BAIRD ELECTRON CAMERA: FIRST EXCLUSIVE DETAILS

TELEVISION

THE FIRST TELEVISION JOURNAL IN THE WORLD

and

SHORT-WAVE WORLD

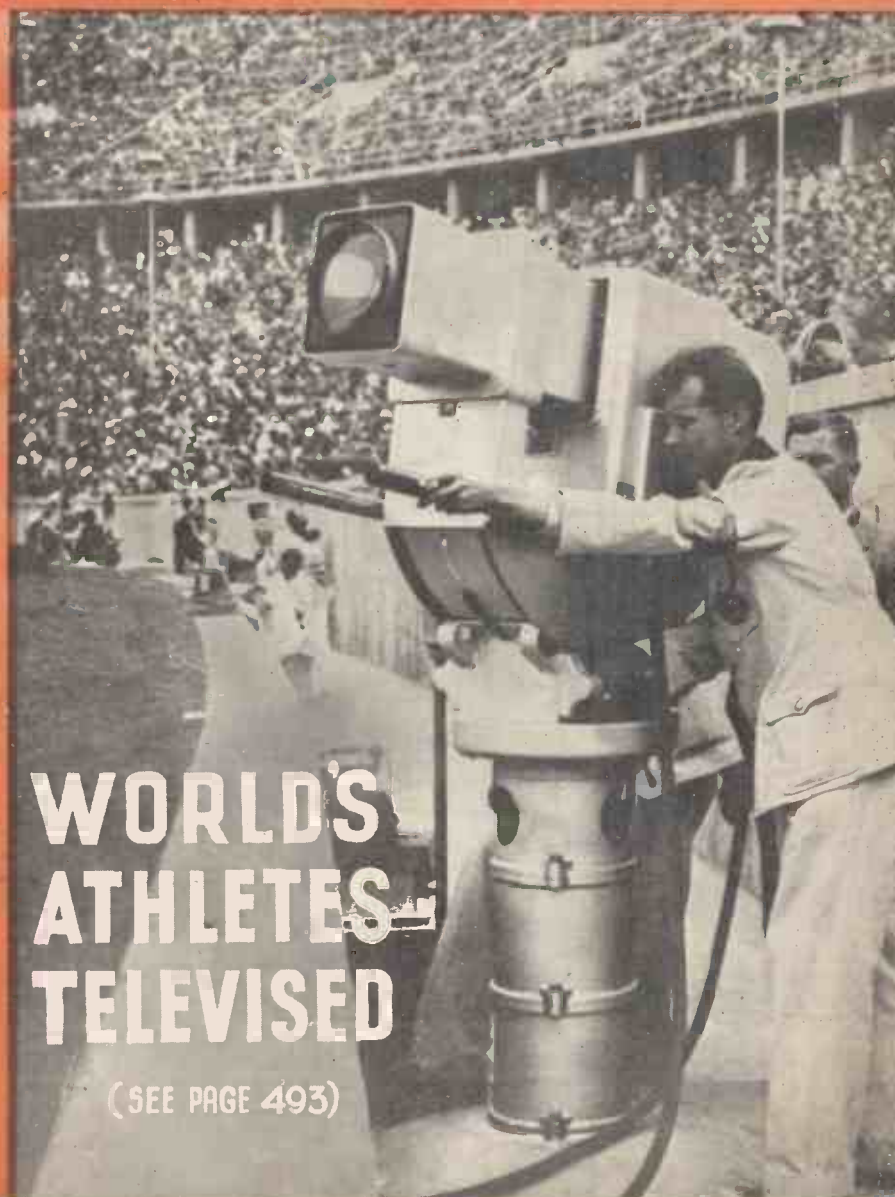
MONTHLY 1/-

SEPTEMBER, 1936

No. 103. Vol. Ix.

BERNARD JONES PUBLICATIONS LTD.,
CHANSITOR HOUSE, CHANCERY LANE
LONDON, W.C.2.

SPECIAL RADIOLYMPIA NUMBER



WORLD'S ATHLETES TELEVISED

(SEE PAGE 493)

BELLING-LEE PROGRAMME

A.—"Bow-Spring" Wander Plug, 12 indications. No. 1112, ea. 1½d.
B.—"Midget" 3-prong spring, 12 indications. No. 1019, ea. 2d.
C.—Flush Plug and Socket, shrouded ¼in., 12 indications. No. 1077, ea. 5d.
D.—Air Force Wander Plug, impossible to come out. No. 1157, ea. 1/-.

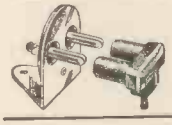
Banana Plug and Socket, 4 mm. No. 1078, pair 4½d.

SOCKET STRIPS

Moulded to take ¼ in. plugs, seven letterings. No. 1047, with plugs, 9d.

SHROUDED PLUGS AND SOCKET

For mains-driven sets or eliminators or when high voltages are met with. Single Plug and Socket. No. 1015, pair 6d. Two flex parts as single coupling. No. 1051, pair 9d. Twin Shrouded Plug and Socket, non-reversible, No. 1014 complete 1/3.
Two flex parts as twin coupling. No. 1013, 1/6.

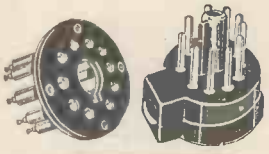


MAINS INPUT CONNECTOR

5-amp. Conforms with British Standard Specification. No. 1115, with bracket, 1/6. No. 1042, 3-amp., with bracket, 1/3.

MULTI CONNECTORS

3-pin No. 1119, 1/3. 5-pin (similar to 10-pin plug shown), shielded panel, No. 1260, 2/6. 10-pin (illustrated). No. 1251, 3/6.



LOW LOSS STAND-OFF BUSHING

Excellent power factor, designed for 7,000 volts between Connector and Panel. Without bracket. No. 1296, ea. 1/2.

LOW LOSS STAND-OFF INSULATOR

Excellent power factor. No. 1292, designed for 10,000 volts, ea. 1/-. No. 1277, designed for 5,000 volts, ea. 8d.

PLUG TOP VALVE CONNECTORS

Spring brass silver-plated. No. 1175, ea. 1d.

Shrouded type safety connector, with Belling-Lee loading. No. 1156, ea. 4d.

With insulated terminal head. No. 1167, ea. 3d.

Adaptor to convert screw top valves to plug top valves. No. 1176, ea. 1d.

S.G. Anode Connector for screw top valves. No. 1030, ea. 4d.

LOW LOSS VALVE HOOD AND CONNECTION

Insulation between valve clip and hood has been carefully chosen. Large special beads insulate lead from flexible metal tube. No. 1224, ea. 1/6.

"ELIMINOISE"

Trade Mark

All-Wave

Anti-Interference Aerial

As easy to erect as an ordinary aerial

The new aerial which gives real suppression of interference from 10—2,000 metres in three bands: 10—50, 100—600, and 1,000—2,000 metres, and without switching. A shielded twin down lead is employed for the first time in an all-wave commercial unit of this kind, and it has been found possible to maintain satisfactory signal strength even at 10 metres. 8 to 10 receivers may be operated from one aerial without interaction.

No. 308. Complete Kit for one aerial, but without cable, 35/- ("C" Type Cable, No. 1221, 8d. per yard)

No. 307. Extra "Eliminoise" Transformers for additional receivers, each, 17/6

MAINS INTERFERENCE SUPPRESSORS

No aerial system can protect a receiver from interference conducted to it via the mains. It is necessary to filter the mains before they reach the receiver.

FLEX LEAD SUPPRESSOR

For fitting at source: vacuum cleaners, fans, hair-dryers, etc.
No. 1174, 2-core cable ... 4/6.
No. 301, 3-core cable ... 7/6.

CONDENSER SUPPRESSOR

Should be fitted at source of interference. May be effective at listener's meter. Type 1118, 10/6.

SET LEAD SUPPRESSORS

These are three-stage choke and condenser filters making it practicable to effect suppression close to a receiver. A child can plug in.

No. 1211, Medium and Long Waves, ½-amp., 17/6.
No. 1256, Medium and Long Waves, 1-amp., 19/6.
No. 305, Medium and Short Waves, 1-amp., 19/6.
No. 300, All-wave ... ... 1-amp., 21/-.

CATALOGUES, etc.

"Radio Spares and Connections" .... free.
"Wireless without Crackling" .... free.
"Interference Suppression Manual" .... 1/-.

"Radio and Electrical Accessories" .... 6d.

This is a new 2-colour publication containing 150 illustrations including 75 blue-prints of curves, diagrams, constructional details and specifications. Of particular value to Radio Engineers, Designers, Service Men, Constructors, etc.

BELLING & LEE LTD

CAMBRIDGE ARTERIAL ROAD, ENFIELD, MIDDX

"R" TYPE TERMINAL

White lettered; bakelite insulated; black or walnut; non-removable rotating head, 4 B.A. stem and collar. Improved sub-connector nuts. No. 1003 ea. 3d.

"B" TYPE TERMINAL

Non-rotating name, bakelite insulated, anti-twist wedge on collar, polished black; white letters. Improved sub-connector nuts; 4 B.A. stem. Insulation washer. No. 1001, ea. 6d.

"Q" TYPE TERMINAL

Rotating and removable head in black, red or brown, 4 B.A. stem and collar. No lettering. No. 1006, ea. 2d.

"H" Type, 100-amp. No. 1005, ea. 1/6. "F" Type, O.B.A. No. 309, 1/3. "M" Type, as "B" type, but all-metal. No. 1002, ea. 4½d.

SPADE TERMINALS

Lead-plated spring prongs clip on terminal stem, lettered, Belling-Lee loading. No. 1025, ea. 2d.

With ¾-in. handle. No. 1246, ea. 3d. For heavy duty, or to take aerial wire, 1¼-in. bakelite handle. No. 1247, ea. 6d.

TERMINAL MOUNT

No. 1039, ea. 6d.

Takes two terminals of any make.

Special low-loss mount for short-wave work. No. 1179, ea. 1/-.

CARTRIDGE FUSES

1¼ in., 1 in., ¾in., standard specifications, colour coded, 60 m/A to 3-amp.; all one price, 6d. Also "Scrufuse," for bulb type holders; same price

FUSE PLUG

B.S.S. and R.C.M.F. specifications, 5-amp., but standard with 1-amp. cartridge fuses. One hole fixing, cord grip, small, ideal for radio receivers. No. 1278, complete with two 1¼-in. fuses, 2/-.

FLEX FUSEHOLDER

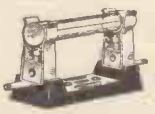
Where other types cannot be fitted. Standard with 1-amp. fuse. No. 1037. Complete, 1/-.

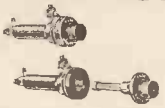
"WANDERFUSE"

For use in the H.T.-lead. No higher than a wonder plug. With 150 m/A fuse. No. 1028. Complete, 1/-.

SINGLE OPEN FUSEHOLDER

A compact Fuseholder to take 1¼ in. fuses. Heavy phosphor-bronze clips, soldering tags and terminals. With 1-amp. fuse. No. 1034. Complete, 9d.





PANEL FUSEHOLDER

Single hole fixing. Insulated from panel. Terminals for easy connecting. 1-amp. fuse or as required. No. 1064. Complete, 1/6.

STANDARD INDICATIONS

FUSED MAINS INPUT CONNECTOR

Conforms to B.S.S., 5-amp. standard. No. 1114. 5-amp. (B.S.S.). Complete, 3/6.

No. 103 VOL. IX SEPTEMBER, 1936.

TELEVISION and SHORT-WAVE WORLD

Special Features

TELEVISION AND SHORT-WAVE WORLD

Proprietors :
BERNARD JONES PUBLICATIONS, LTD

Editor-in-Chief :
BERNARD E. JONES.

Editor :
H. CORBISHLEY.

Editorial, Advertising and Publishing Offices :
Chansitor House, 38, Chancery Lane, London, W.C.2.

Telephones : Holborn 6158, 6159
Telegrams : Beejapee, Holb., London.

Subscription Rates : Post paid to any part of the world—3 months, 3/6; 6 months, 6/9; 12 months 13/6.

Published Monthly—1/- net.
(Last Wednesday in every month for following month).

Contributions are invited and will be promptly considered. Correspondence should be addressed according to its nature, to the Editor, the Advertisement Manager, or the Publisher, "Television and Short-wave World," Chansitor House, Chancery Lane, London, W.C.2.

IMPORTANT

"Television and Short-wave World" is registered at the General Post Office, London, for transmission to Canada and Newfoundland by Magazine Post. Entered as Second-class mail matter, Boston, Mass.

COMMENT OF THE MONTH

Television Rounds the Corner!

WITHIN the next few weeks a new public service will be inaugurated in this country which will have neither precedent nor parallel in the whole world. It is true that television services have been instituted in both France and Germany, but their scope is of quite a limited character and, though excellent work is being done there, we may justly claim that in the new science of television Great Britain now leads the world. The credit for this is largely due to the initial efforts of John Logie Baird and the band of enthusiasts who realised that television was a physical possibility and that the solution of its problems could be attacked from many angles. We have in this country at the present time engineers who in the face of seemingly insuperable difficulties have succeeded in accomplishing the standard set by the Television Committee, both by all-electrical and mechanical-optical methods, another fact which from the technical point of view places this country in a strong position.

It is fitting, also, that at this time a tribute should be paid to Sir Kingsley Wood, who, as Postmaster-General, had the foresight to authorise the setting up of a Committee to investigate the possibilities of television. Without this decision it is probable that private effort would still be fighting a lone hand against strong opposition. The B.B.C. is also to be congratulated on the whole-hearted way it has taken up the development of the television service. Since the policy was settled there has been no stinting of either effort or money and its plans have been based upon the provision of a 100 per cent. efficient service.

Although the service which is to come into operation is stated to be "experimental," it is quite clear that there will be no turning back and the word "experimental" can be read as meaning a step on the road to even better things. Television, most definitely, has come to stay as a new factor in our lives and it is up to the public to take the fullest advantage of it. Opposition, no doubt, will still persist in some quarters, but this is the type of opposition which has been pitted against every development.

Television and the Wireless Retailer

LAST month we commented on the fact that the average wireless retailer appears quite apathetic towards television and that opportunities are being neglected. We also announced our intention of publishing a list of traders who propose taking up the sale of television receivers and giving demonstrations. Although there has been a good response to this invitation it is clear from some letters we have received that there is a definite antagonism in the trade towards television which at this stage of development seems ill-advised.

ABRIDGED PARTICULARS.

Note—Neither this abridged notice nor the full particulars referred to below constitute an invitation to the Public to subscribe, but is issued for the sole purpose of giving information to the Public with regard to the Company.

SCOPHONY LIMITED

SHARE CAPITAL.

Authorised : **1,200,000 Ordinary Shares of 5/- each £300,000**

Issued : **560,000 Ordinary Shares of 5/- each, fully paid.**

140,000 Ordinary Shares of 5/- each, 2/6d. paid, a balance of 5/- per share (including 2/6d. premium) being payable on 1st October, 1936.

There are no Debentures or Mortgages Outstanding.

1. The Scophony System of Television.

The Company was incorporated in April, 1935, for the purpose of acquiring the assets of a Private Company of the same name which was incorporated in 1930 to develop the Scophony System of Television.

Based on novel optical-mechanical lines, the Scophony System was described in the Report of the Postmaster-General's Television Committee published in January, 1935, as being amongst the most distinctive of the Systems under development in this country.

2. Prospects and Development Programme.

The B.B.C. Television Transmissions from Alexandra Palace are expected to commence within a few months, while steps towards establishing public television services are being taken in a number of foreign countries.

The potentialities of the new industry are very great, and the Company is in an exceedingly favourable position since its basic inventions render possible the direct projection of high-definition television pictures suitable both for Home and Cinema entertainment.

Apparatus developed or under construction for both British and Continental standards comprise :—

(a) **Home Receivers,** of compact design, requiring only low power and normal voltages, and giving a picture approximately 16 in. by 12 in.

(b) **Medium Size Receivers,** intended for small halls and for exhibitions, giving a picture approximately 4 ft. 6 in. by 3 ft. 6 in., and

(c) **Cinema Receivers,** the first model giving a picture approximately 12 ft. by 9 ft.

It is believed that the achievements of the Company in the projection of high-definition pictures on large size screens are unequalled.

The Company is engaged also in the development of television transmitters and in intensive research in connection with the application of television to the Entertainment Industry and Commercial Communications generally.

3. Patent Position.

The Company holds a strong Patent position, having 27 granted Patents in the United Kingdom and 99 granted Patents abroad, in addition to 98 pending applications in the U.K. and abroad.

4. Management and Technical Staff.

Mr. S. Sagall, the Founder and Managing Director of the original Scophony Limited, to whom the Company owes much of its present success, continues as Managing Director of this Company.

Mr. G. W. Walton, the technical originator of the Scophony System, is a Director and Technical Adviser.

The Company has an outstanding group of experienced physicists and television engineers in charge of its laboratories and workshops.

DIRECTORS.

SIR MAURICE BONHAM CARTER, K.C.B., K.C.V.O., 40, Gloucester Square, London, W.2, *Chairman* (Director of O. T. Falk & Company Limited).

WILLIAM STREATFIELD VERRELLS, Hampton Court, Grand Parade, Leigh-on-Sea, *Deputy Chairman* (Chairman and Managing Director, E. K. Cole, Ltd.).

SOLOMON SAGALL (British, Russian origin), 1, Stanford Court, Cornwall Gardens, London, S.W.7. *Managing Director.*

OSCAR DEUTSCH, 5, Augustus Road, Edgbaston, Birmingham (Chairman of Odeon Theatres, Limited).

ARTHUR LEVEY (U.S.A.), 5, Square de l'Opera, Paris (Merchant).

GEORGE WILLIAM WALTON, Hyde Park Court, 30/32, Inverness Terrace, London, W.2 (Engineer).

LANCELOT LAW WHITE, 9, Stafford Mansions, Stafford Place, London, S.W.1 (Manager, O. T. Falk & Company, Ltd).

EDWARD JOHN WYBORN, A.M.I.E.E., Ray View, Undercliff Gardens, Leigh-on-Sea (Chief Engineer, E. K. Cole, Ltd.).

SECRETARY & REGISTERED OFFICE.

ALBERT FLETCHER, Thornwood Lodge, Campden Hill, London, W.8.

REGISTRARS & TRANSFER OFFICE.

O. T. FALK & COMPANY, LIMITED, 10, Old Jewry, E.C.2.

Copies of the full particulars advertised with regard to the Company can be obtained upon application to the Registered Office or the Transfer Office of the Company.

TELEVISION ABROAD

By SIR NOEL ASHBRIDGE

Chief Engineer, British Broadcasting Corporation

The following article is a summary of data supplied at the request of Sir Noel Ashbridge by those responsible for the broadcasting services in a number of countries all over the world. The information was first published in "Radiodiffusion," the six-monthly review of The International Broadcasting Union, Geneva. There has been but little material change since this summary was compiled.

THE information given below was supplied at the beginning of January of the present year.

Australia

The Postmaster-General's Department at Melbourne states that no television services are definitely contemplated in Australia at the present time. The world position of television is being closely watched, but an attempt to establish a commercial service is not yet felt to be justified.

Austria

While the position is being most carefully considered, no decisions have yet been taken to establish a service, nor has a system for ultimate use been chosen.

Belgium

The position is being studied, but no decisions have been taken.

Canada

The Canadian Radio Broadcasting Commission reports that there is no television service at present operating in Canada, nor is one yet proposed.

Czechoslovakia

The Czechoslovakian Broadcasting Corporation has not yet begun any television experiments. The Ministry of Posts and Telegraphs, which controls the technical side of broadcasting in Czechoslovakia, is awaiting the results of systems of television in use in other countries.

Television experiments are, however, contemplated in order to allow the public in Czechoslovakia to appreciate the progress of this science, but these will not be broadcast.

Denmark

The developments in other countries, especially in England and Germany, are being watched with the greatest interest. There is, however, no definite plan so far for establishing a television service in Denmark.

Finland

There is no television service at present working in Finland, nor is one contemplated in the near future. The developments in other countries are being watched with interest.

France

In Paris, two experimental television transmitters are working at present; one, a low-definition system, on a wavelength of 180 metres, with a power of 700 watts, transmits 60 lines, 25 frames per second; the other, a high-definition system, on a wavelength of 7 metres, with a power of 1 kW, transmits 180 lines, 25 pictures per second (sequential scanning). A new transmitter having a power of 10 kW in the aerial is being built in the Eiffel Tower, and will be put into service in the spring. The accompanying sound is broadcast from one of the Paris medium-wave transmitters.

The Nipkow disc method for scanning is used, and the picture is scanned horizontally (line scanning). Transmissions are not limited to films. The format of the picture is square.

A special cable connects the studios, in Rue de Grenelle, to the Eiffel Tower transmitter. A carrier current circuit on 1,800 kc. is used, the band width transmitted being approximately 500 kc. The service is carried out by the State Broadcasting Service. It is stated that the price of a receiver is approximately three times that of a normal broadcast receiver. Public viewing rooms are available on Sundays.

Germany

A large amount of experimental work has been done on television in Germany. Demonstrations of television have been given at the annual radio exhibition since 1928. In March, 1935, a public service of television transmissions was inaugurated, and although no receivers were available to the public at the time, a number of public televiewing rooms were established at various points in Berlin, and considerable public interest was aroused.

These took place three times a week, one and a half hours programme being given at each transmission. Two ultra-short-wave channels were used, with a power of 7 kilowatts.

The transmitters were established at the base of the Funkturm, Witzleben, the ultra-short-wave transmitting aerials being supported at the top of this tower. Programmes consisted both of film transmission and direct television by the indirect film method. 180-line pictures were transmitted, 25 per second, sequential scanning. Wavelengths of 6.7 metres and 7.0 metres are used.

The experimental television transmitters were destroyed in a fire which took place during the Radio Exhibition in 1935, but new transmitters have now replaced them, and a regular service is again being given.

Holland

Although no public television service has been establishel, experimental sound and vision transmitters are installed at the Philips Laboratories at Eindhoven.

The power of both the vision and the sound channel is approximately 500 watts, the waves used being 41.208 mc. and 43,200 mc. In the past, experiments have been made with 180 and 360 lines, sequential scanning, 25 pictures per second, but in the near future experiments are to be made with 375 and 405 lines, interlaced scanning, 50 frames per second, 25 complete pictures. An Iconoscope camera, developed and improved in the laboratory, is used for these experiments. The size of the reproduced picture can be 5 × 6 or 7½ × 9 inches.

No receivers are at present available to the public, nor are there any public demonstration rooms. No special cables capable of transmitting a wide band of frequencies are at present available, apart from the co-axial cable used between the studio and the transmitter, a distance of 300 metres.

Hungary

No television transmissions are yet being made in Hungary, but the de-

TELEVISION ABROAD

velopment in other countries is being studied with great interest. A commission of the Royal Hungarian Post Office and of the Hungarian Broadcasting Company is visiting different centres in Europe to ascertain the position of television in other countries. A television committee has been set up.

Irish Free State

No television service is working in the Irish Free State, nor is one contemplated at the present time.

Italy

No television service is in operation, although one is contemplated. No date for this has, however, yet been fixed. The Iconoscope camera will be used for direct television, with mechanical scanning for the transmission of films. Up to 300 lines (50 pictures per second) is contemplated. The power for the vision channel will be 15 kW peak power at maximum modulation, and that of the sound channel 5 kW, Copenhagen rating. Wavelengths for both channels will be between 60 and 43 mc. The method of scanning, sequential or interlaced, has not yet been decided.

The direction of line scanning will be horizontal, and the format of the picture 4 × 5.

No receivers are yet available to the public, nor are there any public televiewing rooms. It is anticipated that both ultra-short wave link and special cable will be used to connect distant pick-up points with the transmitter.

Japan

No information has been received from Japan.

Norway

No television service is at present working in Norway.

New Zealand

The Radio Board in Wellington states that there is no possibility of the inauguration of a television service in New Zealand in the near future.

Poland

It has not yet been decided what system of television will be introduced in Poland, and no date has been fixed for its inauguration.

Portugal

There are no developments regarding television in Portugal at present.

Roumania

No information has been received from Roumania about the television position.

South Africa

Nothing definite is at present under consideration for television in South Africa, and it is unlikely that developments will take place until the public utility corporation for the broadcasting service is established during the current year.

Spain

No television service has yet been established in Spain, but it has been decided that if one should be set up, it will be carried out by the State.

Sweden

The Swedish Telegraph Administration, which is responsible for the technical side of the broadcasting system in Sweden, is not at present operating any television station, nor have any concrete plans been worked out for the future. The Administration is, however, carefully following developments in other countries. It is not proposed to start television on a large scale until the service can be run on a commercial basis and reliable receivers suitable for use by the public are available.

A private company has been authorised to carry out experiments, ultra-short waves being used both for sound and vision. Only a limited number of receivers exist for private use, and for demonstration to the public. These demonstrations do not form part of the official broadcasting programme.

Switzerland

No television transmissions are at present being made in Switzerland, although great attention is being paid to what is being done in other countries.

Switzerland has particular difficulties—and perhaps particular advantages in the transmission of ultra-short waves, owing to the nature of the country. A survey is therefore being carried out on the propagation of ultra-short waves (between 5 and 10 metres)with a view to ascertaining how much Swiss territory could be covered by ultra-short wave transmitters situated on some of the highest points in the country.

Union of Soviet Socialist Republics

At the present time regular low-definition television programmes are being transmitted from Moscow (30 lines, 25 pictures per second). The picture is divided into 1,200 elements. Two long-wave broadcasting transmitters have been used, one for sound and the other for vision.

Transmissions are made during the night hours and specially selected cinema films, concerts, short scenes, etc., are transmitted. The format of the picture is 3 × 4, and the direction of line scanning is horizontal.

United States of America

At the present time there are no stations regularly transmitting television programmes in the United States of America, although low-definition transmissions have taken place irregularly during the past few years.

A very large amount of research work has been carried out in various research laboratories, and economic considerations alone are responsible for there being no high-definition service in operation.

The Radio Corporation of America proposes during 1936 to carry out experimental work in which the National Broadcasting Company will operate a television system for demonstration purposes, without the sale of equipment to the public. The R.C.A. system will be used, the peak power of the vision channel at maximum modulation being 32 kW, the power of the sound channel 8 kW, Copenhagen rating. Sound will be transmitted on 52 mc., and vision on 49 mc. The number of lines will be 343, 30 complete pictures per second, scanned twice interlaced (60 frames per second). The Iconoscope camera will be used, both for film transmission and direct pick-up.

No special television cables are yet available, but the American Telephone and Telegraph Company propose to construct about 90 miles of concentric cable between New York and Philadelphia.

THE BAIRD ELECTRON CAMERA

FIRST DETAILED DESCRIPTION EVER PUBLISHED

By V. A. JONES of BAIRD TELEVISION LTD.

Specially written for and exclusive to "Television"

With the rapid approach of the new high definition television service, interest in both transmitting and receiving equipment is becoming most marked.

Recent development has been devoted towards methods of scanning which are wholly electrical in character and one of the most outstanding of these is the electron camera, general descriptions of which have appeared from time to time. Now that the major problems associated with this device have been solved in the Baird Laboratories at the Crystal Palace, and image tubes are now made which, barring accidents have an almost unlimited life, it is fitting that an accurate technical explanation of the principles involved should be made available to those interested. This article starting from the basic principles underlying the formation of the electron image itself, continues with those features which make this system of television so outstandingly important. Image scanning, together with the conversion of the complete picture into its electrical counterparts and its subsequent amplification through the medium of the electron multiplier, are dealt with. Characteristics concerning the amplifiers handling the video frequency signal, and their associated circuits and equipment are also explained.

IN principle the electron image is a faithful representation in electron density of the light picture thrown on the cathode. This electron picture is obtained by focusing the optic image on to the photo-electric cathode of the electron tube (Fig. 1), by means of a lens. The energy of the light forming the optical image causes the release of electrons from the various points on the photo-electric cathode, in numbers proportional to the light intensity at those points, so that any instant in the plane of the cathode surface an electron image of the optical image may be said to exist.

The electrons forming this image are accelerated towards the anode or target electrode (Fig. 2) by means of a homogeneous electrostatic field produced by the potential V. The coil F (Fig. 2) produces an axial magnetic field parallel to, and uniform along the length of the tube. This field acts on the electrons in a manner analagous to the action of a lens, so that it is reconstituted and brought into "focus" in the plane of this anode instead of the image being diffused by the time it reaches the anode, due both to mutual repulsion of the electrons and their slight initial variations in direction and velocity.

The exact mechanism of this will be better appreciated by a consideration of the following argument.

An electron passing through the magnetic field of strength H and having a component of motion v_r at any angle to the axis of that field will be constrained to travel a circular path in a plane normal to a line of force passing through that axis, and having a radius r where r equals mv/He (m and e are the mass and charge of the electron).

Thus it will return to its point of origin with its initial velocity.

The angular velocity ω with which the electron travels is v/r, and substituting this for the value of r in equation 1, we get: $\omega = He/m$.

That is, the angular velocity is proportional to the magnetic field and not to the component of motion at an angle to the axis; or stated another way, electrons with different velocities will describe circles of proportional radii, but they will all take the same time to describe a complete circle.

Now since the electrons have also a forward component of velocity imparted to them by the field produced by V, they will actually travel along helical paths. The forward component of velocity is substantially constant and any component at an angle to the axis will be converted into a proportional angular velocity. From this it will be seen that individual electrons emitted from any particular point on the photo-electric cathode may travel by quite differen paths along the tube to the plane of the anode (dependent on their initial velocities, etc.) but on arrival at this plane, if the value of H is such that $\omega t = 2\pi$, or any whole number multiple of this, they will all bear the same relation to one another as at the instant of emission.

Thus in this plane a real electron picture of the opti-

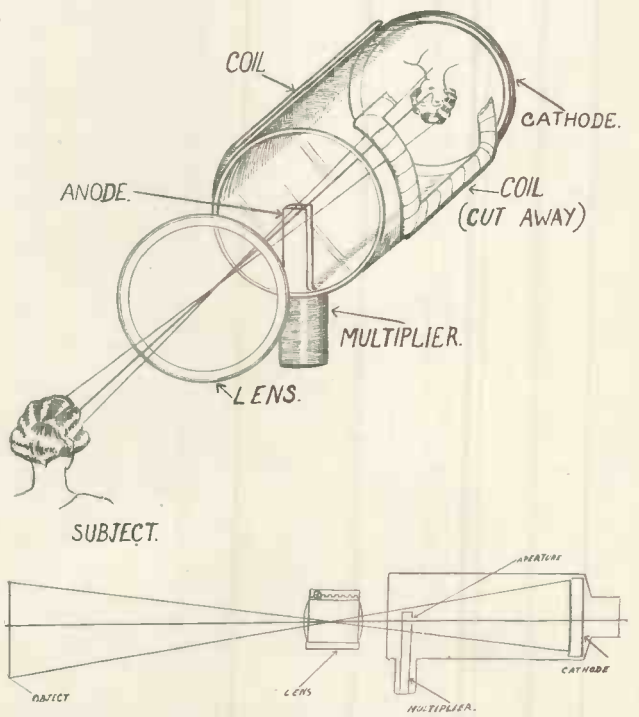


Fig 1.—Pictorial representation of the electron camera showing how the subject is focused optically on to the cathode.

HOW THE ELECTRON IMAGE IS DEFLECTED

cal picture has been reconstituted, and if a fluorescent screen were interposed in this plane, the electron image would be translated into a light image.

Scanning

The image has now to be scanned in order to turn it into a television signal which can be transmitted over a single radio channel, and this is accomplished

The tube in which the electron image is formed and scanned in the manner described in the text.

by deflecting the electron image across the aperture in the anode. (See Fig. 2.)

The method used to obtain the necessary deflection of the electron image is somewhat unusual. Scanning currents are passed through the coils A, B and C, D, coils A, B being the line-scanning frequency and coils C, D the frame-scanning frequency) and the transverse fields developed in these coils are superimposed on the longitudinal field of the focusing coil and a variable component is added into the resultant magnetic field. This variable component is not additional in the sense that it increases the flux of the focusing coil. What it effectively does is to modify the direction of the lines of force in such a way that the axis of the coil may be said to vary in direct proportion to the current flowing through these coils.

Thus, since the axis of the field can be modified, it will be seen that the position of the electron image in the plane of the anode can also be modified for, as we have shown, the electrons emitted from any point on a photo-electric cathode will pass through a focus at a point where their path intercepts a line of force passing through their point of origin. By this means the electron image may be swept across the aperture in the anode, and point by point the minute electron currents forming the image pass through the aperture and are collected on the target electrode and form a " television " signal.

By very careful design of the coils, and providing they are arranged accurately relative to one another, and to the focusing field, a practically distortionless scan is obtained, particularly in the sense that the movement of the electron image will be proportional to the current flowing through the coils at any instant.

