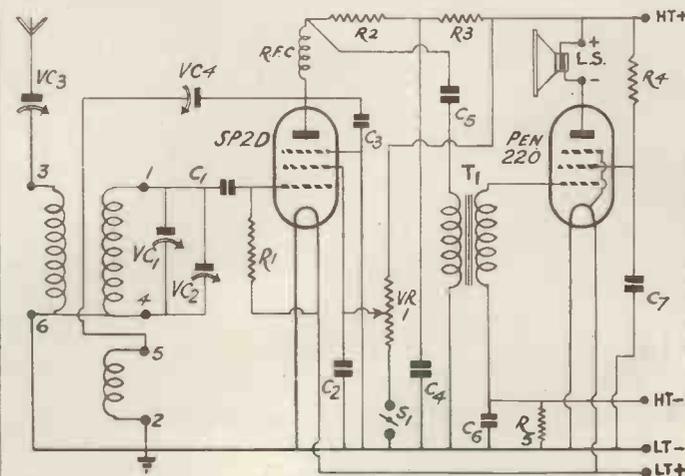
Aerial Damping

In such circumstances, constructors must either reduce the total length of the aerial, or reduce the capacity of VC3. Arrange this so that it is at almost minimum capacity, that is with the top plate as far away as possible from the bottom plate. There is also a possibility that the reaction windings between terminals 2 and 5 have been wrongly connected, so it is well worth while trying the effect of reversing the

connections to terminals 2 and 5. In any case, when making these sets always have the aerial removed, in order that this may not upset the results of the experiments. If a small mA. meter is available connect this in series with the choke side of the headphones. It will be noted that the anode current is about 3 mA., when the potentiometer VR1 is in a central position. Screw down VC4 and if the receiver is going to oscillate the anode current will drop rather gradually and very sharply when the receiver actually goes into oscillation. If it is noticed that the current begins to dip but never actually drops down to a very low level, this shows that the circuit is correct, but for some reason or other, either due to low H.T. voltage or to excessive aerial damping, the circuit will not actually oscillate. These two points should be checked, but there is no need to have more than 100 volts H.T. Generally speaking, with a short aerial of about 25 feet total top length 60 volts H.T. will be ample.

Pentode Amplifier

Next comes the addition of the amplifying valve. This valve is of the pentode type which gives very high amplification without unduly increasing the H.T. current. With a two-



The first part of the receiver is almost unchanged. A pentode valve has been included in the output stage which is parallel-fed transformer coupled to the detector valve.

Auto Bias :: Transformer Connections



Notice now that four out of the five terminals are in use. If headphones are used they should be isolated from the final valve by a 1/1 ratio output transformer.

valve circuit, as shown, a 120-volt battery is required, which must provide a current flow of 10 mA. The total consumption of the receiver should not be more than about 7 mA., but a larger battery will have a much longer life than an actual 7 mA. battery.

Check the circuit on page 508 of the August issue with this two-valve circuit when it will be seen that up to and including the anode circuit of the SP2D there are practically no alterations in connections. The headphones and C4 have merely been omitted from the circuit. Between the H.F. choke and H.T. positive are connected two resistances, R2 and R3. R2 has a value of 75,000 ohms and R3 25,000 ohms. The first resistance is the external anode impedance and according to the value of this so the available amplification is increased or decreased. The higher the value of R2 up to a certain point, the greater will be the amplification, but as this drops the voltage a very high value resistance cannot be used unless 400 or 500 volts are available. This is obviously impossible with a beginner's receiver so for that reason a compromise has to be made. A good average value is 75,000 ohms with a de-coupling resistance of 25,000 ohms. Do not make the mistake that many beginners do of leaving out the de-coupling resistance. Admittedly when the receiver is first tried it will not have any effect on the results, but unless it is inserted trouble will be experienced when the H.T. battery has been in use for a few months.

An inter-valve transformer is used in a parallel fed circuit. In this way, the advantages of a resistance-coupled circuit are obtained with the gain of a transformer coupled stage. One side of the transformer marked H.T. plus

is connected directly to earth. The other side marked P goes to one side of C5. On the secondary, G goes to the grid connection of the output pentode, while GB goes to H.T. negative and to the bias resistance R5. It will be noted that no grid-bias battery has been included. This component is rather a source of trouble to the beginner so automatic bias has been used for it is extremely simple and allows for the grid bias to drop as the H.T. voltage goes down. It is essential, however, that this resistance be shunted by a condenser shown as C6, which has a capacity of 2 mfd.

