

*British*

R A D I O A N D

# TELEVISION

*Incorporating "The British Radio Maker and Exporter"*

Vol. IX No. 10

FEBRUARY, 1955

By Subscription only,  
15s. a year post free



**FERGUSON**



**TELEVISION**

**THORN ELECTRICAL INDUSTRIES LIMITED**

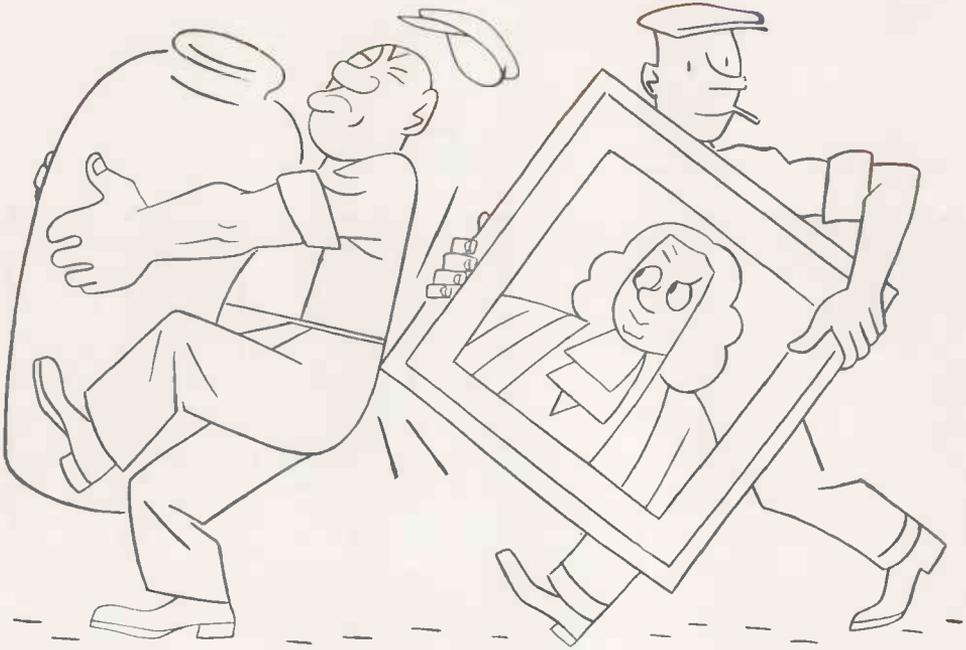
233 SHAFTESBURY AVENUE, LONDON, W.C.2.

RADIO &amp; TELEVISION RECEIVERS · GRAMOPHONE RECORDS



RADIOGRAMS &amp; RECORD PLAYERS · TAPE RECORDERS

# EXTRA SHARP PICTURE



**T**HAT'S not what we meant! Why can't our artist draw what he's told instead of always trying to be the funny man!

All we want is a nice realistic drawing of a pretty girl showing the extra sharp picture you get on a Philips Television Set. Now is that *clear*?

Readers will already know about Philips extra sharp television pictures—which give all the detail. May we, however, remind them that Philips also make a vast range of other electrical apparatus—a selection of which is shown as a border to this advertisement.

# PHILIPS

PHILIPS ELECTRICAL LTD · CENTURY HOUSE · SHAFTESBURY AVENUE · W.C.2.

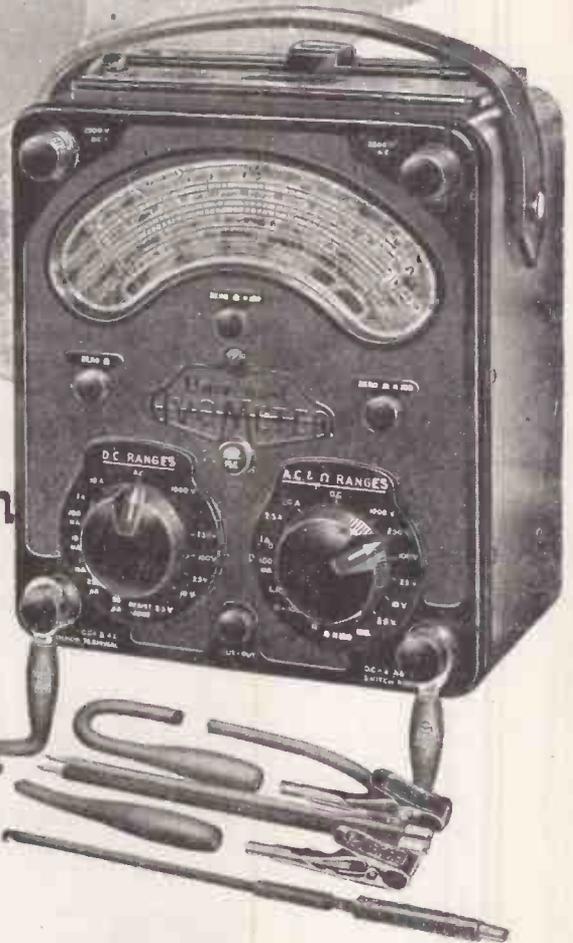
'PHILISHAVE' ELECTRIC DRY SHAVERS · 'PHOTOFLUX' FLASHBULBS · BATTERY CHARGERS & RECTIFIERS · CINEMA PROJECTORS

(P361A)

HIGH-FREQUENCY HEATING GENERATORS · ARC & RESISTANCE WELDING PLANT AND ELECTRODES · ELECTRONIC MEASURING INSTRUMENTS · SOUND AMPLIFYING INSTALLATIONS

MAGNETIC FILTERS · TUNGSTEN, FLUORESCENT BLENDED AND DISCHARGE LAMPS & LIGHTING EQUIPMENT · ELECTRO-MEDICAL APPARATUS · X-RAY EQUIPMENT FOR ALL PURPOSES

**20,000 ohms  
per volt plus  
AUTOMATIC Overload  
Protection**



Produced in response to a demand for a high sensitivity version of the world-famous Universal AvoMeter, this model incorporates the traditional design features of its predecessors, so highly valued for simplicity of operation and compact portability.

It has a sensitivity of 20,000 ohms per volt on all D.C. voltage ranges and 1,000 ohms per volt on A.C. ranges from 100V. upwards. A decibel scale is provided for audio frequency tests. In addition, a press button has been incorporated which reverses the direction of current through the moving coil, and thus obviates the inconvenience of changing over test leads when the current direction reverses. It also simplifies the testing of potentials, both positive and negative, about a common reference point. A wide range of resistance measurements can be made using internal batteries, separate zero adjustment being provided for each range.

It is of importance to note that this model incorporates the "AVO" automatic cut-out for protection against inadvertent overloads.

D.C. VOLTAGE	D.C. CURRENT	A.C. VOLTAGE
2.5V.	50μA.	2.5V.
10V.	250μA.	10V.
25V.	1mA.	25V.
100V.	10mA.	100V.
250V.	100mA.	250V.
1,000V.	1A.	1,000V.
2,500V.	10A.	2,500V.

A.C. CURRENT	RESISTANCE
100mA.	First Indication 0.5Ω.
1A.	Maximum indication 20MΩ.
2.5A.	0—2,000Ω
10A.	0—200,000Ω
—	0—20MΩ
—	0—200MΩ

Size 8½" x 7½" x 4½"  
Weight 6½ lbs. (including leads)

**£23 : 10s.**

The following accessories are available to widen still further the ranges of the instrument:— A Resistance Range Extension Unit to extend the limits of measurement from 0.025 ohm to 200MΩ, a 10kV. D.C. multiplier and a number of A.C. current transformers.

using  
Internal  
batteries.  
using  
external  
batteries.



**THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.**

WINDER HOUSE · DOUGLAS STREET · LONDON S.W.1

Telephone VICTORIA 3404-9

AVOCET  
TRADE MARK

# Vacancies for TELEVISION ENGINEERS

Belcher (Radio Services) Limited is the largest organisation in England dealing exclusively with radio and television service and the installation of television aerials for the trade.

We are continually seeking ways of improving and extending our facilities and as we enter upon this new year—a year which will see the beginnings of commercial television transmissions—we feel that we should make it known that we welcome enquiries from first-class television engineers in all parts of the country who wish to make 1955 a really happy New Year.

We offer, not just another job, but a career in this highly interesting branch of the industry—with top rates of pay, modern transport, exceptional technical and spare-parts support and early prospects of promotion to the right men.

*Write (in confidence) to the Chief Engineer*

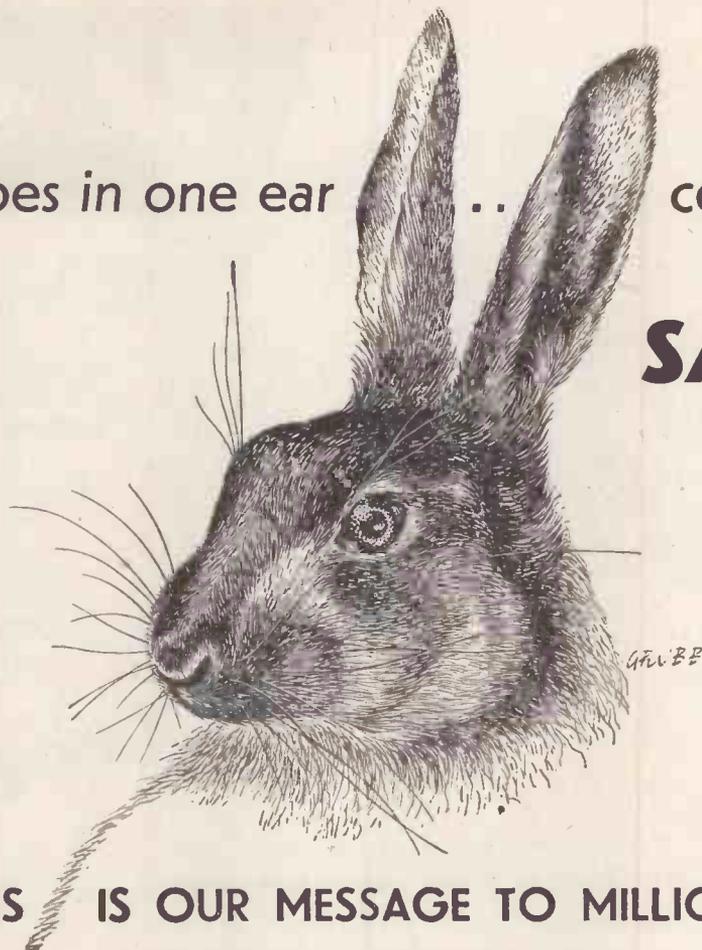


at Head Office: 59 WINDSOR ROAD, SLOUGH, BUCKS

Service Centres at:

BATH, BEDFORD, BOLTON, BOURNEMOUTH, DERBY, EXETER, HANLEY, HORNCHURCH, LEICESTER, LEWES, LINCOLN, MAIDSTONE, SLOUGH, SOUTHAMPTON, STOCKTON-ON-TEES, WORCESTER, YORK.

What goes in one ear . . . comes out  
in  
**SALES!**



THIS IS OUR MESSAGE TO MILLIONS:

**"SEE it... HEAR it**

**at your Cossor Dealer!"**

There's a whole hatful of reasons why you should sell Cossor Television and Radio. But the main one is this: when a prospect comes to you he's already nine parts sold. Just a Demonstration—and your prospect is a *customer*. Our advertising registers where it matters most—in the cash till!

**COSSOR**

Television and Radio

A. C. COSSOR LIMITED, COSSOR HOUSE, Highbury Grove. LONDON, N5

T.38

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# Advance

audio signal generator

## COVERS

15 c/s TO 50,000 c/s

## ACCURACY

PLUS/MINUS 2%

PLUS/MINUS 1 c/s

## LOW DISTORTION

1 WATT OUTPUT

INTO 600 OHMS

OVER ENTIRE

RANGE

# THE TYPE "J.1."

This model completely covers the wide range of 15 c/s to 50,000 c/s in three ranges, with an accuracy of  $\pm (2\% + 1 \text{ c/s})$ . Output (continuously variable) into 600 ohms, 0.1 mW. - 1w (0.25 - 25 v)  $\pm 2 \text{ db}$ , the output impedance approximating to 600 ohms over the whole range. Max. output into 5 ohms is greater than  $\frac{1}{2}$  watt. A 20 db attenuator may be switched into use when a very accurate output impedance is required. The total harmonic and hum content as compared with fundamental above 100 c/s is better than 34 db down (2%) at full output, and better than 40 db down (1%) at 0.1 watt. Weight 20 lb. Size  $13\frac{1}{2}'' \times 10\frac{1}{2}'' \times 8\frac{1}{4}''$

Full technical details are available  
on Leaflet B17

LIST PRICE (in U.K.)

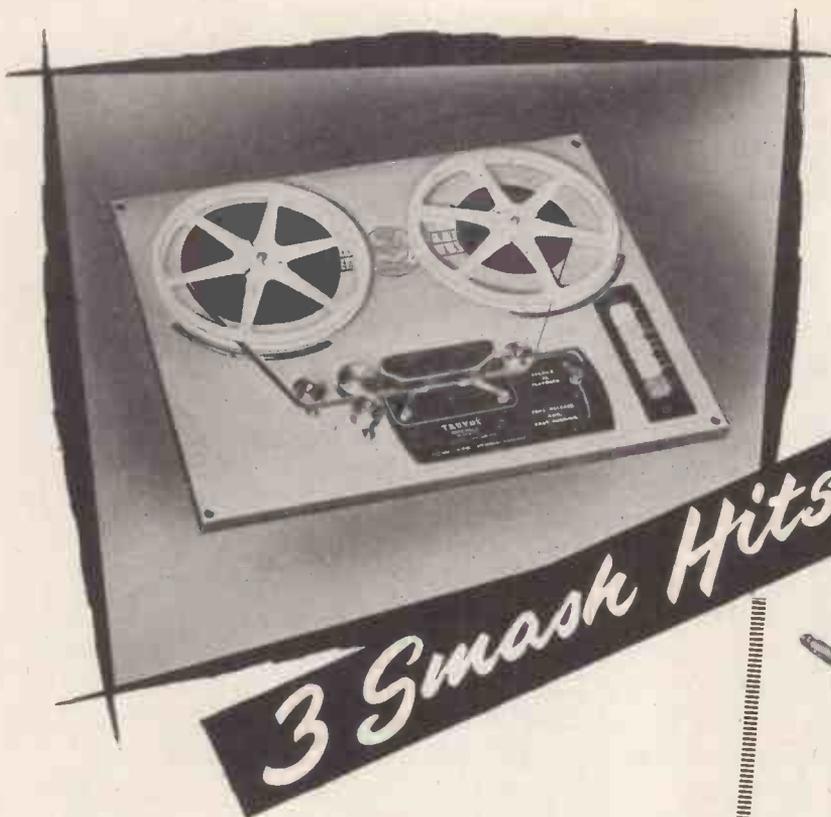
**£35.12s.**

The Type J.2 similar to the Type J.1, but with output voltage meter.  
List Price (in U.K.) £45

**ADVANCE COMPONENTS LIMITED · MARLOWE RD · WALTHAMSTOW · LONDON · E 17**

'Phone : LARKSwood 4366/7/8 'Grams : Attenuate, Walt, London.





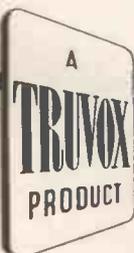
Pre-recorded tapes can now be replayed  
on the proved

**TRUVOX**

TAPE DECK NEW MODEL MK. III U

Incorporates BSS sense of tracking  
Price Still Remains at

**22 GNS.**



Manufactured in Gt. Britain by

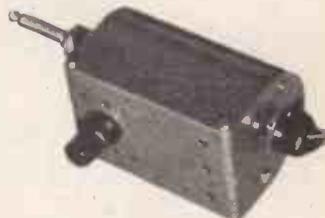
**TRUVOX LTD**

Sales Office : 15 Lyon Road, Harrow, Middx. (Harrow 9282)

Tech & Sales Dept.: 328 The Broadway, Station Road, Harrow, Middx.  
(Harrow 4455)

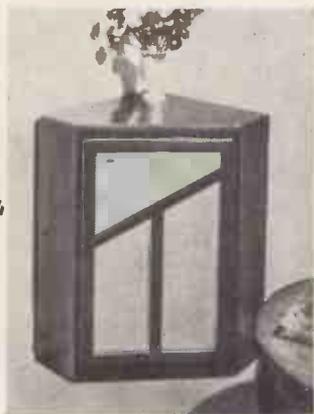


The popular TRUVOX Radio Jacks can now be used with Grundig and other Continental Tape Recorders for listening to and recording Broadcast Programmes.  
Model TA7 (with Continental Plug).  
Model TA3 (BSS Model)  
£2/10/- + 18/4 P.T.



The Light Programme can now be received and recorded with the new SENIOR RADIO JACK which adds the 1500 m. wavelength to the two Medium Wave stations.  
Model TA.8 (BSS Plug).  
Model TA.9 (Metric Plug), for Grundig or Continental Recorders.  
£3/9/6 + £1/5/5 P.T.

# AND A FOURTH ONE



The new Truvox Corner Diffusion Speaker for Hi-Fidelity reproduction, particularly of the pre-recorded tapes played back on Tape Recorders. Increases the pleasure of listening, at the same time a beautiful addition to any home.