If Fig. 3 is studied, it will be seen that an electron starting from the point P on the cathode and travelling to the anode along the helical path (tangential to a line of force, A), will have to travel along a shorter path to reach the aperture than electron emitted from point P_1, when the moment arrives for the line of force starting from this point to intersect the aperture. Since the two distances are different it can be seen that when the current in the focusing coil is adjusted such that the electrons starting from P are focused in the plane of the aperture, the electrons from point P_1 will travel towards the aperture in the path shown and will come to focus at a similar distance from their point of origin, but not at the point at which the line of force crosses the aperture.

In practice this results in considerable defocusing of the edges of the picture; fortunately correction may readily be applied in a number of ways. In most of the tubes shown, deliberate distortion of the electrostatic field is used. This serves to vary the velocity

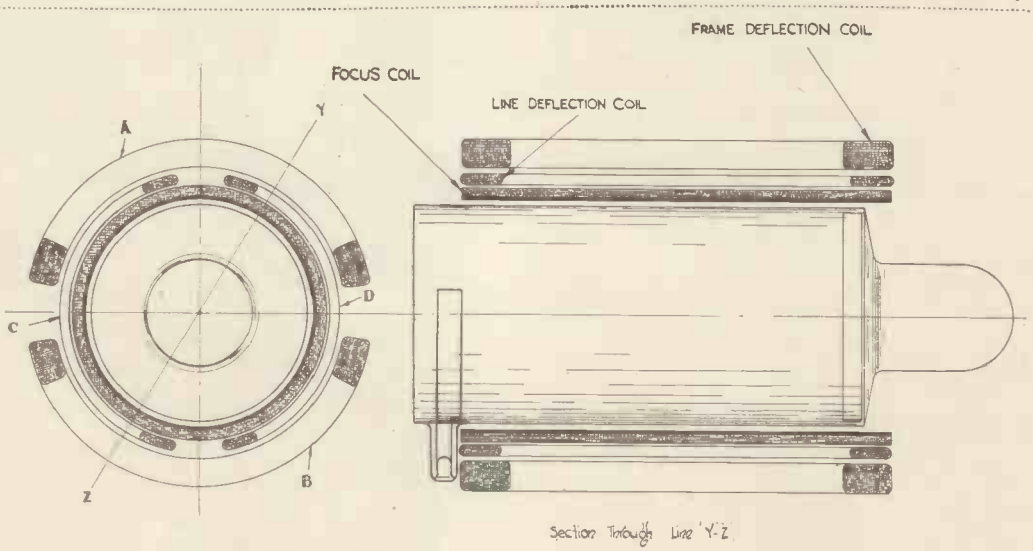


Fig. 2.—Cross section of the electron camera showing relative positions of the focus and scanning coils.

SCANNING WITH THE ELECTRON CAMERA

of the electrons sufficiently to completely balance out the difference in distances.

Scanning Fields

At this point it might be of some interest to note one or two features which are very unusual, and are of some practical importance. The first is that the electron may be caused to describe one or more helixes in

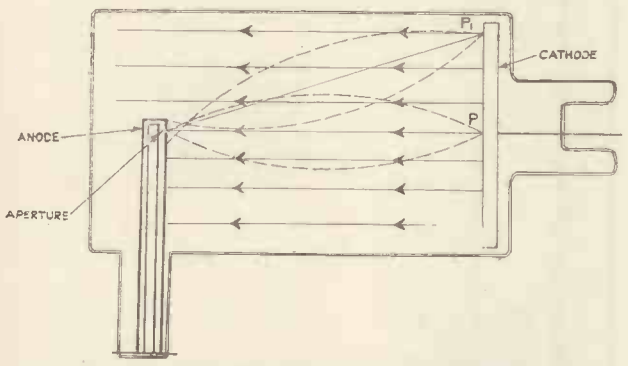


Fig. 3.—The electrons from different parts of the cathode travel along helical paths of different lengths to the aperture.

their paths down the tube, by appropriately altering the strength of the magnetic field. This feature can be put to practical use, as will be explained later. A further feature of passing interest is that the electron beam or phalanx is deflected by coils having their axis and producing field normal to the direction in which the deflection takes place (as may be seen from reference to Fig. 2). Usually, when a magnetic field is caused to deflect an electron beam, the movement of the beam is at right angles to the direction of the lines of force of that field.

Scan Generators

The amplitude of the currents required for scanning are of a rather high order, and special types of generators have been developed for supplying them..

It is of great importance, of course, that the waveform of the sawtooth currents used should not vary from the theoretical triangular shape by more than a few per cent., or this will become noticeable in the form of distortions as shown in Fig. 4. This, of course, implies that the system must be capable of reproducing in the coils, currents with frequencies of many times the fundamental scanning speed (this is, 6,000 cycles in the case of the line scan for a 240-line 25-frame picture). In fact, the departure from linearity does not exceed 10 per cent. up to the 20th harmonic.

It is, of course, necessary in the case of a studio camera that these signals should be supplied over long lengths of cable. The generators which have been developed will give suitable sawtooth waveforms up to 12,000 cycles (with less than 10 per cent. distortion) over cables up to 300 ft. in length. In operation these generators are very reliable, and once having been adjusted can be left to run for very long periods, returning to the same level of output, etc., whenever switched on. A further great advantage of this type of generator is that the circuits used are straightforward and it is possible to construct the frame and the line scan generators so that a wide range of speed may be used. In the standard type of generator it is possible by slight adjustment to operate at any type or speed of scanning at present regarded as of practical use.

Special cathode-ray oscillograph circuits have been developed to indicate immediately any departure from linearity or frequency and to enable control to be exercised should such distortion occur on changing from one type of scan to another.

Untouched photograph of image received on monitor from the electron camera. Exposure 4 seconds with F 4.5 lens panchromatic stock.

Scene in studio showing electron camera in operation on a three-quarter shot. Note the view finder for focusing the optical image on the cathode.

Synchronising System

For rigid control on the scanning system it has been necessary to develop a master synchronising system. To take advantage of the flexibility of the scanning system it is necessary that the synchronising system should also cover a wide range and at the same time, be able to operate independently, controlled by its own master generator, when not supplied from some other system.

It is necessary that these signals should be developed with great accuracy both when working independently and when tied to some controlling circuit. This accuracy is, of course, more important when an interlaced system of scanning is used, as it is essential that the frequency of the line scan should be accurate to a few parts in many thousands with respect to the framing scan, if the interlace is to be correctly maintained. It is not essential that this particular master synchronising system should be used, as any reasonable signal will control the apparatus, or for experimental purpopses it will run stably free of all control.

Characteristics of Signal

We have described how the electron image is formed and scanned, and now it would be as well to discuss some of the characteristics of the signal obtained from the image tube. The most important consideration is, of course, the amplitude of the signal. This signal consists of those electrons in any particular part of the electron image that are selected by the aperture as the electron image is scanned past it. Thus, it will be seen that the average amplitude collected by the target electrodes will be the total electron current in the electron image, multiplied by the area of the aperture and divided by the area of the electron image.

The electron currents flowing in the whole electron image will depend on the total light flux falling on the photo-electric cathode. For normal studio subjects the order of illumination that may be achieved without causing any discomfort to the performers, both in the case of long " shots " and " close-ups " will yield an average light flux of about 0.2 of a lumen on the cathode.

The order of the photo-electric sensitivity that is regularly achieved with these tubes is between 50 to 75 micro-amps. per lumen, this is, of course, a great improvement on the sensitivity of normal types of photo-electric cell of a similar class, and is the first result of some very careful research into the problems associated with the manufacture of these tubes.

Now, with a light flux of 0.2 of a lumen falling on the cathode of the image tube, and assuming its sensitivity of about the order given before, an average current of about 15 micro-amps. will result from the whole electron image. The average amplitude of the current collected by the target electrodes will, therefore, be 15 micro-amps. divided by the number of picture elements or 70,000, that is very approximately for a 240-line 25-frames picture. This figure comes out to be 2.2×10^{-10} amperes, a signal much too small to be amplified by any normal type of amplifier.

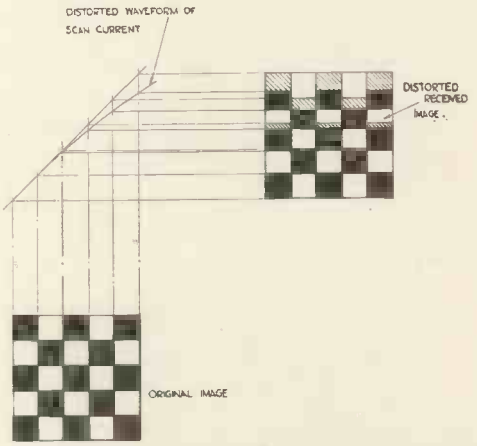


Fig. 4.—Diagram indicating the distortion of a regular image of non-linearity in the waveform of the scanning current generators.

The concluding portion of this article, explaining the Association of the Electron Image Camera with the Electron Multiplier, will be published next month.

Philco (U.S.A.) Television

Earlier in the year there were rumours that Philco would surprise the world directly they demonstrated their system of television.

This demonstration took place on August 11, with great success. The Philco system is 345 lines 30 frames per second with interlaced scanning, and transmitted on a frequency of 51 megacycles, occupying a band of 6 megacycles.

Experimental console models are being tested in Philadelphia, glossy pictures being obtained. The total number of valves used is 36, which is even larger than the experimental receivers in this country. This probably accounts for the price being in the region of £100.

A Guide to the Palace

Here is a little sidelight on the great detail in which everything is being done. Have you ever thought what a difficult business it is to get from Broadcasting House to Alexandra Palace? In recent months, and of course, continuously when the programmes begin, there will be a continuous traffic between these two centres.

Already a television 'bus has been put into service. This is an ordinary green 'bus with eight seats a-side, and it now makes five trips a day between Broadcasting House and " Ally Pally." It takes the staff to and fro, and at present is also being used for the transport of stores and other materials.

And just to make sure that nobody gets into a jam over the question of where Alexandra Palace exactly is located, the B.B.C. has issued a special pamphlet entitled " Routes to the Television Offices, Studios and Transmitters at the Alexandra Palace." This interesting document not only gives a map showing how to get to the Palace from all parts of London, but complete routes, fares, and the approximate times that the various journeys should take.

Scannings and Reflections

THE FIRST TRANSMISSION FROM THE ALEXANDRA PALACE

Performances on a mouth organ

THE first vision transmission was made from the Alexandra Palace on Wednesday, August 12. This, of course, was purely a test transmission and only lasted for a short time. Further tests were made on Thursday and Friday, sometimes sound only and at other times combined sound and vision. About 5 p.m. on Friday the strains of a mouth organ were heard and a little later it was possible to see an engineer playing an instrument of this type. Later a chequer board pattern was transmitted and the station closed down at 6.10 p.m. As there was no opportunity of making adjustments to the receiver in the short time available it is not possible to give an opinion of the quality at the time of writing.

THE LATEST

Test transmissions to continue

At last we really have reached zero hour. From the foregoing it is clear that the Alexandra Palace is finished, the gear is installed and the aerial feeders are connected. In fact everything is ready for the series of test transmissions which are to precede the regular service. It is not improbable, however, that the public will have an apportunity of seeing real television at the wireless exhibition at Olympia though this will be dependent upon the results of the experimental transmissions. Events may prove that this forecast is wrong, but at the time of writing there is nobody, from the Chief Engineer of the B.B.C. downwards, who knows what will transpire.

All the apparatus has of course previously been operated under laboratory conditions, but all sorts of minor difficulties might arise in the new situation and with increased power, all of which will take time to eradicate for there will be no precedent in the way of experience. The B.B.C. and the responsible firms concerned are determined that the public's first sample of modern television shall be reasonably perfect, even though more delay be entailed. The decision is a wise one for first impressions are important and an initial failure or partial failure would take some living down.

On the other hand, of course, everything may go smoothly and anticipated difficulties not develop, but the probabilities appear to be the other way. It may seem remarkable that on the eve of the opening of Radiolympia it is not definitely known whether there will be any television demonstrations there, but obviously this depends on the conditions already outlined.

THE PUBLIC DEMONSTRATIONS

Should they be free ?

Variety News, commenting on the proposed public viewing rooms in departmental stores, asks—if patrons are to be admitted free or whether they will have to pay prices of admission subject to the entertainments tax? It says that the question should be asked and dealt with in advance, because if admission is free or the receipts non-taxable, the new form of entertainment will straightaway be in unfair competition with theatres, music halls and all other places where receipts are taxed. This habit of the stores of giving something for nothing is already causing so much concern among proprietors of places of amusement that an extension of it under the auspices of the B.B.C. would be the last straw that would break the camel's back.

TELEVISION IN JAPAN

A centralised effort

The Nippon Broadcasting Association has decided to amalgamate the investigations which are taking place in that country into one concern and 300,000 yen has been allotted so that research, which previously has been carried out by two technical colleges and the Department of Communications can be centralised.

U.S.A. TELEVISION

Columbia to take a hand

The President of the Columbia Broadcasting System, Mr. W. S. Paley, giving evidence before the Federal Radio Communications Commission recently, said: "Probably the most important economic problem they must face—certainly the one uppermost in eveybody's mind—lay in the approach of television. Perhaps not all of us realised just *how* important, or how great, that problem would be.

"If television was to flourish, it must be made a nation-wide service—a vital part of the life of the American people. Whatever the present technical difficulties, the day could hardly be distant when the public and the national interest would demand network television. It would be tremendously costly. Even the preliminary foundation work must cost millions. This could be justified only if adequate allocations were assured.

"He did not see how it was possible to know now how many television channels would be necessary to insure healthy competition. But even under the most favourable conditions the number of possible television channels would probably be limited. He was not advocating narrower channels in order to make more of them. He meant simply that until the requirements of television become clearly defined, as many frequencies as possible should be reserved for it."

THE LONDON-BIRMINGHAM COAXIAL CABLE

Ready this year

Work on the coaxial cable between London and Birmingham is now well forward and it is stated that it will be ready for telephone service by the end of the present year. Plans have been made for its extension to Manchester and it is expected that this extension will be completed by the summer of 1937. Although it is assumed that this cable will be capable of carrying the frequencies necessary for television, it by no means follows that it

will be used for this purpose, except experimentally, as this would necessitate reserving the cable for certain periods each day.

STAGE LIGHTING ENGINEERS AT THE PALACE

Two stage lighting engineers are included among the Alexandra Palace staff. One of these is from the Playhouse and the other from the Piccadilly Theatre. They are to work under Stephen K. Thomas, who is now to be technical and artistic adviser on lighting.

TELEVISION IN SOUTH AFRICA

Demonstrations at the Empire Exhibition

Replicas of the apparatus used by Mr. J. H. Reyner for the demonstrations that have been taking place at several large London stores are to be sent to Johannesburg for the Empire Exhibition which opens there in September. This apparatus it will be remembered was described in the April issue of this journal. The standard of definition is ninety lines and reception is by means of cathode-ray tube. Five receivers and one transmitter are to be sent to Johannesburg.

MAKE-UP EXPERIMENTS

Different make-up for the two systems

The new television announcers—Jasmine Bligh, Elizabeth Cowell and Leslie Mitchell—have been lending their faces to the make-up experts for experiments at Alexandra Palace in order to discover what combination of paint and powder are best suited for transmission; Baird and E.M.I. systems, it is stated, call for different colour treatment to get the best effects.

THE TELEVISION MAKE-UP EXPERT

Miss Mary Allan appointed

The problems of television make-up and to some extent those of dress at the Alexandra Palace, will fall upon Miss Mary Allan, who has been appointed Assistant in Make-up and Wardrobe. Her duties will be to advise artists on the most suitable type of make-up and dress. From the experiments on make-up already carried out a guide to colour registration has been prepared. Tests have shown that colours, when directly televised, appear on the screen in one of the following three categories: (1) White, red, orange, light brown, and all pale colours become white or off-white. (2) Grey, dark brown, dark green, and dark purple become grey. (3) Black and blues show black. Shiny black material may look grey. Dead black material, the B.B.C. state, should be relieved by contrasting additions, such as a white flower. Miss Allan has had fifteen years' experience in stage and film work, and has recently been engaged in costume design and make-up with British film companies.

TELEVISING THE CORONATION

No decision made

Contrary to the many statements which have appeared in the daily press no decision has yet been taken regarding the televising of the coronation. It is probable that at the present stage there would be many technical difficulties in televising the actual ceremony, though much of the outdoor pageantry would lend itself ideally to the art. Here again there would be a certain amount of difficulty in relaying the transmissions to the Alexandra Palace which would probably entail the laying of special high-frequency cables or, alternatively, necessitate employing micro-wave transmission which by that time may be sufficiently developed to ensure reliable results. It is fairly obvious, therefore, that any decision in the matter will have to be deferred until a considerable amount of further experience has been obtained.

THE LONDON TRANSMISSIONS

The following is a summary of the arrangements made for the television transmissions from the Alexandra Palace :—

The Baird System will use 240 lines, sequential scanning, 25 pictures per second. Marconi-E. M. I. will use 405 lines, 25 pictures per second, interlaced scanning to give 50 frames per second, each of 202 1/2 lines. Receivers can be constructed capable of receiving both types of transmission without undue complicated adjustment. The format for both systems will be 4×3.

The vision signals with either system will be radiated on a frequency of 45 Mc/s (6.7 metres), and the associated sound signals will be radiated on a frequency of 41.5 Mc/s (7.2 metres). The power of the vision transmitters will be 17 kilowatt peak during periods of maximum modulation, while the sound transmitted will have a power of 3 kilowatt, 90 per cent. modulation, Copenhagen rating.

Direct television will be given by the Baird System by means of intermediate film and the image-dissector, while the Marconi-E. M. I. Company will use the Iconoscope camera (Emitron). Film transmissions will also be given, the Baird Company using mechanical scanning and Marconi-E. M. I. the Emitron.

Three programme periods are contemplated daily at :—3.0—4.0 p.m. 6.15—7.15 p.m. 9.30—10.30 p.m.

Programmes will be provided by one system at a time, the two systems working alternately week by week.

CINEMA TELEVISION

New cinema to be equipped

Recent developments have caused another swing of opinion in the cinema trade regarding the possible rivalry of television. Only a few months ago the conclusion was reached that some years must elapse before the matter need be given serious consideration, but recent progress appears to be altering this view. The possibilities of television as an adjunct to ordinary cinema entertainment are also being investigated and one new cinema is being planned to include a television installation. This is the " Rex " which is to be erected in Edgware Road, Paddington, of which the plans have already been passed by the London County Council and Paddington Borough Council. In the design of this new theatre provision has been made for the installation of a television system which will allow of the projection of large size pictures, and it is hoped that the opening will concide with the coronation, when in all probability this will be featured.

E. K. COLE, LTD. AND TELEVISION

Scophony Progress

Speaking at the annual general meeting of E. K. Cole, Ltd., Mr. W. S. Verrells, Chairman and Managing Director, referring to the association of that company with Scophony, Ltd., said that he was pleased to report that considerable progress had been made in that company's laboratories. Apparatus for the reception of the transmissions from Alexandra Palace had been developed, and the directors were negotiating a non-exclusive

licence for the manufacture, sale and distribution of that apparatus. When transmissions commenced they hoped to be in a position to market a suitable receiver at a competitive price.

A CLOSE GUARD AT THE PALACE

Still hush-hush

The B.B.C. still continues to maintain a close guard at the Alexandra Palace. Visitors, even though on business, are not encouraged and a strict watch is kept upon their movements, in fact it is quite impossible to get beyond the administrative offices. It is probable that a date for a Press visit would have been fixed ere this except for the imminence of the wireless exhibition at Olympia. Radio manufacturers feel that publicity given to television might reflect adversely on radio sales and it is believed that representations to this effect have been made to the B.B.C.

SERVICING TELEVISION SETS

In his presidential address to the Institute of Wireless Technology, Mr. Nelson referred to the servicing of television sets. He said:—" It is to be hoped that many have already realised the necessity for a much more comprehensive knowledge than is at present required for general wireless work. I believe that the radio service engineers will ultimately be called upon to service both sound and television receivers. Consequently, as the standard of reception demanded will be very much greater, so will the standard of knowledge and ability also have, of necessity, to be very much in advance of that required to-day."

THE B.B.C. AND ULTRA-SHORT WAVES

Possible use for Relay Stations

Sir Noel Ashbridge is preparing a report for the B.B.C. Board of Governors, on the progress made with ultra short-waves. For some time the B.B.C. technical staff have nursed the idea that ultra-short waves might one day be used to relieve the congestion on broadcast bands. The progress made shows that it is quite possible that ultra-short wave relay stations could take the place of the existing relays so leaving spare channels on the medium waves.

AN ALL-WAVE RADIOLYMPIA

From information to hand it appears quite certain that all the set makers at the show this year will feature at least one all-wave receiver. Practically every receiver of note includes a short-wave section as a standard fitment.

One or two receivers will tune between 6 and 2,000 metres so being suitable for television sound reception. Compared with the number of all-wave receivers at last year's show there has been a big change-over in opinion. It appears that as the public have the opportunity of hearing short-wave stations the time will soon come when every receiver will tune below 100 metres as a matter of course.

THE MAGIC EYE

The cathode-ray tuning indicator introduced by the R.C.A. in America last year is being used in a number of this season's receivers. Actually, the first device of this kind was produced by Standard Telephones at least three years ago, but did not meet with the popularity it deserved. Another instance of an invention being introduced to the public before it was wanted.

The new tuning device works on the same principle as the cathode-ray tube in the television receiver. The green light is due to electrons from a cathode striking the coating on the face of the bulb. Inside the indicator bulb is also a grid and anode of a triode valve with a common cathode. Between the cathode-ray anode and the triode anode is connected a high resistance through which no current flows when no AVC voltage is developed in the receiver, while the grid of the indicator is connected to the AVC line.

When a station is tuned in and AVC voltage is produced, less current flows through the triode so that the voltage between the anode and the cathode-ray anode drops. This causes a smaller shadow or line on the cathode-ray tube face which is used to indicate resonance. The more narrow the line the stronger the station or more correct is the tuning.

OUR COVER PICTURE

THE OLYMPIC GAMES TELEVISED

Proof that television is entering the sphere of important public events is evidenced by the elaborate arrangements which were made for televising the Olympic Games—the World's most important sporting event.

Twenty viewing theatres were established in various parts of Berlin, and audiences were able to witness some of the more important happenings at the Games at the same moment as they were taking place. Although this is not the first time that sporting events have been televised, never before has it been done on such an elaborate scale. Reports state that the quality of the received pictures was very good.

GERMAN AMATEUR RADIO

Will ban be lifted?

It appears very probable that within the next few months the ban on German amateur phone stations will be lifted. At the moment this is one of the few countries imposing such a ban and it has been realised that such a restriction is stopping much of the good work that was carried on under the original licensing regulations.

THE MORSE CODE TEST

Most would-be short-wave transmitters find the morse-code test a stumbling block difficult to overcome. It is rumoured that the G.P.O. are now considering an alteration in this test on the lines adopted in the United States.

Over there the code test has been increased from 10 to 13 words per minute and all licenced stations on the expiration of their permit have to submit to a new test.

Our G.P.O. are considering the advisability of making the test 15 words a minute and to make all operators submit to a new test as permits run out. Whether this comes into force remains to be seen, although the code test has already been tightened up a very great deal.

It will be remembered that the original test was merely to pass at 12 words per minute, a word counting as 5 letters. At the end of 5 minutes the number of words and letters were checked. A seven-letter word with two errors passed as one word, but to-day a single error in a word and the whole letter is crossed out.

TECHNICAL DETAILS OF THE EIFFEL TOWER TELEVISION

BY

Jean Le Duc,
Ingénieur E.S.E. directeur des services " Télévision " de la Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.

and

René Barthelémy,
Ingénieur E.S.E., chef du laboratoire d'études de télévision de la Compagnie pour la Fabrication des Compteurs et Matérial d'Usines à Gaz.

This technical description of the television system employed at the Eiffel Tower is a translated abstract from La Revue Generale de l'Electricite and it has been placed at our disposal by M. René Barthélemy who with M. Jean Le Duc was jointly responsible for the Eiffel Tower television installation.

THE Eiffel Tower television station comprises (1) a studio situated in the Ministère des Postes, Télégraphes et Téléphones, (2) a machine room situated in the north column of the Eiffel Tower and (3) an aerial of a special type situated at the top of the tower. The physical impossibility of uniting these three units in one and the same place singularly complicated the problem. It was necessary to link up the studio with the machine room by a cable, 2,500 metres in length, capable of conducting the necessary high frequencies, and to link up the machine room with the aerial by a feeder 320 metres long, constructed in such a way that the power radiated by the aerial would still be sufficient.

The studio, furnished like all television studios, with soundproof fittings and microphones, possesses, in addition, a direct television photography apparatus and several rows of projectors, with a total power of 41 kilowatts, adjustable in all directions and mounted on a revolving daïs.

Although the amount of light involved is less than that used in film photography, the heat given off by the projectors might cause discomfort to the artists; it was therefore essential to protect them by a current of fresh air without at the same time creating too violent a draught. Moreover, it was absolutely necessary to avoid all transmission of noises coming from the apparatus.

The power of the projectors employed in a relatively confined space presented a special problem as regards ventilation and conditioning of the air. An air conditioning installation was installed in the basement; the temperature in the studio in the centre of the group of projectors can be kept between 25° C. and 28° C. with an external temperature varying between 5° C. and 30° C. and the hygrometric state of the air can be continually adjusted to suit the temperature.

The television camera in the studio sends the picture by a cable as far as the foot of the Eiffel Tower; this picture, checked both on departure and arrival, does not undergo any distortion. The modulated television current is then amplified and transmitted by the wave transmitter and the feeder to a quadruple aerial.

Special precautions have been taken to avoid too great a loss of energy in a feeder of such great length. The latter consists of two strictly concentric copper

The amplifier and control room of the Eiffel Tower transmitter.

The Eiffel Tower studio at the rue de Grenelle.

DIRECT PICK-UP BY MECHANICAL CAMERA

tubes, the exterior tube being 10 cm. in diameter and that of the interior tube about 3 cm.; air being used as the dielectric; elastic junction boxes are set up here and there.

Direct Televising of Scenes

Until the last few years the systems used for high-definition scanning were only mechanical and confined to telecinematography, since the light available was

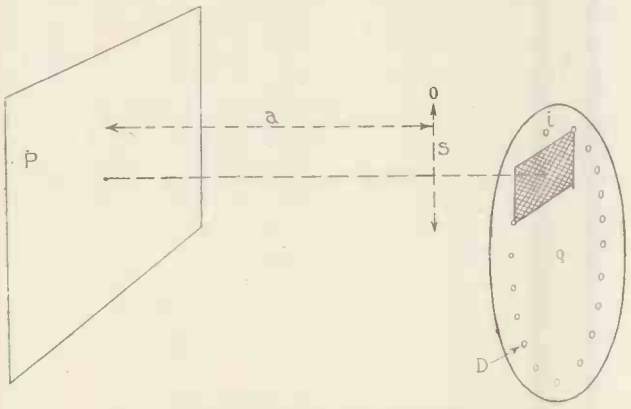


Fig. 1.—Diagram showing the principle of analysis.

brilliant. In order to take scenes directly in the studio or in the open air different systems had to be adopted, e.g., Zworykin's Iconoscope and Farnsworth's dissector. The delicacy of these pieces of apparatus and the long experience necessary to bring them to the industrial stage have prompted us to concentrate our efforts on optical and mechanical constructions, all the possibilities of which have not, in our opinion, been fully explored. We had already set up 60-line cameras which had given entire satisfaction, and, with this result as a basis, we agreed in April, 1935, to prepare and deliver within a period of five months an optical and mechanical camera for direct scene photography for 180 lines and 25 pictures per second, with its amplifiers. In September, 1935, the apparatus was completed and received by the Services Techniques de la Radiodiffusion.

It is somewhat difficult to pass from 60-line scanning to 180 lines. It may be shown, other things being equal, that the light falling on the light-sensitive cell is, in this latter case, 81 times weaker than with a 60-line camera. It was necessary, therefore, to find in the preparation of the various elements preceding amplification a gain to compensate for this reduction. The following factors were investigated in this respect: Illumination of scenes, aperture of the optical system, speed of rotation of the disc, and sensitivity of the cells.

To determine the influence of each of these elements we established a formula which expresses the pencil of light applied to the cell by what is known as a "picture spot." Let us suppose that the scene for transmission, represented by a plane P (Fig. 1), is subjected to a uniform illumination of N units of light. This plane diffuses perfectly, that is to say by hypothesis, the beam which it sends to each spot is uniformly distributed in a solid angle equal to 2π steradions. An objective O projects on scanning disc D the picture i of plane P, and the perforations of the spiral disc describe successively on this picture contiguous arcs of a circle which form the scanning lines.

The light-sensitive cell is placed behind the disc and receives the beam of light emitted from the perforation which is on surface i. Of course, there is only a single hole in front of this surface at any given moment. The picture spot is determined by the area of the scanning hole, and if the spot is assumed to be square in shape, and picture i to be square and to contain n scanning lines, there are n^2 picture elements in the exploration which defines the definition.

When surface P is not absolutely white there is absorption and only a fraction k of the incident light is reflected; we fix this number k according to the reflection factor. In the case of white paper, k is assumed to equal 0.8. The illumination on P being N units of light the light flux received on 1 $cm.^2$ is

$$\varphi_1 = \frac{N}{10^4} \text{ units of light (lumens?).}$$

The stream diffused by this surface element is

$$\varphi_d = \frac{kN}{10^4}.$$

The distribution being hemispheric and surface s (Fig. 2), the surface of entry of the light into the objective, being supposed at a tangent to the sphere of ray a, the fraction of stream φ d which falls on to the objective is

$$\varphi_0 = \frac{kN}{10^4} \frac{s}{2\pi a^2}.$$

If with the aid of the objective a picture of surface s is produced, the stream emitted by this picture into the objective is as nearly as possible

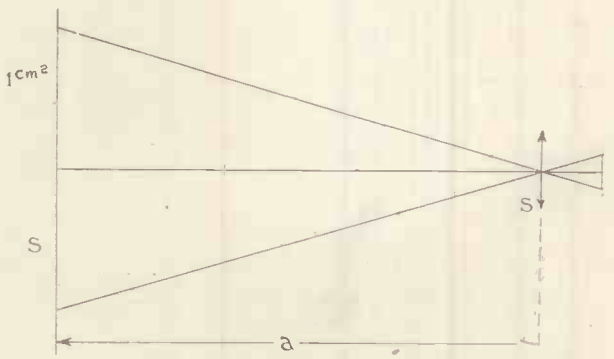


Fig. 2.—Schematic diagram of the production of an image of surface S by the objective of surface s.

$$\Phi = \frac{kN}{10^4} \times \frac{sS}{2\pi a^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

This formula may be expressed in a practical form if two magnitudes which are generally fixed for a given scanning system are taken as parameters. These are (1) the surface i of the projected image which will be explored by the disc or other scanning arrangement,

CALCULATION OF LIGHT VALUES

and (2) the aperture V of the objective employed. Let us call the focal distance of the objective f and its diameter d. Between the picture of surface i and surface S televised there exists the relationship

$$\frac{i}{S} = \frac{f^2}{a^2}.$$

This formula is only approximate, but it is perfectly justified if it is admitted, as is in reality the case, that the object of surface s, the picture of which is transmitted, is very great in relation to the surface S of

The camera used at the Eiffel Tower for direct scanning.

picture i, projected on the perforated disc as on the mosaic background of the Iconoscope. Therefore,

$$a^2 = f^2 \frac{S}{i}.$$

On replacing a^2 and s by their values in formula (1) we have

$$\Phi_t = \frac{kN}{10^4} \frac{sS}{2\pi f2\ \frac{S}{i}} = \frac{kN}{8 \times 10^4} \frac{d^2}{f^2} i.$$

Now the relationship $\frac{i}{f} \frac{d}{}$ exactly expresses the aperture V of the objective; the expression of stream Φ_t then becomes

$$\Phi_t = \frac{kN}{8 \times 10^4} V^2 i, \quad \ldots\ldots (2)$$

i being the surface of the picture in square centimetres.

2. *Determination of light passing through a scanning hole.*

We have supposed that the picture is square, that it has a side c and that it requires n successive lines to scan it. There are n^2 picture elements in surface $c^2 = i$; the surface of one element is $\frac{c^2}{n^2}$. The flux passing into the picture element is

$$\varphi = \frac{kN}{8 \times 10^4} \left(\frac{cV}{n}\right)^2.$$

If an average loss of 20 per cent. is allowed in the objective, the usable flux per picture spot projected on the light sensitive surface is

$$\varphi = kN \times 10^{-5} \left(\frac{cV}{n}\right)^2, \quad \ldots\ldots (3)$$

a formula in which k is the output of the diffusing surface pictured, N the illumination in light of the scene, c the side of the projection of the picture on the scanning system, V the aperture of the objective, n the number of lines of the picture. If the projected surface of the picture spot in square centimetres (in general the surface of the scanning hole) is called p then we have

$$\varphi = kNpV^2 \times 10^{-5}. \quad (4)$$

Very often measurement gives a value greater than that calculated according to formula (4). In reality, with the regulated light used in the taking of scenes, a reflecting effect is present which is not negligible and which gives a maximum flux when the objective is placed in the direction of the pencil, which would be reflected by a mirror coinciding with the diffusing surface. Thus, through a scanning hole 1 mm. in length the picture of a white paper having an illumination of 20,000 units of light given by an objective with aperture $\frac{1}{1}$ furnishes a luminous flux of 1.6×10^{-5} lumen.