Reference to the photographs will give a very good indication as to the lay-out of the components. The inter-valve transformer is mounted on the

side of the wooden chassis, close to the pentode valve. It should be so arranged that the grid leads are short, for it does not matter very much if the primary leads are a little on the long side. The loudspeaker is connected to the same two terminals which were originally used for headphones. However, in the two valve arrangement one side of the loudspeaker is connected directly to the anode of the pentode while the other side of the loudspeaker goes to maximum H.T. voltage.

It will be noticed that the makers of the output pentode state that full voltage can be applied to both anode and screen. This is certainly true but when H.T. current is of value the total consumption of the valves can be greatly decreased by having less voltage on the screen than on the anode. This is done by connecting in series with H.T. plus and the screen, a resistance of 5,000 ohms. The screen side of the resistor is shunted to earth by means of C7 condenser, having a value of .01 mfd. It will also be appreciated that in a normal pentode circuit without screen resistor the voltage on the anode will be lower than the voltage on the screen owing to the fact that a certain amount of anode voltage is lost owing to the resistance of the loudspeaker or headphones.

When connecting up there is one most important point which should not be overlooked. In the single valve circuit L.T. negative and H.T. negative are joined together by means of a fuse. In the two-valve circuit, however, as grid bias is obtained automatically H.T. negative and L.T. negative must not be connected together except by means of the bias resistance R5.

(Continued on page 582)

Components for THE BEGINNER'S 2-VALVE RECEIVER

CHASSIS

1—Wooden chassis 6 x 6 x 3 ins.

COILS.

1—Set 6-pin coils to cover 9-170 metres, type 959 (Eddystone).

COIL HOLDER.

1—Type 6 pin socket type 964 (Eddystone).

CONDENSERS, FIXED.

1—.0001-mfd. type 690W (C1) (Dubilier).
1—.001-mfd. type 690W (C2) (Dubilier).
1—.001-mfd. type 690W (C3) (Dubilier).
1—.01-mfd. type 691 (C4) (Dubilier).
1—.01-mfd. type 690W (C5) (Dubilier).
1—2-mfd. type B.B. (C6) (Dubilier).
1—.01-mfd. type 691 (C7) (Dubilier).

CONDENSERS, VARIABLE.

1—Tank condenser type 1042 (VC1) (Eddystone).
1—Bandspread type 1043 with dial (VC2) (Eddystone).
1—.0003-mfd. trimmer type 2150 (VC3) (Jackson Bros.).
1—.0003-mfd. trimmer type 2150 (VC4) (Jackson Bros.).

CHOKE, R.F.

1—Type S.W.68 (Bulgin).

HOLDERS, VALVE.

1—Type 7-pin chassis less terminals (Clix).
1—5-pin chassis less terminals (Clix).

HEADPHONES.

1—Pair 4,000-ohm (S. G. Brown).

LOUDSPEAKER.

1—Type Baby (W.B.).

RESISTANCES, FIXED.

1—5-megohm ½-watt type (R1) (Erie).
1—75,000-ohm type ½-watt (R2) (Erie).
1—25,000-ohm type ½-watt (R3) (Erie).
1—5,000-ohm type 1-watt (R4) (Erie).
1—500-ohm type 1-watt (R5) (Erie).

RESISTANCE, VARIABLE.

1—100,000-ohm potentiometer (VR1) (Erie).

SWITCH.

1—Double-pole single-throw type S88 (Bulgin).

SUNDRIES.

1—Coil quickwire (Bulgin).
1—Top cap anode connector (Bulgin).
1—Jack type J2 (Bulgin).
1—Plug type P2 (Bulgin).
1—Single fuse holder with fuse (Bulgin).

TRANSFORMER.

1—1.3.5 type AF4 (Ferranti).

VALVES.

1—Type SP2D met. (Tungsram).
1—PEN220 (Mazda).

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“RECOMMENDED
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In this issue of Television and Short-Wave World, Tungstram Valves are once again specified. This time a Tungstram Valve—the SP2D Metallised—has been recommended for use in the “Beginner’s 2 Valve Receiver.”

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Phased Antenna Systems

BRYAN GROOM, GM6RG, has worked a considerable amount of DX with a new type of antenna which he fully describes in this article. It is most suitable with those who are able to erect a high pole.