12 watts, 10,000 lines, 5 or 15 ohms.  
Cabinet only (Patts. Apd. for)

	£26 8 6
Special Speaker to match	£3 0 0
Purchase Tax on Speaker	£1 0 6



Manufactured in Gt. Britain by  
**TRUVOX LTD**

Sales Office: 15 Lyon Road,  
Harrow, Middx.  
(Harrow 9282)

## TELEVISION TRADING SIMPLIFIED

### Are you ready for I.T.A.? New record system Cuts staff! Cuts time! Cuts costs!

Independent Television, coming hard on the heels of H.P. freedom means, of course, that you are expecting a boom.

And how right you are.

But it can also mean a tremendous increase in the paper work necessary to control customers' accounts, to ensure that maintenance contracts are executed to time and correctly costed, that stocks of receivers and replacement parts are properly controlled.

**THERE IS A METHOD THAT WILL DO ALL THESE THINGS and more—WITH LESS CLERICAL EFFORT and with A LOT LESS WORRY THAN EVER BEFORE.**

**HOW?**

Briefly the method is to make out a specially designed card holding comprehensive details of your dealings with each customer.

The cards are then housed in a Shannovue 'book' or cabinet—it depends on the number of cards you have (i.e., 60–10,000). When clipped in, each record shows a visible edge. This edge holds main details such as name, address, number, etc., and a dated strip.

The dated strip is used to signal (by means of little coloured signals) date of next instalment due—overdue payments—date overhauled, etc.

Over the whole card folds an 'auxiliary' sheet on which to note H.P. payments (paid and overdue) and details of reminders sent.

If you would like full details of this very compact little system (the saving in clerical effort is really surprising) just jot 'TV RECORDS' on your bill-head and post to us. Full details, plus a specimen of the actual record, will be with you by return.



**VISIBLY BETTER RECORDS**

The Shannon Ltd.,

857 Shannon Corner, New Malden, Surrey



## A matter of pedigree and history too

English B.C.'s latest

1897 saw the  
first permanent  
It was installed  
Marconi's Wire  
a member of

Remember the  
Talk to your local  
the benefits

**T**HE English Electric Group of Companies possesses a knowledge and a production experience in radio and television unsurpassed by any other group of companies in this country.

An important fact this which is emphasised in all our television consumer Press advertising.

To the dealer herein lies a double significance. He can sell 'English Electric' television with absolute confidence and know that when he does so it is to a public not only receptive and appreciative but also predisposed to the goods we make.

If you do not already hold an authorised 'English Electric' dealership write for details to:—

# 'ENGLISH ELECTRIC'



The ENGLISH ELECTRIC Company Limited, Domestic Appliance and Television Division, East Lancashire Road, Liverpool, 10

Please quote *British Radio and Television* when replying to advertisers' announcements

*British*  
RADIO AND  
**TELEVISION**  
*"Incorporating 'The British Post' Make-up and Consoles"*

Editorial and Advertising Offices:

92 Fleet Street, London, E.C.4

Telephone: CENTral 4100

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Annual Subscription to any part of the World: 15s. post pa

## Ceramic Pearl Capacitors

- Closer tolerances
- Minimum capacitance values
- High stability
- Low power factor
- More values to choose



Style	Dimensions		CAPACITANCE RANGE pF				
			D6	D20	D40	D50	D90
	L Max	D Max	P 100	NPO	NO 33	N 470	N 750
Rd	0.246"	0.197"	0.4	1.0	1.2	2.0	3.2
	0.197"	0.197"	0.5	1.2	1.5	2.5	3.8
	0.158"	0.197"	0.6	1.4	1.7	3.1	4.6
	0.138"	0.197"	0.7	1.6	2.0	3.8	5.4
	0.118"	0.197"	0.8	1.8	2.3	4.5	6.3
	0.106"	0.197"	0.9	2.0	2.5	5.0	7.2
Tolerance			±0.3	±0.5	±0.5	±0.5	±0.5

0.5pF ± 0.3pF  
500 V. -

1.2 pF ± 0.5pF  
500 V. -

3.8 pF ± 0.5pF  
500 V. -

4.5pF ± 0.5pF  
500 V. -

7pF ± 0.5pF  
500 V. -

Terminals—tinned copper wire. Enamelled or phenolic insulated and vacuum waxed.

## STEATITE INSULATIONS LTD.

25 SOMERSET ROAD, EDGBASTON, BIRMINGHAM, 15

Tel. EDGbaston 3990

Tel. Add: "Steatite-Birmingham, 15"



# DEMONSTRATE THE BLACK BOX IN YOUR OWN SHOP AND WIN NEW CUSTOMERS ★

★ CROYDON DEALER SELLS  
13 BLACK BOX *Hi Fi*  
RECORD PLAYERS IN 2 WEEKS

... by running demonstrations in his shop. Pye supplied Tickets, Posters, attractive Window Displays. The demonstrations were given in his own shop and his own cost was practically nil. Another dealer sold 9 Record Players in 1 week.



## WHAT HELPS BLACK BOX SALES?

- 1 Nation-wide Advertising Campaign.  
*In 13 National class weekly and monthly papers.*
- 2 Black Box Demonstrations.  
*Arranged by Pye, in many major towns. Your local Pye representative has details.*
- 3 Substantial Sales Aids :—  
*Luxurious folding window display, 2-colour and 4-colour leaflets, direct mail letters, dealer press announcements, dealer cinema slides.*
- 4 Practical Sales Assistance for your Demonstration:—  
*Suggested talk for one hour demonstration (as used by Pye demonstrators) and suggested programme of records. Announcement posters, invitation tickets, help with hire of suitable hall where necessary, co-operation in local advertising.*

**DEMONSTRATE THE BLACK BOX YOURSELF  
— AND INCREASE YOUR TURNOVER IN THE SAME WAY !**

P Y E L I M I T E D O F C A M B R I D G E

## Tele-opinion

AS THE SUCCESSFUL TV SERIES *The War in the Air* DRAWS TO A CLOSE, THE B.B.C. LOOKS INTO THE FUTURE AND FORESEES

# The War ON the Air

**A**S from next autumn, according to Sir George Barnes, head of B.B.C. TV, it will be the war *on* the air rather than in the air. At a recent Press conference he outlined B.B.C. plans for dealing with the imminent competition from commercial TV. No question of compromise—this is to be a heavyweight contest between Man Mountain B.B.C. and Battling Baby I.T.A.

This, of course, is a little unrealistic imagery. There can be no full competition between the B.B.C. and the I.T.A. because of the fundamental difference in their sources of income. The B.B.C. will continue to thrive on its increasing licence revenue and will be able to look solidly, securely and benevolently on the I.T.A. as a supplementary service—a little competitive, perhaps, but hardly more than a nuisance value.

## One-Sided

The war *on* the air, as most dealers realise, will be a one-sided affair. It is the I.T.A. that will have to compete with the B.B.C.—not vice versa. The commercial programmes will depend for their livelihood and existence on their ability to capture and hold a substantial viewing audience. No viewers, no advertisers, no revenue, no I.T.A. The truth is that the newly-born commercial service will be in the position of a small dealer opening a shop next door to a chain-store branch. To gain custom and turnover he has to attract customers. But whereas the chain store's revenue is assured, the small shop's income will depend entirely on the number of customer's it can woo.

Initially, the I.T.A. will have a curiosity value. Viewers will desert the B.B.C. to see what the new service has to offer. But after the first shock wave has dissipated itself, the balance of audience will depend entirely on the material offered.

The filtering of performers, producers, writers and staff generally from B.B.C. to commercial interests is hardly likely to prove a serious setback. Television is a young medium. The TV top-liners, whether appearing on the screen or working behind the scenes, are yet to emerge. When they do emerge they will almost certainly be TV trained and groomed.

The B.B.C., meanwhile, will continue to operate within the terms of its charter—as it has done so successfully in the past. And it will, no doubt, continue

to extend a helping hand to its new competitor by lending facilities and equipment until the commercial service is able to stand on its own feet.

What does it all add up to in terms of the retail trade? Simply that the one big argument which so often bolsters up sales resistance will no longer be valid. People will not be able to say: I'm not going to buy a television set yet because the programmes are not much good. With two independent and competing services on the air, one of them seeking majority audiences out of sheer necessity to maintain advertising revenue, the public can be certain that the greater part of the TV viewing hours will contain something worth watching, whatever their tastes or interests.

Dealers in the three areas where commercial television stations will start operation should already be thinking ahead and anticipating the problems that are likely to arise. They should be planning their sales campaigns and casting a shrewd eye over the facilities offered by their service departments. The war *on* the air, one-sided or not, will mean big business for the live dealer who is ready to go out and get it.

## The Dem Film

**ELSEWHERE** in this issue we print a letter from a dealer who makes a justifiable complaint about the quality of certain sections of the morning test transmission—in particular the tele-recording of the Paris-London hook-up which continues to figure prominently in its test card sandwich. This particular sequence has no value whatever for either test or demonstration purposes. It can, in fact, have a prejudicial effect on a potential customer seeing television for the first time.

The morning demonstration film is not a gratuitous transmission "thrown in" to help out the trade. It is an important service to the retailing and servicing section of the industry, and merits careful planning and judicious

choice of film material. Prestige is not enough; it will not help to sell a set or check performance.

The department responsible for compiling the demonstration film should make sure that only the best pictures (in the technical sense) are included. In this way the trade will be better served and considerable frustration and time-wasting among dealers and servicing men avoided.

## Selling F.M.

**I**N the near future f.m. is going to be in the news and many dealers will be wondering how they can best exploit the new service to start and maintain the flow of a.m.-f.m. radio receivers from manufacturer to customer via the dealer's premises. It shouldn't be too difficult. In these days of long-playing records, hi-fi amplifiers, and crisp television sound, most people are becoming aware of the meaning of quality in sound reproduction.

Admittedly the B.B.C. have stated that the audio bandwidth to be radiated over f.m. channels will be the same as that currently transmitted on a.m. services so that theoretically there should be no perceptible improvement in fidelity as such. But, in fact, there is an appreciable difference in quality which is almost certainly due to the fact that most domestic radio receivers operating on medium-wave do not do full justice to the available transmission bandwidth. By attenuating the higher frequencies interference is reduced thus providing a quieter background at the expense of quality. On medium waves, of course, interference is a factor of considerable importance.

This consideration does not apply in the v.h.f. spectrum, and the f.m. receiver is well able to accommodate the full band of audio modulation frequencies without attenuation. The improvement in quality is noticeable.

There is, therefore, a great deal to be gained by demonstrating f.m. reception—particularly in areas where medium wave reception is bad and subject to interference. A good demonstration, plus a logical and not-too-technical sales talk, should do much to make the f.m. receiver a selling line worthy of consideration.

## ROUND-UP OF THE MONTH'S NEWS AND VIEWS

### Band III TV Test Transmissions in April

VISION SIGNAL FOR USE OF  
TV INDUSTRY ON CHANNEL 9

FOR industry purposes only, a vision signal on a commercial television frequency is to be radiated from a temporary mast on the I.T.A. site near Croydon some months in advance of the opening of commercial television, the Radio Industry Council announced recently.

The transmissions will be carried out by Belling & Lee, Ltd., well-known aerial manufacturers, who, working in close co-operation with the industry and the I.T.A., are to be given permission by the G.P.O. to radiate a 1-kilowatt Band III, Channel 9, vertically-polarised vision signal, such as a test pattern.

It is expected that the low-power transmissions will start about April 1.

Details regarding times of transmission will be announced later.

"The purpose of this signal," a Radio Industry Council spokesman said, "is mainly to supplement by practical means the aerial manufac-

turers' technical appreciation of the problems of Band III reception.

"It will also provide useful additional data for receiver manufacturers, and it will help retailers in making initial installations of receivers and aerials, but only within a very small area as compared with that which will be covered on the opening of the I.T.A. transmitting station on Channel 9 in the latesummer."

### Extra TV for trade tests to continue

THE B.B.C. announce that the additional hour of television test transmissions introduced for a trial period of four months on September 1, 1954, will be continued until April 30, 1955. These test transmissions, which may be interrupted without notice, are intended to assist the radio industry and trade to test and adjust television receivers.

The morning trade test transmissions will take place each weekday as follows:

10 a.m.—10.57 a.m.: *Demonstration Film.*

11 a.m.—12 noon: *Demonstration Film.*

12 noon—1 p.m.: *Test Card "C" accompanied by recorded music.*

Between 10 a.m. and 10.57 a.m. the high-power stations will operate at reduced power, the standby transmitters being used.

Test Card "C" accompanied by recorded music is also radiated at normal power for the benefit of the radio industry and trade each weekday from the end of the afternoon programme to the start of Children's Television.



### PEOPLE ARE FUNNY

The new Pye People are Funny window display (shown here at Messrs. Oakey and Lee's, Epsom, Surrey) will be featured in the windows of Pye dealers in the towns in which the show is being recorded. *People are Funny*—Pye's Radio Luxembourg show—is now in its second year. This new publicity has been introduced to strengthen liaison with dealers in the areas concerned, and tickets will be sent to dealers together with broadsheets. Dealers are notified well in advance so that they can plan to make the most of the publicity available. At one recent recording a dealer received more than 8,000 applications for tickets.

### TELESTATISTICS

#### BBC Expenditure on television

Revenue expenditure during 1954 was £4,250,000, an increase of £750,000 over 1953.

Capital expenditure during 1954 was £1,750,000, an increase of £750,000 over 1953.

#### Television Programmes

The number of television programmes, including *News* and *Newsreel*, during 1954 was 3,616, an increase of 240 over 1953.

The hours of transmission during 1954 numbered 2,133 in all, an increase of 307 over 1953. Of these programme hours 325 were contributed by the Regions.

#### Television Staff

The B.B.C.'s television staff now numbers 1,700, an increase of 380 over 1953.

### Norwich low-power TV Service

THE temporary low-power station at Tacolneston, 10 miles south-west of Norwich, is now in operation. Test transmissions have been radiated since January 17.

The station operates on the same frequencies as those later to be used by the permanent station so that receivers and aerials set up for reception of the temporary station will not have to be changed when the permanent station comes into operation.

The technical details of the transmissions are as follows:—

Channel 3—*Vision frequency—56.75 Mc/s, Sound frequency—53.25 Mc/s.*  
Polarisation—*Horizontal.*  
Transmission—*Asymmetric sideband system.*

The frequencies of the vision and sound carriers are slightly offset from those of the high-power station using the same channel (Kirk o' Shotts) so as to reduce the effects of mutual interference in the fringe areas.

The area served by the temporary station includes Norwich and its immediate surroundings, and extends approximately to a line through Aysham, East Dereham, Watton, Diss, Beccles and Acle. Reception may be possible at somewhat greater distances, but will be liable to fade and interference at times. Later when the permanent station is completed, the coverage will include the greater part of Norfolk and Suffolk.

In addition to its television transmitters the permanent station will include v.h.f. sound transmitters to give improved reception of the Home, Light and Third Programme in East Anglia.

**FOR ALL IN THE TRADE AND THE INDUSTRY**

**1954 Radio Exports total £30 million**

**EXPORTS** of British radio equipment reached new high levels in 1954, it is announced by the Radio Industry Council. The provisional value is over £29,100,000. This is £3,300,000—more than 12 per cent.—higher than the value for 1953, the previous highest figure.

Of the total, direct exports of capital goods—transmitters, radar and navigational aids and electronic equipment for industry—were valued at over £12,600,000, or £1,450,000 up on the previous highest figure, in 1953. Components and test gear sold at over £6,700,000, nearly £700,000 more than the previous highest figure, in 1951.

A striking increase was also shown in the “high-fidelity”—sound reproducing equipment—section. The value of exports for these goods including record players, tape recorders, electronic amplifiers and public address equipment, was over £3,700,000, nearly £700,000 higher than in 1953.

Exports sales of radio and television sets and radiograms were valued at nearly £3,600,000 and of valves and parts at over £2,400,000.

For equipment which it is possible to classify at this stage (representing nearly £26,000,000 of the total), Holland (£2,200,000) displaced Sweden as the “No. 1” market, with Canada (nearly £1,800,000) next, the increases to both Holland and Canada being in the region of £800,000. The value to Sweden, and also to India, was over £1,500,000, and to Pakistan, South Africa, France, Italy and Belgium, over £1,000,000, each.

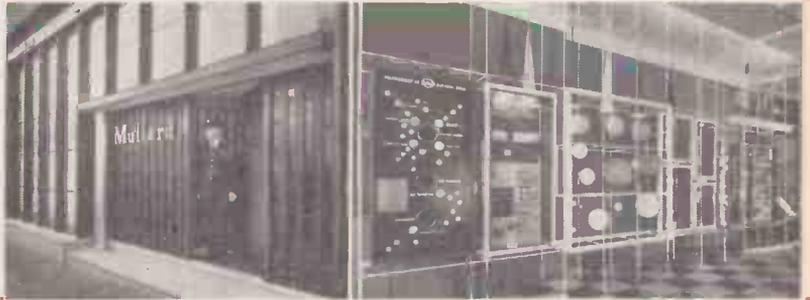
The value to the United States grew by nearly £140,000 to over £580,000 and to Denmark was more than doubled to exceed £570,000. West Germany took £620,000-worth, a rise of over £100,000.

**Radio Sales Doubled**

**RADIO** manufacturers estimate that in 1954 they sold to the trade at home approximately 1,500,000 sound radio receivers, including radiograms and car radio, or approximately twice the number sold at home in 1953.

The number of television sets sold in 1954 has slightly exceeded the record sales of 1,145,000 in 1953, the Coronation year.