We have not chosen these values at random. They correspond to maxima. Thus an illumination of 20,000 units of light (which in itself is not prohibitive since we have up to 100,000 units of light in the sun) requires in the studio some considerable power and gives rise to the problem of ventilating the studio. The aperture of the best present-day objectives seldom exceeds $\frac{1}{1}$. Beyond that there is a loss in transparency or quality.

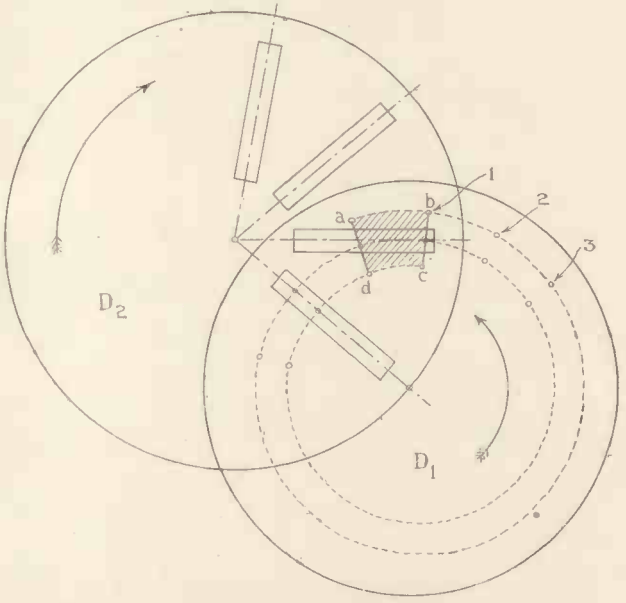


Fig. 3.—Arrangement of multiple spiral discs with obturator.

A NOVEL SCANNING SYSTEM

Thus we have been able to adopt these limits in the establishment of our project. The only variable which, according to formula (4), remains at our disposal is, therefore, surface p of the hole. Assuming the holes to be 0.1 mm. it is found that a disc for 180-line scanning would be 1.20 m. in diameter, which is inadmissible in an easily handled camera. We have therefore

Receiver used for Monitoring.

reduced to $\left(\frac{8}{100}\right)^2$ the useful area (we shall return to this term) of the scanning hole and adopted the artifice of a multiple spiral disc, with an obturator, in order not to exceed a diameter of 50 cms.

Instead of a spiral of holes of a single turn we arranged on a disc, n times smaller in diameter, a spiral of n turns necessitating in all the same number of holes regularly spaced; on the other hand the angular speed is multiplied by n. If the precaution is taken of obturating with an appropriate revolving screen all the spirals successively, with the exception of one, at the end of n revolutions of the disc, the same surface will have been scanned that a disc n times larger could have explored in the course of one revolution.

Let us take a convenient example with a double spiral (Fig. 3). Disc D is provided with perforations 1, 2, 3, arranged on a spiral with two turns. The rate of this spiral is equal to half of the height of the image projected on the disc. If this projection is represented by a b c d it will be seen that it is scanned by holes 1, 2, 3, of the first spiral, then by those of the second, and that its dimensions are determined by the distance of two consecutive holes in respect of its width, its height always being 6/7 of this width.

If no supplementary adjustment were provided there would be two holes on surface a b c d at the same time, the arc belonging to the outer turn and the other to the inner turn. It is therefore necessary to mask the holes of the second spiral while those of the first are passing and vice versa. This operation may be effected in various ways. One of them consists in placing a disc D_2, provided with fairly large radial slits, in front of the principal disc D. If the dimensions of the slits and the speed of the disc are suitably chosen, all the holes of the two turns may be made to appear successively in the surface a b c d without two ever being presented at the same time. The second disc revolves very slowly. Indeed, let us suppose that it possesses 25 radial slits; one slit will have been substituted for the preceding one by the time disc D has effected a single complete exploration of the picture, i.e., after two revolutions. Supposing that the picture is scanned during 1/25 of a second, disc D_2 will only have a speed of one revolution per second.

A reducing arrangement is placed between the two discs D_1 and D_2. The relationship of the speeds is given by $p = n_1 n_2$, n_2 being the number of slits of the obturator disc and n the number of turns of the scanning spiral. Various considerations of the form of the scanning holes ended in the adoption of the circular form, firstly because of greater convenience in practice and then by reason of the superior quality of the transitions. Thus, with equal areas a circular hole gives a derivative $\frac{dp}{dx}$, greater by 20 per cent. than that given by a square hole for the same displacement dx, in the passage from an illuminated portion to a dark portion.

The question of the useful area of the scanning hole was previously raised. It must be observed that the perforations are not made in an extremely fine metal, and with the small diameter of the holes there is a very pronounced "filter" effect with objectives having a larger aperture and which give an emerging flux limited to a cone of 60°. With equal illumination calculation shows that the diameter of the perforation must be increased about 15 per cent. for the example already quoted. The limit is not yet reached from the point of view of rotational speeds of the disc. It can be doubled, which corresponds to quadrupling the light flux on the light-sensitive element. We have under construction a four-spiral apparatus for scene photography which will correspond to these characteristics.

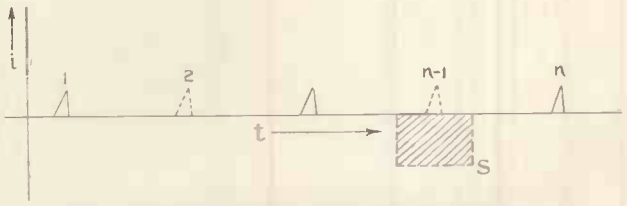


Fig. 4.—Diagram showing composition of the two signals.

The Photo-Electric Cells

Having thus defined the function of the light phenomena in action in the scanning of pictures we sought to utilise this effect to the maximum by the introduction of extremely sensitive photo-electric cells. It is customary to assert that with the high frequencies of television scanning it is essential to use vacuum cells which avoid

(*Continued on page 512*).

RECENT TELEVISION DEVELOPMENTS

A RECORD OF PATENTS AND PROGRESS
Specially Compiled for this Journal

Patentees: Ferranti Ltd. and M. K. Taylor :: C. Lorenz Akt. :: Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett and L. E. Q. Walker :: The General Electric Co., Ltd., and B. P. Dudding :: Radio Akt. D. S. Loewe :: D. M. Johnstone and Baird Television Co.

Cathode-ray Tubes

(Patent No. 445,464.)

The tube is made in double-conical shape, as if two ordinary tubes were placed together with their large ends face to face. A fluorescent screen of coated mica is then rolled up and inserted at one end, where it expands by its own elasticity into position at the centre or widest part of the tube.

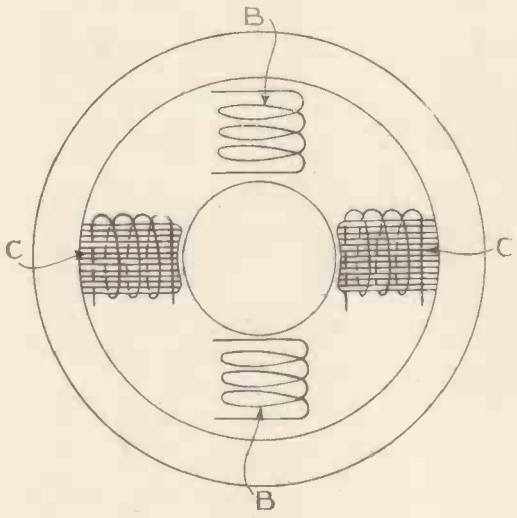
Two electron streams are generated, one at each end of the tube, and are used either for interlaced scanning, or for simultaneous scanning to produce a brighter picture. The screen is " viewed " from an angle. —(*Ferranti, Ltd.*, and *M. K. Taylor.*)

Magnetic Scanning

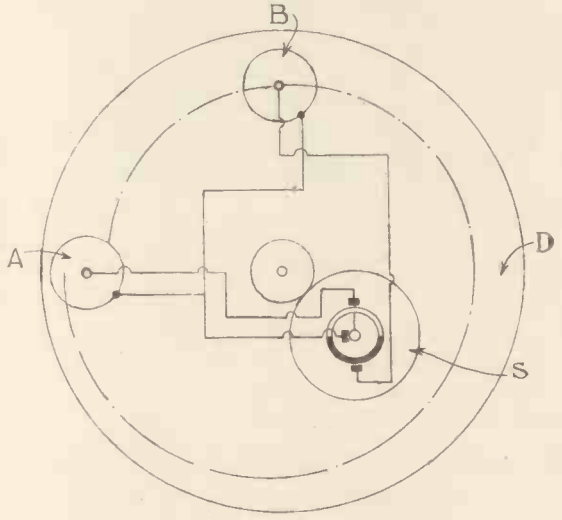
(Patent No. 445,665.)

The scanning electrodes of a cathode-ray tube are usually operated electrostatically, because this method is more economical and requires less power. But it has the disadvantage of producing a more or less "blurred" spot on the fluorescent screen at the wider angles of deflection, whereas magnetic control is more satisfactory in this respect.

But magnetic control requires the use of large coils, which in turn produce large stray fields; also they have a high self-inductance which makes it difficult to pass the high-frequency currents required for line scanning. According to the invention, these various difficulties are overcome by using powder-cored coils such as C for the line-scanning operation, and ordinary air-cored coils B for the comparatively low-frequency framing currents.—(*C. Lorenz Akt.*)



(Left) Combination of powder-cored and air cored coils for magnetic scanning. Patent No. 445,665.



(Right) Scheme for criss-cross scanning. Patent No. 445,894.

" Criss-cross " Scanning

(Patent No. 445,894.)

The image of a picture to be televised is projected by a system of lenses so that it occupies simultaneously two positions A, B at right-angles to each other. Both images are then scanned by the same disc D, but it will be seen that at A the direction of scanning is vertical, whilst at B it is horizontal.

A rotating switch S is arranged to bring the two photo-electric cells at A and B alternately in and out of circuit, so that first a series of vertical scanning-lines are taken and then a series of horizontal scanning lines. These are fed in succession to the transmitter so that the picture signals are built up from both. In reception the same method is used, in combination with two light-cells, to combine the results of horizontal and vertical scanning on the same viewing screen.

By altering the direction of the lines in this way, the tendency to flicker is reduced, and the " pattern," which is seen when the line-traverse is always horizontal or always vertical, is eliminated. In addition the criss-cross scan tends to improve definition.—(*Marconi's Wireless Telegraph Co., Ltd., H. M. Dowsett* and *L. E. Q. Walker.*)

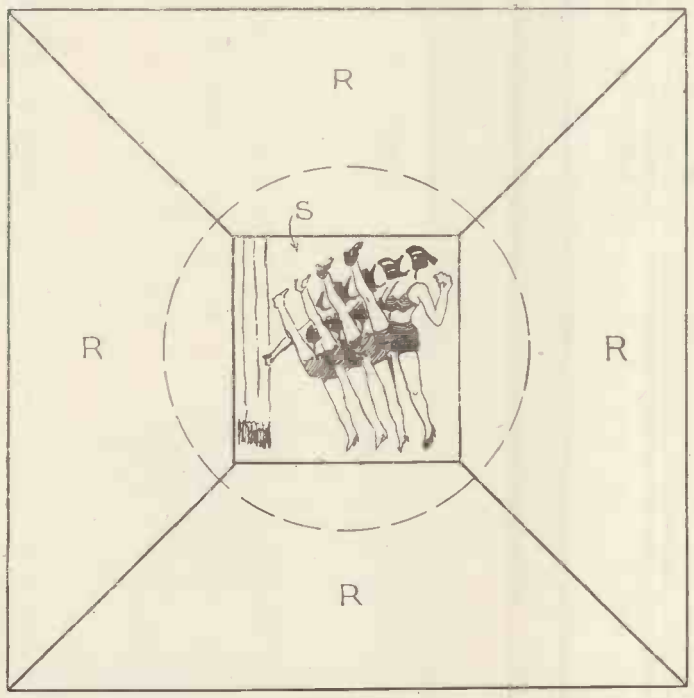
Removing the " Yellow "

(Patent No. 445,978.)

In order to remove the characteristic yellowish colour of a picture as seen on the fluorescent screen of a cathode-ray tube, the screen S is surrounded by a bevelled white surface R which is illuminated from the back with red or orange light. This is found to offset the yellow, and to present the picture in a more natural colour.

The width of the margin R is roughly the same as that of the

screen, and the two are preferably separated by a thin black gap. The light-intensity of the coloured area should be about equal to that of the picture on the screen.—(*The General Electric Co., Ltd.*, and *B. P. Dudding*.)



Scheme for removing the yellow from cathode-ray screen. Patent No. 445,978.

Transformer Couplings

(Patent No. 446,346.)

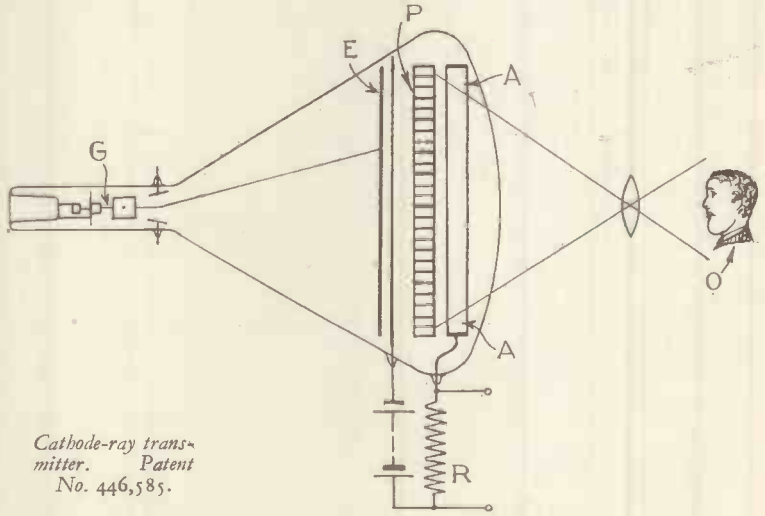
A transformer coupling is made to pass a wide band of frequencies, and to give a substantially straight-line response, by arranging the primary coil so that its inherent or natural frequency is higher than the highest frequency to be handled. Similarly the secondary coil is given a natural frequency lower than the lowest frequency. These conditions are ensured by the insertion of suitable resistances either in series or in shunt with both of the windings.—(*Radio Akt. D. S. Loewe.*)

Cathode-ray Transmitters

(Patent No. 446,585.)

In the Iconoscope type of transmitter the picture to be televised is first focused on to an electrode built up of a large number of minute photo-sensitive cells, and scanning is effected by sweeping the electron stream from the "gun" part of the tube over the image so formed. Since the electron stream impacts directly on the P.E. cells, it tends to damage them after a time.

In order to avoid this, the usual sensitive electrode is replaced by a so-called "storage" plate P, which contains a large number of small wires arranged parallel to its thickness. An image of the objest O is projected on to one side of the plate P, which is covered with photo-sensitive globules, whilst the scanning-ray from the gun G of the tube is swept over a transparent electrode E also coated with a photo-sensitive material. The electric charges built up by the image on one side of the plate P are thus discharged, from the opposite side, by the capacity effect of the electrode E. The resulting currents are collected by a ring-shaped anode A and produce signal voltages across the output resistance R.—(*D. M. Johnstone* and *Baird Television, Ltd.*)



Cathode-ray transmitter. Patent No. 446,585.

Summary of Other Television Patents

(Patent No. 445,507.)

Method of mounting a focusing or control electrode in a cathode-ray tube so that its position relative to other electrodes can be adjusted from outside the tube.—(*F. J. G. van den Bosch.*)

(Patent No. 445,820.)

Cathode-ray tube which is designed to produce a spot of high light-intensity from an electron stream moving at comparatively low velocity.—(*F. J. G. van den Bosch.*)

(Patent No. 445,912.)

Method of controlling the frame synchronising impulses in a system of interlaced scanning.—(*C. O. Browne.*)

(Patent No. 445,975.)

Cathode-ray tube filled with argon, neon or helium gas together with a small amount of hydrogen.—(*F. J. G. van den Bosch.*)

(Patent No. 446,171.)

Safety device for preventing excess voltage from damaging a cathode-ray television receiver.—(*Radio Akt. D. S. Loewe.*)

(Patent No. 446,618.)

Magnetic deflection circuit for a cathode-ray tube.—(*C. Lorenz Akt.*)

(Patent No. 446,661.)

Operation of a cathode-ray television transmitter of the Iconoscope type.—(*A. D. Blumlein* and *J. D. McGee.*)

(Patent No. 447,312.)

Means for regulating the amplification in a television set without affecting the correct half-tone character of the received picture.—(*Radio Akt. D. S. Loewe.*)

MARCONIPHONE TELEVISION RECEIVERS

MODEL 701 VISION AND ALL SOUND BROADCASTING

MODEL 702 VISION AND SOUND FOR B.B.C. TELEVISION

THE Marconiphone Co., Ltd., of Tottenham Court Road, London, N.W.1, have placed on the market two television receivers designated models 701 and 702. The first is intended for receiving

(a) pictures transmitted by either 405 line 50 frames per sec. interlaced or 240 line 25 frame per sec. systems.

(b) Sound on 41.5 megacycles accompanying the pictures transmitted on 45 megacycles.

(c) Broadcast sound programmes on

16.7 — 53 metres.
46 — 143 ,,
185 — 546 ,,
750 — 2,250 ,,

The photograph on the left shows the Marconiphone television receiver capable of receiving the Alexandra Palace sound and vision transmissions and also all broadcast sound. Model 702 (right) is for television and accompanying sound reception only.

It therefore comprises a complete broadcast receiver for vision on 6.7 metres and sound on all wavelengths.

The model 702 is designed for reception of the vision and sound television programmes only transmitted from Alexandra Palace.

The model 702 consists essentially of five units—the Emitron unit, the receiver unit, the synchronising unit, the power pack and the normal sound broadcast receiver.

The vision receiver comprises a six-valve tuned H.F. receiver fixed tuned to 45 megacycles (6.67 metres), which amplifies the signal from the aerial some 40,000 times and rectifies it ready for application to the Emitron. The variation in the signal caused by the modulation of the transmitter output directly controls the brightness of the spot.

The valve train consists of five MSP4's in series followed by an MSP41, the output of which is rectified by a D42. This output is then split and applied to both the Emitron and to the synchronising unit.

The synchronising unit consists of two valve-oscillators. The function of the first is for the line frequencies. This is called the high synchronising blocking oscillator. The other oscillator known as the low synchronising blocking oscillator is for the frame frequencies. The supplies for these units come from a power pack of special design.

The sound broadcasting receiver has been designed to deal with the television sound broadcasting at 41.5 megacycles (7.23 metres) as well as the normal long-wave, medium-wave, and two short wavebands. For the sound accompanying the televised pictures, the input to this is taken from the second stage of the television receiver unit.

Controls

To the left of the lens through which the screen is viewed is a horizontal panel, on which are mounted six controls for the following purposes:

1. *Line Hold Control* (rearmost). This regulates the timing of the horizontal scanning lines, being a variable resistance in the grid circuit of the high synchronising blocking oscillator.

2. *Frame Hold Control* (next rearmost). This controls the timing of the vertical positioning of the picture.

3. *Sensitivity Control* (centre). This control regulates the amplification of the vision signals being received, and hence the intensity of the picture.

4. *Contrast Control* (front). This adjusts the contrast between the light and dark portions of the picture. It is similar in effect to the sensitivity control, but differs in that it does not affect the synchronising.

5. *Brightness Control* (Between contrast and sensivity controls). This control adjusts the brightness of the picture on the screen.

6. *System Selector Switch.* This is a switch provided to adjust the instrument for one or the other of the alternative television systems.

In addition to the manual controls there are four knobs under a moulded cover. These are mainly for installation adjustments only, and once set will not need re-adjustment for a considerable period.

The Emitron tube is 9 in. in diameter and is supported vertically in the cabinet. A mirror inclined at 45 degrees to the vertical reflects the picture formed on the end of the tube through a large glass lens in the front of the raised centre portion of the cabinet. The effective picture size is 10 in. by 8 in.

The cabinet is of figured and straight-grained walnut. It is 46¼ ins. high, 37½ ins. wide and 20½ ins. deep. It has a raised centre portion to accommodate the viewing lens. This centre portion is fitted with a disappearing drop-down veneered flap. A bronze finished metal grille below the picture viewing aperture and symmetrically placed on the front of the cabinet, covers the loud-speaker aperture.

The voltage range of the instrument is 200—250 volts, 50 cycles a.c., and the mains consumption is 260 watts.

The 702 Receiver

As mentioned before the model 702 is for reception of the vision and sound transmissions from the Alexandra Palace only. The picture is formed on a 12 in. diameter Emitron tube supported vertically in the cabinet; this is reflected by a mirror in the cabinet lid, held at an angle of 45 degrees. The picture size is 6½ ins. by 8 ins.

The vision receiver consists of a 6-valve tuned H.F. set employing five MSP4 valves in series followed by an MSP41, the output from which is rectified by a D42 double diode. This unit is similar to the vision receiver employed in the model 701. The output from the double diode is applied in part to the control of the Emitron and in part to the frame and line synchronising circuits, exactly as in the receiver already described. The synchronising arrangements are also the same, although the mechanical arrangement is slightly different to facilitate its accommodation in the smaller cabinet. H.T. supply is provided by a separate power pack.

The sound receiver consists of a 4-valve superhet chassis employing an X41 (met) detector oscillator, a VMP4G (met) I.F. valve, MHD4 (met) detector, and first L.F. amplifier and N41 pentode. This chassis is supported between the shield surrounding the Emitron tube and the front of the cabinet. H.T. is supplied from a U12 rectifier in the separate power pack.

The controls are mounted beneath the lid on two panels running from front to back of the top board which masks the end of the tube. They comprise a brilliance control, a frame hold control, a line hold control, a system selector switch (all on the left-hand panel), and sound volume control, sound tuning control, sensivity control, contrast control, and mains switch. In addition a sub-control panel on the left-hand panel carries four controls which are permanently set.

LARGE SCREEN PROGRESS

THE first and exclusive account of the Scophony large screen picture was given in the July issue of TELEVISION AND SHORT-WAVE WORLD. We understand that since then further progress has been made and that consistently good large screen pictures are now being obtained. These results are largely due to the use of the special Scophony light valve and the efforts of the Scophony engineers under the control of Mr. S. Sagall, the founder and managing director of Scophony, Ltd., who built up the Scophony organisation from small beginnings and piloted it successfully through a considerable amount of hardship and against formidable odds.

The company has received a report on the Scophony system by Professor A. O. Rankine, D.Sc., F.Inst.P., F.R.S., Professor of Physics in the Imperial College of Science and Technology, and Mr. F. Twyman, F.Inst.P., F.R.S., managing director Adam Hilger, Ltd., who state that their investigations have convinced them that the four important inventions used are all based on sound optical principles and that they operate in practice conveniently and in accordance with the optical theory on which they are based. The amount of illumination obtainable is so great as to make feasible the projection of pictures of cinema screen size direct from the radio-ed impulses.

Mr. S. Sagall, Managing Director of Scophony Ltd.

Details are given in this issue of the undertaking which has been formed to take over the assets of the original Scophony private company of the same name set up six years ago to develop the Scophony television system.

Vision System

The issued capital consists of 560,000 ordinary 5s. shares, and a further offer of 140,000 shares at 7s. 6d., in the proportion of one for every four held. The new undertaking is closely associated with O. T. Falk & Co., Ltd., the investment bankers, and with E. K. Cole, Ltd., the radio manufacturers.

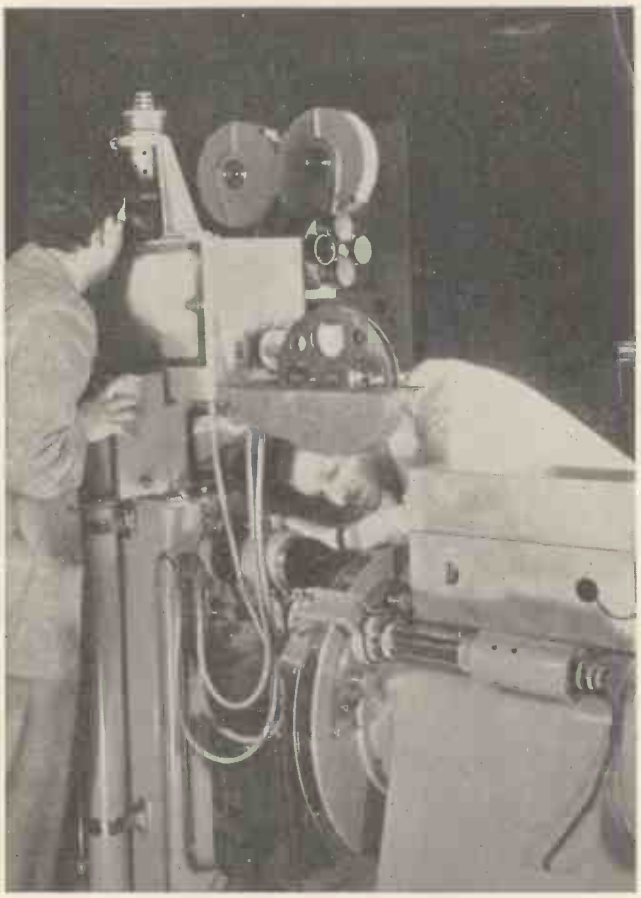
The board of directors of Scophony is stated to be representative of financial, cinema, radio and technical interests. The chairman of the company is Sir Maurice Bonham Carter.

FOR THE BEGINNER

HOW THE BAIRD INTERMEDIATE-FILM GEAR WORKS

Last month we published exclusive details of the remarkable amount of development achieved by the Baird Company. This article describes in greater detail the operation of the Baird intermediate-film apparatus.

THE Baird intermediate film apparatus consists of a film processing unit having a tank divided into separate compartments for the various stages of processing the film, i.e., developing, washing, fixing and washing. The machine employs 17.5 mm. negative film.



The Baird intermediate-film apparatus being used to transmit a studio scene.

The film drive, motion picture camera, sound recording camera, and sound reproducer head, are mounted on a framework which raises or lowers the film into the tank by means of a pneumatic jack. The subject to be televised is photographed with a motion picture camera of the intermittent type mounted directly above the developing compartment. The film, coated with a rapid and sensitive emulsion, after passing through the picture camera, is fed to a sound recording camera situated immediately below. From here the film passes into the processing tank, where it is developed and fixed in about half a minute. The finished negative is then fed into a scanning compartment, where it runs over a skate having a small slit across its centre, the compartment being filled with water. Provision has been made to adjust the processing times if required.

A beam of light from an automatic arc lamp is focused on to a glass window in the scanning compartment, and projects through the slit in the skate. The image of the moving film is then focused through a combination of lenses on to a scanning unit. This consists of an encased scanning disc having a circular trace of sixty minute apertures near the outer rim, revolving in vacuum at 6,000 r.p.m., i.e., four times every picture frame so as to provide a 240-line picture dissection scanned sequentially.

The variations of light passing through the apertures of the scanning disc are focused by a lens on to a photo-electric cell incorporated in an amplifier mounted above the scanning unit. The resultant signal then passes to the control room to be fed finally to the radio transmitter. A check monitor is also included with the system in order to view the outgoing picture.

The Synchronising Impulse Generator

Associated with the scanning unit is a high-frequency synchronising impulse generator consisting of a light source, optical system and photo-electric cell. This operates through sixty synchronising slits arranged in a circular trace with a slightly smaller radius than the scanning holes of the disc itself. This, in conjunction with the special amplifying system housed below the scanning unit, produces square topped synchronising impulses at the end of every scanning line.

The film having been scanned passes to a sound reproducing head which is mounted directly above the scanning compartment. There the film runs over a skate located in a small container supplied with a constant flow of water. A beam of light is concentrated on the sound track of the film as it passes over the skate, the variations of light being focused on to a photo-electric cell in order to produce the required sound signal. From the sound head the film passes on to a spool which dips into a trough of water, the film thus being wound in a wet state. At the end of the run the film is wound from the spool on to a wooden drum where it is allowed to dry and can be stored and transmitted again if required by means of a Telecine machine.

LITERATURE ON TELEVISION AND ALLIED SUBJECTS

Events in the field of television are moving so rapidly that most of the books on the subject are not fully comprehensive almost immediately after publication. The following review of the most suitable literature for the television student has been compiled at the request of a number of readers who wish to take up the study of the subject and although in some cases the publications referred to may not be entirely up to date the information contained in them provides sufficient groundwork of a reliable nature to enable the reader to follow modern developments.

Recent Progress

THERE have been developments in television during the past few months which up to the present have not been included in any published book, and readers are therefore referred to special articles which have appeared exclusively in this journal. Of particular interest is the article on the Scophony light relay, which, under the title "The Scophony Light Control," appeared in the May issue of this year. In the same issue is a comprehensive article "The Salient Facts of Television," which is a comprehensive survey of modern developments, including an outline of important features. The July issue contained a description of the results obtained with the Scophony system, the first published since this concern undertook the production of high-definition pictures by mechanical-optical methods.

The student of cathode-ray practice will find a simple explanation of the theory of the cathode-ray tube in the series of articles which appeared under the title "The ABC of the Cathode-ray Tube" in the issues dated April to November, 1935, inclusive. This series is by Mr. G. Parr a well-known authority on the cathode-ray tube. "The Principles and Practice of Electron Optics," by Dr. N. Levin, is another important series of articles on a subject which hitherto has not been treated in detail. This series commenced in the January issue of the present year and was continued until June with the exception of the May issue. Complete technical descriptions of the Baird and E.M.I. systems to be used at the Alexandra Palace were given in the November, 1935, issue while a complete description of the E.M.I. apparatus to be used in the coming transmissions was given in the March issue of the current year.

The beginner who wishes to take up the study of the cathode-ray tube will find the series of pictorial diagrams which appeared in the February, March and April issues of this year of particular help. Everyman's Practical Guide to the New Television in the October, 1935, issue will also be found invaluable to the beginner. The back issues referred to above are in most cases available from these offices.

Books on Television

First Principles of Television, by A. Dinsdale (1932). Chapman and Hall, Ltd.

Although this book may now be regarded as being somewhat out of date, it is a publication that can be highly recommended for it covers the whole field of the subject in the most complete manner ever attempted. It will therefore provide the student with a thorough knowledge of all the methods attempted up to the date of publication. Naturally a large part of the book is concerned with mechanical systems, but in view of the progress which is now being made with these it loses none of its value on this account. The contents include elementary considerations, a survey of light sensitive devices, details of early experiments, methods of synchronising, an analysis of image structure and a discussion on transmission channels. The price is 12s. 6d.

Television—Theory and Practice, by J. H. Reyner (1934). Chapman and Hall, Ltd.

This is another publication which provides a complete survey of the subject, though of course many developments have taken place since it was written. The student who wishes to obtain a grasp of the fundamentals will find this book very helpful, particularly as a good proportion of the book is devoted to cathode-ray systems and includes chapters on the cathode-ray tube, time-base circuits, cathode-ray television with details of special systems. No historical outline of the subject is given in this work and it deals entirely with practice up to the time of publication. The price is 12s. 6d.

Televiewing, by Ernest H. Robinson (1935). Selwyn and Blount, Ltd.

This is a popular type of book described by its author as explaining television in words that anyone can understand. It is intended for the non-technical reader and contains a concise outline of the principles involved. The history of the subject is combined with explanation, and descriptions are given of all the practical mechanical systems, and the operation of the cathode-ray tube. Included are details of the Iconoscope and image dissector and although the treatment is somewhat brief the information given is sufficient to enable the beginner to obtain a grasp of the principles upon which these devices operate. For the beginner who wishes to obtain an insight into present-day practice the book can be highly recommended. The price is 6s.

Radio Receiving and Television Tubes, by James A. Moyer and John F. Hostrel (1936). McGraw-Hill Publishing Co., Ltd., Aldwych House, W.C.2.

This book is the most comprehensive treatise yet published on valve design and it is the only one, so far as we are aware, that also includes the cathode-ray tube and acorn valve. It is essentially technical and in its 635 pages there are chapters including valve construction, fundamental principles of design, valve testing and applications, cathode-ray tubes and their applications. The book is of American origin and therefore deals principally with American type valves but the information given is so complete that it cannot but be of vital interest to the technician. The data concerning cathode-ray tubes is based upon current British practice. The

book is profusely illustrated and in all contains over a thousand drawings. The price is 24s.

Television Up-to-date, by Robert Hutchinson (1936). Published by University Tutorial Press and obtainable from H. Sanders and Co., 4 Grays Inn Road, London, W.C.1.

This is a thoroughly practical handbook and as it is of recent publication it contains a good deal of information which is up to date. Though it is intended for the student who has not very much knowledge of the subject it provides plenty of information of use to the more advanced reader, particularly as a large portion of the book is devoted to comparatively recent developments. Such apparatus as the Iconoscope and the Farnsworth dissector are dealt with in detail and a considerable amount of space is devoted to the cathode-ray tube. The elementary principles of electricity and low-definition television are dealt with quite briefly and the author has confined most of his attention to modern practice. The price is 2s. 10d. post free.