THE antenna system which this article describes was evolved as the result of a considerable amount of experimental work, details of which are given with particulars of two suggested antennas, one for those with a limited height of mast available and one for those with masts at least 70 feet high.

It is well known that for satisfactory DX operation low angle radiation is desirable, preferably sharply defined, so as to avoid wastage of power. Furthermore, if a wide vertical lobe is

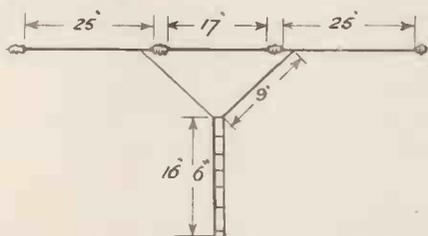


Fig. 1. This antenna has a portion of the top length bent towards the stub.

radiated, fading will be worse at the receiving end due to mutual interference between signals arriving from different angles.

The diamond or V antenna has been upheld as an ideal in this direction, since the angle of radiation can be controlled. The writer has had a good deal of experience with both of these arrays, and has come to the conclusion that from the point of view of the amateur not interested in point-to-point operation, these systems have disadvantages which far outweigh their advantages. It will be realized that in order to obtain a really low angle radiation, these arrays have to be of such dimensions that the horizontal pattern becomes very restricted, a most undesirable condition from an amateur viewpoint.

For this reason, other systems must be used in order to obtain (1) low angle radiation, (2) as high a gain as is simply procurable, (3) a fairly wide horizontal pattern.

It must be remembered that an extra gain is available with a co-linear array, if the adjacent elements are widely separated instead of being separated by a single insulator. This leads to difficulties, for when the elements are widely spaced, then the ordinary quarter or three-quarter wave matching stub will not serve. The obvious cure is to bend down the last nine or ten feet of the antenna wire so as to meet the matching stub as shown in Fig. 1.

If this antenna is erected with reflectors behind and a director in front of

each of the two driven elements, and the whole array is erected well up in the sky, some really good results should be obtained. Actual experiment, however, indicated that theory and practice do not agree.

Such an array was made up and although it worked fairly well, was rather disappointing. The scheme was scrapped, and a fresh start was made on the assumption that the small bend in the antenna was having some queer effect, although there was no obvious reason for it. The next step was to put up two antenna elements, spaced exactly as before, but of the full theoretical length. This arrangement was tried and the antenna was excited by means of a nearby aerial fed from the transmitter.

Stub Length

It was found that the position where maximum current was being obtained in the matching stub was right at the bottom of the stub; three feet of wire were then added, just to see what happened, and it was discovered that the whole system resonated exactly with 2 ft. 6 in. of the additional wire in use. This does not agree with any conventional theory, since if it is assumed that 16 ft. 6 in. each side is acting as the matching stub, then the antenna length becomes 36 ft. 6 in. Alternatively, the matching section could be 19 ft. long, which is most unlikely. There are, however, two other possibilities: (1) each driven element is of the length given above and the matching section is of normal length, or (2) that the whole of the V'd section is added to the antenna making it 43 ft. long and the matching stubs only 10 ft. 6 in. long. Since there is no obvious capacity to tune the stub down to the frequency of the antenna, it is not clear how a case can be made for this suggestion.

Considering the problem from another angle, it will be realized that the antenna array, composed of two half-waves in phase with quarter wave matching stub, is in fact three half-waves of wire with the centre half-wave folded up.

Antenna Length

A straight antenna three half-waves long should be 102 ft. to resonate at 14.2 mc., but the lengths used in this antenna total 107 ft., so once more the problem arises as to why 5 ft. of wire should be added to each stub.

Directors and reflectors were then added and tuned up by the aid of a field strength metre. With this arrangement it was found that reports were all ex-

ceptionally good and were at least as satisfactory as when a diamond antenna was used under similar conditions. It should be emphasised at this point that the diamond array never gave the gain claimed for it.

The 6 element array was then let down, the reflectors removed, and the whole system re-tuned for the frequency in use. This made practically no difference to the reports obtained, so the directors were once again removed and the two remaining elements re-checked. The signal on this array was so far down, and much more so than was expected, so proving that the closely spaced elements were helping very considerably to bring down the angle of radiation.

A second array was tried, consisting of four half-waves in phase, and an 8 element array giving a lower and more concentrated load. In order to make certain that both top and bottom halves of the array were doing an equal amount of work and that they were both accurately tuned an unusual arrangement of matching sections was used.