**NEW MULLARD PUBLICITY CENTRE**



Picture shows the exterior (left) and main showroom (right) of the new Mullard publicity centre opened recently in Gerrard Place, London, W.1. The buildings houses the press and publicity services of the Mullard organisation. On the first floor examples from each group of the company's products are arranged in separately illuminable panels, and coloured wall maps show the ramifications of the Mullard Company at home and overseas. On the lower floor twenty-seven panels are used to display more Mullard products arranged with the themes, “What they are,” and “How they work,” “How they are made” and “How they are used.” On this floor, too, are housed larger exhibits which are featured from time to time in connection with a planned programme of exhibitions and live demonstrations. Part of this lower floor is a cinema in which the visitor may see some of the films and film strips which are produced by Mullard. Visits to this new showroom will be encouraged by the company.

**TV Development in France**

**LA VIE FRANCAISE**, the leading financial and economic newspaper, of France, recently devoted a full page to a study of the nation's television market. Summarising, the paper states: The 1954 sales of television sets have more than doubled those of the preceding year reaching a total of 80,000, 1953 being 37,000. The wealthiest French, who represent 10 per cent. of the population, now own 23 per cent. of television sets.

The middle class, representing 25 per cent. of the population, own 51 per cent., and the lower income group,

45 per cent. of France's population own 26 per cent. of the television sets. The remaining percentage of the population are either unclassified or foreign residents.

The *La Vie Francaise* states that manufacturers are looking forward to an extremely prosperous market next year. French manufacturers are confident in the quality of their sets and urge improvement of programmes, increase hours of transmission and increased coverage of the nation.

*La Vie Francaise's* study says that the Paris area North, East and South East of France are well covered by the stations of Paris, Lille, Metz, Strasbourg, Mulhouse, and Monte Carlo, but deplores reception in the West and South West of France.

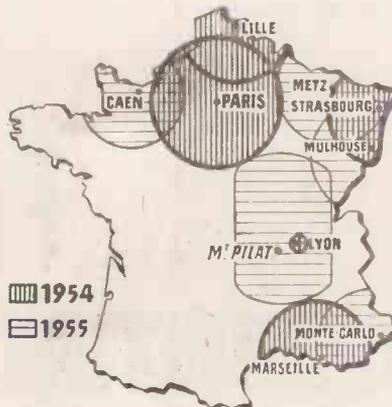


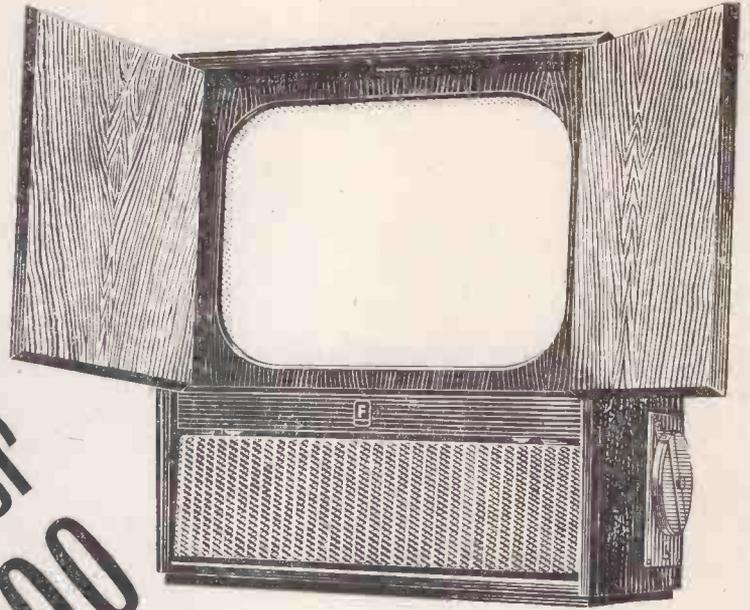
Diagram at left shows the present distribution of television service areas over northern and eastern France (dark shading). The lightly shaded zones indicate proposed extensions of the service during this year.

**Brown Bros. in Plymouth**

**A** NEW branch of Brown Brothers, Ltd., was opened last month in Plymouth. The premises, which have been built to the company's own design, occupy a site on the corner of Martin Street and Sawrey Street, and hold a comprehensive stock of radio and electrical equipment. Branch manager is F. V. Matthias.

A van delivery service is to be introduced as quickly as possible. Parking space is provided at the back of the premises for customers' vehicle s.

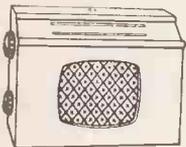
The  
biggest  
picture under  
£100



MODEL 20T4 89 gns.

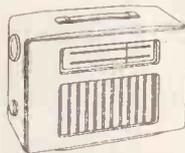
This Ferranti projection model with its 20" (diagonal) screen gives the biggest picture under £100. That's *still* the biggest news — sales news — in television today. *We* are continuing to take advantage of the fact in our national advertising — *sales* are

continuing to rise, as more and more customers ask for the 20T4. It's a 13-channel receiver. It has all the qualities of the most expensive set, but at a table model price. No wonder it's one of the most popular sets on the market.



MODEL 545 AC/DC  
Transportable  
17 gns.

MODEL 945 A.C.  
Mains & Battery  
Portable 19½ gns.



**FERRANTI**

**CLEARLY FERRANTI FOR SIGHT & SOUND**

FERRANTI LTD · RADIO SALES OFFICE · MOSTON MANCHESTER 10

**NEWS ROUND-UP  
CONTINUED**

**Baird-Ambassador  
Merger**

THE directors of Hartley Baird, Ltd., announce the merger of Ambassador Radio & Television, Ltd., with Hartley Baird, Ltd. Under these arrangements Ambassador becomes a wholly owned subsidiary of Hartley Baird, Ltd., but will continue to trade as a separate company under its own name.

R. N. Fitton remains as managing director of Ambassador Radio & Television, Ltd., and joins the board of the parent company. At the same time R. G. Cooke, A. W. M. Hartley, and J. W. McFetridge join the board of Ambassador Radio & Television, Ltd.

The new board of Hartley Baird, Ltd., includes: R. G. Cooke (chairman), A. W. M. Hartley (group managing director), R. N. Fitton (director in charge of radio and television), L. F. Odell (technical director), J. W. McFetridge (financial director and secretary), and W. D. Cussen.

**S.O.R. Schemes**

SEVERAL manufacturers, among them Ferranti, Kolster-Brandes, G.E.C. and Bush, have introduced sale-or-return or consignment stock schemes which will remain in force until Budget Day or any official purchase tax announcement prior to that day. The object of these schemes is to safeguard dealers against losses which might be incurred due to purchase tax reductions. Details have already been distributed to accredited dealers.

**Luxembourg TV**

Sustaining programmes of films are now being transmitted from the new Luxembourg television station operating on the French 819-line system. Regular commercial programmes will begin on March 1.

The transmitter and studio equipment was supplied by Pye of Cambridge and French and German companies. Pye also supplied mobile transmission equipment for outside broadcasts.

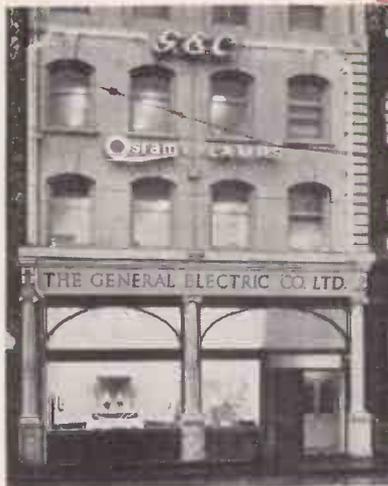
The programmes will follow the familiar pattern of Radio Luxembourg. It is intended to produce films in Britain for transmission via "Tele-Luxembourg."

**NEW G.E.C. PREMISES AT LEEDS**

JUST before Christmas the chairman of the Yorkshire Electricity Board, D. Bellamy, O.B.E., D.L., opened the reconstructed premises of The General Electric Co. Ltd. in Wellington Street, Leeds. The opening ceremony was attended by Mr. Leslie Gamage, M.C., Vice-Chairman and Joint Managing Director, and many friends of the G.E.C. in the area. After the ceremony visitors were taken round an exhibition designed to illustrate as much as possible of the wide range of the company's activities.

The ground floor of the new building houses a spacious entrance hall, the trade counter, and the offices of specialist departments. Fluorescent lighting has been adopted throughout the office accommodation. Showrooms on the first floor comprise one of the most comprehensive displays in Yorkshire of electrical radio and television equipment for the home.

The designs for the new premises were prepared by the Company's Constructional Engineers' Department at Wembley.



**English Electric Appointments**

DETAILS of new appointments resulting from recent changes in the organisation of the appliance division and television department of the English Electric Co., were announced last month by H. C. Timewell, manager of the domestic appliance and television division.

Seven divisional area managers will be responsible to A. M. Parkinson, sales manager (home and export), with V. Coffee as assistant sales manager (domestic appliance section) and H. Ford as assistant sales manager (television section). R. J. Tilbury continues to specialise on export matters.

The following members of the staff are promoted to area managers: J. C. Wood (Scotland), F. J. Lochhead (Yorkshire and the North East), W. Yates (East Midlands and South Wales), J. R. Green (Eastern and South

East England), A. W. H. Bradstreet (London and South England) and J. H. Barber (South West). J. E. Pearson continues as area manager in the North West and North Wales.

The area managers and sales representatives are responsible for the full range of English Electric domestic appliance and television receivers.

**F.M. FROM WENVOE**

THE B.B.C. has obtained permission to build a v.h.f. transmitting station at Wenvoe in South Wales, bringing the number of such stations approved by the Government to ten. These stations are part of the proposed network of v.h.f. f.m. stations designed to reinforce the existing l.w. and m.w. stations radiating the Home, Light and Third programmes. The Wenvoe station is expected to be in service early in 1956.

Details of the ten stations so far approved are:—

Station	Home Mc/s	Light Mc/s	Third Mc/s	E.R.P. (kW)
Wrotham (Kent)	93.5	89.1	91.3	120
Pontop Pike Co. Durham	92.9	88.5	90.7	60
Divis (N. Ireland)	94.5	90.1	92.3	60
Meldrum (Aberdeen)	93.1	88.7	90.9	60
N. Hessay Tor (S. Devon)	92.5	88.1	90.3	60
Sutton Coldfield	92.7	88.3	90.5	120
Norwich	94.1	89.7	91.9	120
Blaen Plwy (W. Wales)	93.1	88.7	90.9	60
Holme Moss	93.7	89.3	91.5	120
Wenvoe	94.3*	89.9*	92.1*	120

\*Frequencies subject to confirmation.



A recent visitor to E.M.I. Ltd., at Hayes, was Mr. Randall Reid-Adam, Counsellor (Commercial) to the British Embassy in Stockholm. Picture shows Mr. Reid-Adam examining an Emisscope cathode-ray tube with Mr. A. Thorpe, manager of the E.M.I. Assembly Factory.

## NEWS ROUND-UP CONTINUED

### Permanent Europe TV Link

A PERMANENT two-way Anglo-French television link is to be installed between London and the Continent, the B.B.C. announced recently. This will replace some of the temporary equipment that has been used for making the Eurovision exchanges that were such a successful feature in the 1954 viewing programme.

The first section of the permanent link, which it is hoped will be ready for use before the end of this year, will consist of coaxial cables between London and St. Margarets Bay. The next section will consist of a two-way radio link across the English Channel.

This will take some three years to complete, but in the meantime the permanent coaxial cables will be temporarily extended from St. Margaret's Bay to Swingate near Dover, where the B.B.C. and Radiodiffusion et Television Francaises will provide and operate a temporary two-way cross-channel radio link between Swingate and Cassel in Northern France.

### PHILIPS RECORD WEEKS

REPORTS received from regional and branch offices, radio representatives and record wholesalers, indicate that the Philips Record Weeks held last Autumn were an outstanding success.

Although the campaign was planned, primarily, to stimulate interest in Philips *Minigroove* records, reports indicate that sales figures for 78 r.p.m. records also increased during this period.

### E.M.I. Recorder System for Nigeria

E.M.I. have designed and built a comprehensive tape-recording system for installation in the House of Assembly of the Western Region of Nigeria to record debates and legislative proceedings. In this way it is hoped to overcome the difficulties of language and dialect which often prove an obstacle to shorthand writers. Picture shows the operating console which controls the inputs from seven microphones distributed throughout the House and feeds them to four type TR50 E.M.I. tape recorders in the recording room, each of which provides one hour of recording per reel. At the same time the microphone outputs are fed through separate amplifiers to twelve

### PYE HI-FI ON TOUR

DETAILS of the Pye Hi-Fi recitals currently being held in various parts of the country are now available. The programme for February is as follows:—

January 14 and 15, Chatham, Sun Hotel.  
January 28 and 29, Leicester, Bell Hotel.  
February 1, 2 and 3, Edinburgh, Assembly Rooms.  
February 3, 4 and 5, Sheffield, Montgomery Hall, Council Room.  
February 7 and 8, Doncaster, Danum Hotel.  
February 7 and 8, Aberdeen, Gloucester Hotel.  
February 10 and 11, Leeds, Y.M.C.A.  
February 15 and 16, Oxford, Forum Restaurant  
February 16 and 17, Huddersfield, Collinsons Restaurant.  
February 21, 22 and 23, Hull, Regal Cinema.  
February 23 and 24, Plymouth, Continental Hotel.  
February 26 and March 1, Wakefield, Stratford Arms Hotel.

In charge of the recitals is Peter Craig-Raymond, the writer and broadcaster. Between the records he will explain just what "Hi-Fi" is.

### COMPONENT SHOW APPLICATIONS

APPLICATION cards for badges for admission to the Radio Component Show, to be held at Grosvenor House from April 19 to 21, are now being posted to individuals and organisations likely to be interested. No person is to be admitted this year without a badge. Application cards can be obtained by written request to the Secretary, Radio & Electronic Component Manufacturers' Federation, 22 Surrey Street, Strand, London, W.C.2.

The exhibition is intended primarily for engineers and technicians in all the industries and in the Services. Every bona fide applicant will receive a badge.



THIS special window display is available to Pye dealers who wish to link up with Pye's intensive national advertising campaign for "Hi-Fi," with the accent on the Black Box. Pye Hi-Fi advertisements are appearing in Sunday newspapers, high-class literary magazines, musical magazines, and the technical press.

### Direct TV Replacements Handbook

A NEW edition of the *Replacements and Rewind Handbook* published by Direct TV Replacements, 134-6 Lewisham Way, New Cross, London, S.E.14, is now available from the company. In addition to listing the television replacements and rewind service offered, the handbook, which contains more than 60 pages and is well illustrated, contains technical information and articles on line output transformers.

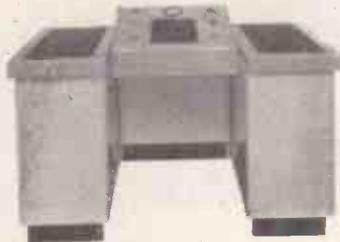
Price of the handbook is 1s. 3d. (postage 3d. extra).

### FELGATE COMES OF AGE

A STAFF party was held recently by Felgate Radio, Ltd., to celebrate their coming-of-age. Many well-known personalities of the radio industry were present in addition to members of Felgate's staff. The party took place at the Hammersmith Town Hall, London, and was attended by the Mayor of Hammersmith, Councillor H. G. Reynolds.

Among the speakers were H. A. Donisthorpe, B. J. Benzimra, and A. S. Williams. Mr. Benzimra, managing director of Felgate Radio, said that the company had always as a matter of policy sponsored the popular radiogram. He paid a tribute to the loyalty of their staff.

Responses were made by E. L. Edwards, on behalf of the guests, and by G. H. Coe.



headphone sets in the Press Gallery. Intercom and monitoring facilities are incorporated in the equipment.

# TWO MORE MODELS OF PERFECTION

from



**THE 'THREE-TEN'** A 6-valve, 3 waveband High Fidelity Console Radiogramophone, with 6 watts Push-Pull output, that more than maintains the R.G.D. reputation for high quality. 10" P.M. loudspeaker and Collaro RC.54 3-speed mixer changer with turnover crystal pick-up head fitted with sapphire styli.

**59 Guineas** TAX PAID

List Price £46.18.1 Pwr. Tax £15.0.11.

*Available to accredited dealers only*

## MODEL 1455T

A fine 17 valve, 14" Table Television with 13 channel circuit and a 6" loudspeaker giving an output of 1½ watts. Wonderful exclusive features include fully automatic IMPROVED PICTURE CONTROL and 'SYNCHROLOCK', ensuring brilliant and correctly contrasted pictures on latest tinted screen.

**72 Guineas** TAX PAID

List Price £56.11.0. Pwr. Tax £19.1.0.



*The Aristocrat of Radio & Television*

RENOWNED IN THE INDUSTRY FOR A QUARTER OF A CENTURY

RADIO GRAMOPHONE DEVELOPMENT COMPANY LIMITED, EASTERN AVENUE, ROMFORD, ESSEX

GGG

Please quote *British Radio and Television* when replying to advertisers' announcements

# CHANNEL BAND 3 CONVERTORS

## ANNOUNCING

### OUR NEW IMPROVED TWO-PROGRAMME BAND 3 TV CONVERTOR

#### TYPE C.1.

This redesigned new-look model incorporates several exclusive features, including

- ★ Attractive streamlined case
- ★ Front knob gain control
- ★ Quick-change programme knob
- ★ Hidden easy-access tuning trimmers

The C.1. provides instant choice of your B.B.C. Band 1 programme, or any one Band 3 programme.