The Electrical Handicraftsman and Experimenter's Manual, by H. R. Langman and J. H. Moore (1936). The Technical Press, Ltd.

Although this book is not directly concerned with television it will prove a most useful manual for the experimenter. It is described as a new practical *vade mecum* for experimenters, inventors and all interested in the construction of electrical mechanisms. The book is unique in its way for it describes the construction and application of practically every electrical device, among which may be mentioned switches and contacting devices, electro magnets, devices for conversion of electrical energy into mechanical energy, models for illustrating basic principles, experimental electrical apparatus together with a considerable amount of data of value to the experimenter. It will prove a very valuable work of reference for the experimenter. The price is 7s. 6d.

Colour Cinematography, by Adrian Bernard Klein (1536). Chapman and Hall, Ltd.

This is another book which although not directly concerned with television will be of interest to experimenters and all those interested in picture projection. The book deals with the history, theory and practice of colour cinematography and describes the methods which have been employed. It is stated by the author that from three to five million pounds have been invested by the public for the perfecting of colour cinematography and it will be appreciated therefore that the research work, most of which is probably recorded in this volume, has been very considerable. The book contains 350 pages and is well illustrated. It is of a technical nature, but the explanations are not beyond the ability of the average reader who would be interested in the subject to follow. The price is 25s.

Modern Radio Communication, by J. H. Reyner (second edition, 1936). Sir Isaac Pitman and Sons, Ltd.

This book is a concise resumé of modern radio engineering practice intended for the advanced student. It covers the whole ground of transmission and reception in a brief manner, but in sufficient detail for the final stage of the City and Guilds Examination. There are separate chapters dealing with picture transmission and television, short-wave operation and the ultra-short waves. The treatment is almost entirely non-mathematical and although the work is not elementary it is written in such an explicit manner as to be easily understandable by the average technically-minded reader. The price is 7s. 6d.

The Cathode-ray Tube at Work, by John F. Rider (1935). Published in this country by Holiday and Hemmerdinger, Dolefield, Bridge Street, Manchester.

This book is of American origin. Very largely it is concerned with the use of the cathode-ray tube in the servicing and checking of radio receivers, but a complete explanation is given of the various types of cathode-ray tube and their operation. The design of cathode-ray oscillographs is dealt with also, but primarily the object of the author has been to explain their applications. Some of the principal chapter headings include features such as the theory of the tube, sweep circuits, commercial cathode-ray oscillographs, practical application of the cathode-ray oscillograph, alignment of tuned circuits, radio testing, transmitter adjustment, etc., etc. The book is very fully illustrated, particularly with untouched photographs of oscillograms taken in the author's laboratory. The use of the tube in connection with television has been purposely omitted, but there is sufficient information on the operation of the tube to enable the reader to grasp the fundamental principles in this connection.

Television, by M. G. Scroggie (1935). Blackie and Son, Ltd.

This is a small handbook of 68 pages in which the author presents a brief survey of television in an easily understandable form. Principles, equipment, mechanical and cathode-ray systems and special devices are explained in non-technical language. The book can be recommended as a simple introduction to the subject.

Popular Television, by H. J. Barton-Chapple (1935. Sir Isaac Pitman and Sons, Ltd.

This is another book that will be found useful to the beginner who has a limited knowledge of radio, but is uninformed regarding television. Explanations are given of the apparatus used, including brief descriptions of the more recent developments. In a total of 109 pages the author manages to cover the ground in a concise and informative manner. The price is 2s. 6d.

Photo-electric and Selenium Cells, by L. J. Fielding (1935). Chapman and Hall, Ltd.

This book surveys the field of photo-electricity in a manner which can be readily understood by the non-technical person. It is a practical treatise and provides information on the construction of apparatus within the ability of the amateur. Constructional details of selenium cells and photo-cell amplifiers are given. The latter part of the book is devoted to suggested and industrial applications of light cells of various types. The price is 6s.

Television Reception, by Manfred von Ardenne, translated by O. S. Puckle (1936). Chapman and Hall, Ltd.

This is the only book published up to the present describing in detail the construction and operation of a modern cathode-ray tube receiver for the reception of the high-definition television broadcasting. Sufficient practical information is given to enable the average person with some knowledge of wireless to build a complete combined sight and sound receiver. A full review of this work appears on another page in this issue. The book costs 10s. 6d. and it can be highly recommended

TELEVISION AND SHORT-WAVE WORLD

STUDIO & SCREEN

A MONTHLY CAUSERIE on Television Personalities and Topics

by K. P. HUNT
Editor of "Radio Pictorial"

CLAD in their curious white smocks, all the members of the B.B.C.'s television staff are now at Alexandra Palace busily engaged in their new duties.

These white smocks, which everyone—even the girl secretaries—wear, look something like ecclesiastical surplices, and they form an arresting contrast to the dark linoleum of the floors and the studio drapings.

Gerald Cock himself, the B.B.C.'s Television Chief, of course does not appear in this apparel, nor does Hyam ("Bumps") Greenbaum, the television orchestra director. But apart from these two, so far as I can gather, this buff-white attire is to be a sort of permanent insignia of office, and Gerald Cock evidently intends thereby to begin a sartorial tradition similar to that so universally respected by producers in the film world.

The Television Orchestra

Mentioning "Bumps" Greenbaum reminds me to tell you that his 22-piece television orchestra is now rehearsing daily. At the moment of writing, the entire personnel of the band has been settled with the exception, I understand, of the double bass.

The composition of this orchestra, which undoubtedly will be one of the most capable in the country, embraces a string section consisting of three first violins, two second violins, one viola, one 'cello and one bass; a wood-wind section comprising one flute, one oboe, two clarinets and one bassoon; and a brass section formed of two trombones, two horns, one tenor trombone, piano and percussion.

I hear that two or more saxophone players also will be added. The names of the players are being kept a close secret until their appointments are confirmed, but I am able to reveal that the leader of this super orchestra is none other than Boris Pecker, who, as first violin, should be a very useful acquisition.

Boris, of course, is a well-known musician, and, if I remember rightly, there was some talk about six years ago of his joining the B.B.C. Symphony Orchestra.

It is already clear that this television orchestra will be an exceedingly versatile combination, and in this respect it will follow the versatility of "Bumps" himself.

"Bumps" is of medium height, very dark, and I might describe him as healthily plump. He is very obviously a musician, and I have noticed that occasional dreamy expression in his eye which bespeaks the artist. Already he is very popular with the members of his orchestra, and during the short time they have been rehearsing, I hear that they have all been thoroughly amazed by his wide knowledge of every form of music.

Here is a man who, for instance,

Miss Mary Allan, who has been appointed Assistant in charge of Make-up and Wardrobe in the B.B.C. Television Department.

conducts a variety orchestra in the afternoon, and then goes home to arrange century-old Scarlatti music!

"The Television Orchestra," he told me, "must be capable of playing anything and everything, from jazz to symphony."

I do not think anything like so much trouble has been taken anywhere else to find suitable players for an orchestra as has been necessary in the case of this television orchestra. It has required three months of intensive search, and during that time no fewer than 300 auditions have been given. All to find the 22 men who now have got the jobs.

"Naturally I considered, first of all, the musicianship of the applicants," "Bumps" explained to me the other day. "At the same time, the question of appearance obviously is important. For instance, a man with bright red hair might appear in certain circumstances as an albino! Which, you will agree, would not be at all attractive.

"So far as faces are concerned, I was looking chiefly for men without obtrusive features, who would look well in close-up shots."

Exactly how the orchestra will be shown on the television screen has not yet been settled, but it is certain that they will appear not only *en masse*, but that we shall see occasional close-ups of key players.

Many members of this orchestra, not a man of which is more than 35, have come from London; although, I understand, about one-third have been brought in from the provinces, chiefly Manchester and Birmingham.

I then asked Mr. Greenbaum what sort of clothes the orchestra will wear, but it appears that this has not yet been decided.

The Orchestra's Uniform

There is likely, however, to be a standard uniform, consisting of plain black trousers and a special coat of distinctive design, the exact colour of which also has not yet been settled. It seems probable that it will be of some shade of red, which will televise off-white, with black facings

THE TELEVISION ORCHESTRA

giving a good contrast. Everyone will don this uniform except "Bumps" himself, who will probably wear an ordinary lounge suit during the afternoon broadcasts and the usual tails in the evening.

I forgot to tell you last month that "Bumps" was for three years musical director to C. B. Cochran. From 1916 to 1927 he was second violin in Sir Henry Wood's Queen's Hall orchestra, and from 1923 to 1926 worked for the famous Diaghileff, where he acquired a thorough knowledge of ballet music, which no doubt will be of tremendous use to him in his present work, for ballet is expected to figure considerably in the B.B.C.'s new television programmes.

"Bumps" was in Spain not long ago. He had only a week's holiday, and went over there to join his wife, Sidonie Goosens, the famous B.B.C. harpist, who had been there for a month.

He told me that she had been stopping at a place where there were no telephones or telegraphs, and when the trouble broke out he began to get frightfully anxious.

So he made his way over there and finally got her to the nearest port, Port Bou, where they boarded the British man o'war "Gallant," which took them to Marseilles.

"We found the Spanish people very kind and courteous," "Bumps" said, but adding with a twinkle in his eye, "although Spain is not exactly a healthy spot to be in just now." He told me that he and his party were practically the last English people to get away from the port. So the barrier closed on "Bumps."

The Make-up Expert

One of the most significant appointments of the month in the B.B.C.'s television department is that of Miss Mary Allan, as make-up expert and wardrobe mistress. This charming lady is as fully fitted as anyone could be for the onerous post she has undertaken.

Of medium height, blue eyes, fair complexion, this alert and very attractive girl is tremendously keen on problems of make-up in which she has specialised for years.

She told me that it was at the age of 18 that she was first fired with an ambition to study make-up in detail. It came about this way. She was made up as an old woman of 90, and the character was such a success that Sir Gerald du Maurier said: "Why on earth don't you wait until you *are* 90 before you play that part?"

She was first seriously interested in make-up, however, when Oscar Asche insisted that all members of the cast of "Chu Chin Chow" should take special make-up courses.

Mary Allan, in fact, has very definite ideas about make-up. She has made a special study of the human skin and has even undergone long instruction in surgery. She feels that make-up to-day is much more important than ever before in the history of entertainment. She pointed out to me, for instance, that the improved lighting of all kinds in studios and stages is merciless and requires the most exacting make-up as compared with the old gas illuminnation of only a few years ago.

Experiments

Mary tries everything on herself first, generally at home, and she is now experimenting continuously to discover the ideal make-up for television performers which will not harm the skin. The exact colouring which will be required for television, however, is being determined experimentally by making-up Miss Elizabeth Cowell, one of the two television announcer-hostesses, and Leslie Mitchell, the announcer, Miss Bligh being away ill at present.

Mary has to her credit 15 years' experience of make-up problems. She has been associated with the films, and has been making-up at Elstree until quite recently. She is already very popular with the Alexandra Palace staff.

The contract for supplies of make-up to Alexandra Palace obviously is a valuable one, and a little bird told me that three firms are competing for it. They are now sending in material, and tests are being conducted on a closed circuit to determine its efficacy as actually seen on the television screen. A small committee of television producers will judge the result, and on this basis the contract will be awarded.

Learning their Jobs

Talking of the two television hostess-announcers reminds me that they have been frightfully busy during practically the whole of the month, preparing themselves for their new work. They have done a lot of announcing, most of which has been recorded and played back to them, so that they can study and correct any defects.

This television announcing job is by no means so simple as many people seem to think. These two girls did a four-hour broadcast the other day. They first have to write their announcements and then memorise them, for it is obviously impossible for a television announcer to read announcements as is usually done in aural broadcasting.

Cecil Madden

Cecil Madden, whom I mentioned only briefly last month, already is taking quite an important part in the preparations for the television programmes. He is one of the four producers under Mr. D. H. Munro, and brings to his new task a wide variety of experience.

It is to him that credit really belongs for the popular "Saturday Magazine" feature in the ordinary broadcast programmes. Almost two years ago he introduced into the B.B.C.'s Empire programmes a feature then known as the "Empire Gossip Hour," the title of which was later changed to "Empire Magazine." The feature in the ordinary programmes was pretty closely modelled on this prototype.

Cecil is in the early thirties, fair, tall, and with a dry sense of humour. I can best describe him as a man who is absolutely teeming with ideas, which, of course, was clearly evidenced by the tremendous advances in the B.B.C.'s Empire programmes soon after he took charge.

Before joining the B.B.C., he had written and produced quite a number of plays in the West End, and there is no doubt about his tremendous enthusiasm for television.

If Cecil Madden has one fault, it is that he tries to work for too many hours out of the 24. I know for a fact that when he was doing the Empire programmes he often spent all day rehearsing and then practically all night broadcasting.

At the present moment, I hear that he is co-ordinating the ideas of the various producers, and I elicited one very important piece of news about

BOOKING TELEVISION ARTISTS

an aspect of the work which Mr. Madden is now going into with great thoroughness. He is getting together a complete list of variety artists suitable for television, not only from England, but all over the world.

He believes that British television should have an international appeal, and that material should be obtained from anywhere in the world if it is suitable. He disclosed to me that he is preparing an index giving a full description of everybody who possibly may offer likely material, and I got the impression that this human dynamo of activity intends to stop at nothing in order to get the very best for British television.

The Possibilities of Television

" I feel," he told me, " that we can bring almost anything to the television screen, from the world's most famous men and women even down to prize pigeons. There is absolutely no limit to what we can do indoor or outdoor."

When Cecil got going explaining these points there was no stopping him. " We might give not only excerpts of current plays, but televiewers might see the author himself who would tell them all about how he wrote the play.

" We could even make the game of chess exciting," Mr. Madden said with emphasis, his eyes glowing.

The impression I got from him was that a great drive will be made to secure as much topicality as possible in the forthcoming television programmes. Mr. Madden mentioned that on the eve of the Derby, for example, the B.B.C. might be able to bring the winning jockey of this classic race to the television studio, and, if required, also the winning gee-gee ! " In fact," he added, " we could bring the whole race to life in a way which hitherto has been totally impossible in the history of entertainment."

At the present moment, so far as I have been able to glean, the productions manager and four producers at Alexandra Palace are not specialising, but are working as a team.

The Stage Managers

Two of the other Alexandra Palace officials whom I mentioned only briefly last month but who are destined to play an important part in the programmes, are Peter Bax and Harry Pringle, the stage managers.

Curly-headed and plump, Peter is very urbane and jolly. He is what you might call the literary type. He is an universal favourite and already seems to be known as " Peter " to everyone.

Here is a man absolutely steeped in stage lore. He has just written a book on stage management which is unique and doubtless soon will become a sort of classic with all amateur dramatic societies. The book, which I have not yet actually seen, contains, I am told, a veritable mine of backstage information never given to the public before.

Peter Bax and Harry Pringle, the stage managers at the Alexandra Palace.

Harry Pringle, who also brings a great wealth of experience to his new task, is a completely different sort of man. I can best picture him to you as the music-hall type. He, too, is very jovial, is rather thick-set, and has eyes with a perpetual twinkle in them. Harry has travelled extensively all over the world, and he knows so many people that nowadays he seldom meets anyone connected with the stage whom he does not know.

The high light in Harry Pringle's career, of course, was that he was stage manager of Radiolympia last year, a job which he carried out with great skill and satisfaction to all concerned.

Booking the Artists

Yet another appointment has been made to the B.B.C.'s staff during the month—that of Mr. W. L. Streeton. He is announced as assistant in the Programme Contracts Department but will deal with television artists.

I hear that he will not be domiciled at Alexandra Palace like the rest of the television staff, but will work at Broadcasting House in conjunction with Arthur Brown who, as readers know, is responsible for the booking of artists in the B.B.C.'s aural programmes.

Streeton gives you the impression of being an easy-going, easy-to-get-on-with sort of fellow, but actually he conceals a great alertness of mind behind that somewhat placid exterior.

At one time he did a lot of film publicity work for Pathé, Fox and other well-known firms, but when I first met him, some years ago, he was the artists' and recording manager to The Gramophone Company, a post which he filled with conspicuous success for eight or more years. At that period, practically everybody of any note recorded for H.M.V., including all the principal dance bands, and naturally Streeton came into contact with everyone in the show business. This will be a tremendous help to him in his new sphere, and I learn that he has already tentatively booked a large number of artists, actual details of which, however, are quite secret at present.

B.B.C. Dance Orchestra

I mentioned last month that the first dance band in the new television programmes would be Henry Hall and the B.B.C. Dance Orchestra. A few Sundays ago I attended a cricket

TELEVISION AT RADIOLYMPIA?

match in which members of the B.B.C. Dance Orchestra took part. Henry then confirmed to me that his band would certainly be the first on the television screen.

I understand that the special rostrum on which this and other dance bands may appear in the television studio is being built in three steps. This will enable the band to be grouped together in something like a pyramid formation so that the whole band can be seen at once. The rostrum will be painted matt black like the floor of the studio itself, to avoid reflections and glare, and it is probable that the members of the band will all sit on steel chairs.

Velvet curtains of different shades will be used at the back and sides, so you can imagine that the B.B.C. Dance Orchestra in this setting will indeed look very attractive.

First Features

I hear that one of the first regular television programmes will be "The Television Magazine," a sort of " Saturday Magazine" - cum - " In Town To-Night " feature. Possibly Leslie Baily and Jack Cannell will have the difficult task of finding and writing material for this feature. Both of them discovered many of the personalities who contributed to "In Town To-night."

The first film to be transmitted from Alexandra Palace is likely to be either a Mickey Mouse film or one of Madeleine Carroll in " I was a Spy."

Since writing the above, news has leaked out that the B.B.C. intends to broadcast a television programme several times daily from Alexandra Palace to Radiolympia during the currency of the Exhibition.

Test transmissions of the Alexandra Palace apparatus actually began a fortnight ago, first, sound only, then vision, but so far as can be conjectured at present the regular daily television programme will not begin until October 1 or thereabouts.

Transmissions for Radiolympia

The Radiolympia transmissions are an entirely distinct proposition and apparently are intended merely to take advantage of the opportunity available at Radiolympia for showing the public exactly what the new high-definition pictures will be like.

B.B.C. officials are extremely reticent regarding these proposed Radiolympia programmes, but already it is known that a number of artists have received contracts for the work.

The probability is, I gather, that transmissions will be given twice a day during the ten days of the Exhibition. These visual programmes will last about half-an-hour each.

Early Bookings

One of the acts which I hear has been booked for Radiolympia is called The Three Admirals and is, of course, well known to ordinary listeners. This is a close harmony act now composed of Norman Bartlett, Joe Lee and Harry Lee.

Originally, the act consisted of four men and two girls. That was in Kansas City where they began by appearing at church concerts and small local entertainments. Following a tour of the States, the act split up. Norman Bartlett is now the only survivor of the original partnership. Six years ago he joined up with the Lee Brothers and when they first hit Britain a few years back they did not immediately meet with much success. Slowly, however, their merit was recognised and they began broadcasting and recording. The Three Admirals appeared in " Anything Goes " at the Palace; they also did film work with Max Rheinhardt and the last " Radio Parade," in which they played the parts of telephone operators.

More interesting still is the booking of crooner Helen McKay for the Radiolympia television transmissions.

I met this charming red-head last week as she was dashing off to a television rehearsal at Alexandra Palace. Here is a really clever girl who should do very well in this new sphere.

Yet few of the many thousands of people who may see her on the television screen will have the faintest idea of her amazing story.

She was a shop-girl who made good! She used to work behind the counter at Marshall and Snellgrove's, but got tired of it and begged her mother to allow her to train for a theatrical career.

Eventually she was allowed 12 dancing lessons, her great ambition at that time being to become a famous ballerina. She did, in fact, dance in a touring ballet company but later did a good deal of chorus work, notably in " Silver Wings " and C. B. Cochran's spectacular review, " One damn thing after another."

Then she decided to make a change and began a double act with Ian Hardy with whom she appeared in cabaret at the Kit Cat Restaurant and at the Café de Paris. Then came a venture into non-stop variety at the Leicester Square Theatre, appearances with the Crawford Sisters and in Philip Ridgeway's " Parades." She has also broadcast to the Empire.

One day she was looking over some new numbers in a music publisher's office in Charing Cross Road. More or less unconsciously she was humming over a chorus to herself. Someone in the doorway stopped, looked and listened. It was Lew Stone, the famous radio band leader who, there and then, signed her up as a vocalist with his band and with whom she quickly achieved radio fame as one of our outstanding dance band vocalists.

Since leaving Lew Stone's band, Helen has been fre-lancing with Sydney Shasid's band, Sydney Bayne's, Oscar Rabin, Bram Martin and others. At present she is doing late night cabaret work again and is shortly to broadcast, I hear, from Luxembourg.

This tall slim girl is a dynamo of enthusiasm. She is only in her early twenties so has plenty of time to become a big television star.

Publicising Television

Complete details of the remainder of the Radiolympia programmes are not available at the time of writing, and it is to be deplored that even within a few days of the expected transmissions a hush-hush policy is still being pursued, the wisdom of which I confess is not apparent, for it renders it unnecessarily difficult for the Press to play its part in helping the B.B.C. and generally publicising the advent of this latest and most wonderful development in the radio field.

It now seems practically certain, however, that before many weeks have passed, the first regular television programmes will be definitely announced, and I hope in these notes next month to be able to give actual details.

H.M.V. TELERADIO

His Master's Voice are to show two of their television receivers at Radiolympia which opens August 26. Here are the first advance details of these two receivers.

This is the H.M.V. model 900 television and all-wave receiver which is housed in a figured and straight-grained walnut cabinet. It is approximately 4 ft. high, a little over 3 ft. wide, and 20 in. deep. As the viewing mirror occupies the total width of the cabinet lid, many viewers can look in simultaneously.

AMONGST the new H.M.V. receivers to be on show for the first time this year are two complete television receivers, models 900 and 901. These two receivers will be available for the general public before the first regular television transmissions are radiated from the Alexandra Palace, but at the moment no orders can be taken, while the selling price has yet to be decided.

Model 900 is a combination television and radio instrument of a comprehensive type. It is suitable for reception of E.M.I. 405 line 50 frames per second, or the Baird 240 line 25 frames per second. Either system can be received merely by the adjustment of a master switch.

The 200 ft. high television aerial at Hayes.

The receiver unit is of the tuned high-frequency type, pre-set tuned to 45 megacycles, while the sound receiver—also pre-set tuned to 41.5 megacycles is a conventional ultra short-wave super-het.

In addition to ultra short-wave reception, a standard all-wave broadcast receiver is embodied tuning from 16½ metres to 140 metres, and from 185 to 2,250 metres.

The Emitron or cathode ray unit has a 12 in. face, giving a picture approximately 10 by 8 in. Owing to the length of this tube it is mounted vertically, the picture being reflected by a mirror mounted to an angle of 45 degrees. This mirror, as can be seen from the illustration, occupies the entire inside of the cabinet lid.

This wide angle vision enables a number of viewers to look-in simultaneously. In addition there is no need to use this receiver in a darkened room providing light is not allowed directly to fall on the face of the tube.

There are 23 valves in the model 900, six in the super-het sound receiver, two in the power pack, and 15 in the vision and synchronising units. In spite of all these valves, as the sound and vision receivers are pre-set, the number of active controls are kept down to six.

Model 901 is almost identical with model 900 as far as reception of television signals is concerned, but no provision has been made for the reception of normal broadcasting. This model is intended for use in addition to the standard family receiver. It makes use of no less than 22 valves, four being in the super-het sound receiver, three in the power pack, and 15 in the vision receiver and synchronising units. Sound and vision receivers are again pre-set to the required frequency.

Power consumption from the mains is approximately 230 watts for both models, giving approximately 4½ hours service for the cost of one unit.

These receivers are supplied complete with multi-short-wave di-pole aerial cut to length, with necessary insulators and transposed lead-in wires.

The aerial can be mounted internally as required, while provision can be made for the aerial to be no less than 50 yards away.

Scottish Short-wave Radio and Television League

This League is sponsored by the *Daily Record* and holds its meetings at Newspaper House, Pope Street, Glasgow, each Friday at 7.45 p.m. Mr. J. L. Baird is the hon. president, and arrangements have been made for a series of lectures on short-waves, television, and kindred subjects.

The annual subscription is 2s. 6d., and full details can be obtained from the secretary, Mr. James Neilson, 14 Bolivar Terrace, Glasgow, S.2.

"THE EIFFEL TOWER TELEVISION" (*Continued from page 497*)

the "lag" phenomena apparent when gas cells are used. In reality, with certain pressures and appropriate gases the response of the gas cells, although diminishing with increase of frequency, still remains superior to that of the vacuum cells. There is room in the succession of amplifiers to re-establish the equilibrium between the low-frequency and the high-frequency limits, but instead of being confined to a photo-electric current of 25 or 30 micro-amperes per lumen we can reach 200 micro-amperes per lumen, and if we were limited to a frequency of 100,000 (90-line scanning) a sensitivity of 400 micro-amperes per lumen.

The last word in this respect has not yet been said either. Certain writers speak of a gain of 100,000 to 1,000,000 being obtained with secondary emission cells. We are much more modest, and at the point which we have reached with an apparatus for optical and mechanical scene photography a multiplication by 100 would suffice to solve practically all the problems. Without anticipating the future, but referring simply to what is already in use, we can count on a photo-electric sensitivity of 200 micro-amperes per lumen.

We may conclude from this that a white signal, scanned by a two-spiral apparatus for scenic photography, will provide for us in the circuit of the cell a current of 0.003 μa. It was the verification of this formula which allowed us to accept, in 1935, the conditions formulated by Les Services Techniques de la Radiodiffusion concerning direct scenic photography.

Production of the Synchronising Signal

The method of synchronising consists in the production of a short pulse at the end of each line lasting for 1/100th of the line duration. The sense of the signal is opposite to that of the modulating impulses which brighten the picture. The picture synchronising impulse is simply obtained by suppressing the penultimate line at the bottom of the picture.

Both these synchronising signals are produced by the aid of a scanning disc and photo-cell, the disc being punched with a series of holes or slits through which the light passes to the cell. The light is so arranged that at the end of each scanning line the auxiliary cell is excited and sends a short current impulse to a local thyratron relay circuit. This gives an amplified pulse of as short a duration as required.

In practice this method presents difficulties in the case of multi-spiral discs. Such a disc can only have n/m synchronising slits where n is the number of lines and m the number of spirals.

It is therefore not possible to mask a slit for the picture signal as it would occur m times too often. Instead it is preferable to suppress the line signal electrically by applying an opposing e.m.f. of convenient phase and amplitude. This impulse is obtained from a small separate disc and synchronous motor.

Fig. 4 shows the composition of the two synchronising signals. The $(n-1)$th signal is suppressed by the opposing e.m.f. produced by the components.

The insertion of the synchronising signals in the modulation is accomplished without difficulty by altering the screen volts of the pentode in the amplifier by the amplified "kicks" of the impulse, the degree of modulation being controlled by a cathode-ray tube monitor.

At the output terminals of the amplifier a high vacuum C.R. tube serves to monitor the picture and a gas-focused tube is used to control the depth of modulation.

Description of the Transmitter

The transmitter is of the master oscillator type with H.F. amplification. The stages comprise:

(1) The master oscillator having two pentodes of 15 W dissipation.
(2) A separator stage with similar pentodes (P.15).
(3) A first stage with two 250 W triodes type E.656.
(4) A second stage with two 350 W triodes type E.756.
(5) The output stage having two ultra-short wave triodes type E.1456.

In addition there are two power stages for applying the modulating signal to the anode of the 756 valves. These stages use a 200 W valve, type E.200M., feeding two E500M triodes in parallel.

The choice of pentodes for the master oscillator has several advantages from the point of view of frequency stability since they are less dependent on anode voltage for stability of frequency. In the buffer stage the use of pentodes avoids the disadvantage of neutrodyning—an important point in avoiding tendency to instability in the master oscillator. Both these stages are fed from a separate rectifier supply. The heater circuits are supplied from a small motor generator giving 4 volts. The anode and screen voltages are 500 and 150 respectively.

For the following stages, only triodes can be employed, since screen-grid or pentode valves do not allow a sufficiently short transit time for amplification of the ultra-short waves. The greatest care was taken in the layout and wiring of these stages and special insulating material was used in the high-frequency sections.

The last stage has two water-cooled valves, type E1456, which have very low internal self-capacity and which perform satisfactorily on wavelengths down to 3 metres. The two valves supply 2 or 3 kW of power to the feeder.

Aerial

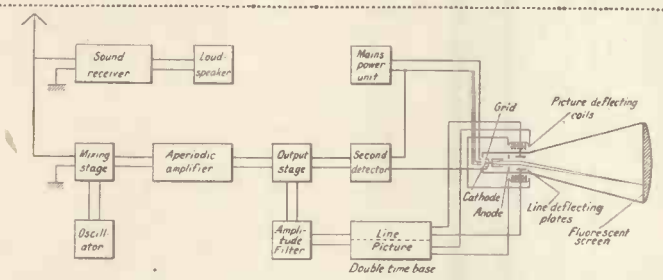
The aerial comprises the aerial proper and a tubular feeder cable which runs the full height of the Eiffel Tower. The feeder is connected at the fourth story of the tower with the aerial through connecting boxes. The aerial is of a complex type necessitated by the structure of the tower and the impossibility of erecting it at the extreme summit. The aerial consists of four upright rods spaced equi-distant on an 8-metre circle, each rod being one wavelength long. Two are fed direct from the connecting boxes and two by means of horizontal feeders joined to the mid-points of the rods. This arrangement is the most favourable for uniform radiation consistent with the disposition of the tower structure, and with a radiated power of 1 kW from the doublet it was estimated that a field strength of 100 mV per metre at 5 km. was obtainable. (5 km. = 3 miles approximately.—Ed.)

"TELEVISION RECEPTION"

Construction and Operation of a Cathode-ray Tube Receiver

THIS is an English edition of a book by Manfred von Ardenne describing in detail the complete construction of a combined vision and sound cathode-ray tube receiver. In his foreword von Ardenne says: "The purpose of this publication is to describe in its entirety the hitherto carefully guarded secrets of a few engineers, and to provide an impulse towards activity on the part of amateurs in the newest and perhaps most interesting branch of electrical engineering.

The author commences by analysing the problems of television and then outlines the methods by means of which they may be overcome and the apparatus necessary. The second chapter deals in detail with the cathode-ray tube and its operation. Included in this chapter are the reasons for the superiority of the hard tube over the gas-focused type for television, the influence of the space charge, the ray generating system and the characteristics of the fluorescent screen.



Schematic diagram of the television receiver described in "Television Reception."

Practical constructional details of a cathode-ray tube receiver commence in Chapter III, which deals with the power unit. Parts lists are provided which include the values of the components used. The same treatment is accorded the time bases, complete circuit diagrams, photographs and component values being given. Included also are some notes on time base faults and their correction. Synchronisation is dealt with in Chapter V, the method of filtering out the signals being described in detail.

The picture receiver is described in detail in Chapter VII and in this case again all the required information for building the receiver is given. The receiver is a super-het employing six valves. Although no layout is provided the photographs are sufficiently clear to enable the receiver to be constructed from the information provided. The sound receiver is described in Chapter VIII and the book closes with a description of the results obtained with this apparatus and several photographs of pictures actually received.

Coming at the present time and from the pen of such a well-known authority as von Ardenne this book supplies a real need, particularly as it has been adapted to English requirements to a very large extent. The translator is O. S. Puckle, A.M.I.E.E., who is a member of the research staff of A.C. Cossor, Ltd., and was responsible in collaboration with Mr. L. A. Bedford for the development of the Cossor velocity-modulation system. The price of the book is 10s. 6d. and it is published by Chapman and Hall, Ltd.

Our Readers' Views

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

Long-distance Reception on Television Wavelength

SIR,

As a result of experimental work carried out on ultra-short wavelengths of the order of 5 metres at various times over a period extending back for over ten years I have been led to give up all hope of "DX" ranges in the ordinary way. It is more or less generally accepted now that waves below 8 metres are not likely to be deflected back to earth by the upper ionised layers of atmosphere except, perhaps, under certain rare freak conditions. One of these freaks must have occurred a few nights ago when I received what was unquestionably a German programme. The details are as follows:

My receiver is a simple super-regenerative with an oscillating detector, a separate quench-oscillator valve and one stage of L.F. amplification. The aerial used was an ordinary broadcast receiving aerial consisting of a single outdoor wire 60 ft. long and about 25 ft. above the ground.

On Friday, August 14, between 8.30 and 9.00 p.m. I was listening on 7.2 metres in the hope that I might pick up some preliminary tests from Alexandra Palace and I at once heard a loud sound broadcast programme, which, however, proved to be a commentary in German on some sort of sporting event involving a good deal of cheering, playing of bands and so forth. At the same time on a slightly lower wavelength of about 6.8 metres it was possible to hear more faintly a television picture channel in operation. I have very little doubt that I was receiving the sound and vision channels of the Berlin television transmitter being used for the Olympic Games broadcast.