The two top elements were constructed with a three-quarter wave matching section and the bottom two elements with a single quarter-wave matching section, both arrays being complete with directors of the length previously found to be correct. A separate half-wave antenna was then added, and was equally spaced between

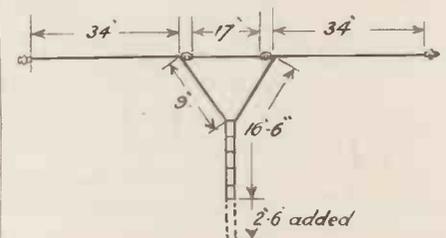


Fig. 2. With this arrangement the aerial has an effective length of 43 feet.

top and bottom halves and directly coupled to the transmitter.

The ends of the two matching sections were left open and the half-wave doublet was excited. After this, the matching sections were brought roughly into tune by means of a thermo-couple meter and shorting bars put temporarily into position. The temporary half-wave aerial was then removed and a co-axial feeder from the transmitter was connected to the matching stub of the lower elements and adjusted until the maximum load was placed on the transmitter.

Then the temporary shorting bar was

"Phased Antenna Systems"

(Continued from preceding page)

removed from the matching section of the top elements, and the correct tuning position was obtained by the thermo-couple meter, after which a permanent shorting bar was soldered into position. The co-axial cable was then transferred to this stub and adjusted as previously explained.

The shorting bar was then removed from the matching stub of the lower elements and the point of exact resonance being located, the stub was cut to a point 5 ft. less than the resonant position. The cut ends of the lower matching stub were soldered into position 5 ft. up the matching stub of the top elements. The long section was given a half-turn twist so that the elements would be in phase, and the co-axial cable was adjusted to a point where maximum load was placed on the transmitter. A final check was made with a field strength meter, coupled to a half-wave aerial.

With this system, the reports immediately went up by three points along the line of beam, the signal being of such strength that widely made comments made it apparent that this antenna could be used to advantage by anyone having a 70 ft. mast.

Attention should be drawn to the fact

that as with any antenna system particularly when close spaced parasitic elements are added rigidity is important, and since it is more difficult to pull up a heavy aerial than a light one, weight saving is very much worth while.

It is suggested that for spacers light

bamboo curtain poles be used, for these are extremely strong. The spacing between top and bottom elements is not important, as long as it is not less than 34 ft. Any separation between 35 and 40 ft. gives much the same results,

(Continued on page 584)

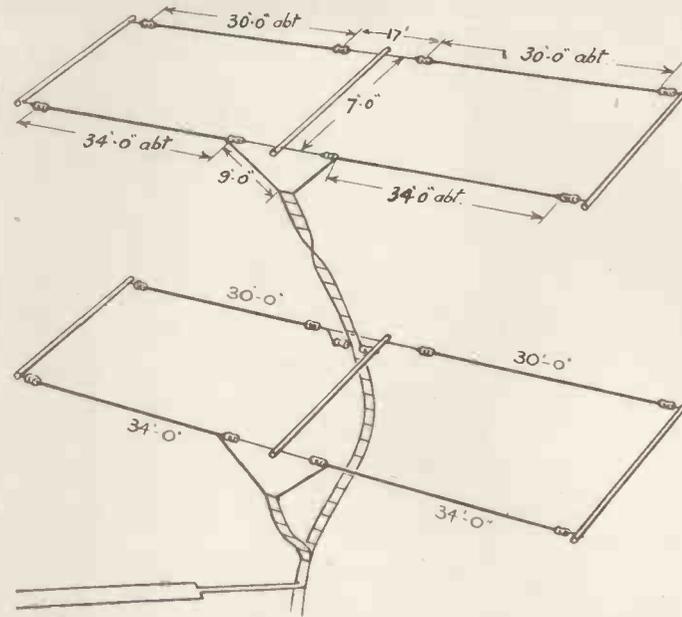
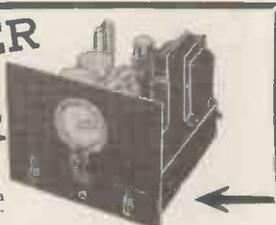


Fig. 3. The final scheme which has a very strong broadside pattern. Only a moderate length is required between poles, but the best results will only be obtained when the top length is at least 70 feet above ground.

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Radiolympia
Short Waves 1938/9

(Continued from page 564)

stock. Modulation transformers, chokes, American valves and test equipment are also available, while a special modulator giving 16 watts of output is priced at £11. Transmitters ready for operation can also be applied in various types from 10 watts upwards.