### THE CHANNEL FOUR-PROGRAMME BAND 3 T.V. CONVERTOR

#### TYPE C.2

This is the ONLY Band 3 converter on the market providing

#### INSTANT CHOICE OF 4 TELEVISION PROGRAMMES

(B.B.C. plus three in Band 3)

In the C.2 the Channel design staff have covered all possible future programme requirements in any T.V. area.

PRICE **9 GNS.** RETAIL

*subject full trade discounts*

Now in quantity production. Delivery against existing C.1. orders commences Feb.

PRICE **10 GNS.** RETAIL

*subject full trade discounts*

NOW IN PRODUCTION

Sample deliveries commence February

#### SPECIFICATION — BOTH MODELS

- Attractive modern style steel case, finished in CHANNEL blue-hammer enamel.
- Size 8 x 4½ x 2½ in., generously louvred for adequate Ventilation.
- Quick-fix 2-hole mounting behind the receiver
- The socket locations (below) permit very short connection to receiver, thus minimising risk of break-through.
- Fully enclosed custom-built chassis
- Front knob gain control on Band 3.
- Adjustable inter-band filter.
- Unit stage gain approx 10db
- Instant switch selection of programme
- Quick access to tuner trimmers
- 70/80 ohm coaxial input and output
- Separate inputs for Band 1 and Band 3
- High-Q low-loss circuits with full bandwidth
- Stable oscillator, in double-screened compartment to prevent re-radiation.
- Suitable for a.c. or a.c./d.c. receivers
- Easy to install and adjust
- No alteration to receiver necessary.
- Supplied complete with instruction leaflet
- Guaranteed for 12 months (valves 3 months)

IF UNOBTAINABLE FROM YOUR USUAL WHOLESALER, WRITE TO:—

# CHANNEL ELECTRONIC INDUSTRIES

Office & Works : PRINCESS ST.

**BURNHAM-ON-SEA, SOMERSET**

Phone : 3167

Phone : 3167

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**PERTH SELF-CONTAINED RADIOGRAM UNIT**

*Perth Radios, Ltd., 9 Judd Street, London, W.C.1.*

A NEW self-contained radiogram unit designed for easy fitting into any cabinet and ready for immediate use is being produced by Perth Radios. The unit incorporates a 5-valve 3-waveband radio chassis and a 3-speed mixer autochanger with turnover crystal pick-up. Output (4 watts) is via a 10in. x 6in. elliptical loudspeaker for high-quality reproduction. A rear socket panel has aerial, earth and extension speaker terminals. The unit is designed for operation on a.c. mains, 200-250V, 50 c/s.

The case in which the unit is fitted is made of metal and hardboard, finished in stove enamel, and measures 22in. x 13½in. (top). The depth when mounted is 8in. below and 4½in. above the mounting board. The autochanger is slightly recessed to reduce height. A special feature of the design is that the ends of the case are flush to form the inner walls of record storage compartments in the housing cabinet.



The Perth self-contained radiogram unit.

A small circular window in the front panel of the case is located opposite a dial lamp; this facilitates the fitting of a cabinet pilot light, if desired, by simply drilling a hole in the cabinet front opposite the unit window and fixing a small perspex cover.

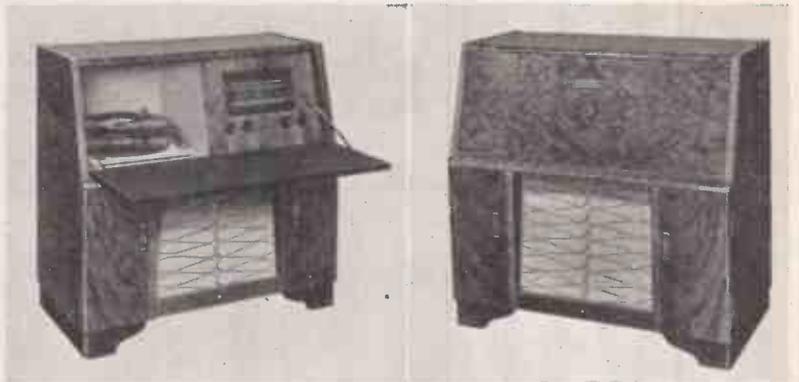
Price of the radiogram unit is 33 gns. retail (tax paid).

**NEW PILOT RADIOGRAM**

*Pilot Radio, Ltd., Park Royal Road, London, N.W.10.*

ILLUSTRATED is the latest addition to the Pilot range, Model RGA100 7-valve 3-waveband autoradiogram. For quality reproduction the out-

*The latest in Radio and TV Receivers and Accessories*



Two views of the new Pilot radiogram, Model RGA100, housed in bureau-style walnut-veneered cabinet.

stage uses two pentodes in push-pull feeding a 10in. p.m. loudspeaker. The instrument is designed for operation on 200-250V a.c. mains.

The radio has three wavebands: long, medium and short, and the scale incorporates a tuning log for fine station location. A special moving illuminated indicator shows the selected waveband.

The Garrard 3-speed autochange Model RC111 has a lightweight magnetic pick-up for faithful reproduction, with a finger grip attached to the pick-up head. The gram. compartment is automatically illuminated when the set is switched to gram. The bureau flap is covered with felt as an aid to acoustics, reducing needle-scratch to a minimum and for the protection of records. Two record compartments, one on either side of the speaker grille, will accommodate more than 120 records.

The cabinet is finished in walnut veneers with blond interior in the gram. section, and gilt-finished speaker grille of new design. Handles are of burnished bronze. An external indicator lamp gives warning when the set is switched on.

Price of Model RGA100 is 72 gns. (tax paid).

**VALIDUS TV AERIAL**

*Validus Aerials, 57 Hornsey Road, London, N.7.*

LATEST addition to the Validus range of TV aerials is the No. 7 "H" array which is supplied with a new-style aligned spreader having insulated junction boxes already positioned and fitted with "anti-storm" grommets as a safeguard against wind and rain. A 6ft. steel mast with cap welded in position is included in the equipment along with a heavily galvanised chimney bracket, corner plates and thimbles. All dipole and reflector

elements are of heavy alloy treated with *Anti-Corrodol* and are sealed. The array is easy to instal and carries a guarantee. Price (net trade) is £2 10s. complete. Supplied packed in pairs.

**FERGUSON TABLE RADIOGRAM**

*Thorn Electrical Industries, Ltd., 105-109 Judd Street, London, W.C.1.*

THE new Ferguson table radiogram, Model 391RG (illustrated), incorporates a 6-valve radio receiver with a 3-speed autochanger for standard or long-playing records. The receiver tunes over three wavebands: l.w. 733-2,050m.; m.w. 184-575m.; s.w. 16.7-55.4m. A push-pull output stage feeding a 10in. x 6in. elliptical m.c. loudspeaker ensures good quality of reproduction. Output is 6 watts.

The gram. unit is ivory-finished to match the cream interior of the gram. compartment. A *Ronette* turnover crystal pick-up is fitted. The cabinet is

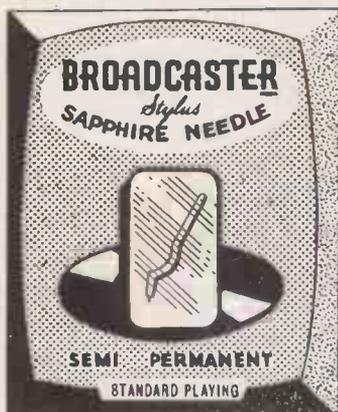
(Continued on page 733)



Ferguson table radiogram, Model 391RG.

**LOOK** *for the name*

# BROADCASTER



## *Stylus & Sapphire Needles*



For B.S.R. T/C4  
33 1/3—45 R.P.M.  
L.P. Long Playing



For B.S.R. T/C4  
78 R.P.M. S.T.D.  
Standard Playing



For B.S.R. HGP  
37 L.P. Long  
Playing



For B.S.R. HGP  
37 S.T.D. Stand-  
ard Playing



Trailer for  
Heavy Mag-  
netic Pick-up



Straight for  
Standard Crystal  
Pick-up



Lightweight for  
Miniature Pick-  
up



**5'11**  
EACH

PERFECT REPRODUCTION—STOCKED  
BY ALL GOOD DEALERS

**J. & A. MARGOLIN LTD.**

Plus-a-Gram House, 112/116 Old Street, London, E.C.1



*Continued*

acoustically designed and is finished in selected walnut veneers, with a woven plastic non-soiling fabric over the speaker grille. The gram. unit has a hinged lid.

Dimensions of Model 391RG are 20in. × 14in. × 15in.; price, 39 gns. (tax paid).

**ANTIFERRECE IMPROVEMENTS**

*Antiferrence, Ltd., Bicester Road, Aylesbury, Bucks.*

NEW developments in the design of Antiferrence aerials are announced by the company. The patented *Snapacitor* correction incorporates an improved type of anodised insulation which, while tougher than the original, enables higher capacity to be obtained with greater signal efficiency. Each coupling has an average capacity of 1,000pF, and the reactance at television frequencies is so small that the difference in performance between *Snapacitor* coupling and direct metal-to-metal contact is indistinguishable.

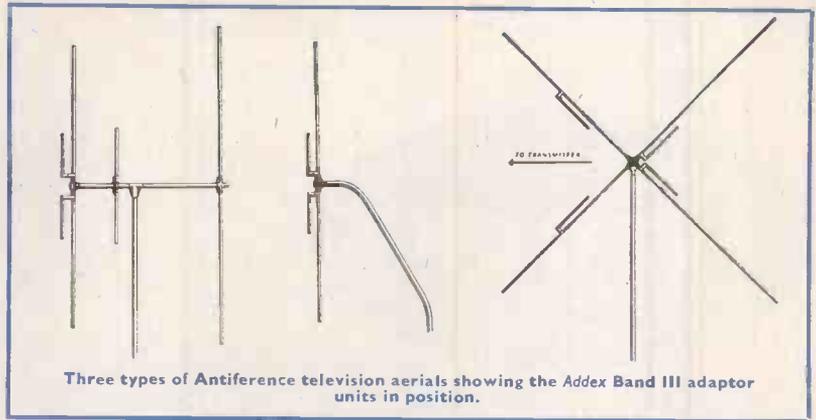
The introduction of spoke bolts for mast grips on the mounting bracket of all Antiferrence aerials will facilitate erection. The bolts are fully retained and can be swung aside to allow the mast (already cabled) to be easily inserted in the bracket. The bolts are then simply swung into position and tightened.

This development ensures that no part of the aerial needs to be removed for assembly purposes and leaves the rigger with both hands free at all times. A further advantage is that the spoke bolt head cannot rotate, so that one spanner only is needed to tighten the mast grips. The spoke bolts are of high-quality steel, heavily plated to prevent corrosion. Bulldog grips and thimbles for terminating the lashing cable are still being supplied to provide a greater safety factor and obviate splicing cable ends.

Another improvement comprises vibration dampers in the form of hollow plastic plugs inserted at the extreme ends of the aerial rods. Each plug contains a small lead weight which is free to move laterally to a small extent. The movement of this weight when the aerial starts to vibrate opposes the setting up of audible resonances and completely silences the aerial in high wind. It also alleviates "flutter" on the screen due to the vibration of the aerial elements.

**Addex Aerial Kits**

Details are now available of the Antiferrence *Addex* aerial kits, prototypes of which were shown at the National Radio Show. The kits embody a simple



Three types of Antiferrence television aerials showing the *Addex* Band III adaptor units in position.

snap-on bracket incorporating the *Snapacitor* coupling principle for easy fitting to any *Antex*, "H" or dipole aerial with 1/8in. or 1/4in. dia. rod elements. No separate lead-in cable is required and existing cable connections can be left undisturbed.

Three models are available: type X for all *Antex* aerials (15s.); type H for all "H" aerials (15s.); and type D for all single dipoles (7s. 6d.). Each kit is packed in a paper envelope, supplied

in cartons of six, and distribution is through appointed Antiferrence stockists.

The *Addex* kits are simple to fit to an *Antex* or "H" aerial and provide a performance on Band III comparable to that of a 3-element aerial without affecting the Band I reception. It is anticipated that the units will be suitable for distances up to 15-20 miles from the transmitter, depending upon local conditions.

An additional unit is the *Addex* type BX which is for all *Antex* X aerials in the Midlands channel 4 area which will only require two *Addex* units. The list price of kit BX is 7s. 6d. The *Addex* type X kit, which comprises four rods, is for use with *Antex* X aerials in channels 1 and 2 only.

An interim range of Band III Aerials suitable for high band channels 8 and 9 is also released, comprising 3- and 5-element folded dipole arrays with various forms of mounting, including models for attaching to existing aerial masts. They are pre-assembled, being constructed of the same materials as used for the Band I range and intended for test purposes and dealers' premises. A completely new range of Band III aerial equipment will, however, be released in April.

Also available are Band III indoor aerials, constructed of the same material as used for the U series Band I indoor range. They employ a cream-moulded insulator with telescopic rods tunable for peak performance which can be swivelled and locked in any angular position.

**ERIE DRAW-PACKS**



THE new Erie Draw-pack is ideal for radio and TV service departments. It keeps resistors and ceramics tidy, waste is eliminated and the packs can be added to unit by unit to build up an efficient and easy storage system. Each Draw-Pack is a two-drawer cabinet, ruggedly constructed and attractively finished in red chamois leatherette. It is supplied free of charge with every order for 24 12-packs, or for 24 10-packs, or for any assortment of 24 of both or either. Erie carbon resistors, high-stability resistors, and tubular ceramics are packed in 12 of one type, one value and one tolerance in 12-packs; and *Silertex* miniature wirewound resistors in 10 of one type, one value and one tolerance in 10-packs. Within these limits all Draw-packs are supplied strictly in accordance with the customer's requirements. They are manufactured by the Erie Resistor Co. Ltd., and are available from wholesalers.

**BELCLERE TRANSISTOR TRANSFORMERS**

*John Bell and Croyden, 117 High Street, Oxford.*

LATEST addition to the range of *Belclere* transistor transformers is the type F, a miniature transformer specially designed for use with transistor circuits. The size of this unit (17/32 in. × 7/16in. × 5/16in.) has been reduced to the absolute minimum consistent with highest possible performance.

(Continued on page 735)

# STOCK

## Model T37DA

A 5 valve, two waveband, DC/AC mains  
'Companion' Receiver. Easily transportable  
— just plug into mains supply.  
£15.15.0 (Tax Paid)

# SHOW

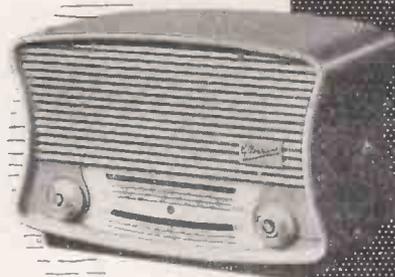
## Model T35AB

5 valve AC mains/battery portable in  
grey imitation lizard skin.  
£17.10.0 (Tax Paid) (without batteries)

# SELL

## Model T38A

A high quality 5 valve superhet AC table  
receiver. 3-waveband. Sensitive permanent  
magnet speaker. Polished wooden cabinet.  
£22.1.0 (Tax Paid)



# MARCONIPHONE

THE FIRST AND GREATEST NAME IN RADIO

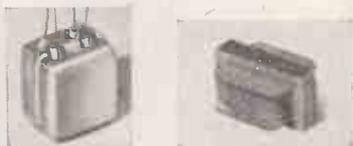


*Continued*

The tiny size and low weight has been achieved by the use of very fine wire, light former and special nickel alloy high mu magnetic core. Leads are flexible and colour coded.

The transformer is designed primarily for hearing aids in conjunction with transistors and these units are also employed in computer circuits, pocket radios, recorders and other applications. A mu-metal can has been designed to contain the "F" type transformers for application where screening is necessary.

The standard range consists of one output, two input and two interstage transformers, but, of course, special "F" size units can be designed and produced to suit customers' requirements.



Pictures show actual size of the Belclere type-F transformers.

Full details, and characteristics are contained in a leaflet obtainable on application to the company. Prices are available on request.

**NEW WEBMORE TV AERIALS**

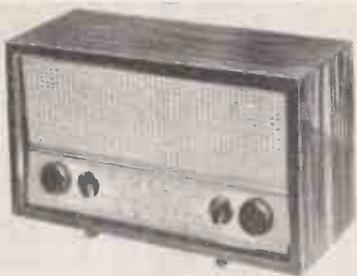
*Webmore (1948) & Co., Kings Norton, Birmingham, 30.*

TWO new outside TV aerials are announced by the company, both of the loop type. Type TV16 is designed for chimney lashing, and is supplied complete with lashing equipment and a 4ft. 6in. cranked mast at £2 19s. 6d. retail. Type TV14 is designed for mounting on walls, eaves, and window frames, and is supplied complete with mounting bracket and 3ft. upswept stand-off arm at £1 17s. 6d. retail.

Both aerials have a wide acceptance angle with two sharp minima at right angles to the direction of maximum gain. To obtain peak signal and discriminate against interference and ghosting is merely a matter of orientation. Because of smaller physical dimensions in comparison with standard aerials, the effects of wind resistance are greatly reduced, with improved freedom from flutter and hum.

The aerial and fittings have an anti-corrosive protective finish. The lightweight masts and stand-off arms are sherardised, and the mounting plates and chimney lashings are galvanised. All aerial elements are anodised.

The loop aerial only, where mast or mounting brackets already exist, is available at £1 8s. 6d. retail.



The new Pam table radio, Model 955U.