The sound signal was behaving in the manner usual with short-wave long-distance reception, *i.e.*, there was slow fading with more rapid regular superimposed fading of about a two seconds period. At times the signal was so loud that the quench valve could be dispensed with and the receiver used as a straight two-valve receiver with a moderate amount of reaction, signals being good headphone strength.

Unfortunately, although I have a cathode-ray tube with time-base circuits available things were not in a sufficient state of readiness to receive the picture.

The time when the reception took place was the half-hour at sunset which precedes darkness. Signals had disappeared at 9 p.m. when darkness had just about completely fallen at my locality (near London).

I have listened on the same wavelength at the same time for two or three evenings since, but have not repeated the reception yet.

E. HOWARD ROBINSON

(Cheam, Surrey).

Direction-finding Equipment

Used by

The Southall Radio Society

THE Southall Radio Society was founded six years ago, and from the earliest days short-wave radio held considerable interest for a large proportion of its members. Morse classes were organised to assist those who wished to take full advantage of the short-wave transmissions or to qualify for experimental licences, and for the past four years an energetic short-wave section has been in existence.

Among other activities of the section, much practical work has been done in direction-finding, and members have competed from time to time with success in direction-finding contests. Last year, teams from Southall were placed first and second in the contest organised by the Golders Green and Hendon Radio Scientific Society, and this year Southall entered four teams, only achieving, however, third, fourth, sixth and seventh places.

Field Days

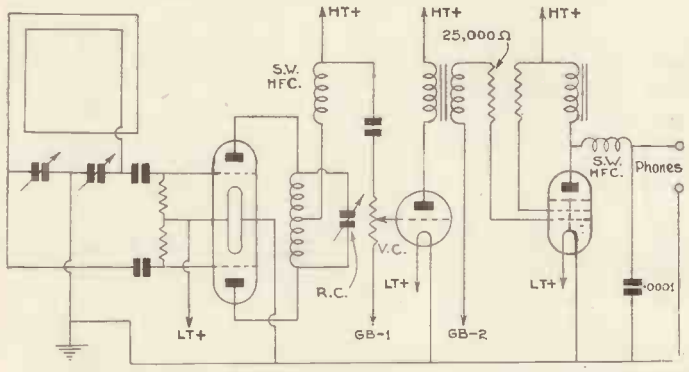
The latest phase of the Southall Society's activities has been the holding of several field-days for members, at which more serious experimental work can be undertaken than on the occasion of a competition. A transmitting member has placed his mobile equipment at the disposal of the Society, and three successful meetings have already been held this year, one for the general testing of receivers, and others for more critical determinations and the collection of data.

Some notes on the equipment used this year by members may be of interest to those contemplating experimental work in direction-finding. So far as the receivers themselves are concerned, experience has indicated that at the ranges and with the powers employed in amateur direction-finding contests a straight circuit consisting of a grid detector and two low-frequency amplifying stages is the most reliable and generally effective, although good results have also been obtained with sets employing a stage of radio-frequency amplification.

Portable Gear

One of the advantages of the simpler set is its extreme portability, for it can be made compact, reasonably light and with the simplest of controls—all points of the greatest value during the final stages of a D.F. competition.

Of particular interest are the various means used by members for avoiding or reducing the "vertical error." Experiments have, for instance, shown that a design in which the receiver and its compass table are placed directly on the ground and not on a tall tripod is of great help in this connection, and that when the equipment is mounted on any form of tripod the extra elevation increases the vertical error. A wide variety of methods have been used for balancing the capacities to earth and thus ensuring electro-static symmetry in the high-frequency circuits. Good results have been obtained with the well-known scheme of connecting a differential condenser or its equivalent across the terminals of the frame with the moving plates earthed, but a better arrangement is to use for tuning the frame a split-stator condenser and to employ a push-pull detector stage.



The equipment needed for amateur direction finding experiments is of the simplest type. Most of the components are of the conventional receiving set pattern.

3-valve Circuit

The attached diagram shows the basic circuit of the receiver used by Southall No. 2 team (leader, B.R.S. 1520) using this arrangement. The frame is tuned by a midget 2-gang condenser with the common rotors earthed and, as will be seen, the detector is an ordinary class B valve with the conventional leaky grid circuit. The centre-tapped coil in the anode circuit is tuned by another variable condenser and gives perfectly smooth reaction *via* the inter-electrode capacity of the valve. Resistance-capacity coupling is used between the detector and the first low-frequency amplifier—a valve of the H.L. type, the grid leak being a potentiometer used as a volume control, which is most essential in a direction-finding set. The last valve is a small pentode, coupled to the previous stage by a tranformer, and to avoid any high frequency reaction *via* the 'phone leads to the frame aerial a short-wave choke is inserted in the output circuit.

So far as construction is concerned, a very compact arrangement and perfect screening are adopted, and a midget high-tension battery and small non-spillable accumulator are accommodated in the metal receiver box.

As the result of many experiments most members have adopted the "plug-on" system of erecting their equipment in the field, the receiver being accurately located on the compass table by pins and sockets, and the frame similarly plugged in on the top of the receiver.

Two teams provide themselves with alternative frames, a large one for taking careful bearings and a smaller one for exploring on foot to enable the receiver to be carried by hand. In one instance this subsidiary frame was fitted with a "sense indicator," comprising a very short vertical aerial and an aperiodic variable coupling coil, giving a heart-shaped polar diagram, thus indicating the actual direction of the transmission. This was found to be of particular value in the exciting last stages of contests when the direction-finding team is within a few hundred yards of the hidden transmitter.

Interest in D.F. Work

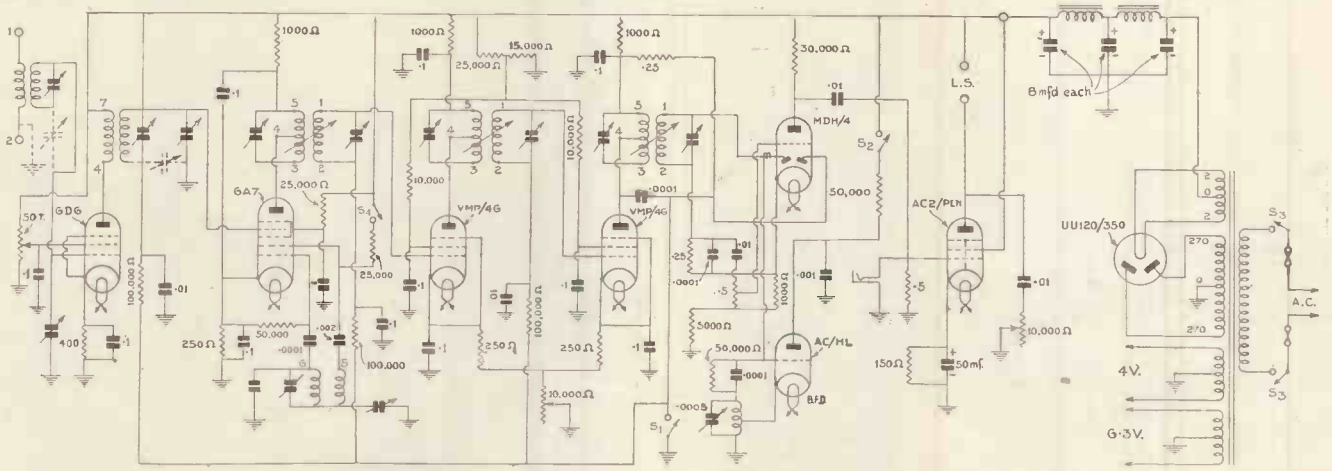
Great interest has been found to attach to D.F. work of a practical nature—a form of activity which can be cordially recommended to amateur societies. In the first place it gives members a greatly increased knowledge of short-wave working; it provides a more varied outlet for constructional activities than the building of receivers merely for programme listening, and offers greater scope for ingenuity and creative ability. It offers a means whereby membership can be kept together and interest maintained during the summer when so many societies go into recess; it furnishes enjoyable meetings in the open air; and on competition days it provides first-class fun and satisfies the hunting instinct possessed in some degree by everybody.

The Tobe Amateur Communication Receiver

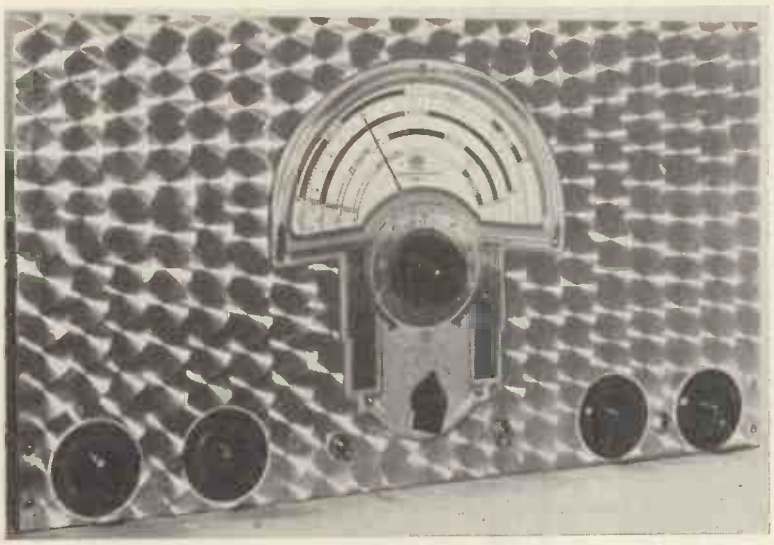
We have very great pleasure in introducing the first of our 1936—7 amateur receivers. It has been designed by **Kenneth Jowers,** *in collaboration with the* **Tobe Deutschmann Corporation,** *of Canton, Mass., U.S.A.*

IN the May, June and August issues I gave some advance details of the new amateur super-het receiver which was under construction, but owing to the fact that no arrangements had been made to supply the tuner and other special components, the actual construction had to be held over until the present time.

In a way this was very fortunate for since the early part of May I have had the receiver in daily use. This enabled me to make several small adjustments and accurately to determine whether or not it was the ideal amateur set. These three months have proved conclusively that any amateur using the Tobe receiver will be able to receive a fair measure of DX even under abnormally bad conditions, and that it is as good a set as any that I have tried, commercial or otherwise, using an equivalent number of valves.



Although this circuit is for amateur band reception, by the substitution of the Standard Tobe tuner for the type H specified, broadcast wavelengths are covered.



One of the finest dials I have ever tried is fitted to this tuner. The 20-metre amateur band covers almost 7 ins.

For a consderable time I have been in communication with amateurs in America with a view to obtaining a very ambitious receiver. From the reports obtained it appeared that the Tobe kit and that the Tobe tuner were the best of their class.

Early experiments confirmed these reports, for in addition to strikingly fine band-spread, the sensitivity was of a high order and all of the little refinements wanted by the amateur were included.

The original Tobe receiver uses seven valves and one intermediate frequency stage, but to my way of thinking, a second I.F. stage is a great improvement. Admittedly, the noise level increased by as much as 50 per cent. with maximum gain, but with the same output as would be given with one I.F. stage, the inherent noise was distinctly lower.

The Tuner

After going very carefully into the matter with the designers of the tuner, an 8-valve circuit was evolved that appeared to be the last word in efficiency.

1 Microvolt Sensitivity on all Amateur Bands

The heart of the receiver is, of course, the Tobe tuner model 35H, consisting of coils and tuning condenser for a sharply tuned aerial circuit, a stage of radio-frequency amplification on all bands and an oscillator circuit. A 6-gang 4-point switch brings into circuit any waveband at will. This switch short-circuits all coils, including primaries, secondaries and regenerators, which are not being employed in the circuit, so eliminating resonant effects in the coils, which would tend to produce dead spots.

The tuner is constructed so that American amateur bands are placed in the middle of the dial and cover approximately two-thirds of the scale. The wave range, however, has been very slightly widened so as to cover all amateur bands and adjacent channel reception.

There are only seven connections and a negative line to this tuner which the constructor has to make. In addition the tuning pack is completely wired and tracked before delivery, but the trimmers are so placed that the constructor can make minor alterations necessary without the aid of an oscillator. The receiver is then absolutely single dial control and is calibrated very accurately in frequencies on 20, 40, 80 and 160-metre bands.

The Circuit

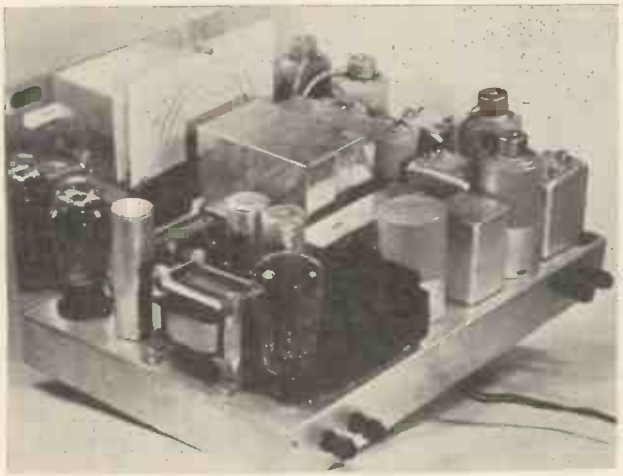
The super-het circuit in which this tuner is embodied consists of a sharply tuned aerial coupler, a single pre-selector stage, two band-pass intermediate-frequency amplifiers, diode detector, automatic volume control, a beat-frequency oscillator, power pentode and rectifier.

A double-pole double-throw switch is embodied to turn off the A.V.C. when the beat-frequency oscillator is in circuit, and vice-versa. A volume control is included in the R.F., I.F. and L.F. stages, which makes the receiver extremely flexible and partly for that reason the signal-to-noise ratio is particularly low.

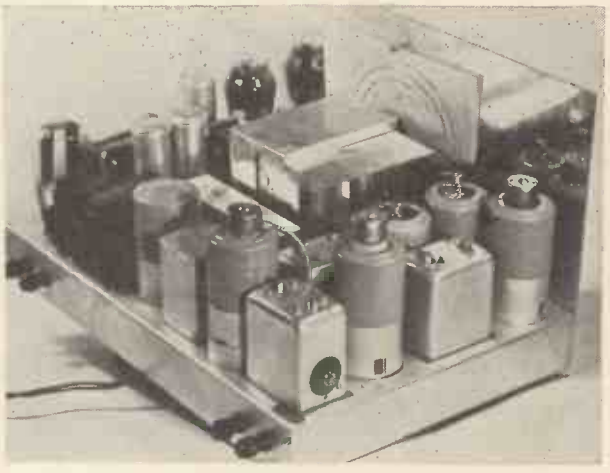
Sensitivity is better than 1 microvolt on all bands, which is greater than can normally be used, except under extremely favourable conditions. Generally speaking, the noise level in most areas is considerably higher than 1 microvolt with the possible exception of the 20 and 40-metre bands.

Examine the photograph showing the plan view of the receiver. On the extreme left can be seen the first I.F. amplifier, then the I.F. coil, followed by the second I.F. amplifier. The R.F. amplifier and detector-oscillator are to the left of the tuning pack. The second detector is between the two I.F. coils to the back of the chassis, and on the right-hand side of this is the B.F.O. coil and valve. On the extreme right, next to the panel is the AC2/PEN output valve with the full-wave rectifier in the top right corner. This layout, although rather unconventional, gives very short leads and lends itself to easy assembly.

The photograph showing the base of the tuner is rather an interesting one. It can be seen that the tuner is split into three sections with four coils in each. In the first two sections trimmers are mounted on the coils, but in the third



A good idea of the layout of the power pack can be obtained from this view. 24 mfds. capacity are used in the smoothing circuit.



The B.F.O. valve and coil are mounted to the back of the chassis behind the tuner. Notice the variable selectivity on the I.F. coils.

Components for THE TOBE AMATEUR COMMUNICATION RECEIVER

CHASSIS.
1—Aluminium 14 gauge 18 in. by 12 in. by 2 in. (Peto-Scott).
1—Aluminium panel 16 gauge 18 in. by 10 in. (Peto-Scott).

CONDENSERS, FIXED.
4—.0001-mfd. type 665 (Dubilier).
1—.001-mfd. type 670 (Dubilier).
1—.002-mfd. type 670 (Dubilier).
2—.01-mfd. type "M" (T.C.C.).
4—.01-mfd. type 4512 (Dubilier)
11—.1-mfd. type 4513 (Dubilier).
1—25-mfd. type EC4 (Bulgin).
1—50-mfd. type 402 (Dubilier).
3—8-mfd. type 0281 (Dubilier).

CONDENSER, VARIABLE.
1—.0005-mfd. type 2093 (J.B.

COIL.
1—Home constructed B.F.O.

CHOKES, LOW-FREQUENCY.
2—Type WWCI (Sound Sales).

HOLDER, FUSE.
1—Type FII (Bulgin).

HOLDERS, VALVE.
1—6-pin type V4 American (Clix).
1—7-pin type V4 American (Clix).
4—7-pin type V2 (Clix).
2—4-pin type VI (Clix).

PLUGS, TERMINALS, ETC.
4—Terminals type B marked Aerial, Earth, L.S.-L.Sc. (Belling-Lee).
3—anode connectors type 1224 (Belling-Lee).
1—Jack type J2 (Bulgin).

RESISTANCES, FIXED.
1—150 type 1 watt (Erie).
3—250-ohm type ½ watt (Bulgin).
1—400-ohm type ½ watt (Bulgin).
4—1,000-ohm type ½ watt (Bulgin).
1—5,000-ohm type ½ watt (Bulgin).
2—10,000-ohm type ½ watt (Bulgin).
1—15,000-ohm type 1 watt (Erie).
1—25,000-ohm type 1 watt (Erie).
2—25,000-ohm type ½ watt (Bulgin).
1—30,000-ohm type ½ watt (Bulgin).
3—50,000-ohm type ½ watt (Bulgin).
2—250,000-ohm type ½ watt (Bulgin).
3—100,000-ohm type ½ watt (Bulgin)
1—.5-megohm type ½ watt (Bulgin).

RESISTANCES, VARIABLE.
2—10,000-ohm type potentiometer (Reliance).
1—50,000-ohm type potentiometer (Reliance).
1—500,000-ohm potentiometer (Reliance).

SUNDRIES.
48—6B.A. round head nuts, bolts and washers (Peto-Scott).
4—K58 knobs (Bulgin).
4—IP8 dials (Bulgin).
3—Coils Quickwyre (Bulgin).

SWITCHES.
2—S80 (Bulgin).
1—S81 (Bulgin).

TRANSFORMERS, Intermediate Frequency.
3—type BP95 (Varley).

TRANSFORMER, Mains.
1—Special to specification (B.T.S.)

TUNING UNIT.
1—Special amateur type with air spaced trimmers type H (Tobe Deutschmann (Eves Radio)

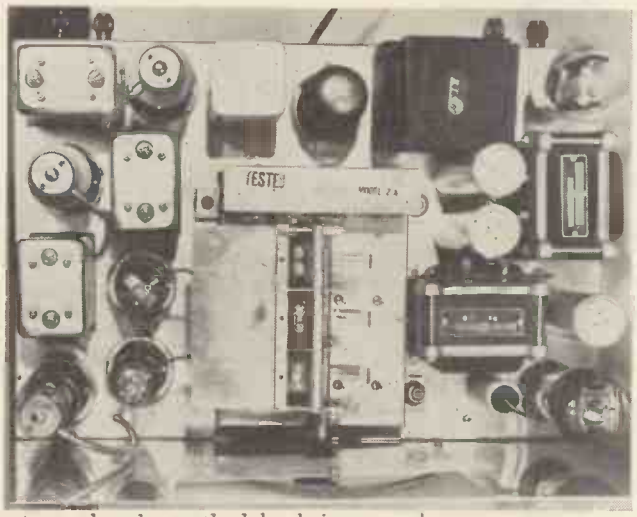
SCREENS.
5—Valve screens open top type (Colvern).
1—Valve screen type closed top (Colvern).
1—B.F.O. screen type 8 (Goltone).

VALVES.
1—6D6 (Eves Radio).
1—6A7 (Eves Radio).
2—VMP4G Met (Osram).
1—MHD4 Met (Osram).
1—AC/HL Met (Hivac).
1—AC2 Pen (Mazda).
1—UU120/350 (Mazda).

No A.C. Ripple :: Regeneration :: The Transformer

section, air spaced trimmers are mounted on *top* of the coil chassis.

Another feature is the special B.T.S. mains transformer designed for this receiver. It measures 4 in. by 3 in. by 2½ in. and gives an output of 275-0-275 volts at 75 ma., 2-0-2 volts at 5 amps., 2-0-2 volts at 2.5 amps., and 3.15-0-3.15 volts at .6 amps. It is supplied with an electrostatic screen and has certain centre taps already earthed by being connected to the core.



This plan view shows the lay-out of all the major components.

Other than this the remaining components are standard and available on demand, so that constructors will not have any difficulty in obtaining the complete kit. Arrangements have been made with Eves Radio to supply a Tobe kit on hire-purchase terms, while tuners and other components are available on demand from Messrs. Raymart. Knowing that the amateur cannot afford too high a price for the receiver and that he wants his components immediately, special attention has been paid to these two points.

Construction

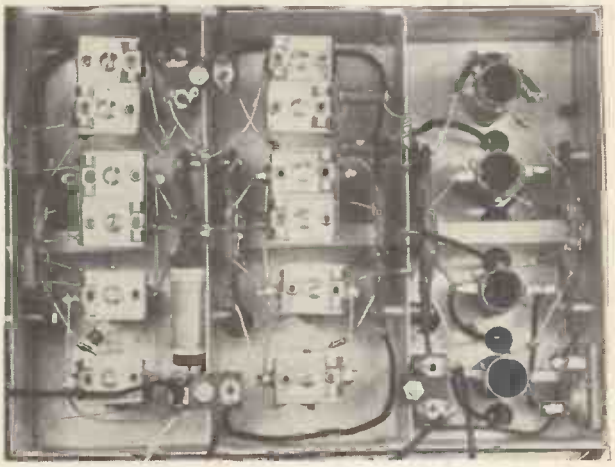
A chassis already drilled can be obtained from Messrs. Peto Scott. It measures 18 in. by 12 in. by 2 in. 16-gauge metal. The panel is 18 in. by 9½ in., again 16-gauge metal. Varley I.F. transformers have their bases removed and are bolted directly to the chassis. The beat-frequency oscillator coil is mounted on a piece of ebonite inside the coil screen.

As many amateurs will use this receiver with headphones even though there is no real need, special precautions have been taken to ensure absolute freedom from hum. To this end, two Sound Sales type WWC1 chokes are used with 24-mfd. of capacity. No hum can be detected on the loudspeaker, while the receiver is equally silent when headphones are plugged into the grid circuit of the output pentode. Incidently, smoothing chokes have been chosen owing to the fact that they are entirely free from lamination or winding vibration.

The Panel

All of the variable resistances have dead spindles, so they can be mounted directly on to the front panel. In this way there is no need for any bushing.

The panel has to be very carefully cut and readers will perhaps wonder just how the tuner is fitted, for a totally different system is employed to that used by English manufacturers. First of all, the escutcheon for the switch and tuning dial is in one section. Second, the actual scale is not fixed to the panel in the normal way. It is simply held in position by the three screws which fix the escutcheon. This enables the gap between dial and panel to be adjusted so that the cursor does not foul. Mount the switches before fixing the tuner. Incidentally since the receiver was first built I have now added a send-receive switch so as to permit of easy break-in. This switch disconnects the high-tension from the anode of the 6A7 oscillator and is mounted directly beneath the wave-change switch.



Only 7 connections need be made to the tuner and the whole of the R.F. detector and oscillator circuit is ready for use.

The I.F. Stages

Readers who wish for regeneration on the I.F. stages will find that the receiver goes into oscillation when the volume control reaches 10 o'clock. This has been done deliberately for it does increase the sensitivity of the I.F. stages, although such gain will rarely be required. If, on the other hand, readers prefer the I.F. volume control to be perfectly docile and for the receiver to be absolutely stable in all circumstances, the resistance on the H.T. side of the screen-grid resistance network should be increased in value from 25,000 to 40,000 ohms.

A Doublet Aerial

Arrangements have also been made for the use of a doublet aerial, the feeders simply being connected across terminals 1 and 2 in the tuner. Terminal 2, however, should be connected to chassis for normal operation.

As previously mentioned, the mains transformer has been specially designed for this receiver and has the following colour code: primary common, black, 200 volts white, 220 volts blue, 240 volts red. H.T. winding red flex with the centre tap internally connected to core, .5 amp. winding enamel wire covered with red systoflex, having the centre taps internally earthed. The 2.5 winding is black flex with the centre tap free; while the .6 amp. winding for the American valve is green flex with the centre tap earthed. The electrostatic screen is a yellow wire, again internally connected.

A full-size wiring blue-print, giving all possible details, is available from our Blue-print Department, 37 Chancery Lane, W.C.2, price 2s. 6d. Ask for No. S.W.208. In the next issue will be given the remaining constructional details, method of operation, together with full details of testing, checking and alignment.

From VK2NO.

A Volume Expander

It is not possible correctly to reproduce from gramophone records all of the normal frequency spectrum unless some system of top note boosting is employed. This volume expander, designed by R.C.A., enables the constructor to build a high-quality amplifier to give natural reproduction and to compensate for line and other losses.

THE upper limit of recorded volume is determined largely by the available width and durability of the track on the record. If the lateral swing of the grooves is large there is the danger of breaking through the wall.

The lower limit is determined by the scratch level from the record itself. If this is reduced so that the music or sound is no greater than the noise level the effect is that the background noise appears approximately equal to the output level.

The maximum range reached by the average gramophone record is approximately 60 to 70 per cent. of the total frequency range covered by a symphony orchestra. In figures expressing the range in decibels the full orchestra has a range of about 70 db. By the time the sound has been recorded and passed through transmission lines the range actually accepted is no more than 55 db, and in some cases as low as 40 db.

It is obvious that to obtain the full advantage of the gramaphone record and to obtain reproduction similar to the original some system has to be employed to boost the frequencies lost in recording. Many arrangements have been suggested, all of which give a fixed amount of increase in gain at a given frequency which is not by any means satisfactory.

The R.C.A. Company in America have created a unit called a volume expander using the 6L7 pentode valve. This valve, in general, is one of the standard 6.3-volt pentodes with the extra grid. It has, of course, the usual control grid with variable mu characteristics. This is in addition to the screen, suppressor and pentode grids.

The 6L7

By varying the voltage on the extra grid the valve gain can be controlled between wide limits. Refer to the circuit of the suggested expander. The 6L7 is wired up as an L.F. amplifier following on the output from the pick-up. The grid is biased at 10 volts negative; in the anode circuit is a 100,000-ohm resistance and a 100 volts has to be applied to the screen.

Directly from the hot end of the pick-up a lead is taken to a .1-megohm potentiometer, the slider of which is connected to the grid of a 6C5 triode valve. The output from this valve is fed into a diode of the full-wave type having both anodes strapped together. In practice any valve with diode plates can be used or even a triode with anode and grid-coupled together. The idea of this diode is merely to rectify the output from the preceding L.F. amplifier.

The output from the diode is fed directly into the extra grid of the 6L7. When a strong signal is fed into the first amplifier it produces a strong signal in the loud-speaker without the expander in circuit. With the expander working the special grid receives voltage from the diode to coincide with the strong signal and by increasing the amplification from the 6L7 makes the resultant signal even stronger. In effect this is L.F. automatic volume control, actually a valve having variable amplification increasing or decreasing in proportion to the strength of signal applied to its grid.

In operation the circuit is so adjusted that the loudest signal passed through the amplifier is increased over the normal circuit by about 20 decibels with a proportionate increase at lower volume level. Taking the limit of records as 45 db an addition of 20 db brings up the range to within a reasonable distance of 70 db provided by a full symphony orchestra.

Results

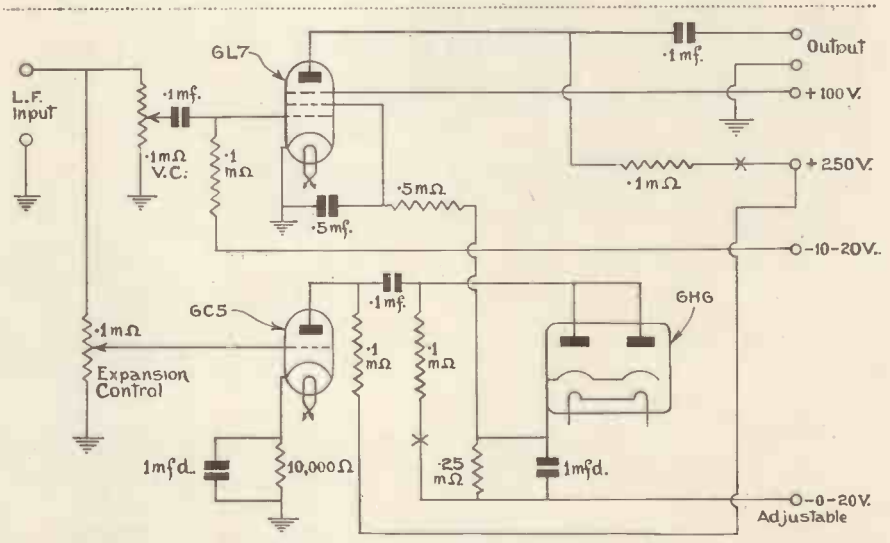
The net result will be to retain the full output of the amplifier on the loudest passages, but to make ever softer the quieter passages. This gives the effect of less surface noise, which is generally more noticeable on the quieter passages.

There are several critical component values. The potentiometer marked "expansion control" governs the amount of gain. When turned off altogether no signals are passed through the 6C5 expander circuit so that 6L7 works as a normal L.F. amplifier. By adjusting this control to the correct point a proper degree of expansion can be obtained.

The 6C5 has its cathode bias resistance by-passed by a 1-mfd. condenser. This is to reduce the low-note response in the first stage, otherwise there will be a tendency for too much boosting of low notes owing to their often excessive output from records.

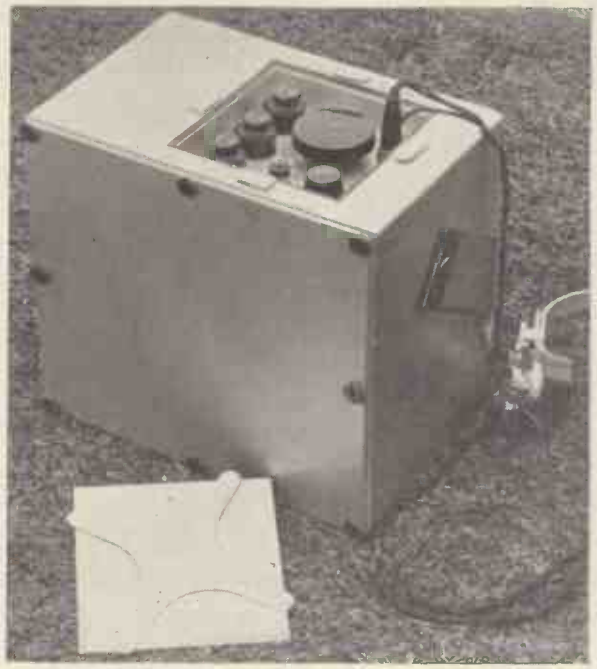
In order to keep low-frequency degenerative effects from spoiling operation, all the bias voltages shown should come from a fixed source, while all voltage points should be well by-passed to avoid voltage variation. The low negative potential of 20 volts is a variable quantity and should be adjusted to give satisfactory results. Approximately 12 volts are correct for the valves as shown but the valve variation causes appreciable changes in bias voltage requirements. As a rule adjustment of this voltage can be carried out by means of a potentiometer and as a guide should be varied until the current flow is between .15 and .12 ma. The position of the meter to read this current is indicated by the cross in the battery lead.

(*Continued on page 534*).



The recommended valves for the expander are of standard American type readily obtainable in this country

Short Waves for Explorers



This is the entire receiver mounted in a metal case. It measures 10 by 9 by 6 in. and is a model of compactness.

A PARTY representing the Public Schools Exploring Society is shortly leaving London to explore little known parts of Finland under the leadership of Surgeon Commander G. Murray-Levick.

They will keep in touch with the outer world by short-wave apparatus. The entire outfit, consisting of six receivers and two transmitters was designed, constructed and presented by the Pye Short-wave Radio Society.

One of the most important considerations in planning this equipment was that it must be light enough to be carried in ruck-sacks and simple enough to be operated by persons whose experience is somewhat limited. The receivers measure 10 ins. by 9 ins. by 6 ins. and weigh 19½ lbs. each. They consist of a straight two-valve battery circuit using a variable-mu pentode as reacting detector, resistance capacity coupled to pentode output stage. The wave bands covered are 20, 40 and 80-metre amateur bands and 600 metres for time-signal purposes. A special coil is also incorporated covering 8,630 kilocycles for the purpose of picking up the Admiralty signal, with whom the expedition will contact.

Plug-in Coils

Wave changing is carried out by means of plug-in coils, all of which are contained in the receiver, and are so arranged that they cannot be wrongly inserted. Current is automatically switched on and off when the receivers are opened and closed, thereby preventing wastage. The receiving aerial and head-phones are carried separately.