The RME 69 receiver; DB20 pre-selector and 510X frequency expander are available in addition to National, Hallicrafter and other popular American receivers. The true bearing map produced by this company and also a globe marked with amateur prefixes and

W.A.C. coverage should be owned by every enthusiastic amateur. It is difficult accurately to erect an aerial in the correct direction unless a map of this kind is used. The staff of Webb's Radio includes six well-known amateurs, all of whom are prepared to assist constructors in the design of receivers and transmitters. A branch has been opened at Birmingham at 41 Carr's Lane, Birmingham 5, for the benefit of amateurs who are unable to visit the London Office.

Westinghouse Brake and Signal Co., Ltd., 82 York Way, King's Cross, London, N1.—A complete range of Westinghouse metal rectifying units for radio and television are being

marketed this year. These include high tension and low tension types for mains units, battery charging and for energising a loudspeaker field. High-frequency rectifiers for detection and automatic volume control are available and these are excellent for use in monitors. Special high voltage rectifiers for television tubes are made in a variety of types, but actually can be embodied in any equipment where high voltage at a low current is required. Stand 35.

The Beginner's
2-Valve Receiver

(Continued from page 578)

Unless this resistor is correctly connected there will not be any grid bias on the output pentode which would probably ruin the emission of the valve very quickly.

One or two youthful readers, who obviously have been trying to save money by making one set fulfil two purposes, have asked why they cannot use this receiver on broadcast wavelengths. The answer to that is that the receiver can be used to pick up the ordinary Regional and National programmes, but as the selectivity is poor on the longer wavelengths there will be very great difficulty in obtaining separation between stations. Coils are available to cover up to 3,000 metres, but it is unlikely that the set will be of much use except for the locals.



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"THE PLAIN FACTS ABOUT TELEVISION"

(Continued from page 520)

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The designer of the above receiver, Mr. D. E. Osman, wishes to point out a small error in the circuit number 7 on page 456 of the August issue. In this circuit the 6.3 volt heater winding is shown connected to the negative side of the 550 volt winding. This, of course, is incorrect, as the cathode of the C.R. tube is taken to earth and the brilliance control is shorted out.

(This incorrect connection will not cause any damage to components or tube, but will stop satisfactory pictures being obtained.

[AN EXPERIMENTAL 1 1/4 METRE TRANSMITTER AND RECEIVER

Mr. G. Parr has asked us to point out that the article on the experimental 1 1/4 in. receiver was not written by himself, although it describes the work which he has been carrying out in this field.

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**Phased Antenna
Systems**

(Continued from page 581)

although a slight additional gain is obtained at 40 ft.

Lack of height made it impossible to try the effect of wider spacing as the lower elements were only about 25 ft. up at one point. It will be realised that as the impedance of the whole array is very low, there is considerable current flow in the matching section which should be constructed of at least 12 gauge wire. Furthermore, as it is impossible to match in a transmission line having an impedance of much higher than 150 ohms, Q bars should be used to match a 500 ohm line down to the stub.

The Q bars should be of the correct length, but their impedance is unimportant as long as they will step down the transmission line to something below 100 ohms. At this station, the Q bars are made of 1/2 in. copper rod with 1 in. spacing between centres. This brings down the impedance of the transmission line to about 60 ohms,

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which operates very well indeed.

This array, as with any high cure ray, has to be accurately tuned, so that care should be taken to find the exact points after which it can be marked. With a reasonably sensitive meter and assuming that the stub wires have been thoroughly cleaned, it is possible to find the point of tune to within half an inch. All that now remains to be done is to attach each side of the matching stub to the Q bars and arrange for the transmitter to feed a small power up the line. By sliding the Q bars up and down the stub and re-tuning the transmitter as required, standing waves can then be eliminated.

Invicta Television

The Invicta Company has produced an extremely cheap television unit for approximately twenty-one-and-a-half guineas. It consists of a vision receiver plus a short-wave converter and provides a picture 4 in. by 3 3/8 in. It uses 12 valves, including 2 diodes and 2 rectifiers. It is for a.c. mains only and has one major control. The type No. is TL4.

A table model, which includes both sound and vision, is also available, the type No. is TL5, and the picture size is 7 1/2 in. by 5 3/4 in. The approximate price is 30 guineas. Both these units can be inspected at Radiolympia on Invicta Stand No. 17.

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