**PAM A.C.—D.C. TABLE RADIO**

*Pam (Radio and Television), Ltd., 295 Regent Street, London, W.1*

LATEST addition to the Pam range is Model 955U (illustrated), a 5-valve 3-waveband superhet table radio receiver for operation on 110–120V or 200–250V a.c.-d.c. mains. Basically the set is similar to model 955, but it has a universal chassis.

Main features include: flywheel tuning; wavebands 24–51m, 74–200m, 570–2,000m; 3-position tone control; provision for the use of any standard type of crystal or magnetic gram pick-up (78 or long-playing).

The cabinet is finished in contrasting veneers and measures 16in. x 9in. x 6½in. Price 19 gns. tax paid.

**PYE "CAT" RECEIVER**

*Pye Telecommunications, Cambridge.*

THE company have introduced the Cat communications receiver designed in close co-operation with the Admiralty. This is a high-grade instru-

ment, having a frequency range of 60 kc/s to 31 Mc/s in eight wavebands which are all individually visible on a large tuning scale directly calibrated in frequency.

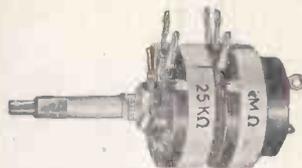
Four positions of selectivity give a range of choice from "wide" bandwidth to "very narrow" crystal-gate bandpass for c.w. reception. On the higher frequency bands a double-superhet circuit is used, and the first oscillator (normally variable) may be crystal-controlled on any one channel between 1.5 and 31 Mc/s.

The receiver is suitable for a.m., c.w., or m.c.w. reception and has a stability better than 1 kc/s after warming up. A small separate a.c. power unit gives greater flexibility of installation and reduces heat in the receiver itself.

**NEW RADIOSPARES REPLACEMENTS**

*Radiospares, Ltd., 4–8 Maple Street, London, W.1*

NEW additions to the Radiospares range of exact replacement volume controls are listed in the January issue of the Radiospares catalogue which is



One of the new range of Radiospares exact-replacement volume controls.

available to bona-fide members of the radio trade on application to the company. The new components are types V14 and V15, both of which are ganged

*(Continued on page 737)*

**NEW PACK FOR ACOS PRODUCTS**



Cosmocord Limited have recently introduced a novel form of packing for their pick-up heads, cartridges and styli, in the form of aluminium canisters with screw lids. These canisters not only afford adequate protection for the various units, but also make a very attractive display. The canisters in turn are supplied in quantities of a dozen in specially designed boxes suitable for use as counter displays. In the case of the HGP39 pick-up heads, the moulded packing inserts are also designed so that they may be screwed on to the motor board and used as a protective storage clip for the pick-up heads when not in use.

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**. . . . . Satisfied Customers . . . . .**

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**Champion**  
**BERKELEY**

**33 Gns.**  
 (Tax Paid)

3-speed fully automatic Radiogram 4-valve super-het. Long and Medium wavebands.

(£26. 4. 8. +  
 £8. 8. 4. P.T.)



**Model 805**  
**Champion**  
**REV-LER**

3-speed record player with speaker and amplifier.  
 (£11. 2. 6 + £3. 11. 6 P.T.)

**14 Gns.**  
 (Tax Paid)

**Model 806**  
**REV-LETTE**

3-speed record player, less speaker and amplifier.

**9½ Gns.** (Tax Paid)  
 (£7. 11. 0. + £2. 8. 6. P.T.)



**Model 784**  
**Champion**  
**£9. 5. 0**

(Tax Paid)

4-valve A.C.-D.C. mains. Medium Waveband. Plastic Cabinet available in Red, Cream, Green, Blue.  
 (£7. 0. 0. + £2. 5. 0. P.T.)



**Model 825**  
**Champion**  
**SERENADE**

**11½ Gns.**  
 (Tax Paid)

4-valve A.C.-D.C. super-het. Long and Medium wavebands. Plastic Cabinet available in Red, Blue, Green, Cream.  
 (£9. 2. 9. + £2. 18. 9. P.T.)



**Champion** ELECTRIC CORPORATION

Head Office & Works : Newhaven, Sussex. (Newhaven 500)  
 London Office : 16 Berkeley Street, London, W.1. (Mayfair 6774)



*Continued*

types suitable for pre-war Murphy radio receivers.

Type V14 is a combined volume and tone control for Murphy Model Nos. A48, A48RG, D48, D48RG. V15 is a combined volume and tone control for Murphy Model No. B47. The controls are designed for instantaneous replacement in these particular sets.

Details are: V14— $25k\Omega + 1M$ , d.p. sw.; V15— $0.15M\Omega + 2M\Omega$ , d.p. sw.; price of both types 12s. 6d. each.

The catalogue also lists useful additions to the ranges of metal tubular electrolytic condensers and pilot lamps. The company announce that the grade of their 18 s.w.g. activated cored solder has been changed to 60 per cent. tin and 40 per cent. lead, which makes it more suitable for present-day requirements.

### K-B 21-INCH MULTICHANNEL TV

*Kolster-Brandes, Ltd., Footscray,  
Kent.*

A 21-INCH multichannel television console, Model LFT100 (illustrated), is now being mass-produced by the company. Features include a 12-position turret-type programme selector, *Contramatic* picture control to reduce fading and aircraft flutter, automatic frequency control, and full interference suppression.

The cathode-ray tube is a 21in. mirror-backed rectangular type operating at 15,500 volts; picture size is 18½in. × 14½in. The multichannel turret incorporates coils for five channels used by existing B.B.C. stations plus the two known channels 8 and 9 in Band III



K-B Model LFT100 21in. television console.

for commercial programmes. Additional coils will be available when further frequencies are announced.

All important controls are easily accessible at the front of the cabinet which is finished in high gloss two-tone walnut veneer with full-length doors. Dimensions: height 37½in., width 26½in. depth 24in. Price, 148 gns. (tax paid).

### New A.C.-D.C. Radio

Model LR15 is the a.c.-d.c. version of Model LR10 and is similar in main details. It is a 5-valve 3-waveband superhet with permeability trimmed i.f. transformers and a linear tuning scale with 6in. pointer travel. Power output is 3 watts to a 6½in. p.m. loud-speaker. Extension speaker sockets (with provision for internal speaker muting) and pick-up terminals are incorporated. The aerial is an in-built Ferroxcube rod.

The cabinet is finished in high-gloss walnut veneer and measures 15½in. × 11in. × 6½in. Price, 19½ gns. (tax paid).

### NEW BATTERY SUPERSEDER

*General Electric Co., Ltd., Magnet  
House, Kingsway, London, W.C.2.*

WHERE several battery-operated devices are located near a mains supply, it is often an advantage to dispense with batteries and feed the equipment directly from the mains through a suitable low tension rectifier unit. G.E.C., Ltd., have recently introduced an l.t. rectifier, known as a battery superseder, specially for this type of work. It is made by Salford Electrical Instruments, Ltd.

This new equipment, which provides an adjustable output voltage stabilised against load changes, is particularly suitable for use in test laboratories, but will also find many applications elsewhere since maintenance costs, as compared with batteries, are negligible and the absence of acid fumes is advantageous in certain fields. In addition, the battery superseder can be used for charging batteries at constant voltage, a technique which tends to prolong battery life.

Though not strictly portable, the unit is light enough to be transportable and compares favourably in size with a set of batteries giving the same output. Since it does not incorporate any moving parts or delicate equipment, it is extremely robust.

The battery superseder has been designed to operate from a single phase mains supply of 230V at 50 c/s, but inputs from 190-250V are permissible, provided the output voltage limits are not exceeded.

The circuit on the output side consists of two identical rectifier sections, each capable of delivering 9.5-15V at 0.10A. These sections can be arranged in parallel or in series by means of an output selector switch, giving two ranges: 9.5-15V at 0-20A, and 19-30V at 0-10A. The voltage control is effected in both by switching appropriate tappings on the mains transformer; a total of 36 positions of "coarse" and "fine control" switches provides a nearly continuous range of adjustment.

The power efficiency of the battery superseder varies with load, but reaches its maximum value of 50 per cent. at full load, while the input power factor ranges from 0.59 to 0.75 dependent on both load and output setting.

The unit, which was originally developed for the Ministry of Supply, is suitable for use under widely varying conditions of temperature and humidity.

### NEW CHANNEL CONVERTERS

*Channel Electronic Industries, Burnham-on-Sea, Somerset.*

TWO new Band III converters are announced by Channel. Type C1 is an improved version of the model first exhibited at the Radio Show last September. The unit is housed in an attractive streamlined case with front-knob gain control, quick change programme knob, and easy access tuning trimmers. This model provides instant choice of any B.B.C. Band I programme or any channel in Band III. Price, 9 gns. retail.

Converter type C2 is designed to give instant choice of four programmes (one channel in Band I plus three in Band III) to cover all likely future programme requirements in any TV area. Price, 10 gns. retail.

Specifications of both models include: separate inputs for Band I and Band III; high-Q, low-loss, full bandwidth circuits; stable oscillator in double screen compartment to prevent re-radiation; unit stage gain approximately 10 db; 70-80 ohm coaxial input and output; size: 8in. × 4½in. × 2½in.; quick-fix two-hole mounting behind receiver; suitable for a.c. or a.c.-d.c. sets; guaranteed for 12 months (valves three months).

Both models are now in quantity production and are subject to the usual trade discounts.

*(Continued on page 738)*



The new Channel Band III converter



*Continued*

## NEW MULLARD VALVES

*Mullard, Ltd., Century House, Shaftesbury Avenue, London, W.C.2*

A NUMBER of different types of valves for use in radio, television and electronics have recently been released by the company, also cathode-ray tubes for radar and test equipment applications. There are also two junction transistors which are now being manufactured in large quantities.

Although the properties and advantages in certain applications of transistors are well-known, a limiting factor to their more widespread utilisation has to date been the difficulty of obtaining uniformity of performance and properties in the quantity production of such items.

Mullard have devoted very considerable research to the solution of this specific problem and two junction type transistors (types OC70 and OC71) are the successful outcome of this work. These two transistors are now being made available in large quantities and maintain a degree of consistency hitherto unobtainable.

Junction transistors have definite inherent advantages over the earlier point-contact types. They have improved stability and reliability and, in addition, two other advantages enabling them to be used for all stages of audio frequency work; namely, their low circuit noise and complete freedom from microphony. One of their earliest successes in fact has been their application to hearing aids, in which they are widely used.

Amongst the many other applications of Mullard junction transistors on which investigations are being actively progressed are those in telephone circuits and computers.

The OC70 and OC71 are low-power transistors. While the OC70 is intended for use in microphone input and amplifying stages, the OC71 can also be used as an output stage for telephone earpieces and hearing aids.

A special process of fusion sealing provides an all-glass fully hermetically sealed envelope. These envelopes measure about 0.6in. long and 0.25in. in diameter for both types.

## Novel Tuning Indicator

The Mullard EM80 is a cathode-ray tuning indicator ("magic eye") for

a.c. mains-operated broadcast radio receivers. Unlike conventional tuning indicators, in which the luminescent screen is viewed through the end of the valve, the EM80 is designed for viewing from the side. Thus, although the valve is a miniature all-glass type, the area of the display is quite large (14.5mm. wide and 19mm. high), and is clearly visible over a wide angle. When a station is being tuned in, alternate bands of light and shadow in the display vary in size, the shadow diminishing as tuning becomes more correct.

The valve is sufficiently sensitive to ensure that small changes in tuning which cannot be detected by ear are nevertheless clearly visible.

The EM80 is on the B9A noval base, and has a heater rating of 6.3V, 0.3A. Mounting position is unrestricted, and the design of the valve makes it easy and economical to mount so as to give a clear indication of tuning, and at the same time be aesthetically pleasing.

## Long Life Double-Triode

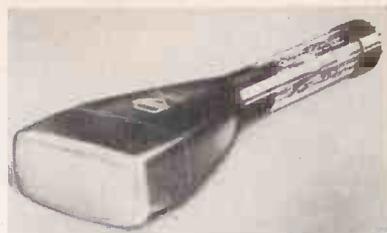
The Mullard E90CC is a new low impedance double-triode valve having a life expectancy of over ten thousand hours, and electrical characteristics kept within specified limits. It is intended for use in electronic switching circuits such as are used in digital computers, high-speed counters, and scalars. It is also suitable for use in conjunction with the Mullard High Speed Decade Counter Tube E1T.

The following electrical characteristics are closely controlled: mutual conductance, anode current, balance between halves, and cut off. With a standing current of 8.5mA ( $V_a=100$ ), the mutual conductance has a value of  $6mA \pm 1.2mA/V$ . In a typical circuit, under fixed bias conditions, the tolerance on anode current at 5.6mA is 0.6mA (approximately 10 per cent.). The negative grid voltage required to reduce the anode current to 100 micro-amps is less than 10 volts.

The balance between the two halves of the valve is such that, with the latter value of anode current in each section, the grid voltages of the two triodes are within 2 volts of one another. Long life is achieved in part by reducing the temperature of the cathode. This results in less loss of barium by evaporation, which reduces cathode life and can cause undesirable stray emission. The disadvantage of reduced cathode temperature, namely, reduction in omission, has been overcome by increasing the cathode area, and a peak emission of 75mA for each triode is specified.

## Rectangular Oscilloscope Tube

In radar and oscilloscope displays, it often happens that only a small horizontal strip in the centre of the screen of a cathode-ray tube is occupied by the trace. If instead of a conventional circular face a face of rectangular form is used, the trace can occupy the whole of the working screen area. Such a rectangular screen has been adopted in the new Mullard DG16-21 tube, which enables much equipment space to be saved. It is the first British tube of its kind.



Mullard rectangular c.r. tube for oscilloscope and radar use.

The tube will find particular application in radar range-finding, decoding IFF or beacon signals, and echo sounding equipment. Where it is desirable to compare visually the signals in several channels, DG16-21 tubes, because of their bulb shape, can readily be stacked close together, thus facilitating easy direct comparison.

The DG16-21 tube has a screen size of 5½in. x 1½in. The deflection sensitivity is of the order of 0.2mm/V. The angle alignment between X and Y plates is kept within one degree of the nominal value of 90 degrees: this close tolerance ensures the high degree of perpendicularity necessary where accurate measurements have to be made. The tube has a 6.3V heater, and would normally operate at a final anode voltage of 6kV.

## Voltage Stabilisers

Special Quality versions of the Mullard gas-filled voltage stabilisers 90C1 and 85A2 are now available, designed to operate satisfactorily under severe conditions of shock and vibration such as are encountered in aircraft, ships, vehicles, and in industry. They are tested to withstand impacts of 500g and vibrations of 6g at 175 cycles per second.

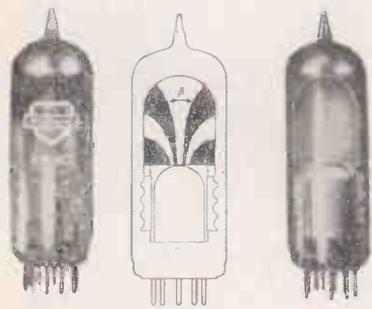
The new tubes are electrically equivalent to the 85A2, the 90C1, and the 150B2. They are available in two forms, one with pins and one with flying leads. Flying leads are desirable because, since they can be soldered firmly in place, variations in contact resistance such as are encountered when plug-in types are subjected to vibration are eliminated.

Such variations give rise to noise and minute voltage fluctuations which degrade the high performance of a voltage reference tube. The fact that replacement is more difficult mechanically than with plug-in types is of little importance in view of the long life of these tubes.

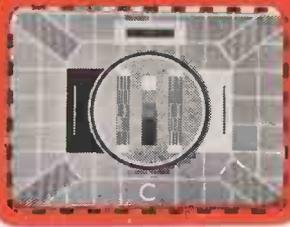
The type numbers of the new Special Quality stabilisers are as follows. The M8098 and M8142 are electrical equivalents of the Mullard 85A2 voltage reference tube (CV449). M8098 has a pin base and M8142 a flying lead base. The M8206 and M8207 are pin base and flying lead base equivalents respectively of the Mullard 90C1 voltage stabiliser. The M8163 and M8208 are pin base and flying lead base equivalents of the Mullard 150B2 voltage stabiliser (CV2225).

## High-power Thyatron

Type XG2-12 is a new, large mercury-vapour triode thyatron capable of handling a current of 12A, with a peak inverse voltage of 2,500 volts. It can, therefore, be used on all normal industrial 3-phase supplies, and is likely to be of particular value for motor control and the control of large welders. A special rating permits the valve to draw high currents (up to 20 amps.) at intervals of five minutes or more. This is particularly useful for motor starting.



Front and rear views of the Mullard EM80 tuning indicator with (centre) diagram of tuning pattern.



James Huxley's

No. 2

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Engineer ?



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# TECHNICAL GEN for SERVICING MEN

**Edited by James Huxley**

**HELP YOURSELF**

to all the technical gen in this feature, which is your feature, presenting details of faults encountered by engineers in current radio and television sets, and explaining how those faults were diagnosed and overcome. The aim of this feature is to guide

**AND HELP**

all in the radio and TV trade. If you have come across any unusual fault in a set recently, write and tell James Huxley, "British Radio and Television," 92 Fleet Street, London, E.C.4. All published contributions are paid for, and your contribution may help



**OTHER ENGINEERS**

**Ekco TRC124**

**No Line Hold** In this model the line-hold was found to slip after 15 minutes or so.

The SP61 was replaced, and all appeared well. Seven days later we were called back with the same complaint only now the line slip was permanent. The chassis was removed and the 2.2 MΩ resistor R56 (*Test Report TV49*) in series with line-hold control was suspected, and when measured was found to read some 4.5 MΩ. Replacing this with a larger 1-watt component cleared the fault.