Both transmitters which are designed to operate only on telegraphy, are crystal controlled and can operate on several frequencies on either the 20, 40 or 80-metre amateur wave bands. When on 80 metres the 80-metre crystal is used, feeding a neutralised sub-amplifier which in turn feeds a neutralised power amplifier, while on 40 metres the same crystal can be used with the middle stage acting as a frequency doubler. Alternatively, on 40 metres the 40-metre crystal can be used, but on 20 metres the second stage always acts as a frequency doubler. Arrangements are made for switching from one crystal to another when operating on any wave-band in order to clear interference which may be experienced on any particular frequency. All bias potentials are obtained from a battery-driven generator. The generators have been supplied by Mortley Sprague and Co., Ltd., to the specifications of the Pye Short-wave Radio Society, and supply 1,500 volts at 180 milliamps. maximum. The potential is dropped through resistors for the first and second stage supply.

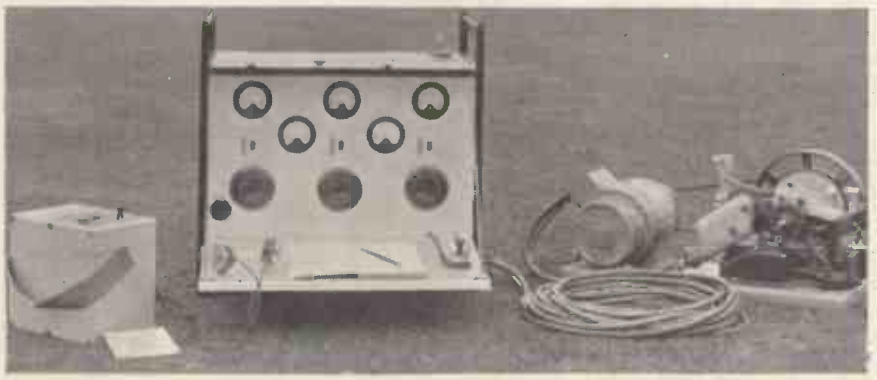
The transmitting aerials have been cut to half-wave length long on 80 metres and are loosely coupled to the power amplifier anode circuit in order to be safe from D.C. shock in the event of any one accidentally touching them.

Complete circuit diagrams for each receiver and transmitter, together with full instructions and trouble-finding charts have been supplied to the expedition. Two test sets have also been supplied in the case of breakdowns and a complete set of spares for each transmitter and receiver. Sets of H.T. batteries and accumulators have been included to provide against failure of the power supply.

Tests with G5JO

It is hoped later to establish contact with the amateur station G5JO in Cambridge, which is owned and worked by Mr. L. W. Jones, a member of the Pye Short-wave Radio Society. Mr. Jones' call sign was used for the testing of the equipment and with the kind permission of the Director of Signals at the Admiralty complete tests were carried out with the finished transmitters between G5JO and the Admiralty Stations GZZ2 and GYD2.

The work which has been carried out by the Pye Short-wave Radio Society in connection with this expedition has shown what a very high standard of efficiency and lightness can be reached in portable transmitters and receivers, and it is not difficult to appreciate the value of such equipment in times of war.



Power is obtained from the generator on the right while the size of the transmitter can be gauged by comparing it with the receiver on the left.

Heard on the Short Waves

By Kenneth Jowers

AN afternoon with the receiver on the 40-metre band gave me the impression that G8's hold a monopoly on 7 Mc. I notice that the call signs have got as far as G8D, which means that over 75 stations have been licensed during the past month or so.

Listeners should make a special note that these new stations will probably appreciate helpful reports until the transmitters are working efficiently. All G8's I have worked so far have been most keen to have reports on modulation, quality and signal strength as compared with other stations on the band, so here is a chance for the BRS to acquire more cards.

Conditions on the 40-metre band have been very unreliable even for short-waves, and more schedules have been broken during this summer than ever before. Some stations, however, appear to be consistent, notably G15MZ Belfast, G6VH Glasgow, G5CU Scarborough, and the old stager G5JO Cambridge. None of these stations are really high power so it is rather interesting that they, out of all the 1,200 odd active stations, should be heard so well.

This photograph of the party of amateurs that toured Belgium under the guidance of G5UK was taken on board the "Vienna." The group includes G2WJ, 2WS, 5IO, 5IX, 6UB, 5JO, 6MN, 6CJ, 2AX, 5QO, 5VQ, 2AZP, 5UK, 5NU and 2AFK.

40-metre Reception

A check on my log book shows that the best time for 40-metre reception is between 6—9 a.m. when many QSA5 contacts can be made with distant G's and many continental stations. Amongst stations I have in mind are the Norwegian LA3Q, Swiss HB9AE, Dutch PA0AU, and a whole lot of Belgian and French. Troubles in Spain have effectively stopped most EA contacts for the time being, although some of these stations are still on the air.

A country that has come to the front in amateur radio is the Irish Free State. Most EI stations, such as 8J,9D, for example, have been coming over at great strength with splendid quality.

Break-in

I am very glad to find more stations working break-in for it does give the little man a chance to have quick contacts with almost the same pleasure as duplex. As any receiver can be used for break-in, before long this idea will probably come into general use.

There appears to be an unusual amount of congestion around 7,100—7,200 Kc. while the ends of the band remain free. This is most noticeable below 7,050 Kc. where there is practically no QRM. It would be a very good idea if some of the E.C.O. stations were to go to the end of the band to remove some of the congestion from the middle. Surely it is not so important that the 7 Mc. crystal double into 14 Mc. for most amateurs have at least two different crystals.

Now that the B.B.C. have decided that ultra short-waves have some commercial value, perhaps amateurs will take a serious interest in the 56, 112, and 224 Mc. channels. It appears that after three years' research work, the B.B.C. find programmes can be transmitted on the U.H. frequencies well enough to relieve some of the relay stations of their duties.

It would be a very fine scheme if a number of the stations on say 112 Mc. were erected around some of the larger towns where reception is generally bad.

G5UK and his band had a fine time during the August Bank Holiday when they took their now annual trip to Holland and Belgium. Visits were made to several well-known stations, while G6LL was worked from one of the stations visited. Amongst those in the party were G2IO, 2WG, 2AX, 5VQ, 5 JO, and several others.

G2XO

I was under the impression that G2KT was one of the very early amateurs, but he appears quite youthful when compared with G2XO, operated by A. Turner, who was first licensed in 1907. He has operated on 1,000, 440, 180, 90, 45, 40, 20, 10 and 5 metres, while he has also experimented with low-definition television on the 10-metre band.

My previous mention of break-in brings to mind the "Break-in Club." To join this club members have to work "BK C.W.," be able to QSY and also to work on the official frequency of 7270 kc. The chief members of this club are G5JH, 5UA, 6LZ, 5KJ, 6MY, 2IS, D3VGH, PA0IR, and several others who are not at the moment able to QSY.

Those who knew Mr. C. W. Goyder in the early days of short-waves will be pleased to hear that he has accepted an appointment as chief engineer to the All-India Radio, the equivalent of the B.B.C. It will be remembered that Mr. Goyder worked two-way with America as far back as 1924.

Some interesting news about the civil war in Spain can be gleaned from the news bulletins broadcast from the Radio Club of Teneriffe (Las Palmas) on their new wavelength of 31.66 metres. Their version of the war does not always agree with Press reports, so as an alternative, try Moscow on 25 metres and then compare notes. In this way some idea as to how matters are going can be obtained. The Las Palmas station is on the air every night at 23.00 G.M.T., while Moscow usually goes over to the English news review at 21.00 G.M.T.

20-metre Phone

Although G5NI and one or two of the other big fellows get over, W-G contacts on 20 metres seem to be few and far between when it comes to phone work. From reports I have received it seems that the 10-watt stations have to get up very early in the morning to get over to America QSA5.

Incidentally many G's are under the impression that they should have a crystal with a frequency in the American phone band if they are to be heard. It is my experience that the best frequency is just outside the phone band where QRM is very much less. The American phone band spreads from 14,150 to 1,420 ks. with the Canadians just on the outside edge at both ends. Just miss the VE's and the chances of low-power getting over are greatly increased.

Australian Programmes

Those who are interested in Australian reception should make a special note of the transmitting times of Sydney and Melbourne. These times are for September only and are G.M.T.

VK2ME Sydney.
Sundays only, 07.00-08.00.
11.30-12.30.
18.30-19.30.

VK3ME Melbourne.
Nightly, Sunday to Saturday,
11.00-14.00.

Sydney, operating on a frequency of 9,590 kc., equal to a wavelength of 31.28 metres, with a power of 20 kW, is best heard during the afternoon session.

A Mercury Aerial Switch

This ingenious aerial switching arrangement has been designed by F. N. McDowell, GI5MZ. It appears to be a solution to the problem of obtaining maximum efficiency on both 40 and 20 metres.

The glass tube is mounted on a T-square in the exact centre of the aerial. Platinum contacts must be used.

THE primary idea of fitting a switch in the radiating portion of the aerial is to enable an aerial operating half-wave on 7 mc. to be switched for half-wave operation on 14 mc

At GI5MZ, the aerial is an orthodox Zepp with a 66 ft. top running north and south with 45 ft. feeders. When working on 14 mc. it is essential to radiate most strongly east and west if any DX is to be obtained. It is well known that a full-wave top running north and south will not fulfil these requirements on 14 mc. so for that reason a half-wave top must be used.

Unless one is fortunate enough to be in a position to erect two aerials some effective switching has to be devised. The mercury switch has the great advantage that 7 mc. aerial can be changed to 14 mc. from the operating position. The principle and construction of this mercury switching can be seen from the illustrations on this page.

It will be realised that a switch operating in the aerial and suspended far out of immediate reach must be positive in action and, as it is exposed to the elements, be corrosive proof as far as the contacts are concerned. The mercury switch meets these requirements in every respect.

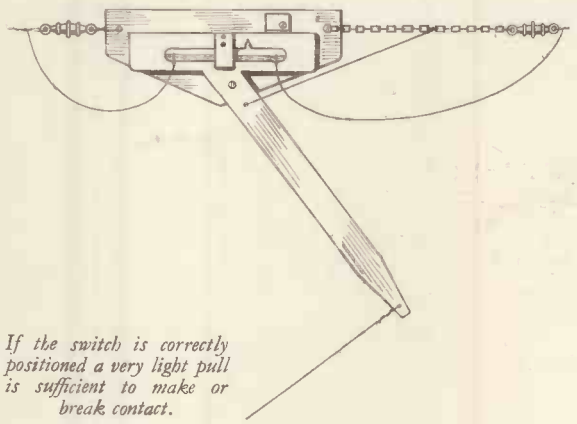
Use a T-square

The base of the switch—the part taking direct mechanical strain—is triangular in shape and measures 9 in. by $3\frac{3}{4}$ in. measured to the apex. The "T" piece, or moving portion, is $13\frac{1}{2}$ in. long overall, the top of which is $6\frac{3}{4}$ in. across by 2 in. deep.

This "T" piece is pivoted by a bolt secured through it immediately below the tube and running in a bush of generous dimensions fixed in the base. These parts are made from $\frac{1}{4}$-in. ebonite and the measurements need only be approximate, as any modification of the physical dimensions will not affect the principle involved providing the moving portion has freedom of action. The switch itself consists of a $\frac{1}{2}$-in. diameter glass tube, $4\frac{1}{4}$ in. long and filled with mercury to little more than half its length.

Platinum Wire

Near each end of the tube a length of platinum wire is sealed through the glass so that it stands vertically when the tube is viewed in a horizontal position. Platinum wire must be used as this metal and glass have the same coefficient of expansion, so removing the danger of glass fracture on heating. The sealing enamel should be used to bond the wire and glass, while the two halves of the aerial are each connected by a length of flex to the platinum wires.



If the switch is correctly positioned a very light pull is sufficient to make or break contact.

A moment's reflection will make it obvious that excellent electrical connection will be established by the mercury between the platinum wires when the tube is in a horizontal position. Tilting the tube out of the horizontal immediately breaks contact while at the same time the electrical capacity at the "break" is infinitesimal.

The tube is mounted on the "T" piece in the following way. Two blocks of ebonite each $1\frac{3}{4}$ in. long by $\frac{5}{8}$ in. by $\frac{1}{2}$ in. are held firmly in a vice, the $\frac{5}{8}$ in. faces being held together. At the junction of the faces and $\frac{1}{2}$ in. from one end, a $\frac{1}{2}$-in. hole is drilled. This $\frac{1}{2}$-in. hole carries the tube which is firmly clamped between the two blocks and bolted to the "T" piece of the switch as indicated in the illustration. If ebonite of the required thickness cannot be procured oak is a good substitute.

It will be observed that no springs are used to bring the switch back to the closed position when the control cord is released. This swing back is effected by the strain link anchored below the fulcrum of the lever, the other end terminating at the middle of the supporting chain. About 8 in. of chain is used to give the whole action a steady but flexible movement. When the switch is open it will be observed that the strain link is bearing a portion of the load imposed by the weight of the aerial, and this tension will immediately close the switch when the control cord is released.

As many aerials are higher at one end than the other, some means of compensation for this condition must be provided. The check block mounted to the base or fixed position is drilled off-centre and so four positions of setting are available, depending on the hang of the switch when in position Proper adjustment is, of course, that which maintains the tube in a horizontal position when no tension is applied to the control cord.

The control cord fitted is that used by golf club manufacturers for lapping, and can be procured from the "Pro." of the local golf club for a few pence. Alternatively, any dealer specialising in golfing equipment will be able to oblige.

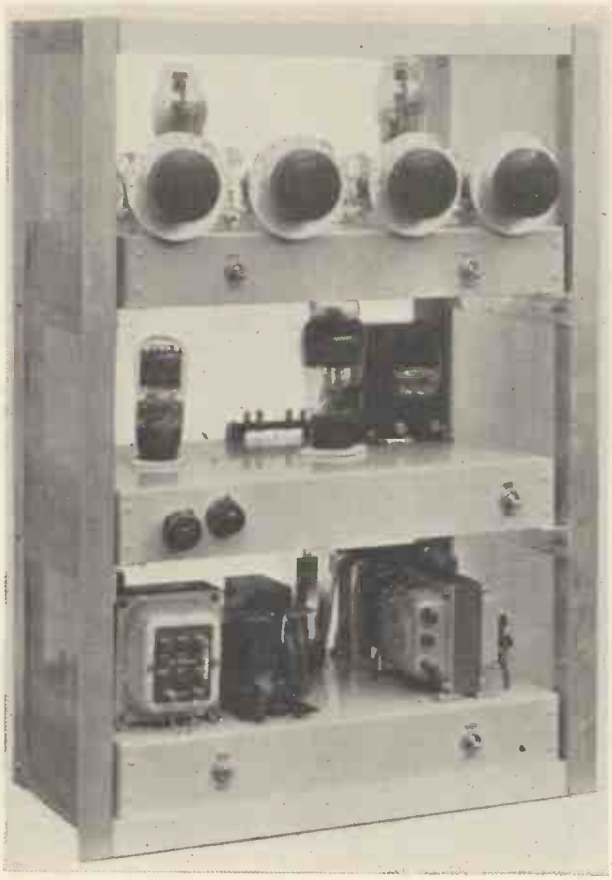
Permanent Contact

An alternative design to give leverage from the control point when the operator's position is at or near the centre of the aerial, is shown in the sketch. This switch has been in use for some time at GI5MZ and has proved satisfactory through bad weather conditions. The movement of a swinging aerial is almost completely a lateral sway so that the contact remains constant when the switch is closed, irrespective of weather conditions. Movement of the aerial is still less likely to affect the switch when it is in the open position.

Our Policy
"The Development of Television."

U.H.F. Oscillator-amplifier Transmitter

We have had several letters from readers disagreeing with our views on the design of simple 5-metre transmitters. We still feel, however, that the time is not yet ready for a crystal controlled circuit, but something better is needed than single valve ultra audion, so we have designed an oscillator amplifier which should meet the requirements of most experimenters.



We feel that as the cost of the materials needed for the rack cost less than 6/- more transmitters of this type will be built. The top chassis is for the oscillator amplifier with the modulator in the middle and the two weighty power packs on the bottom.

IN the July issue we published the design of a single stage 5-metre transmitter which proved most satisfactory. There has been, however, a demand for a crystal controlled 5-metre transmitter that would give an appreciable R.F. output. While we appreciate that this type of apparatus is without question the most suitable, we do not feel that the expense is entirely warranted. It must be realised that at the moment the 5-metre band is not treated as seriously as it might be. Several bands of experimenters are doing very good work with modern equipment, but their number, as compared with the total number of amateurs in this country, is negligble.

For this reason we have gone no further in the design of this transmitter than to use four triodes (actually two Class B valves) in push-pull. This arrangement gives very good frequency stability and we have been able to obtain an appreciable R.F. output at 5 metres.

The Rack

First of all, the circuits. The entire transmitter is built up of four units; the oscillator amplifier, its associated power pack, the speech amplifier and modulator, and a second power pack. The whole has been mounted on three aluminium racks in chassis formation as shown by the illustration.

We do not want intending constructors to be frightened by the apparent cost of this rack. It is home constructed and can be built quite easily, while the total cost of the materials used is approximately 6s. We were agreeably surprised at this low cost, and have realised that this type of rack construction lends itself to further development.

In the top chassis is the oscillator amplifier transmitter, in the second rack the speech amplifier and modulator, quite a neat and simple affair. All the weight is in the bottom rack where the two power packs are mounted. In this article we are not giving the details of the modulator and second power pack. This is being held over until the October issue. We want constructors to obtain satisfactory results with the transmitter before worrying about modulation.

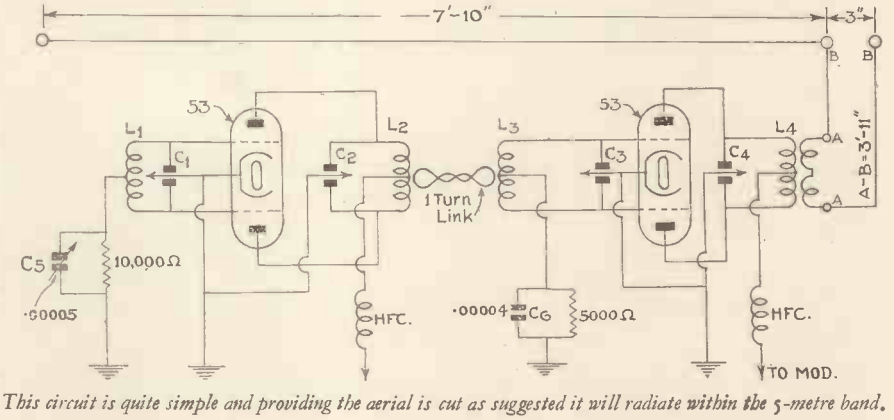
Construction

The first unit to build is the transmitter power pack. This consists of a Sound Sales 250-volt mains transformer and a 2½ volt filament transformer obtainable from C. F. Ward. Smoothing consists of one 60 m/a choke and 16-mfd.. capacity. This power pack then gives 250 volts at 60 m/a with an absolute freedom of a.c. ripple. All of the filament windings, with the exception of the rectifier heater, are ignored, for the only filament voltage required is 2.5 to heat the two 53's. The electrolytic condensers are of the cardboard box type obtainable from Ferranti. These are fixed in position by means of little metal clamps underneath the chassis. These clamps are home made from some thin aluminium.

The primaries of both filament and mains transformers are paralleled and connected to the mains lead through a Bulgin toggle switch. A four-way terminal saddle is fitted to the left-hand corner of the chassis and this is used to terminate the filament windings and the positive and negative high tension. Notice that the centre tap of the 2.5 filament winding is connected directly to chassis.

Double Push-pull

The actual transmitter is simple to construct, but has to be carefully made owing to the lack of space. All com-



This circuit is quite simple and providing the aerial is cut as suggested it will radiate within the 5-metre band.

Coil Data :: Auto Bias :: Crystal Control

ponents have been kept close together so as to reduce the length of wiring. First of all, mount the four tuning condensers. These are special Polar type E two-gang, which have been double-spaced and have an approximate capacity of .00005-mfd. In between these condensers are mounted the two 53 valves. The actual holders are off the chassis approximately ¾ in. by means of midget stand-off insulators.

Tuning coils are similarly mounted and should be as close to the anode and grid terminals of the valve holder as conveniently possible. The actual coil-to-valve leads in the original transmitter are approximately ¾ in. in length. Four coils are required. A five turn in the grid of the first 53, a four turn in the anode, a four turn in the grid of the second 53 and a six turn P.A. coil. The actual coupling coil between P.A. and aerial is home constructed, and varies with the aerial in use. We used a loosely coupled coil having a single turn at either end, which proved most satisfctory.

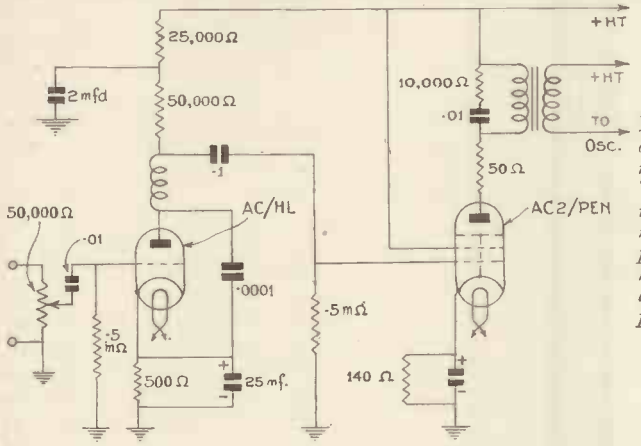
The coils L2 and L3 are link coupled by means of a single turn loop 1¼ in. diameter, and this gives very loose coupling. The actual coupling wires between L2 and L3 are taken to stand-off insulators, so that the wiring is particularly rigid. It is most important that the high-frequency chokes be of different types. The series choke in the L2 circuit is an Eddystone type 1011, while the choke in the L4 circuit is a Raymart CHN. Most unsatisfactory results were obtained when two chokes of a similar type were employed.

Auto Bias

Bias for the first 53 was obtained by means of a 10,000-ohms resistance, which is by-passed by a .0005-mfd. condenser. This condenser is shown as a variable in the theoritical circuit, and although such is the case, it is actually a pre-set used at its maximum capacity.

When connecting up take all negative return leads to one point. We have used one of the fixing bolts to the grid by-pass condensers as the earth return. All connections have been taken to this one point, and the two halves of the transmitter linked together with a piece of braid.

The filament and H.T. connections are terminated at four stand-off insulators, which are then linked to the terminal saddle on the power pack by a Bulgin four-way cable. This makes a very neat way of connecting, particularly if the cable is pinned to the framework of the transmitter rack.



For those who wish to get on with the modulator here is the circuit suggested. The undistorted output is rather more than 3,500 milli-watts. If a low output microphone is used a head amplifier should be connected between the microphone and first amplifier.

With 250 volts applied to both 53's, the anode current is approximately 20 m/a for the first 53, and 33 m/a for the second 53. The variation is, of course, due to the higher bias in the oscillator stage.

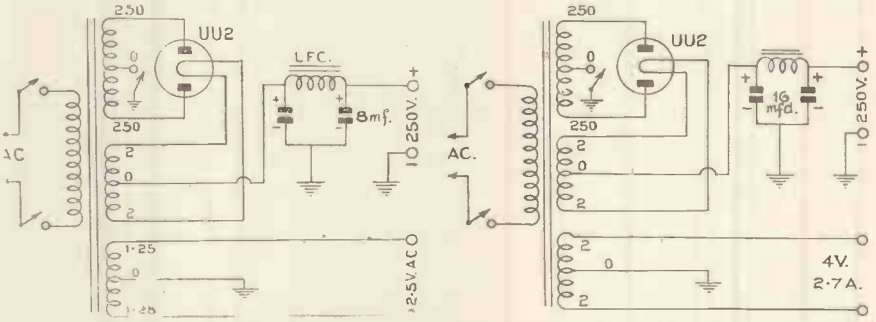
The efficiency, of course, at this frequency is quite low, as is only to be expected, but between 2 and 3 watts of R.F. can be obtained.

Crystal Control

Those who are only interested in crystal control may be interested to know that we are at the present moment testing such an arrangement which can be used in conjunction with this present transmitter. But the details will not be ready until two months.

A simple modulator for this transmitter using an AC/HL and an AC2/PEN, giving an output of 3.4 watts, will be described in the October issue. For those, however, who wish to proceed with the modulator, a theoretical circuit is given in these pages, together with its associated power pack. Although a carbon microphone through a high step-up transformer will fully load the AC2/PEN, we are at present using a transverse

(*Continued on page 534*).



These two power packs are similar but the modulator pack on the right needs the additional smoothing included.

Components for A 5-METRE OSCILLATOR AMPLIFIER TRANSMITTER

TRANSMITTER SECTION.

CHASSIS.
2—Aluminium chassis 14 in. by 8 in. by 2 in. 16 gauge (Peto-Scott).
1—Aluminium transmitter rack to specification (Peto-Scott).

CONDENSERS, FIXED.
2—8-mfd. electrolytic type 500 volt working (Ferranti).
1—Preset condenser type SW82 (Bulgin)
1—Air spaced padding condenser type UPC (B.T.S.).

CONDENSERS, VARIABLE.
4—50-mmfd. double spaced type E (Polar).
2—40-mmfd. type UTC (B.T.S.).

COILS.
1—6 turn type 1020 (Eddystone).
1—5 turn type 1020 (Eddystone).
2—4 turn 1020 (Eddystone).

CHOKE, LOW-FREQUENCY.
1—60 M/a 30 Henry (Bryan Savage).

CHOKES, HIGH-FREQUENCY.
1—1011 (Eddystone).
1—CHN (Raymart).

DIALS.
4—1026 (Eddystone).

HOLDERS, VALVE.
2—7-pin American (Premier Supply Stores).
1—4-pin chassis type VI (Clix).

INSULATORS, STAND-OFF.
4—Type 1029 (Eddystone).
4—Type SS (Raymart).
4—Type SM (Raymart).

PLUGS, TERMINALS, ETC.
3—4 terminals saddles type 996 (Eddystone).

RESISTANCES, FIXED.
1—10,000-ohms type 1 watt (Varley).
1—5,000-ohms type 1 watt (Varley).

SUNDRIES.
2—4 battery cables type VC2 (Bulgin).
½—lb. 14 gauge tinned copper wire (Peto-Scott).
24—6 BA. round head nuts and bolts (Peto-Scott)
2—Lengths 2 m/m sleeving (Peto-Scott).

SWITCHES.
3—S80 (Bulgin).

TRANSFORMERS, MAINS.
1—Standard type 250/60 (Sound Sales).
1—2.5 volt filament transformer (C.F. Ward).

VALVES.
2—Type 53 (Premier Supply Stores).
1—UU2 (Ediswan).

The Short-wave Radio World

Tuning the Receiving Aerial

MOST of the modern multi-valve receivers have such a high overall stage gain that amateurs are inclined to overlook the efficiency of the receiving aerial. Some of course use a doublet with a low-impedance line and finding that it works well on all bands forget about the probable poor transfer efficiency.

Many of the latest type super-het receivers are equipped for low-impedance input and are working quite efficiently when a doublet is used on its fundamental frequency, but a worth-while

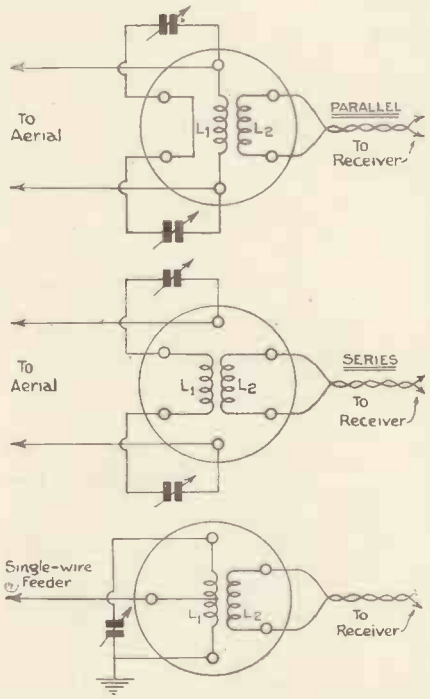


Fig. 1.—These aerial couplings are intended for different types of input. Correct matching is obtained in every case.

improvement can be made by matching up more closely on harmonics.

Then there is the amateur who wishes to use a transmitting Zepp or single-wire Hertz aerial for reception purposes. The general idea is to run a wire over to the receiver and to break it by means of a switch when the transmitter is running. The signal transfer with this arrangement is very poor, although there may be a slight increase in volume over a normal receiving aerial owing to the length and usually better location of the transmitting aerial.

A suggestion that worked well and overcame these little matching troubles is shown in Fig. 1. It consists of a tuning system readily adaptable to the type of aerial used and coupled to the receiver through a low-impedance line. Provision is made so that by plugging in the proper coil either series or parallel tuning can be used. In the case of a single-wire fed Hertz no provision for series tuning is necessary.

To prevent the valves in the receiver being damaged when the transmitter is running (high grid current can be drawn even though anode voltage is switched off) provision can be made for shorting the input of the receiver. The transmitting aerial, if used for receiving, should be switched from the coupler to the transmitter. This switching, of course, can be done by means of relays.

Referring again to the three little sketches in Fig. 1, these are designed to connect to standard 5- and 6-pin coil forms. In general, inductances must be adjusted by experiment for optimum results. L1 should be of sufficient inductance to resonate at the required frequency in conjunction with the 100-mmfd. condenser C1. With series tuning the number of turns required on L1 is small, while the link coupling coil should have from 2 to 5 turns, depending upon the band and the input circuit.

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

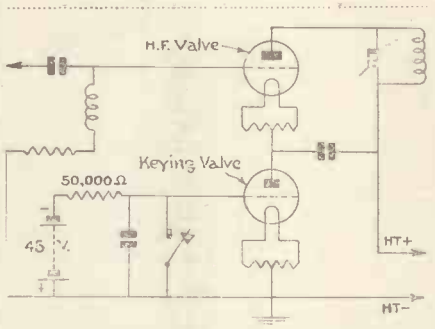


Fig. 2.—With this method of keying no clicks will be noticed.

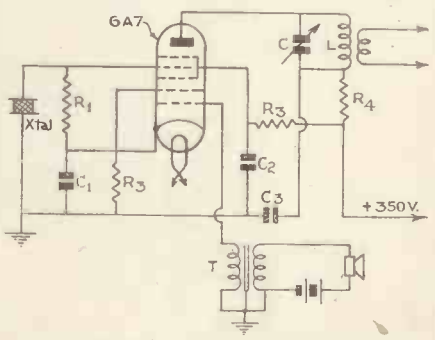


Fig. 3a.—The 6A7 is of the receiving type, modulation being applied to the inner grid.

Improved Keying-valve Circuit

W6HFF suggests the keying-valve circuit with a fixed bias supply for blocking. A reference to the circuit, Fig. 2, shows that the internal resistance of the keying tube is in series with the centre tap return. This resistance is high with the key open, so giving high bias and low effective anode voltage on the valve being keyed. The bias on the keying tube need not be as great as in usual valve keying systems, for the effective bias on the two valves in series in the high voltage circuit blocks the anode current.

The operation of the system is more positive than either grid-block or valve keying alone, and the current broken by the key is less. A slightly lower value of grid bias or leak than usual should be used for the plate resistance of the keying tube at zero bias is in series with the centre tap return (cathode bias) with the key down. This system works ex-

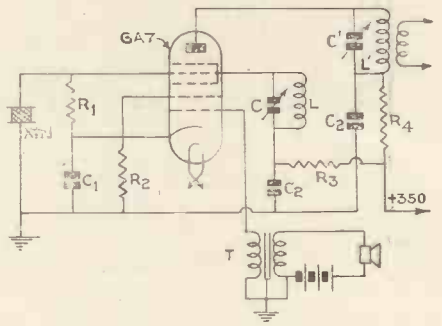


Fig. 3b. In this circuit the 6A7 is used as a crystal oscillator and frequency doubler.

cellently with the crystal oscillator and allows break-in operation without any click in a receiver next to the transmitter.

A Pentagrid Single-valve Transmitter

6A7 valves intended by the designers for use as first detector-oscillators are being purchased for as little as 3s. 6d. W3LKV makes some interesting suggestions on how to use this valve as a transmitter. Fig. 3a shows how the 6A7 is used as a crystal oscillator with modulation applied to the inner grid. Fig. 3a is for operation at the crystal frequency while Fig. 3b shows how the transmitter is modified to give a good second harmonic output. In the latter case a circuit tuned to the crystal fundamental is inserted in the screen (grids

(*Continued on page 526*).

And now one even better!

Really high sensitivity, really good quality, and freedom from colouration in a popularly priced commercial instrument are by no means as easy to achieve as to describe. We of the Whiteley Company do not claim to have reached the ultimate perfection; but we do know that by dint of constant specialised research we have come nearer to it than has been managed before.