Intermittent frame collapse on these receivers can be caused by the screened cable to the top cap of the SP61 developing a leak. This consists of an inner piece of rubber flex, then braid, and then rubber covering. The inner lead was found to be moist.—A.E., Liverpool, 5.

**Bush TUG26**

**Curious Frame Fault** This set came in with a particularly troublesome fault. Every four or five seconds the frame would flick over just once. The frame lock was found to be up to standard, with a normal range of control. Valve replacement and voltage tests did not reveal anything, so a 'scope was put to use. It was found that when the 'scope was connected to the anode of the frame output valve (pentode section of ECL80), the sawtooth waveform would almost collapse when this flick-over occurred on the set. Condenser trouble was suspected, so these were checked by replacement and it was found that C39

(makers' manual) a 200 pF condenser in the feedback circuit was the culprit. This condenser was tested afterwards and with 500V across it would short every few seconds.—J.B., Crawley, Sussex.

**Murphy V200**

**No E.H.T. Sound or Vision** Symptoms experienced on this set were: no sound, vision, or e.h.t. Valves V6, V9 and V15 were running cold. The above condition was very intermittent. It was thought at first to be a cathode-to-heater short-circuit in the heater chain and valve V17 was suspect as it had produced similar symptoms on a previous occasion. However, valve replacement did not clear the fault.

While carrying out examination of valve base connections of V6 it was

necessary to remove the metal screen from the underside of the receiver chassis. This was done while the fault was "on," and on removal the symptoms cleared.

Further investigation showed that a black plastic lead, wired from the heater of V17 to the heater of V6, had been cut into by the sharp edge of the metal screen. To look at the lead you could not see any exposed conductor. Cure was effected by fitting sleeving.—J.W., Perth.

**Invicta 119T**

**Sound Distortion** The sound output screen-grid decoupling condenser is covered in plastic sleeving and fitted under a clip. The clip sometimes perforates the cover, and as the negative return of this condenser goes to the cathode of the output valve the bias is short-circuited to chassis, thus causing sound distortion.—R.V.A., Birkenhead.

**Regentone 14T**

**First Anode Negative** The complaint was from the customer that the picture had deteriorated over a short period of time, it was collected for bench test, when it was found that no raster was obtainable.

Routine tests were commenced. In the process it was noticed that the ion-trap was loose, readjustment was tried—this being of no avail. Next e.h.t. was measured and found normal, and then

**Write to James Huxley**

on Service Department matters, and pass on all the hints and tips and dodges that you have found useful in dealing with day-to-day service problems. Articles on all subjects of technical service interest are welcomed. All published contributions are paid for.

(continued on page 743)

The Editor does not necessarily endorse the views expressed by contributors to this feature

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**Model V8-15, 61 GNS.**

Ultra Programme Tuner (Price 6 gns.) easily fitted.

**Model VT8-15, 67 GNS.**

Ultra Tuner already built in.

**Note BIG picture size:**

**12½ x 9½ ins.**

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- ★ **SIMPLE PROGRAMME SWITCH**
- ★ **B.B.C. TUNING CIRCLE  
23% LARGER THAN  
POSSIBLE ON  
14 in. RECTANGULAR TUBE**
- ★ **DE-LUXE CABINETS**



# TECHNICAL GEN

Continued

tube measurements were checked. It was found that the first anode was reading considerably negative.

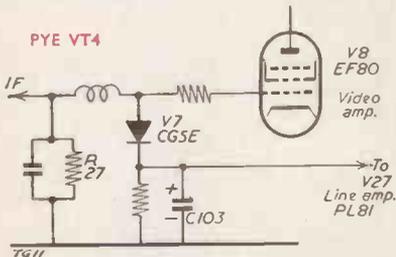
The chassis was now removed and the boost voltage feed to the A1 traced; the voltage could be read by an electrostatic meter at the junction of R58 2.2MΩ and R48 680kΩ (maker's manual). R48 itself was measured and found correct.

Now C65 300pF to the primary of the frame blocking oscillator transformer was disconnected, whereupon voltage was present at A1 of the tube.

Replacement of the component with a 1kV working type restored the receiver to normal order again. The 300pF condenser had a leak of 750KΩ.—J.K.G., Exeter.

## Pye VT4

**Low Definition** The symptoms were: poor definition and right-half of raster brighter than the left. It was found that the raster brightness was a modulation trouble and not line time-base, and C103 was suspected of being o/c, i.e.,



pulses from PL81 circuit reaching V8 via V7. Placing a 25µF condenser across C103 brought the raster back to normal, but the poor definition remained. V7 is a clamp diode to limit V8 until the a.p.c. begins to operate after switching on. When this was disconnected, definition became normal.

Replacement of V7 did not effect a cure, however, and further tests showed no voltage at the junction of V7-C103. Disconnecting C103 (the original) brought definition to normal, and fitting a replacement C103 restored normal operation. It would appear that the original C103 was intermittent s/c not o/c as first suspected.

It is interesting to note the operation of V7. The d.c. at the grid of V8 leaks away via V7 to earth until V27 assumes working conditions when a potential develops across C103. This backs off V7 and allows V8 to work

normally. In this particular case, the backing off voltage across C103 never developed, and the grid of V8 remained clamped, causing the poor definition.—E.C.S., Darlington.

## Ekco TV Series

**Variety of Faults** The following hints may prove useful to engineers when servicing Ekcovision receivers: *Distorted sound and low volume intermittent in nature*—replace either C49 or C50. Ekco service sheet T205/T217 and associated models using same circuit. *Weak sound, no vision intermittent in nature*—check C9 and C10 for o/c found in oscillator coil can. Service sheet for T207/T217/T205, etc., also C9/C12 for T161, etc. *No line hold, or continued change of frequency until control is at end of travel*—replace R67. Ekco T2141, etc., and R56 TS188, etc. *Poor frame-hold as set warms up for half-an-hour or so or no frame hold at all*—replace metal rectifier in frame circuit which develops high forward resistance. All Ekco's from T161 (modified) onwards.—S.F.H., Stroud, Glos.

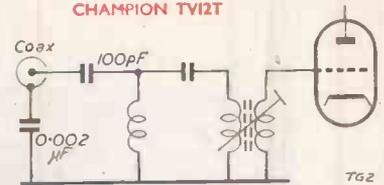
## Champion TV12T

**Spots on Screen** Spots were noticed on the screen of such a character as to immediately suggest arcing e.h.t. Examination of likely points showed nothing of the kind. No sparking could be heard, and there was no smell of ozone. A more critical look at the screen showed the spots to be roughly grouped in two bands across the screen, which pointed to some 100-cycle fault. We examined the heater circuit with no luck. Then we found the fault disappeared with

## Bush TUG26

**Raster Distorted** In a recent issue F.O.R., of Wolverhampton described a distorted raster fault on a Bush TUG36 television receiver. The photographs below show the symptoms in greater detail, this time on a Bush TUG26. In this instance the fault was intermittent, the effect being as illustrated, but when the fault was absent the

## CHAMPION TV12T



removal of the aerial, and varied with signal strength.

An examination of the aerial circuit showed that the connections to the coaxial inner and outer had been covered, and the two isolating capacitors, 100pF and 0.002µF, were in each others position. Correcting these points reduced the trouble but didn't cure it.

We thought maybe the peak voltage might be causing a leakage in the capacitors so we changed them both. Result—a spotless picture!—P.B., Bradford.

## Philips 1100U

**Frame Fold-over** The customer complained of a bright white line across the picture about 2 in. from the bottom.

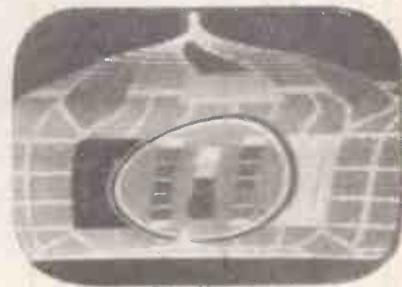
This occurred at irregular intervals and it was decided to return the set to the workshop for soak test. The frame output valve (ECL80) had been changed at the customer's house and the fault had recurred after about two days.

On test the voltages were found to be normal, so substitution checks were made on components in the frame oscillator and output circuits, with no improvement. A further study of the circuit diagram was then made and it was seen that the only part of the frame output circuit not so far checked was

(continued on page 745)

picture was perfect in all respects and was set up on test card "C."

The trouble was eventually traced to the 8µF boosted h.t. line decoupling condenser (C21 in maker's manual), but a "red herring" was a sparking at the scan coils which looked suspect but which was found to be due to a heavy coating of grease around the flare of the tube. This was easily cleaned off.—T.F.M., Glasgow, S.2.





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**TECHNICAL GEN**

Continued

the h.t. feed from the boost line to the frame output stage. On measuring the voltage at the junction of R75 and R76 the fault cleared. It was found that if R75 was moved slightly the fault could be produced and cleared at will.

Replacing R75 cured the trouble.—S.W., Bristol.

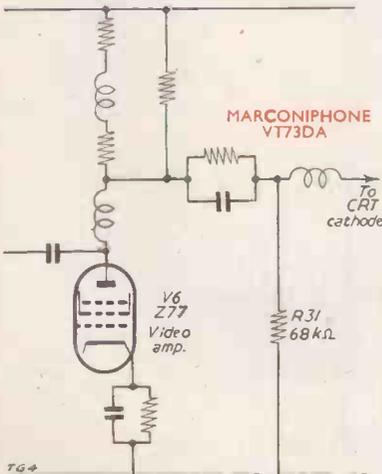
**Bush PB10**

**Transformer Fault** A common fault occurring in this model is crackling in the background and occasional loud bursts of noise. Determining the stage at fault by the "grid-grounding" method showed that in this case the output stage was the culprit. Hooking up a test-panel speaker transformer revealed the trouble. To our surprise the primary of the transformer was o/c yet the set had been playing full volume with only slightly background crackle.—D.G.W., Farnborough, Hants.

**Marconi VT73DA**

**Brightness Varying** The symptoms were—low maximum brightness and dull picture going intermittently bright and then darkening after half-an-hour's working. At first a low emission c.r.t. was suspected but on closer inspection, however, I found that the cathode read 130V instead of 110V. The receiver was left running with a meter connected to tube cathode and during the fading the cathode voltage was found to change in sympathy.

The resistor R31-68 kΩ (Test Report TV10) was measured and read 1.4 MΩ instead of 68 kΩ. This was assumed to

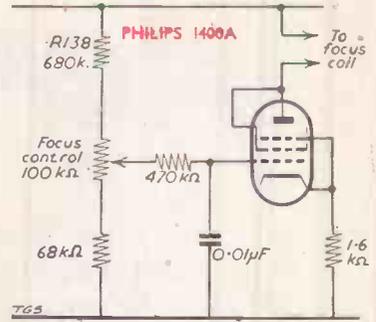


vary with temperature. Replacing this resistor with a 1-watt type restored everything to normal, including c.r.t. cathode volts.

Intermittent weak sound on the same receiver was caused by loose valve cans.—A.E., Liverpool 5.

**Alba T394**

**Frame Scan Trouble** A bad case of frame dither occurred on one of these sets recently after the set had run for five minutes. The frame time-base was suspected, as distinct from the sync circuit, and every component checked with the assurance that this must be it. Everything was o.k. It was then decided to take a more accurate check on h.t. voltage. Everything went normally until the five minutes elapsed, then the voltage started varying up and down by about 10V. Apparently one of two PY82 rectifiers was "dropping out of circuit." Two new PY82 valves cured the trouble.—R.V.A., Birkenhead.



**Philips 1400A**

**Focus Control Drift** The trouble with one of these projection sets which came into the workshop was that the focus control was at the extreme end of its travel, and after the receiver had been running a short time the focus drifted out of the range of the control.

A check was made of the focus coil current and this was found to be low, so our attention was turned to V24, this being a PL82 which acts as focus stabiliser. The culprit turned out to be R138 which is a 680,000 ohms resistor in the grid circuit of this valve.

The value of this component had risen to over a megohm. This was replaced and the focus control was once more found to function normally.—A.T., Welling, Kent.

**Strad TA1414**

**Vision Instability** A peculiar effect on this set was for the picture to disappear and white vertical bars to appear. Checking down the i.f. strip it was found that after touching the f.c. grid the picture reappeared. Repeating the action brought the instability back again. The decoupling condensers were quickly passed as o.k. The 6BW7 f.c. valve was then replaced and the set behaved normally once more.—R.V.A., Birkenhead.

**Ferguson 989T**

**E.H.T. Spots** One of these models recently "broke out in spots"—large, uncontrollable spots, covering the entire screen. The fault was obviously due to e.h.t. arcing. The e.h.t. generator components were cleaned, also the insulating cover of the metal c.r.t. This eliminated the spots while the chassis was out of the cabinet, but they reappeared on replacing the chassis.

The fault was traced to arcing from the edge of the c.r.t. anode, across the insulator and the sponge rubber dust excluder to the cabinet and foil lining.

(continued on page 747)

**ODD SPOT**

A viewer complained that at intervals his TV picture became larger, lost brilliance, and would not lock. The set was duly removed to our workshop for soak test, but after several days the original fault did not occur.

It was reinstalled, and performance checked, but the next day, the owner complained again of the same symptoms, particularly when anyone washed their hands or washed pots. This was confirmed: each time a hot water tap was turned on, the fault occurred.

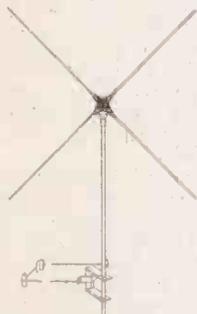
After a few minutes thinking, the set input voltage was checked. This was found to drop by some 1.5V when a hot tap was turned on.

Further investigation revealed that the TV power point had been "tacked on" to the existing immersion heater wiring, which in itself was not sufficiently heavy for a power point. The thermostat switched the heater on whenever hot water was drawn, caused a 15V drop on the cable feeding both the heater and the receiver.

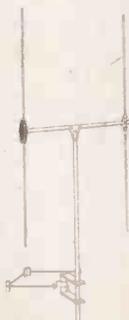
The TV point was re-routed, and a strong recommendation made for the heater wiring to be replaced with the correct type cable, thus ending what had at first appeared to be a "fairy story."—A.E.P., Leicester.

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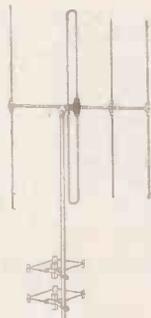
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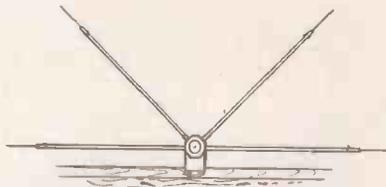
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**TECHNICAL GEN**

*Continued*

The old dust excluder was removed (it is affixed to the mask with glue) and a new piece of sponge rubber glued in its place. This effected a complete cure.

A check of this component may be carried out by partially withdrawing the chassis so that arcing to the rubber cannot take place.—F.R.P., Herne Bay, Kent.

**Ultra W817**

**Ticking on Sound** The fault on this model was described as "ticking on sound." This could not be controlled by the volume control and continued when the grid of the sound output valve was earthed, so putting the sound output transformer under suspicion.

This proved to be o.k., however, and it was then found that shorting the sound output valve cathode to earth stopped the ticking. In this set the sound output bias condenser (C72-50µF) and the line amplifier bias condenser (C39-50µF) are sections of a 50-50µF dual condenser and the fault was due to a breakdown between the two sections—a fault that could only occur with dual capacitors in these particular circuits.—W.H.B., Wolverhampton.

**Sobell T225**

**Frame on Sound** If frame pulses are found on sound it may save time to check first the grid circuit wiring of the a.f. amplifier (triode section of ECL80). The lead to the input side of the grid capacitor disappears through a hole in the front of the chassis. We have found that it may be cut 4 or 5 inches too long and the surplus disposed of by taking it alongside the frame scan valve and back again.

The cure is obvious.—P.B., Bradford.

**Bush TV43**

**Short on H.T. Line** No fewer than three of these sets, new from the manufacturers, developed the same fault, on the same day, during the first hour's run up. Suddenly, sound and picture went off and a hum came up on the set. Suspected h.t. short was quickly verified but location and replacement of faulty component took a little longer.

A 560pF ceramic condenser (C9 on manufacturer's sheet) which is used as a screen decoupler for V2 (PCF80) went s/c on each occasion. Its position in the bandswitch compartment, tucked

down under the switch block, makes replacement a little difficult.

If an h.t. short develops this condenser can very quickly be checked. Connect an ohmmeter between h.t. pin of the 5-pin plug in rear of main deck and earth. Rotate the band-switch slowly between Band I and Band III positions. If the h.t. short disappears in midway position of switch, then C9 is the condenser in trouble.

Incidentally there is another 560pF ceramic in the compartment and although it only has about 100V d.c. across it, one can quickly appreciate why if C9 goes I also change C3 whilst the unit is stripped down, just "in case"—M.J.H., Christchurch.