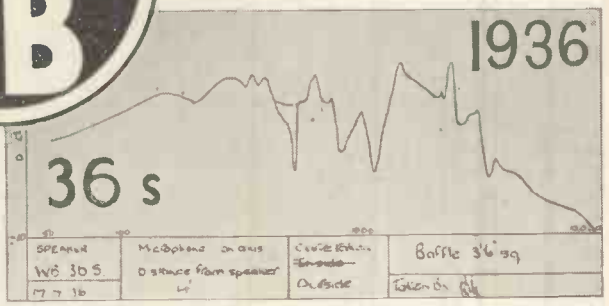
Of this new range of 1937 models we are particularly proud—for we have indubitable evidence that this year's step forward is the greatest we have made.

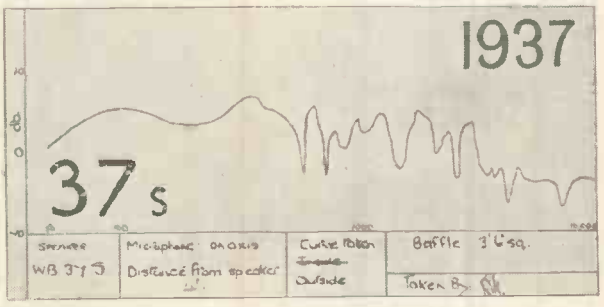
Better cone, stronger magnet, minute adjustments of speech coil proportions and a host of careful minor modifications all play their part in bringing this new performance. In all confidence we ask you to hear it.

You can now buy the Senior Chassis on convenient hire-purchase terms. Ask your dealer, if you are interested.

1937 STENTORIAN PRICES

CABINET MODELS		CHASSIS MODELS	
37 SC (Senior) ...	63/-	37 S	42/-
37 JC (Junior) ...	49/6	37 J	37/6
37 CC (Cadet) ...	39/6	37 B	23/6
37 BC (Baby) ...	29/6	37 M	17/6
Duplex	£6 6	EM/W	70/-
		Duplex	94/-





The frequency curves reproduced here are taken under similar conditions from 1936 and 1937 Stentorian Senior Speakers respectively.

They tell more graphically than any words how far the new design eclipses last year's successful model. Notice the improved top response, absence of harsh bass resonance, general "levelness," and freedom from sharp "peaks."

If you know the 1936 model, you will realise that this new speaker is indeed worth hearing. It costs no more!

SEE THEM AT RADIOLYMPIA
STAND 66

1937 STENTORIAN

WHITELEY ELECTRICAL RADIO CO., LTD., MANSFIELD, NOTTS. Sole Agents I.F.S.: Kelly & Shiel, Ltd., 47 Fleet St., Dublin.

3 and 5) lead, the anode circuit being tuned to twice the crystal frequency. The ordinary single button microphone and transformer has a sufficiently high output completely to modulate the output from the oscillator.

It is claimed that no frequency modulation is detectable so long as the anode current of the oscillator does not change with modulation. These circuits have been used successfully on the 160- and 40-metre bands using an input of less than 3 watts. British heptodes and pentagrids of the mains and battery-operated type can be substituted for the 6L7.

R.F. Amplifications at Signal Frequency

QST published an original idea showing how to obtain additional sensitivity

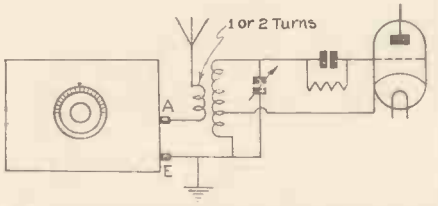


Fig. 4.—An arrangement of this kind can be used with any set.

and selectivity by the use of a regenerative receiver, having no R.F. amplification, when used in conjunction with a conventional super-het. Readers are familiar with the re-radiation qualities of the regenerative receiver, the gain in sensitivity is obtained generally because of the re-radiating property.

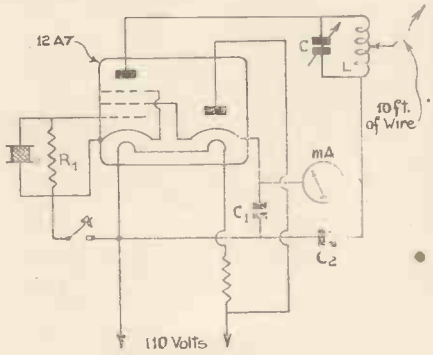


Fig. 5.—The 12A7 valve used in this circuit has no British counterpart. It consists of a rectifier and pentode in a common bulb.

The system is as follows. Disconnect the aerial from the super-het receiver and introduce between it and the aerial terminal the regenerative receiver. The aerial and earth are connected to this auxiliary receiver, while the normal super-het is also earthed to a common point. Assuming that an 80-metre signal has been tuned in prior to the introduction of the regenerative receiver the next step is to tune in this same signal with both units in operation when it will be noticed that a very decided gain in signal strength is obtained.

Another method is to introduce an old regenerative broadcast tuner in the lead from a short-wave converter to the input terminal of a broadcast receiver used as an I.F. amplifier. The result is the same, but the inconvenience is not so great since the regenerative receiver need only be tuned once. This scheme has excellent possibilities for increasing the amplification and providing signal-frequency selectivity with amateur band super-hets not having pre-selection.

A QRP Transmitter

It is becoming generally appreciated that for local working a small single-valve low-power transmitter has many advantages. W9EHC has utilised the 12A7 as a crystal-controlled oscillator. The circuit is shown in Fig. 5 and this arrangement has been used to work stations up to 400 miles. The 12A7 is a combined pentode and power amplifier with separate cathodes mounted on one foot. The circuit is arranged so that the rectifier converts the A.C. input to D.C., the filter condenser being C1. The R.F. portion of the circuit is the familiar pentode crystal oscillator. A line cord with built-in resistor R2 drops the A.C. input to the correct value for the heater of the 12A7. We can thoroughly recommend this simple circuit, particularly for the beginner.

Controlled Carrier Modulation

Radio's engineers are very keen on controlled modulation. In the June issue of *Radio* there are full details of a simple transmitter that could be adapted for British use. In the suggested circuit the grid bias modulation system is exactly the same whether the controlled carrier is switched in or out.

The controlled carrier system uses a type-46 high-gain triode in series with the buffer or doubler stage. This 46 valve acts as a cathode bias resistance, reducing the anode current of the buffer valve to nearly zero when there is no speech input. Directly the microphone is spoken into, the 46 valve acts as a valve voltmeter so that with an increase in input, anode current rises to normal value. This current also means an increase in buffer anode current and radio-frequency output.

The 46 valve requires little low-frequency power to drive its grid circuit and to lower the anode impedance. It is suggested that the 2A5 modulator supply this power as well as the power needed for the modulation of two type 50T's in push-pull.

Both grids of the 46's should be tapped across one half of the load resistance so as not to cause overload in the 2A5 pentode circuit. Since only the D.C. change in anode current is required in the control of grid bias in the buffer a small filter choke and two .5-mfd. condensers would be sufficient to prevent speech modulation in this stage.

The D.C. anode current follows the variations of the voice and therefore carrier power is supplied to the grids of the final amplifier in proportion to the speech input.

If greater control is required, a choke input filter from the power supply would give better regulation. This system is easily applied to any grid-modulated phone transmitter, providing the buffer stage has sufficient power output for normal C.W. operation. With controlled carrier this buffer output is reduced even on peaks to about one-fifth or at the most one-third of the normal output.

A valve such as a 2A3 with fixed bias set near to cut-off allows more output to be obtained from the buffer stage on speech peaks than can be obtained from the normal 46. The latter valve does not require any fixed bias and only low driving power, so does not reach as low an output impedance as the 2A3 or 2A5.

High power controlled carrier grid bias modulation is also quite simple to operate. One or two 2A3 valves biased to cut-off serve as a control for carrier output. Two 2A3 valves will enable a RK-31 buffer stage to operate with a fairly low value of anode voltage. A 2A3 valve again serves as a cathode bias resistance varying in sympathy with the speech voltage output.

In America controlled carrier units can be obtained suitable for almost any input. These units are easily connected into circuit so that any transmitter can be changed over to controlled carrier with the minimum of alteration.

The Columbia Broadcasting System, which operated a low-definition television service three years ago, has announced that it is keeping a close watch on developments and will await the outcome of the R.C.A. experiment.

To maintain Good Reception

Is the performance of your set as efficient as it should be? Nine times out of ten the reception you should get is lost because of small defects. If they are traced, remedied, you can put new life into the performance of that set of yours.

With "Avo" Testing Instruments you can trace faults speedily and accurately. It is, of course, essential that highly accurate instruments are used.

"Avo" Instruments, famous for precision, are designed to meet the needs of every radio enthusiast as well as of service men.

See "Avo" Testing Apparatus at Radiolympia.

The D.C. AVOMINOR

A compact moving-coil combination meter—13 ranges of readings in milliamps, volts and ohms. It tests circuits, valves, components, batteries, power units, etc. Provides a degree of accuracy unapproached by any other instrument at anywhere near its price. In case, with leads, interchangeable testing prods and crocodile clips, and complete instruction book.

40/-

Deferred Terms if desired

The UNIVERSAL AVOMINOR

A smaller brother of the Universal Avometer. It gives 22 different ranges of readings (A.C. and D.C.) Has 3-in. scale. Total resistance 200,000 ohms. Complete with instruction book, leads, and interchangeable testing prods and crocodile clips.

Price £5

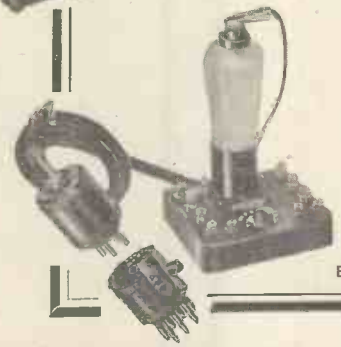
LEATHER CASE 10/-

Deferred Terms if desired

The AVO-OSCILLATOR

A compact Oscillator of extreme usefulness for service work. Provides a steady local signal, modulated or non-modulated at will, the fundamental frequency of which can be varied over the long, medium and intermediate wave-bands. Harmonics extend the range down to the short waves. Small size (6 in. by 4 in. by 3 in.) enables the instrument to be easily carried. Complete with shielded lead, valve and H.T. and L.T. batteries. Price £5 10s.

Deferred Terms if desired.



The AVODAPTER

Every valve test can be made externally on the bench. No grovelling about inside the set or having to sever connections. Tests are made with ease and under actual working conditions. Instantly adaptable for 4-pin, 5-pin or 7-pin valves.

Price 25/-

The AVOCOUPLER

Renders the Avo-Dapter instantly suitable for 9-pin valves. Complete with instructions. Price 12/6

"AVO" TESTING ACCESSORIES

Accurate and simple testing is greatly assisted by the boxed kit of "Avo" Testing Accessories. They do away with nondescript lengths of wire. You can test more quickly without making dangerous mistakes. For use with any testing meter.

Price 2/6.

BRITISH MADE

Radiolympia

Stand 31

RADIO SERVICING SIMPLIFIED with Supplement

This invaluable book explains every phase of fault-tracing and testing in non-technical language. Multitudinous tests are so set forth as to be a matter of straightforward procedure. The comprehensive information and numerous diagrams enable everyone to test sets and apparatus with ease and success.

Price 2/6 Post Free 2/9

The word "AVO" is a Registered Trade Mark.

'AVO' TESTING INSTRUMENTS

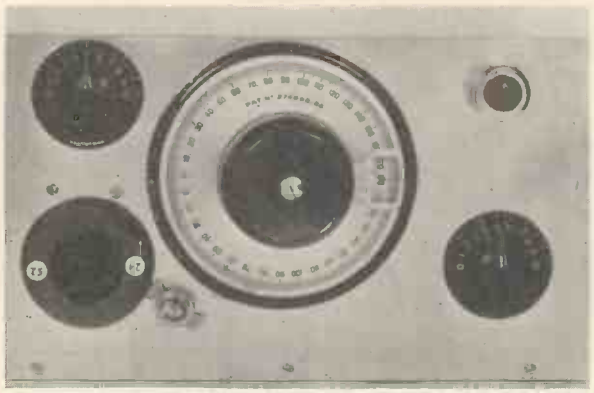
WORLD FAMOUS FOR ACCURACY

If you do not visit Radiolympia, write for lists of "Avo" Instruments.

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD.
WINDER HOUSE, DOUGLAS STREET, LONDON, S.W.1 *Telephone: VICTORIA 3404-7*

A Unit-constructed Short-wave Receiver

Designed by DIALOG



Each section of this receiver is complete in itself. This is the detector portion showing the plug-in coil arrangement and 360 degree tuning dial.

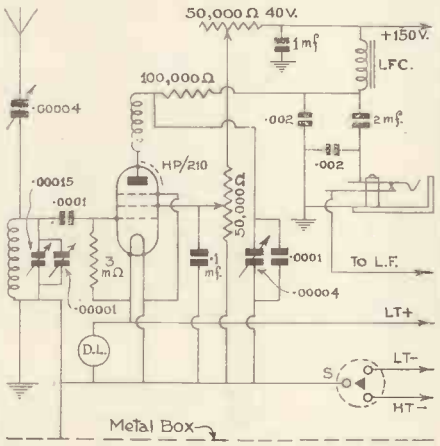
FOUR units are needed to complete this three-valve receiver, but the beginner can construct merely the detector circuit and then be in a position to receive short-wave stations. The completed set consists of a high-frequency amplifier, pentode detector, and pentode low-frequency amplifier, with an additional valve in the signal strength meter circuit.

The various units can be used in numerous ways. For example, as a one-valve detector, as a detector and amplifier, high-frequency amplifier and detector, high-frequency amplifier, detector, and low-frequency amplifier.

In designing this receiver, I had in mind those short-wave listeners who could not afford to build a complete receiver at once. So by having the separate circuits after the detector stage has been completed, there is no need to wait for the further components to complete the set before coming on the air.

The Detector Unit

The circuit for the detector unit is shown in Fig. 1. It is complete in itself, and uses an HP210 pentode valve



Very smooth reaction is obtained with this detector circuit.

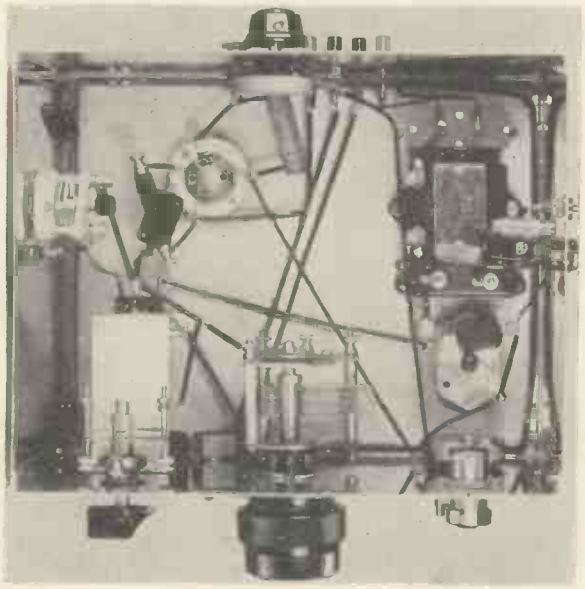
with an ingenious reaction circuit. All of the components are mounted within one metal box, complete with headphone jack and on-off switch. The aluminium box is quite easily put together, the sides being fastened with nuts and bolts. It is, however, a good plan to mark out, drill and mount the front panel with condensers, etc., and to fit the terminal strip to the back panel before putting the box together.

All the other components can be wired up on the baseboard, and then dropped into the aluminium box as a completely wired unit, so that the whole set can be wired without difficulty. The .00004-mfd. pre-set condenser for coupling, and the phone-jack are the last components to be mounted. Take particular care in marking out the front panel, as if the components specified are used, there is only a very small amount of space to spare.

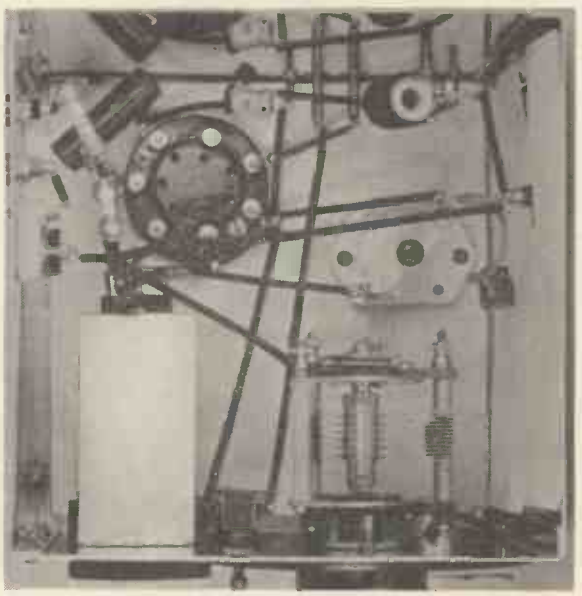
Assembly

Cut a large hole with a hand-drill or fret-saw for the coil holder. A half-round file will take off all the rough edges, but make the hole just large enough tightly to grip the ebonite moulding, which forms part of the coil holder. Before mounting the coil holder on to the baseboard, unscrew the valve holder section and fix it so that the anode pin is to the top—this makes wiring shorter and easier. In addition, before finally fixing, solder a short wire from the grid pin to any fixing screw, so earthing the grid coil.

Apart from mentioning that large clearance holes should be drilled to prevent the terminals on the terminal strip touching the metal box, little other precautions need be taken. The Eddystone microdenser has in the original model been taken to pieces and reassembled with two moving and one fixed plate, but it will be quite in order for



If the components are mounted as suggested in the text no difficulty will be experienced in wiring.



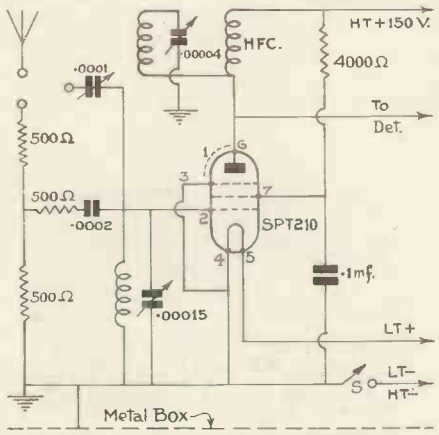
This is the H.F. amplifier showing the resistance network in the aerial grid circuit.

An Efficient Oscillating Circuit : The H.F. Unit

the condenser to be used as originally made.

If the detector valve specified is used, make sure that the correct filament terminal on the valve holder is earthed—otherwise, follow the maker's directions for earthing, so as not to short-circuit the low-tension accumulator by incorrectly earthing the metal coating. A three-point on-off switch has been embodied so as to stop any H.T. leakage across the potentiometer, for it breaks both L.T. and H.T. negatives.

If the wiring is copied exactly as



shown in the illustration, no trouble will be experienced as regards "hand" or "body" capacity. In fact, when tuning in weak signals, the box can be handled without shifting frequency in any way.

Reaction

It will be noticed that no high-frequency choke is used and that the conventional reaction condenser is also missing. By using the simple system employed, reaction is noiseless and absolutely smooth. Signals can always be tuned in at the same dial reading, showing absence of frequency drift.

When the detector unit has been completed, plug in the specified valve and coil, connect up the accumulator and H.T. battery, but do not switch on. Set the 50,000-ohm variable resistance at the back of the chassis at minimum and the potentiometer on the front panel at maximum. Then with a piece of ebonite or wood, to be used like a screwdriver, set the .00004-mfd. reaction pre-set condenser so that the vanes are half in mesh. Connect a voltmeter with the positive clip on the moving arm of the 50,000-ohm variable resistance and the negative clip to the metal box, and switch on. The resistance should be adjusted until the voltmeter shows 40 volts, after which it can be disconnected. Plug in the aerial and adjust the aerial pre-set condenser to approximately half its capacity and insert the headphones.

The potentiometer on the front panel should then be adjusted from maximum towards minimum until a very faint plop is heard in the headphones. If this does not occur, adjust the reaction pre-set until the vanes are completely in mesh.

Signs of life will then be heard and signals of some sort or other will be obtainable, and unless the valve is changed, there will be no need to re-

On the left is the circuit for the H.F. amplifier which uses a pentode valve. Reaction increases the stage gain while the input resistance network has many advantages.

On the right is the low-frequency amplifier with the Sifam R strength meter. This meter is taken out of the box supplied by the makers and re-assembled as shown.

adjust this reaction pre-set, oscillation being controlled by the variable resistance.

If other types of coils are used it may be necessary to change the .0001-mfd. condenser, which is in parallel with the .00004-mfd. pre-set, for one of a higher or lower value. In some instances .00005-mfd. will be sufficient capacity, while occasionally as much as .0002-mfd. is required. This capacity depends on the reaction winding of the coil in use.

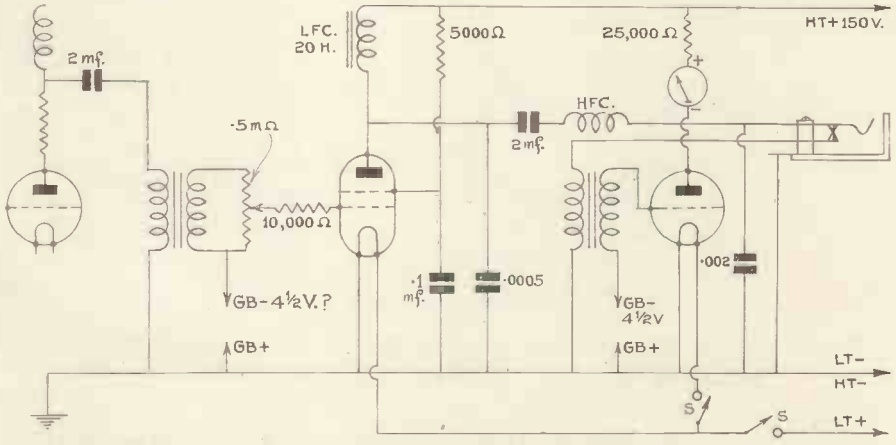
As soon as a few stations have been tuned in it will be realised just how smooth this resistance controlled reaction can be, and that weak stations are more easily pulled in than with the variable capacity method.

Some Results

Using merely this one-valve detector, amateur stations including American and some from the Belgian Congo, have been heard, while the *Queen Mary* in New York, the airship *Hindenburg*, and many other transmissions of a similar type, have been tuned in at good strength.

The H.F. Unit

This unit is simplicity itself, and in view of the small number of components, naturally requires a smaller box, but the previous remarks as regards layout and general construction still apply. Another H.F. pentode is used, but of the 7-pin type. Two methods of coupling the aerial to the grid of this valve are indicated. One method is by the use of the ordinary series con-



Actually this valve is the Tungsram pentode type PP222 with three grids, but to simplify matters the third grid has been omitted in the wiring as it is connected internally.

denser of .0001-mfd., while the other is made up of a resistance network. This resistance network may at first sight appear to be confusing, but it is easily wired in position and actually does improve results. When interference and sometimes fading are bad, on plugging the aerial into the resistance network, signal-to-noise ratio and fading are often improved. Although the idea is not entirely original, it has been found well worthy of inclusion as in many cases it is beneficial when receiving weak stations.

An unusual feature of this unit is the inclusion of a small pre-set reaction condenser mounted on the baseboard. It has been noticed that by adjusting this condenser so as to have a small amount of capacity, an increase in high-frequency amplification can be obtained. Once, of course, this condenser has been adjusted, there is no further need for it to be touched, otherwise it will affect calibration.

The aerial series condenser should be adjusted to suit the aerial in use, while a steady 120-150 volts high-tension are essential. The coupling lead between this H.F. unit and detector unit should be short, in fact, no more than 3 in. in length. It must also be realised that with the receiver switched on the coupling wire must not touch either case, for this wire is live. For those who wish to take further precautions, a .001-mfd. fixed condenser can be connected in series with this coupling wire, so as to prevent any accidents to the valve occurring.

The Amplifier

The low-frequency amplifier section is also mounted in an aluminium box. It is again easier to fix all the components on the baseboard and the "R" strength meter on panel before fixing the sides of the case together. The output pentode is the new Tungsram PP222, which has the suppressor grid connected internally. We have in this instance omitted to show the suppressor grid in order to assist the beginner. The "R" strength meter is supplied all ready wired and can be left mounted as received from the manufacturers, but if the receiver is to be made compact and self-contained, it should be fitted to the aluminium container and wired up as indicated.

To take a signal strength reading, the loud-speaker should be disconnected by means of the switch for that purpose, and all volume control set at maximum. If readers adhere to the detector valve specified, this receiver will oscillate down to well under 10 metres, and by using a special 7-metre coil, B.B.C. sound transmissions on 7.2 metres are receivable.

A variation on this receiver is to have one metal box with dividing partitions. But this is purely a matter of taste.

Components for A UNIT-CONSTRUCTED S.W. RECEIVER H.F. and DETECTOR UNITS.

BASEBOARDS AND SCREENING BOXES.
1—Wooden baseboard 9½ by 7⅞ by ⅞ in. (Peto-Scott).
1—Wooden baseboard 6 by 6 by ⅜ in. (Peto-Scott).
1—Metal screening box 10 by 8 by 6 in. (Wearite).
1—Metal screening box 6½ by 6½ by 6 in. (Wearite).
CONDENSERS FIXED.
2—.002-mfd type tubular (Graham-Farish).
2—.0001-mfd. type M (T.C.C.)
1—.0002-mfd. type tubular (Graham-Farish)
2—.1mfd. type 250 volt (T.C.C.)
1—2mfd. type 250 volt working (T.C.C.)
CONDENSERS VARIABLE.
2—.00015-mfd. type 2043 (Jackson Bros.)
1—.00002-mfd. type 900/20 (Eddystone).
3—.0004-mfd. type UTC (B.T.S.).
1—70/140 mfd. (Cyldon).
COILS.
2—Complete sets of type E (B.T.S.).
CHOKE, HIGH-FREQUENCY.
1—type 103 (B.T.S.).
CHOKE, LOW-FREQUENCY.
1—Ni-Choke (Varley).
DIALS, SLOW-MOTION.
2—Micro-dials (Utility).
2—type 1044 (Eddystone).
HOLDERS, VALVE.
1—7-pin type SW 51 (Bulgin).
2—4-pin type (B.T.S.).
PLUGS, TERMINALS, ETC.
1—4-pin socket strip (Clix.
1—3-pin socket srtip (Clix).
5—insulated sockets (Clix).
12—insulated plugs (Clix).
1—Universal plug (B.T.S.).
1—Midget closed circuit jack (B.T.S.).
RESISTANCES, FIXED.
1—50,000-ohm. type 1 watt (Erie).
3—500-ohm type ½ watt (Bulgin).
1—4,000-ohm type Ohmite (Graham-Farish).
1—100,000-ohm type Ohmite (Graham-Farish).
1—3-megohm type Ohmite (Graham-Farish).
RESISTANCES, VARIABLE.
2—50,000-ohm type potentiometer (Erie).
SUNDRIES.
1—dial light type D9 (Bulgin).
Connecting wire and sleeving (Peto-Scott).
36—Round head bolts with nuts and washers (Peto-Scott).
SWITCHES.
1—Toggle type S80T (Bulgin).
1—Type Toggle S87 (Bulgin).

ACCESSORIES.

ACCUMULATOR.
1—2 volt (Exide).
BATTERY, HIGH-TENSION.
1—120 volt (Drydex)
BATTERY, GRID-BIAS.
1—9 volt standard (Drydex).
VALVES.
1—HP210 (Tungsram).
1—SPT210 (Cossor).

AMPLIFIER SECTION

CONDENSERS FIXED.
1—.1 mfd-type 65 (T.C.C.).
1—.2 mfd-type 65 (T.C.C.).
1—.005-mfd type 300 (T.C.C.).
CHOKE, HIGH-FREQUENCY.
1—Ni-choke (Varley).
HOLDERS, VALVE.
1—5-pin type baseboard (Bulgin).
1—4-pin type 4CH (B.T.S.).
METER.
1—Complete "R" strength meter (Sifam).
PLUGS, TERMINALS, ETC.
1—3-socket terminal strip type 1119 (Belling-Lee).
3—Midget plugs type 1019 (Belling-Lee).
1—Insulated terminal type H marked E (Belling-Lee).
RESISTANCES, FIXED.
1—25,000-ohm type 1 watt (Erie).
1—10,000-ohm type ½ watt (Erie).
RESISTANCES, VARIABLE.
1—500,000-ohm. (Erie).
SUNDRIES.
1—Closed circuit jack (B.T.S.).
Connecting wire and sleeving (Peto-Scott).
SCREENING BOX.
1—Aluminium 6 by 6½ by 6½ in. (Wearite).
SWITCHES.
1—on/off type S80B (Bulgin).
TRANSFORMER, LOW FREQUENCY.
1—1—5 ratio type PP (Graham-Farish).
VALVE.
1—PP222 (Tungsram).

Making a Microphone Stand

By 2BZN

THE modern microphone is a very delicate and sensitive instrument and is extremely susceptible to shocks and vibrations. In one instance very bad a.c. hum on a transmission was traced to the vibrations from a mains transformer in the power supply unit, travelling to the microphone via the floor and the operator's desk. The microphone in this case was simply standing on top of the receiver cabinet. The microphone stand to be described below, besides imparting to the station a definitely "commercial" look, completely cured the hum.

The construction of the stand is very simple and may be undertaken with confidence by any amateur, even though workshop facilities are limited to drill-brace, pliers and the kitchen table.

Materials required are: brass strip 3 ft. long, ⅜ in. wide, ⅛ in. thick; 16-gauge steel wire 12 ins. long, 9½ ins. by 6BA brass screws with nuts; ebonite 2 in. by 1 in. by ¼ in.; electrician's wood block 3 in. diameter 1 in. deep; stout rubber band (such as used around the top of glass preserving jars). The total cost of everything should not exceed 1s. 6d.

Forming the ring is the first operation. Use a round jar or tin about 7 in. in diameter, it need not be exact size, 6-8 ins. will answer quite well, then firmly bend the brass strip around this. Bend the whole strip, do not attempt to cut it to size first. Then there is a ring with the two ends overlapping considerably, cut the ends off *both together*, This will ensure that the ends of the ring "butt" perfectly. The ring is joined by drilling four ⅛ in. holes near the two ends and bolting them to the ebonite. The ebonite is then fastened to the wood block with four screws, one at each corner.

The next operation is to drill five holes ⅛ in. diameter around the strip to take the small hooks that hold the rubber band. Drill the first hole exactly at the top of the ring, then two more holes 4 in. each side of this and another pair of holes again 4 in. from the previous pair.

Make five hooks from steel wire, thread them through the holes and loop the rubber band around them. If the microphone is not equipped with hooks four more will have to be made and attached to the "mike" by any convenient method, depending upon the type of "mike." The microphone is hooked on to the rubber band and the stand is complete.

If the microphone is particularly heavy it may not hang centrally in the ring, in which case use thicker rubber bands.

PREMIER SUPPLY STORES

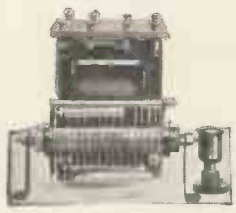
LARGEST RADIO MAIL ORDER HOUSE IN EUROPE

SEND FOR OUR NEW ILLUSTRATED GIANT CATALOGUE AND VALVE LIST 4D. POST FREE

MAINS VALVES, famous Europa 4v. A.C. types, HL., L., SG., Var-Mu-SG., HF. Pens., Var-Mu-HF-Pens. 1-, 3- and 4-watt A.C. directly heated output Pentodes. Full Wave rectifiers, 250v. 60ms.; A.C./D.C. types, 20v .18 amp., SG., Var-Mu-S.G. H., HL., Power. 4/6 each. Full Wave rectifiers, 350v. 120 m/a. and 500v. 120 m/a. 2½ watt, indirectly heated Pentodes. Frequency Changers, Octodes, Heptodes, 5/6 each.

BATTERY VALVES. 2v., HF., LF., 2/3; Power, Super Power, 2/9; SG. Var-Mu-SG., 4- or 5-pin Pentodes, HF. Pens., V-Mu-HF. Pens., 5/-; Class B, 3/6.

AMERICAN VALVES. Genuine American **DUOTRON,** all types, 3/6. **HYTRON** super quality, 3 months' guarantee, all types, 5/6. New Metal Glass Valves, all types, 6/6.



PREMIER CHARGER KITS (for A.C. mains)

Include Tapped Mains Transformer and Westinghouse Rectifier.

8 volts at .5 amp.	14/6
8 volts at 1 amp.	17/6
15 volts at 1 amp.	19/-
15+15 volts at 1 amp. ...	37/6
15+15+15 volts at 1 amp. ...	50/-
8v. at 2 amps. ...	29/6

PREMIER MAINS TRANSFORMERS
Screened Primary Wire-end Type

250+250 or 300+300 v. 60 ma. 4v. 1-2a., 4v. 2-3a., 4v. 4v. 3-4a., all C.T.
H.T. 8 & 9, 4v. 1a., 4v. 4a., all C.T.

8/6 EACH

350+350 v. 120 m.a. 4v. 1-2a., 4v. 2-3a. 4v. 3-4a., all C.T.