**H.M.V. 1816**

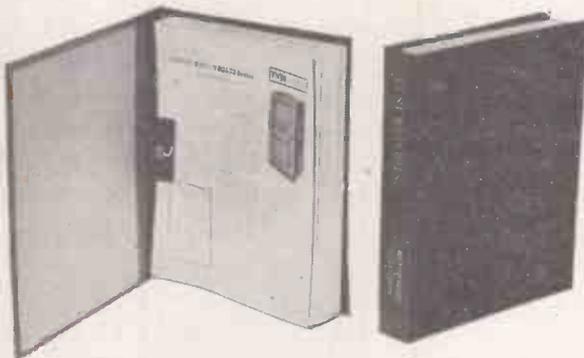
**Trouble with Coaxial** This might be called the case of the inverse fault!! We were summoned to investigate a "flashing" picture. In accordance with the perverse nature of things, the receiver failed to go wrong for the field service engineer, who brought it in for bench test. He remarked casually that the customer had a ghostly, grainy picture and, having erected his own aerial, was quite satisfied—except for the "flashing."

On our aerial the picture was near perfect, so we decided to investigate the aerial system. This was a single dipole, chimney mounted, with 80-ohm coaxial feeder brought over guttering

*(continued on page 753)*

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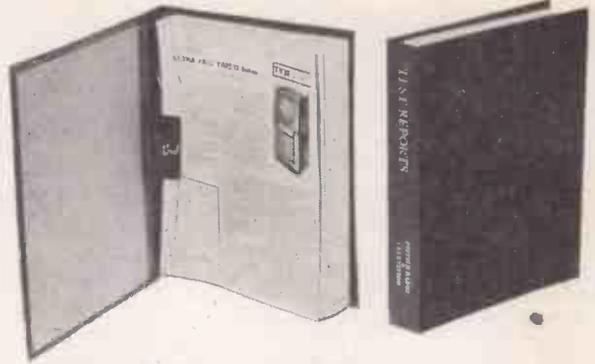
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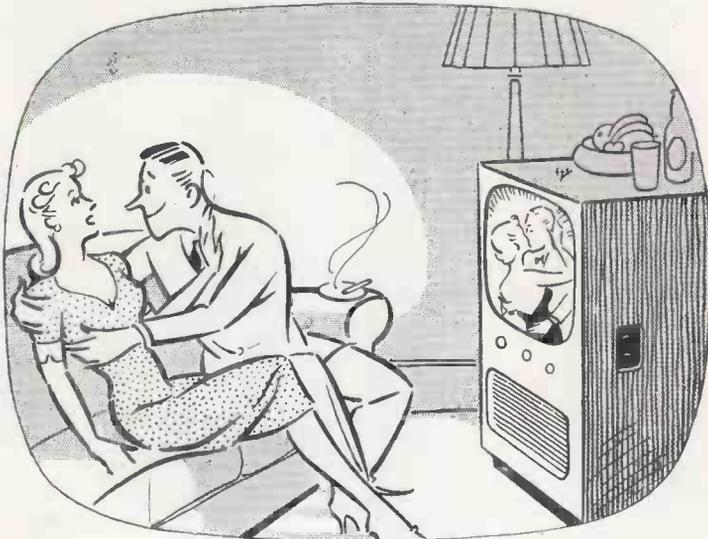


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# TECHNICAL GEN

Continued

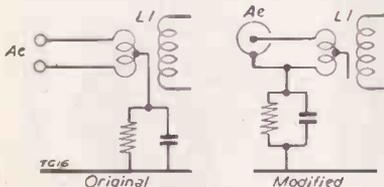
and under the eaves, through the loft and neatly down to the receiver.

All appeared well at the aerial but where the coaxial passed over the gutter trough there was a sharp angle and a possible source of trouble, so my assistant "made slack" and moved the lead. As he did so the picture "flashed." We experimented and by doing so found that the flashing was due to intermittent earthing of the outer conductor where protective insulation had worn. This was soon cured by the provision of a gutter clip.

But it had been obvious during our experiments that the "flashing" was actually a brief period of greatly improved picture, so further experiments were carried out with a spare length of coaxial and a matching stub approximately 6½ ft. long was found to effect a tremendous improvement in signal quality. Result, a delighted, if slightly mystified, customer.—H.W.H., Bargoed, Glam.

## Pye 18T, LV20 Series

**Fringe Area Mod.** For fringe area operation it is a great help to use coaxial aerial feeder and modify the receiver as follows: Remove the aerial lead and sockets and replace with coaxial socket.



Disconnect the aerial coil centre tap and connect the earthing condenser to one end of the coil. Finally, join the coaxial lead to the coil ends, braiding to the coil-condenser junction, inner to free end of coil as in the diagram. Removal of the second aerial coil core often increases the gain.—F.R.P., Herne Bay, Kent.

## Ultra 121

**No Short Waves** The fault here was no l.w. signals, and the oscillator grid volts were either absent or extremely low.

The fault seemed almost certainly to be in the oscillator circuit but after all the usual tests we failed to produce results. Eventually we discovered a bad joint on that section of the waveband switch which deals with the inter-station

## WHEN SENDING IN REPORTS TO JAMES HUXLEY FOR TECHNICAL GEN . . .

please write (or type) on one side of the paper only, leaving space between the lines for editorial use, and add a rough sketch where possible.

muting circuit. This joint could be made to produce or cure the fault at will—a result so unexpected that it was thought worth reporting.—P.B., Bradford.

## Invicta T119

**Faulty Width Control** This set was difficult to service as the fault occurred only once or twice a week.

A graphic story was told us by the customer who drew a picture of about seven arrows coming in from each side of the picture, complete with heads! We were duly intrigued, and the set was put on soak test and well prodded, but it wouldn't react. At the end of a week of futile testing it was decided to rule out the scanning coils and line transformer and concentrate on the width and linearity inductances.

We then found that the width control inductance when squeezed produced an

effect similar to that described. Careful inspection revealed a minute pin-hole in the insulation of the winding through which arcing had been taking place between solder tag and turns. Re-insulation completely cured the trouble.—R.V.A., Birkenhead.

## Ferguson 996

**Poor Sound Quality** In one or two cases we have had complaints of too much "top" in sound on earlier models of this set. This was found to be due to the volume control being incorrectly wired so that the grid of the output valve was connected to the top of the volume control instead of the slider. We have not encountered this error in later production runs.—R.V.A., Birkenhead.

## Murphy V214

**Intermittent Fuse** Reported fault was intermittent h.t. Receiver was left running with voltmeter across main h.t. line and it was noted that breakdown was on input side of circuit. Owing to the intermittent nature of the fault a "blown" fuse was not suspected and circuit was checked for dry joints, etc., but the fault persisted. Finally, in desperation—for such things have previously occurred! the fuses were re-

(continued on page 755)

# The Vision Detector Circuit

(CONTINUED FROM PAGE 760)

## Filtering

The video signal developed across the load resistor must be fed to the grid of the video amplifier valve, minus the r.f. currents that will be present. While this unwanted r.f. content is predominantly at intermediate frequency, it also incorporates signal frequency voltages and harmonics which, if allowed to reach the video stage, can produce instability and pattern interference.

Owing to the present (but decreasing) tendency to use comparatively low i.f.'s it is extremely difficult to filter out the i.f. component without at the same time seriously attenuating the higher video frequencies which, in commercial receivers, constitute up to no less than 25 per cent. of the carrier.

In radio receivers using an i.f. of 465 kc/s and with a peak audio frequency of say 8 kc/s the ratio of carrier to modulation frequency is 465:8 (or almost 58:1). Separation is easily accomplished by a low-pass filter com-

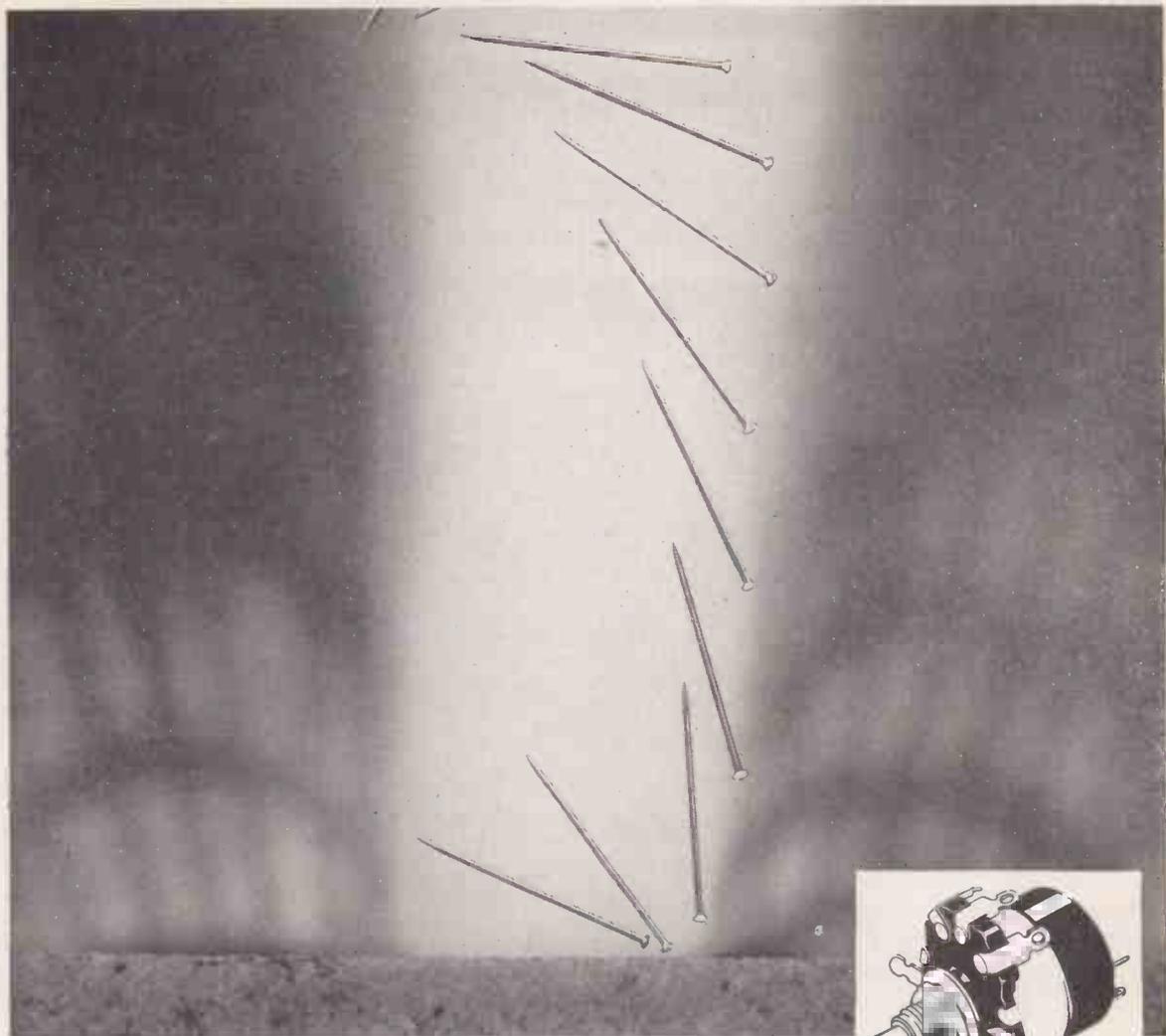
prising a medium value resistor and two 100pF capacitors. In the TV video circuit, however, such a procedure even with scaled down values would be disastrous to the higher modulation frequencies.

## I.F. Choke Design

Invariably, therefore, a low-inductance choke is utilised. It is specially wound to have as high an impedance as possible to the dominant r.f. frequencies without unduly attenuating the v.f. signal. This is accomplished by designing the choke so that its inductance in conjunction with the circuit capacitances will tune and form a high impedance to these r.f. currents.

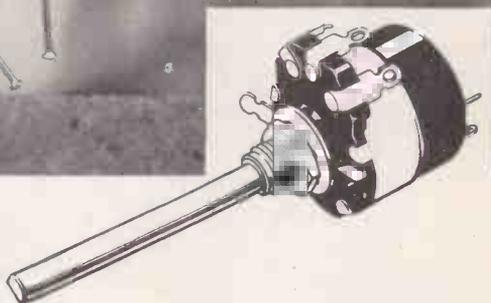
In some receivers the choke is wound on a resistor of about 47kΩ, and is connected in parallel with it, so if the choke develops a break, and goes o/c, reception will still be possible but with reduced definition.

The video amplifier does not have a grid resistor as such; as it is directly fed from the detector diode, the diode-load resistor fulfils the dual function.



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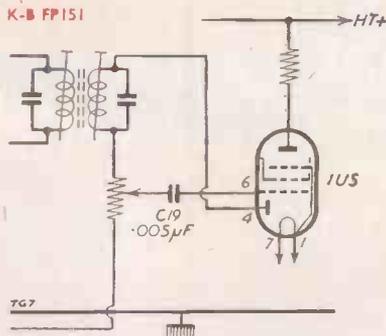
# TECHNICAL GEN

Continued

moved and cause of fault was revealed: a deposit of some sticky, dirty substance had effectively insulated the inner bracket of H.T.1 fuseholder. Scraping and cleaning effected an immediate cure.—H.W.H., Bargoed, Glam.

## K-B FP151

**Feed-back trouble** Symptoms took the form of a high-pitched whistle or "screech." The fault was found to be caused through the 0.005μF fixed tone control capacitor being placed too close to the sound output valve (3V4). I repaired



the fault by repositioning the 0.005μF capacitor a good distance away from the output valve and by screening the two ends of the capacitor. The screening used was from small gauge coaxial cable.—A.D., Newton-le-Willows.

## Philips 200U

**Valve Pin Leak**

The fault on this receiver was very heavy crackling and low volume with distortion. After voltage checks it was found that the anode of UBC41 read only 20V instead of the usual 65V. The anode load resistor was measured and found correct. The valve was next tested for element shorts and while doing this it was noticed that between the adjacent anode and heater pins the glass had a coloured stain on it. On applying a meter to the pins a varying reading of 100 kΩ to 200 kΩ was obtained. (The stain was removed with carbon tetrachloride and set was then o.k.)

This fault has been known to occur on ECN42 f.c. valves in certain Philips receivers since, and invariably causes crackling.—A.E., Liverpool, 5.

**I**N the early days of broadcasting, when the majority of receivers in use were home-made—often by those having great enthusiasm but little technical knowledge—there were frequent complaints that enjoyment of the programme was marred by interference radiated from a neighbour's set. This trouble is now to all intents and purposes eliminated, at least so far as commercially-built broadcast sound receivers are concerned. Occasionally, however, instances occur of interference with the sound broadcast programme by a nearby television receiver.

A television receiver can produce interference with broadcast reception over a limited area. This interference is chiefly due to induced electric and magnetic fields set up by such parts of the television receiver as the line output transformer and high potential points associated therewith; the deflector coils; and high impedance circuits near these components.

Interference by re-radiation of parasitic oscillations generated in the television receiving circuits is seldom serious as steps to prevent this are always taken in designing the receiver.

### Droitwich Programme Most Susceptible

As already mentioned, interference can be due to both electric and magnetic induced fields. The electric field is the more troublesome since it will affect broadcast receivers using conventional aerials. The magnetic field will affect only those sets having frame aerials.

It is the 200 kc/s (1,500 m.) Droitwich programme which is most sus-

## When TV Receivers cause Interference

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ceptible to this form of interference, because the 20th harmonic of the line time-base is 202.5 kc/s.

### Methods of Overcoming Interference

The obvious solution to the problem is, of course, to make provision in the design of the television set for preventing radiation due to these fields. Such measures are described below:

- (i) Ideally, the e.h.t. transformer, booster diode and line output valve should be totally screened by a can which makes good contact with the chassis. By "good contact" is meant multiple connections — a two-hole fixing arrangement is not entirely satisfactory.
- (ii) Width or linearity controls, if of the type employing coils, should be separately screened if they cannot be accommodated in the line output screening can.
- (iii) Deflector coils should be screened by an aluminium can or by metal foil wound coaxially round the coil and earthed to chassis. Care

must be taken to avoid risk of breakdown between the screen and the coils.

- (iv) In the design of the receiver care should be taken to keep circuits of high impedance well away from possible sources of interference.

It is recognised that these precautions are chiefly matters for the set manufacturer, and that they cannot always be conveniently applied in the service department. But there are other points which might receive the attention of the maintenance man.

### Earthing Graphite Coating

For example, the earthing of the graphite coating of the picture tube should be as efficient as possible to reduce forward radiation from the deflector coils. Preferably earth connections should be taken from two separate points on the coating.

Then both poles of the mains supply should be connected to the earth terminal via 0.05μF paper capacitors rated for 600V r.m.s. working.

Finally, a perforated foil screen at the back, top and sides of the set connected direct to earth will effect a considerable improvement, and will tend to confine radiation to the front of the set.

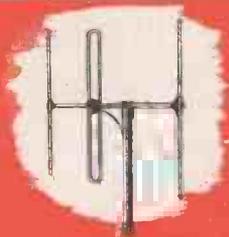
### Back Radiation Most Serious

Much can be done to avoid interference with a neighbour's reception by selecting the position of the television set. If the receiver is installed against a party wall, radiation may easily affect a broadcast receiver on the other side of the wall. Under all domestic conditions, therefore, and particularly in flats, the back radiation is the most serious.

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**UNEX.**—A driven X-shaped aerial with 3.0dB forward gain and quick connecting elements and assembly. Fully waterproofed junction box with easily removable inspection cap. Retail price is £3/14/6.

**AERFRINGE.**—For fringe areas, this range has high forward gain of 7.5dB. The aerial is quickly erected since it is pre-assembled with the elements in a folded position. Retail prices £10 with 2in. x 10ft. alloy mast, double lashings, etc. Other aerial types include models for loft, skirting board, wall and window sill mounting.