10/6

500+500 v. 150 m.a., 4v. 2-3a., 4v. 2-3a., 4v. 3-4a., all C.T.

19/6

100-watt auto transformers. 100-110v. to 200-240v. **10/-** terminal type.

Terminal Types, as illustrated, 1/6 extra. **Westinghouse** H.T. 8 or 9 Rectifiers, 8/6 extra. H.T.10, **9/6 extra.**

PREMIER SMOOTHING CHOKES

25 m/A. ...	2/9
40 m/A. ...	4/-
60 m/A. ...	5/6
150 m/A. ...	10/6

Speaker Replacement Chokes, 2,500 ohms, 5/6.

MOVING IRON METERS

Any range between 10 and 500 m/A. Also 1.3 or 5 amps. Read A.C. or D.C. Flush Bakelite case, 2⅜ in. diam. B.E.S.A. standard specification 89. 5/9 each.

MOVING COIL METERS

0.1 m/A. 100 ohms resistance. Diameter 2⅜ in., 18/6. Larger model, diameter 3½ in., 22/6. Flush mounting. Bakelite cases B.E.S.A. first-grade accuracy. **Multipliers** for above, 1/- each.

PREMIER ELIMINATOR KITS

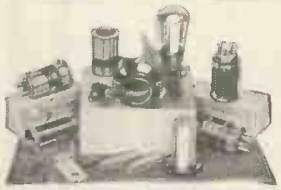
(for A.C. mains)

Comprise mains Transformer, Westinghouse Rectifier, Choke, Condensers and resistances.

120 volts 20 milliamps ...	20/-
With Trickle Charger ...	28/-
150 volts 30 ma. and 4v. 2-4a. C.T. L.T. ...	25/-
With Trickle Charger ...	31/6
250v. 60 ma. with 4v. 3-5a. ...	30/-
Class "B" Eliminator Kits ...	27/6

Diagrams supplied.

Callers to:
20 and 22, HIGH ST., CLAPHAM, S.W.4.
Macaulay 2381.



PREMIER SHORT-WAVE KIT

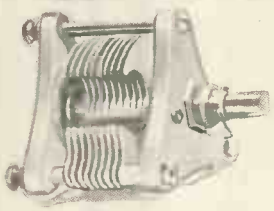
for 1 Valve Receiver or Adaptor, complete with Chassis 3 Coils, 15-170 meters. Condensers, Circuit and all parts.
VALVE GIVEN FREE ! ! !
2-VALVE S.W. KIT complete with valves, **19/6.**
3-VALVE S.W. KIT, S.G. Det. Pen. complete with valves, **40/-.**

PREMIER SHORT-WAVE COILS

13-26, 22-47, 41-94, 76-170 metres.

1/9 EACH

Four or six-pin fitting. On highest grade plastic material. Formers only, 1/- each.
Special Set of Three 4-pin Coils 15-150 metres, 4/-.
Premier 3-band S.W. Coil, 11-25, 19-43, 38-86 metres. Simplifies S.W. receiver construction, suitable any type circuit, 2/-.



SHORT WAVE CONDENSERS

super ceramic S.L.F. .00016, .0001, **2/9** each; double-spaced, .000015, .000025, .00005, **3/-** each; all brass, with integral slow-motion, .00015, tuning, **3/9**; .00015 reaction, **2/9.**

PREMIER ALL-WAVE 3-VALVE KIT

From 12-2,000 metres in 4 wavebands without coil changing. Tuned S.G. detector and Pentode. Complete with 2-volt valves and Moving Coil L.S. Blueprint supplied.
Nothing else to buy.....**60/-**

PREMIER 3-VALVE BAND-PASS KIT
Illustrated

Complete set of parts for this splendid receiver, includes Valves and Speaker.

Battery Kit	50/-
A.C. Model	70/-

Blueprints included Free.

WIRE-ENDED RESISTANCES

1 watt any value ...	6d. each
4 watts ,, ,, ...	1/- each
8 ,, ,, ,, ...	1/6 each
15 ,, ,, ,, ...	2/- each
25 ,, ,, ,, ...	2/6 each

BUZZERS

Bakelite Cased type, 1/- Premier "Loud Tone," 2/6.

SHORT WAVE HF. CHOKES

10-200 meters, 9d. Screened ditto, 1/6. Screened chokes, 180-2,000 metres, 1/6.

All Post Orders to:
JUBILEE WORKS, 167, LOWER CLAPTON RD., E.5.
Amhurst. 4723.

GRAMOPHONE MOTORS. Collaro Gramo Unit, consisting of A.C. motor 100-250v., high quality pick-up and volume control, 45/-; Motor only 30/-; Universal Model 100-250v. A.C./D.C., with high quality pick-up and volume control, 67/6; Universal Motor only 49/6; Edison Bell double-spring motors, including turntable and all fittings, 15/-; Cosmocord Gramo Unit, comprising A.C. motor, pick-up and volume control (list 55/-), 35/9.

PREMIER "HIGH FIDELITY" P.A. AMPLIFIERS

10 watt A.C. output, **£7 7s.**
20-watt A.C. output. **£10 10s.** With Valves, Also supplied as Kits.
20-watt ... **£8 8s.**
10-watt ... **£5 5s.**
7-watt A.C./D.C. **£4 4s.**
3-watt A.C. **£2**
All with valves

TRANSVERSE CURRENT MICROPHONE (Reisz Pattern)

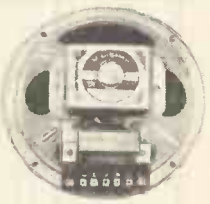
High-grade, large output unit, having an exceptionally fine frequency response, with low Hiss Level. The Frequency Range being from 45 to 7,500 cycles, plus or minus 2DB. Real depth shading and brilliancy of music as well as clear, clean-cut personality of speech.

Microphone ...	30/-
Transformer ...	5/-
Table Stand ...	7/6

5,000 TELSEN RG4 L.F. TRANSFORMERS

Latest type Super LF. All brand new and boxed (listed, 12/6), **2/9.**

Lissen "Hypernik" Q.P.P. 8-1 Transformers (listed, 12/6) **3/6.**



SPEAKERS, MAGNAVOX, Mains energised, "154" 7-in. cone, 2,500 ohms 4 watts, **12/6,** "154" Magna, 5 watts, **25/-**; "152" 9-in. cone, 2,500 ohms, **17/6**; "152" Magna 9-in. cone, 2,500 ohm 6 watts, **37/6.** Magnavox P.M.'s "254" 7-in. cone, **16/6**; "252" 9-in. cone, **22/6.** Goodmans P.M., **10/6,** Cossor P.M., **13/6**; Blue Spot 29. P.M., **15/-,** in cabinet, **25/-.**

FIXED CONDENSERS

Electrolytics		Paper Types	
T.C.C.:		Dubilier:	
8mf. 650v. surge	4/-	4mf. 500 v. working	4/-
4mf. 650v. surge	4/-	4mf. 800v. ditto	6/-
15mf. 50v. ...	1/-	2mf. 750 v. ditto	3/-
15mf. 100v. ...	1/-	4 mf. 1000v. ditto	10/6
50mf. 12v. ...	1/-	4mf. 2000v. ditto	13/-
Dubilier:		Western Electric:	
4mf. 500v. ...	3/-	4mf. 250v. ditto	2/-
8mf. 500v. ...	3/-	2mf. 250v. ditto	1/-
8+4mf. 500v. ...	4/-	1mf. 250v. ditto	6d.
50mf. 50v. ...	1/9	4mf. 350v. ditto	2/6
12mf. 20v. ...	6d.	2mf. 350v. ditto	1/6
25mf. 25v. ...	1/-		
U.S.A.:		**CONDENSER BLOCKS**	
4, 8, or 12mf. 530v. peak ...	1/9	All 250 volts working.	
8+4mf. 500v. peak	2/3	Dubilier:	
4+4mf. 500v. peak	1/6	2+2+2mf. ...	2/-
8+8mf. 500v. peak	2/6	2+2+1+1+1mf.	2/6
12+8mf. 500 v. peak	2/6	H.M.V.:	
12+4mf. 500v. peak	2/6	4+1+1+1+.5+.5+.5mf.	1/6
		Lissen:	
		4+4+1+1mf.	3/-

Wego 1mf. 450v. working, 1/-; 2mf., 1/9; 4mf., 3/-; 2mf. 700v. working, 2/-; 4mf., 3/6. 1mf. 1650v. working, 3/6; 2mf., 5/6.

City Callers to:
165 and 165a, FLEET ST., E.C.4.
Central 2833.

"Oscillator Amplifier 5-metre Transmitter"

(*Continued from page 523*).

current microphone with single stage head amplifier.

Aerial Lengths

The aerial is most important, and although a vertical aerial seems to give most satisfactory results, we can get a stronger signal in a given direction by using a horizontal aerial of the dimensions as shown. This aerial is 7 ft. 10 in. with feeders 3 ft. 11 in. and spaced 3 in. This aerial will then resonate on the edge of the 5 metre band.

An indication of resonance can be obtained by inserting a bulb in the electrical centre of the aerial, but approximately ½ in. of wire should be removed from each side of the aerial to compensate for the bulb. The following aerial lengths should be used for the frequencies as given :—

56 Mc.	8 ft.	3¼ in.
57 Mc.	8 ft	1½ in.
58 Mc.	7 ft.	11¾ in.
59 Mc.	7 ft.	10 in.

Thse lengths do not take into consideration the effect of the resonance indicating bulb, which will alter the length of aerial by approximately 1 in.

The valves in this transmitter are of the American 53 type, obtainable for 3s. 6d. as indicated in the list of components. We feel that experimenters will have little difficulty in obtaining these valves, and will build up this transmitter in view of the low valve cost. . Any points which are not quite clear can be raised by writing to the Technical Dept. of "Televison and Short-wave World," 37 Chancery Lane, London, W.C.2.

"A Volume Expander"

(*Continued from page 518*)

Time Lag

It is also possible to delay the action of the expander until the signal being handled rises above a certain value negatively by biasing the diode plates. The small cross at the bottom of the diagram in series with .1-megohm leak and the 20-volt supply indicates just where the diode voltage can be introduced.

It will be seen that in the lead to the injector grid are a 5-megohm resistance and a .5-mfd. condenser. These are included to create a time lag to prevent expansion taking place instantaneously. If the effect were instantaneous the output would be jerky and unpleasant. By using a variable resistance in this position a variable time lag could be introduced so that the expander operated exactly to individual cases.

Valves suitable for use in this circuit are obtainable for as little as 3s. 6d. so there is no reason why amateurs or those interested in quality reproduction should not try out this latest idea.

A Real All-wave Radio Receiver

TECHNICALLY one of the most interesting exhibits at this year's Olympia show is the H.M.V. All-wave Bureau Autoradiogram model 581.

It is one of the few receivers that can truly be called all-wave, for it covers wavelengths of between 7 and 2,200 metres. The 7-metre band is intended for the reception of sound transmissions from the Alexandra Palace, which start in October.

This receiver can actually be used as a writing desk while records are being played by the automatic gramophone or as programmes are being received *via* radio.

The price, 48 guineas, indicates that this year's radio receivers will be cheaper than ever, while the higher priced radio gramophones will be even better value for money.

Television for the Amateur Constructor.

The Mervyn Sound and Vision Co., Ltd., of 4 Holborn Place, W.C.1, are now in a position to supply television receivers for high-definition vision.

A special feature of their equipment is that it can be unit constructed, so being suitable for the home television set builder.

Supplies of all television apparatus are now available so that intending constructors can go ahead and build a television receiver in time for the experimental transmissions which have started.

Mervyn ultra short-wave receivers are also suitable for the reception of 5 and 10-metre amateur transmissions, while a complete range of specialised short-wave components are now being listed. Full details of television and short-wave apparatus can be obtained from the Mervyn Sound and Vision Co., Ltd., at the above address.

The Ipswich and District Radio Society.

The last meeting of the above Society was held at Oxborrows Hotel, Ipswich, by the kind permission of Captain Horne. It was decided that the old Ipswich Radio Society should be reformed and to that end the following officials were elected. Chairman, Mr. C. Runnicles, G2YZ; Secretary, Mr. G. H. Barbrook, G8AN; treasurer, Mr. A. G. Wood, G6TI.

Any interested short-wave listeners should get in touch with G8AN at Radio House, St. Peter's Street, Ipswich. Amongst the active members who have already joined are G2YZ, G8AG, G8AN, G6TI, 2AJR and 2AXZ.

Straight Receivers for Television.

It is interesting to note that the Marconiphone television receiver, details of which will be found on another page, makes use of a straight tuned R.F. arrangement for the reception of vision signals.

Whether this is due to frequency drift in either the receiver or transmitter is not quite clear, although the former is probably the case.

We have noticed on normal short-wave bands that super-het receivers cannot be accurately tuned to given frequency without creep appearing within quite a short time. This also applies to large American receivers.

Our Policy
"The Development of Television."

A NEW MICROPHONE for AMATEUR AND P.A. USE

WE have been making some exhaustive tests in the laboratory and over the air through our short-wave station G5ZJ of the new microphone designed by the Aintree Production Co. It is one of the first high-quality microphones suitable in every respect for amateurs.

First, it is a sound engineering job built from cast aluminium and solid ebonite. The carbon granules are of the finest grade and so packed that there is not the slightest trace of rustle, or, in fact, any background noise at all.

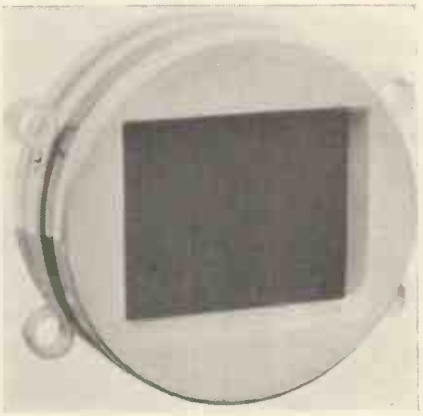
Several new patents have been used in the construction of this microphone, the principle one being to eliminate any possibility of packing.

As an indication of this the microphone can be moved into any position while it is in use without any background noise being noticed.

The quality is such that the frequency response is sensibly level between 100 and a little over 6,000 cycles while there is quite an appreciable output at 8,000 cycles and below 50 cycles.

The voltage developed averages .4 volt R.M.S., which is quite high for a quality microphone and enables ample modulation to be obtained with a low-gain amplifier.

It has been designed to operate with 2 volts energising when the current consumption is 5-6 m/a. When the voltage is increased to 10 the current rises to 30 m/a with a large increase in top note response. When operated under such conditions several stations have been under the impression that a crystal microphone was being used. This also speaks volumes for the tonal quality.



This microphone is very suitable for amateur work. The quality is well above the average for units of this type while it is only priced at 37/6d.

It should be used with a microphone transformer of between 10 and 15/1 if the best balance is to be obtained. The Ferranti output transformers are suitable for the job, but a special transformer has been designed to sell at 7s. 6d.

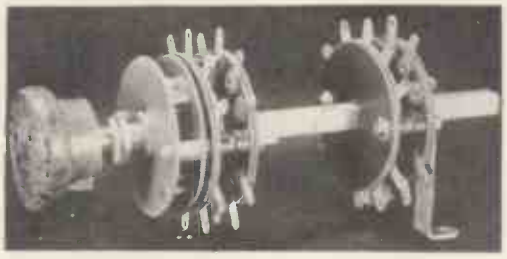
We consider that the Q.M.S. microphone priced at 37s. 6d. is a very good investment and solves the microphone troubles for many amateurs wanting quality coupled with very low cost.

There is no excuse for the amateur still to use the old-fashioned P.O. type microphone with this cheap unit now available.

Deliveries started on August 21, and all details can be obtained from the Aintree Production Co., of Brockley.

An All-wave Radiolympia

RADIOLYMPIA, 1936, will stand out as being the first exhibition really to push the short-wave side of reception. In previous years the number of stands showing short-wave apparatus could be counted on the fingers of one hand. But not so this year, for most manufacturers have at least one good all-wave set to sell, while many have redesigned their range of components so that they are now really worth using.



Bulgin have introduced this low-capacity switch for short-wave coil switching and for use in circuits where low losses are essential.

Automatic Coil Winders, who market Avo test equipment are now outstanding as manufacturers of meters of all kinds. An Avo signal generator will be on show for the first time on Stands Nos. 33 and 34, and those interested in service work should make a special point of getting details of this instrument. It is priced at 15 guineas and covers a continuous fundamental range from 3,000 metres to below 20 metres. It has been designed so that it can produce internally or externally modulated signals and a pure R.F. note. This is but one of the many test instruments introduced by The Automatic Coil Winder and Electrical Equipment Co. this year.

Belling-Lee have at last got down to the problem of noise elimination on short-waves, without eliminating signals at the same time. Their solution to this problem is the "Eliminoise" aerial kit shown for the first time on Stand No. 98.

From our tests, this aerial cuts out the bulk of local interference without signal attenuation, while on certain wavelengths there is a distinct increase in signal strength. Most short-wave listeners are at some time or other troubled by interference, so we advise them to inspect the special noise-elimination components on the Belling-Lee stand.

The biggest maker of television and radio components in this country is Bulgin. There are over one hundred new lines introduced this season, all of which will be on Stand No. 1. One of the components which interested us was the type VHT1 Vibrator Converter, which gives 250 volts at 60 M/a when driven by a 6-volt accumulator.

To our way of thinking, this solves the problem of power supply, while for car radio or field day use it is ideal. It is priced at 20s. Many new Bulgin television components will be on show for the first time, while short-wave constructors now have a further source of supply of super low-loss condensers, valve holders and similar components.

Decreased filament current coupled with greater efficiency is a feature of the new Mazda valves. A new book-booklet giving full operating data on receiving and transmitting valves, and cathode-ray apparatus can be obtained from the Edison Swan Electric Co., on Stand No. 69. Amateurs should make a mental note to view the crystal microphones and pick-ups introduced by Ediswan for the first time, for they are ideal for transmission purposes.

A good pointer as to public requirements can be obtained by noting the receivers on Ferranti Stands Nos. 8 and 80. Every receiver in this year's Ferranti range embodies a short-wave section so that amateur and commercial stations can be received at will. As these receivers are extremely low-priced, would-be kit constructors are advised to consider the purchase of a guaranteed receiver such as the Ferranti Parva at 9 guineas.

Very suitable condensers for high voltage and television work are these Dubilier oil-immersed suitable for 2,000 volts.

(*Continued on page 540*).

"An All-wave Radiolympia"

(*Continued from page* 538).

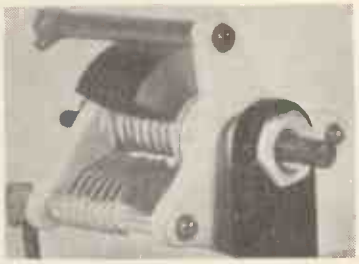
One of the most popular commercial short-wave receivers has always been the G.E.C. Colonial. This has now been completely redesigned so that it is suitable for tropical use and amateur band reception. Details of this and other G.E.C. receivers can be obtained from Stands Nos. 57 and 68.

Our experiences in the construction of short-wave and television apparatus have shown that variable and fixed resistors must be absolutely noiseless in use. Erie resistors fulfil such requirements and in particular with their variable potentiometers we cannot recollect ever having a faulty one. The reason for this can easily be seen if the partially constructed models are examined on the Radio Resistor Co., Ltd., Stand No. 16.

One of the few chokes that can be used for modulation purposes without chattering is the Sound Sales "WWC1." It has a large core, plenty of iron, while the windings are so tightly put on that there is no possibility of movement. This choke is being shown on Stand No. 94, together with some high quality amplifiers suitable for P.A. or modulation work.

A check receiver for the transmitter should give good reproduction, which means the loud-speaker must have a level frequency response. In addition, as short-wave stations are now putting out fade-free programmes, the loud-speaker becomes one of the most important accessories to a receiver. The new Magnavox Duode 33 has a very wide frequency range of up to 15,000 cycles, which is distinctly better than many loud-speakers of a similar type. It can be examined on the Benjamin Electric Ltd., Stand No. 91. This new Duode 33 costs 5 guineas complete with output transformer.

A. J. Balcombe have a fine range of all-wave receivers with sensibly designed tuning scales. Their cheapest all-waver is priced at 11 guineas, while an all-wave radiogram at 22 guineas will surely be one of the creapest sets of its kind available this year. Alba receivers are being displayed on Stand No. 58.



B.T.S. have some fine variable condensers for the transmitter or receiver. The end plates are made of ceramic material.

Burndept have designed a receiver to give all-wave loud-speaker reception with only a battery for high tension. Their model 251 at £7 19s. 6d. should be closely examined. It can be seen on Stand No. 82, along with a whole host of very fine receivers.

A television receiver built by Baird will be shown for the first time on Stand No. 67 under the name of Bush Radio. This stand will probably create more interest than most, for our readers will surely want to see the multi-valve television receiver. But do not lose sight of the fact that Bush Radio are marketing this year a really high-power all-wave receiver with an outstanding performance.

A complete new range of odd-sized condensers is being marketed by Dubilier. We have in mind the type BE311 500-volt working 0.1 + 0.1 for 3s.; also .5 mfd. condensers, 650-volt working for 2s. 6d. A new series of electrolytic condensers with capacities of 10, 25 and 50 mfd. cost 2s. 3d., while block condensers, such as the type 305, cost 5s. This condenser is suitable for 300 volts D.C. working and is a 4+4+2+2+2 mfd. Constructors should

(*Continued on page* 541).

"An All-wave Radiolympia"

(*Continued from page* 540)

make a point of seeing the new Dubilier components.

The familiar circular dial on the Ekco sets will be almost entirely absent this year. All Ekco receivers and cabinets have been entirely re-designed, allowing for an increase in efficiency and an appreciable decrease in price. There are two outstanding receivers in this range, the AW87 all-wave at 12 guineas, and the CT77 Console at 13 guineas. This console receiver should make new records in value for money.

A valve that is really universal in application has been introduced by Hivac. It can be used in any stage of almost any receiver, so reducing the number of valve types per set. This valve is probably the most modern development at Radiolympia. Several new valves for short-wave receivers with ceramic bases and a top grid contact will also be shown on Stand 28.

There is always a difficulty in obtaining neutralising condensers that will stand a reasonably high voltage. The J.B. type 2140 seems to solve this problem, for even in the rare cases where the spacing may not be sufficient the construction of the condenser lends itself to double and triple spacing. This and other short-wave condensers are being displayed on Stand 99.

A receiver tuning from 7 to 2,200 metres has been designed by H.M.V. engineers and can really be called all-wave. The 7-metre channel has been introduced so as to enable listeners to hear the sound portion of the Alexandra Palace transmissions. The cheapest 7-metre receiver in the H.M.V. range is the 481 at 18½ guineas. At least eleven all-wave receivers are being shown on The Gramophone Company's Stand No. 71.

Marconiphone are also making a special feature of their numerous all-wave receivers, and two complete television receivers models 701 and 702. Model 701, which is a very complete home entertainer, provides, in addition to a 10 by 8 television picture, reception from 7 to 2,200 metres.

A high-quality all-wave receiver on the usual McMichael lines can be examined at their Stand No. 64. It is a new departure for McMichael to foster all-wave receivers, but their model 362 is really a fine set in every way. Cabinet work, reproduction, construction and efficiency, are all above reproach, and at 15½ guineas this receiver should appeal to the fastidious set-buyer.

One of the most efficient all-wave receivers of the 1935-6 season has been the Pye T10. This has now been improved and is being kept company by a new Empire all-waver using 10 valves. The tuning dial is a vast improvement on the normal broadcast set dial, and strikes a new note in design. The Pye

(*Continued on page* 542)

"An All-wave Radiolympia"

(*Continued from page 541*).

Empire at 33 guineas will probably be the cheapest 10-valve receiver at the exhibition. Pye are exhibiting on Stand No. 65.

Every short-wave and television enthusiast will make a bee-line for Eddystone Stand No. 25. There will be a large number of new components for ultra short-wave working. 5-valve all-wave battery operated super, a 6-valve mains operated super, an amateur band single signal receiver, and many other items which have not been shown before. The transmitting amateur will also find one or two complete transmitters housed in Eddystone steel racks.

The new T.C.C. electrolytic condensers are surge proof and suitable for constructor receivers.

One of the best oscillator valves we have tried is the Tungsram 0/15/400, a valve that will stand considerable overload and give high R.F. output. This, and other transmitting valves, can be seen on Stand 36, while actual operating data will also be available. A new range of economy battery valves will also be available at Olympia.

Constructors should remember that T.C.C. electrolytic condensers are surge-proof and will stand a fair percentage of overload. Some readers have experienced difficulties with electrolytic condensers working on 500 volts, so they should bear in mind these new T.C.C. units which will overcome this trouble.

Litz-wound intermediate frequency transformers have been introduced by Varley and are suitable for 465 and 110 Kc. Another cheap component is a mains transformer for 37s. 6d., giving 350–0–350 volts at 120 M/a with four filament windings which is certainly an investment. This transformer can be used to advantage with a low-power transmitter, so we advise readers to obtain information regarding this new product. Varley also list a number of tapped inter-valve and output transformers which have a multitude of uses. It is not generally realised that Varley make a large number of components suitable for the transmitting amateur.

Invicta Radio make one of the few receivers that cover the 160-metre amateur band. Their model AW57 at 14 guineas covers all wavelengths from 13 to 2,000 metres, that is all amateur, ship and police wavebands.

A midget battery-operated portable receiver has been introduced by Vidor who are displaying it, together with a large number of dry batteries of all kinds, on Stand No. 78. Readers who are looking for a very cheap radio-gramophone are well advised to see the Vidor model 237 at 18 guineas. It uses 5 valves and covers 200 to 2,000 metres. An all-wave radiogramophone, model 235, is also available, and priced at 15 guineas.

Litz-wound coils are used in these Varley I.F. transformers. They are ideal for amateur band receivers where the maximum gain and selectivity are required.

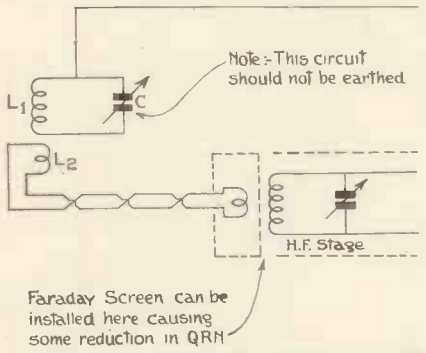
Those who have not tried short-wave reception should consider buying the Vidor converter, which can be added to almost any receiver. It tunes from 13 to 50 metres, and is priced at 47s. 6d.

Two Useful Hints for the Amateur

By G2IS

A Simple Means of Improving Antenna Coupling

THE effectiveness of the tuned R.F. stage in the average amateur receiver is a function of the efficiency of the grid input circuit of the R.F. amplifier valve.



It is often the case that a good coil and condenser combination is severely penalised by the heavy damping imposed on the circuit by the antenna coupling load. There is an added loss in the impedance mis-match which is usually present between the antenna network "looking out" and the grid circuit "look-in."

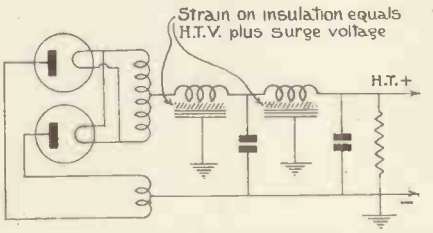
A vast improvement in signal strength and sensitivity can be obtained by using the extremely simple and inexpensive arrangement shown in Fig. 1. The inductances, L1 and L2 are wound on an ordinary coil former of about fourteen threads per inch and consist of the usual number of turns for the bands required. The condenser has a capacity of .00016-mfd. and should preferably be of the slow-motion type. The number of link turns at the R.F. grid circuit should be determined by trial and error, while there is no need to screen the L1- L2-C combination.

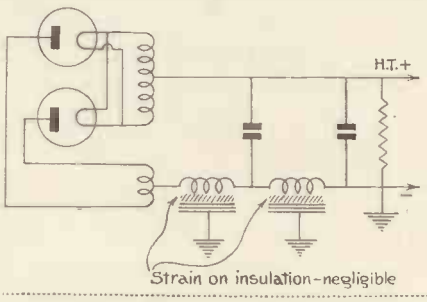
In operation the receiver is turned on and left oscillating. C is then slowly rotated until resonance is indicated by a sudden rise in noise level. The tuning of the unit requires very little retouching to cover the entire amateur band in use.

An Improved Rectifier Arrangement

Ninety-nine per cent. of all high-voltage rectifier circuits show the smoothing chokes in the high-tension positive lead. This arrangement is an excellent example of the way engineering habits are automatically followed.

There is every reason for not putting chokes at this point in the circuit. Good practice demands that the choke frames be rigidly earthed. Fig. 2 shows a typical circuit whereby there is a difference of potential equal to the total output of the rectifier applied between the windings and core of the L.F. choke. In such cases, as condenser input is used, there will be an extremely high instantaneous voltage set up in the choke with the accompanying possibility of choke insulation breakdown which would cause the failure of rectifying valves and probably smoothing condensers.





(*Continued in 3rd col. of next page*).

INDEX TO ADVERTISERS

(*Continued from page 544*).

Fig. 3 shows the same circuit but with the smoothing chokes moved to the negative line. In this case the potential difference between winding and choke core is only equal to the voltage drop across the choke. With a total resistance of 500 ohm and a current flow of 100 ma. the total strain on the insulation is only 50 volts, so that if a choke should go down to earth there is no possibility of damaging the remainder of the rectifier equipment. As far as smoothing is concerned, this circuit is identical in effectiveness to Fig. 2.

MISCELLANEOUS ADVERTISEMENTS

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

REVIEWED.—Practical Wireless, August 8th. New Theory Book. Post free 1/1d. D'Arcy Ford, 15, Gandy Street, Exeter.

JOHN SALTER of Featherstone Buildings, Holborn, W.C. Pioneer, since 1927, of Television components, will be pleased to hear from old friends and new customers requiring up-to-date apparatus.

WANTED—Kerr cell, Nicols, motor and mirror drum, Cheap. Box No. 6.

PATENT AND TRADE MARK AGENTS

GEE & CO. (Estab. 1905), patents and trade marks throughout the world (H. T. P. Gee, Mem.R.S.G.B., A.M.I.R.E., etc.), 51-52, Chancery Lane, London, W.C.2 (2 doors from Government Patent Office.) 'Phone : Holborn 1525. Handbook free.

KINGS PATENT AGENCY LTD. (B. T. King, Patent Agent) 146a, Queen Victoria Street, London, E.C.4. ADVICE, Handbook and Consultations free Phone City 6161.

SITUATIONS VACANT

PHYSICIST REQUIRED to initiate a Vacuum Laboratory for the study of the application of Vacuum Devices to Television and Radio Development. Unique opportunity for a man with ideas and the requisite experience.—Pye Radio Limited, Dept. 44/VP, Radio Works, Cambridge.

Constructors' Circle

T. Horan, 12 Miller Street, Newcastle, Staffs; A. G. Clampin, " Karasouli," Mill Street, St. Osyth, Essex; W. Richards, 38 Bryntaf, Aberfan, Merthyr Vale, Glam.; Mr. Humblestone, 5 Busaco Street, London, N.1; Mr. Linwood, 21 Surgeys Lane, Arnold, Nottingham; G. Richards, 54 New Park Street, Castle Fields, Shrewsbury; M. S. Bell, 17 Bainbridge Road, Leicester; Leonard Grugson, Dallen, Chiseldon, Wilts; A. S. Landsler, 37 Broadfields Avenue, Edgware, Middlesex.

TELEVISION DEVELOPMENTS

A NEW LARGE DIAMETER TUBE FOR TELEVISION REPRODUCTION

TYPE 12H TUBE

This Cathode Ray Tube can be seen in operation at Radiolympia, Stand No. 42.

The Ediswan Type 12H tube has a screen diameter of 12" giving a television picture 10"x 7½" without distortion.

The screen is of special material giving a close approximation to a black-and-white picture.

Specification:

Indirectly heated high vacuum tube.

Heater Volts	2.0
3rd Anode Volts	6000
2nd Anode Volts	1200
1st Anode Volts	150-400
Sensitivity (mm./V.)	950/V*

*V = anode volts

List Price **£15.15.0**

We also supply
HIGH VACUUM RECTIFIERS
GAS-FILLED RELAYS
MERCURY VAPOUR RELAYS
for Television Scanning circuits.

ENTIRELY BRITISH MADE

EDISWAN RADIO VALVES

THE EDISON SWAN ELECTRIC CO. LTD. 155 CHARING CROSS RD., LONDON, W.C.2

R.E.299

USED BY ALL GOVERNMENT DEPARTMENTS

Printed in Great Britain for the Proprietors and Publishers, BERNARD JONES PUBLICATIONS, LTD., Chansitor House, Chancery Lane, London, W.C.2, by THE PRESS AT COOMBELANDS LTD., Addlestone, Surrey. Sole Agents for South Africa: CENTRAL NEWS AGENCY. LTD. Sole Agents for Australia and New Zealand: GORDON AND GOTCH (AUSTRALASIA), LTD.