## BAND III

**AERIALS.**—The types to be offered, include separate aerials with 3, 4 or 5 element folded dipole arrays. There are also similar models for attachment to existing aerial masts. Finally there are composite aerials with multimoded element arrangements, for Band I and III reception. These aerials have a new lightweight waterproofed insulator of special design manufactured in polythene. Aerialite Band III aerials were used at the Baghdad Fair recently.

**CONVERTORS.** Priced at £9/10/- retail, the Aerialite Converter is attractively finished in dark oak stove enamel and has cream coloured control knobs. The unit has facilities for fitting to the receiver or may be placed at the top of the set. The electrical performance is excellent, the gain being 6-10dB with no "patterning" occurring. The model is available for 200-250 volts AC and may be used with either AC or AC/DC sets. The demand will be heavy for these converters and are advised to order early.

**DOWNLEADS.**—Aerialite Aeraxial Cables with their special five cell construction were designed and introduced to provide better downleads with lower losses for Band III. Competitively priced, these cables are the answer for highly efficient aerial installations.

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To meet the demands for high efficiency aerials for F.M. (Band II) reception the Aerialite range includes single dipole, "H" type and three element folded dipole aerials.

The high quality materials used in these aerials together with the careful design of the electrical characteristics ensures better reception in terms of forward gain, directivity and broad bandwidth.

F.M. aerials are erected with the elements in the horizontal plane.

These aerials have fully waterproofed insulators with quickly removable inspection caps. The range covers chimney and wall mounting dipoles, H aerials and Aerfringe and Dublex types.

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By P. Binns

## Radio and TV Testing with Lamps

**A** DEVICE which has given much satisfaction over a period of many years is a slight variation of the electricians well-known "series bulb" method of continuity testing. Many service engineers will be familiar with it, and perhaps some of the younger engineers who have been trained in this "electronic" age may be interested in this purely "electrical" device—if only as a relic of days long ago.

In its original form it comprised simply two B.C. lampholders wired in series across the mains. One contained a small bulb as an indicator whilst the other was equipped with a B.C. adaptor and a length of flex terminating in test prods. It was, of course, used for testing low resistance circuits such as domestic electrical appliances.

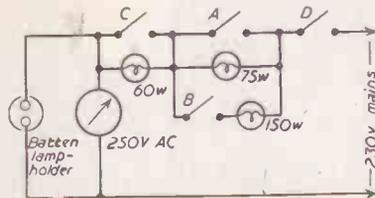
This 230V a.c. testing can still be of value in radio equipment in the odd cases where the 1.5V cell of the normal resistance meter is quite inadequate, for example, intermittent isolating capacitors in a.c.-d.c. sets, which only break down at something approximating the normal working voltage.

### Details

The diagram illustrates the circuit of the modified system for use by radio and television service departments. The wiring is included in the permanent wiring of the bench, with the switches near to hand, the bulbs in any position, visible or otherwise as desired, and the voltmeter located so that it is readily readable.

The outlet is a brass button holder with a captive B.C. to a two-pin adaptor, fitted because it is the most generally useful. Connection to the more unusual plugs is by a 6in. length of flex with a two-pin plug and crocodile clips, and a suitably placed cup hook on which to support the plug of the set on test. This latter arrangement does expose the mains to the touch but is no more dangerous than the chassis we play with every day.

It will be seen that by operation of switches A, B and C a number of different resistances may be placed in series with the equipment on test, or, with A and C closed, a normal straight through connection is made, and whatever the load the voltmeter will read the mains voltage, as it will with any position of A, B and C if no load is connected.



Circuit diagram of lamp-test system for radio and TV.

With a load connected the meter indicates the actual voltage applied which may be varied with switches A B and C. D is, of course the normal on/off switch.

### Applications

Many applications will no doubt immediately be suggested, among which are the following "difficult" servicing problems.

The a.c.-d.c. set with an intermittent short circuit which blows a fuse and clears the fault simultaneously, after which it works well for another few days. With bulbs in series the fuse remains intact and so, usually, does the fault. A voltage check with a testmeter will now reveal where this lies. An example recently encountered is a television receiver with an intermittent anode-cathode short circuit on the PY82 rectifier.

The set which produces "clouds of smoke" is an obvious subject. The source of the smoke can be examined with no fear of an immediate explosion.

The receiver which comes along for a quotation for overhaul is quickly seen to have short circuited turns on the mains transformer without waiting for an hour to see if it will fry eggs.

If any suspicion is held of an intermittent heater in an a.c. valve acting like a thermal contact breaker it is quickly checked by noting the meter reading which will vary with any varying load on the outlet. 110-120V sets may be checked with suitable bulbs in circuit.

### Testing Portables

Another candidate for test is the mains-battery portable which is reported to "fade on mains after twenty minutes" or even worse to "fade on mains occasionally"—which could be when the mains voltage drops, and in fact usually is. The current drain of this type is so small that both 75W and 60W bulbs will have to be in circuit to test. It will, however, immediately be proved if low mains voltage causes silence and tests may be made to locate the trouble.

### Lamp Selection

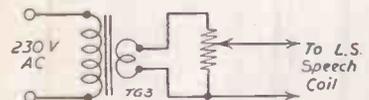
The sizes of bulb shown on the diagram were selected to be of the most general use. For instance the 75W bulb alone gives the best indication of a slight extra load within a.c. 0.2A and 0.3A a.c.-d.c. radios, and with the 150W added in parallel the input to these types is about normal and is sufficient to show up the intermittent short circuit which only occurs at normal voltages.

With 75W and 60W in series the input is reduced by about 20 volts with a battery-mains portable, and a low emission DK91 or failing metal rectifier is soon exposed.

Finally, any hazardous repair which normally is apt to "blow up the service department" may now be attempted with impunity.

## Buzz-testing Loudspeakers

The diagram illustrates the circuit of a useful piece of apparatus which we have found very helpful as a "buzz-test" after centring a loudspeaker cone. It consists of a night-light transformer with an adaptor made from the base of an ordinary screw-in flashlamp bulb. Across the two leads coming from the adaptor is a 500-ohm potentiometer, and the two output leads from this are



terminated in crocodile clips which connect to the loudspeaker speech coil. The output is about 6-8V and gives a clear hum free from the slightest dither which makes a perfect test.—H.W.G., Folkestone.

# TV Disturbance Testing

DETAILS OF A SHORT-CUT METHOD TO SPEEDY TELEVISION FAULT ANALYSIS AND DIAGNOSIS

by D. Wayne

THE three main divisions of television servicing procedure can be roughly defined as diagnosis, isolation, and cure. Diagnosis involves the allocation of the fault to a particular section or circuit of the receiver by observation of the breakdown symptoms. Isolation means the identification of the particular part or component which is faulty. Cure is, of course, repair or replacement.

In normal workshop practice it is generally true that fault diagnosis and isolation account for the greater part of the time spent on servicing. The actual process of fault clearing (i.e., replacing a resistor, capacitor, or valve) can usually be accomplished speedily enough. Line transformers may be more obstinate. But it is a fact that the hours accorded to many service jobs are invariably spent in trying to find the point of origin of the trouble.

it isn't—and to show how it can be used, when necessary, to save time and speed fault diagnosis and isolation in servicing television sets.

### Disturbance Tests

In dealing with specific faults that are not due to incorrect installation servicing, procedure is normally aimed at localising the trouble to one particular stage.

The time-saving technique used by the majority of engineers for short-cut servicing has been called "disturbance testing" in America, and is basically a method of signal injection, except that no signal is used. The idea is not new, of course. Disturbance tests in one form or another are fundamental to radio servicing as a whole, but in their application to television special points of usage arise which will be covered in this and subsequent articles.

They are commonly used by engineers and technical staff engaged in production-line testing. They enable a weak or faulty stage to be located in a minimum of time, using only the simplest of equipment—a screwdriver, a 0.1  $\mu$ F condenser, a length of insulated wire, a pair of crocodile clips, and, of course, a test meter.

The principle of disturbance testing is to interfere momentarily with the normal operating conditions of the stage under test, thus producing a change in the overall performance of the receiver (if the stage is functioning

SEVERAL years ago we published a popular series of articles dealing with short-cuts to systematic television receiver testing. In response to requests from a number of readers who are unable to obtain the appropriate back-numbers, we have asked the author to write an abridged and revised version of this series, which, we are sure, will be of interest to all servicing men

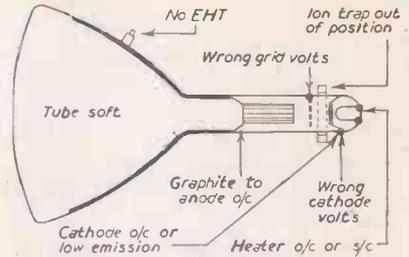


Diagram indicating possible causes of "no raster" fault symptoms

properly), or creating transient voltages which, containing many higher order harmonics, will act as a signal substitute in both the r.f. and a.f. stages.

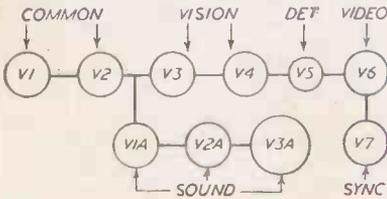
Simple examples of both functions are:

- (i) in a case of severe non-linearity of frame scan—shorting the cathode of the frame output valve to earth to see if any change is produced in the raster form. If not, then the cathode must already be at earth potential, indicating a short-circuited cathode by-pass condenser;
- (ii) scratching the grid pins of the valves in an r.f. vision strip with a screwdriver blade to determine the stage at which signals cease—indicated by the absence of white spots on the screen when the inoperative valve is reached.

### Receiver Analysis

For the purpose of analysis a television receiver divides naturally into five sections: the power supply (l.t., h.t., and e.h.t.); the vision receiver (including the sync separator and video stages); the sound receiver; the scanning circuits; and the cathode-ray tube with its associated control circuits—focus

(continued opposite)



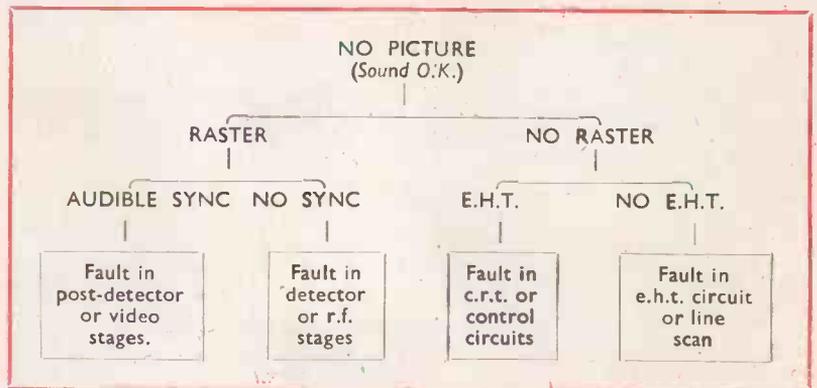
Diagrammatic analysis of "no picture" fault. If sound is normal, then the fault must be at V3 or later. If sync is audible, fault is at V6 or later. No audible sync fixes fault between V3 and V6

Obviously it is desirable to reduce the amount of time spent in diagnosis and isolation, whether in the workshop or in the customer's home. For one thing pressure of service work usually makes it imperative that jobs be cleared as quickly as possible if adequate and rapid service is to be offered to the customer. Secondly, time is money, and both the dealer and the customer stand to lose on jobs which require long periods of detailed inspection before diagnosis or fault isolation is possible.

In the day-to-day routine of TV servicing the engineer uses a large number of short-cuts to speed the preliminary process of pinning the fault down. These short-cuts, which may involve nothing more ambitious than a screwdriver, do not replace the correct use of test equipment; rather do they avoid the unnecessary use of the correct servicing equipment before the faulty stage has been adequately isolated.

These short cuts can be grouped together in logical order under the general title of "disturbance testing," and it is the purpose of this short series of articles to explain just what "disturbance testing" is—and what

### TELEVISION FAULTFINDING "TREE"



**QUALIFIED** radio and television engineers are to-day in great demand. With more and more equipment being sold, especially television receivers, the need for fully qualified service engineers is also increasing. Some thought must, therefore, be given to the future availability of such engineers, if the industry is to copy with the corresponding increase in servicing requirements.

The advent of commercial television and f.m. radio will provide plenty of work in the future. The trade will be hard pressed to supply enough engineers to cope with the need. Many engineers have learnt their trade in the workshop over the years, but this is not really a satisfactory way of producing the skilled man. Theory as well as practical ability is essential.

### Basic Training

The theory can only be acquired by attending a course on the subject. This is much easier to-day than in the past as standards have been introduced and training schemes instituted. The dealers and engineers of to-day can do a good deal to help by encouraging any young persons who are interested. If all servicing establishments were to take on one apprentice each now, in a few years time there would be more than enough engineers in the country.

The best way of finding the right youngster, is to apply at the local secondary school. It is well worth while having a chat with the parents of

## Servicing Men in the Making

NOTES ON THE RECRUITMENT AND TRAINING OF YOUNG SERVICE ENGINEERS IN THE WORKSHOP

by D. E. WINTER

a suitable lad, with a view to explaining the prospects of the job, also to find out a little of his background. Then, in the interests of all concerned an apprenticeship agreement should be drawn up by a solicitor. This will usually operate for a period of five years.

During this time, the boy will undertake to attend evening classes at the local polytechnic school to study for the City and Guilds radio and television servicing certificates. If necessary he should be allowed time off from work for study, and leave a little earlier on the days he has to attend classes; usually two evenings a week.

The deed of apprenticeship ensures that both parties concerned will mutually

co-operate in their own interests, thus inducing a good working basis.

In the workshop, it is better for the apprentice to work with an engineer all the time, rather than be made to do all the odd jobs, and be at everyone's beck and call. In this way the boy's interest is stimulated and his usefulness increases daily.

The theory he is learning is put to practical use right from the start. This is most important, as so many lads lose interest when they find themselves spending most of their time running errands, wrapping parcels and doing other sundry jobs. Of course, a certain amount of odd jobbing is inevitable; everyone must start at the bottom, but a careful watch should be kept to see that it is not overdone. The technical training is the prime consideration.

### Potential Salesman

As well as learning all the practical radio and electrical work, the boy will begin to accept responsibilities involved, such as customer liaison, politeness and etiquette. This matters a great deal, as the service engineer is a potential salesman, working as he often does in the client's home. An experienced engineer can quickly size up his customer and instigate potential sales.

When the apprentice is seventeen, he should be taught to drive a car or given help and assistance in order to learn. Then, when he has passed his driving test, he can do a certain amount of collecting and delivering of sets and other small outside jobs. This experience helps in building confidence and makes a change from routine workshop procedure.

### National Service

At the age of eighteen, the question of national service arises. If the boy is properly apprenticed, however, and is attending a recognised course then it is very likely that deferment may be obtained until the period of training is finished. Application for deferment is made at the time of registering for national service.

It is much better for the boy to qualify in his trade, than interrupt his training to do service. The Services themselves prefer a trained technical man and, of course, this arrangement suits the employer. In most cases the young apprentice will return to his former employer having completed his national service.

In this way it is possible to build up a staff of trained and trusted men, and although a long-term policy, is well worth while. The prestige of the business rises and the goodwill increases; a sound foundation for successful trading.

## TV Disturbance Testing (Contd.)

and brightness. With modern flyback receivers the e.b.t. and line circuits are, of course, inter-related, but for preliminary analysis e.h.t. can be regarded purely as part of the basic power supplies to the receiver.

The majority of faults can be related quite easily to one or other of these fundamental units. In some cases where ambiguity exists a simple test or two will usually indicate the source of the trouble.

### Example

*For instance—a receiver has "no picture," and it is not known whether the fault lies in the vision receiver, c.r.t., or e.h.t. circuits. If a normal raster appears when the brightness control is advanced then clearly the fault is the vision receiver.*

*On the other hand, if there is no raster then the receiver section is probably all right and the fault is in the tube, its control circuits, or the e.h.t. supply. If a small arc can be drawn from the tube e.h.t. connector cap with the aid of an insulator screwdriver (beware of shocks!) then it can be assumed that e.h.t. is present, and probably normal.*

*Provided the tube heater is alight, the fault is likely to be found in the control circuits, especially brightness. If on shorting the tube cathode pin to the grid (with the same screwdriver) a normal raster appears at full brilliance then the indications are that the tube is being biased*

*to cut-off by a fault in the brightness circuit (of potentiometer, etc.).*

*However, if on first switching on it was found that a normal raster was obtainable, but with no trace of modulation, then attention should be concentrated on the vision receiver. Normal sound indicates that the valve stages common to both sound and vision must be functioning correctly, and that the fault is to be found further back in the vision strip.*

*Whether the signal is reaching the detector or not can easily be determined by manipulating the line hold control. If the line whistle changes its pitch smoothly there is no line sync and the signal is not reaching the sync separator. The fault, therefore, may be in the detector or in the stages preceding it.*

*On the other hand, if the line whistle changes its pitch in well-defined steps (suggestive of multi-vibrator harmonics) then the signal must be reaching the sync separator (and controlling the line frequency), in which case the fault must lie in the post-detector or video circuits.*

The logical form of this method of analysis will be apparent in the table (or fault-finding tree) reproduced opposite.

In this preliminary introduction no mention has been made of specific faults or types of circuit, but these will be incorporated in future articles. In the next a step-by-step tour of a standard television receiver circuit will be started.

By George R. Wilding

## The Vision Detector Circuit

PRACTICAL POINTS ABOUT THE DESIGN AND  
SERVICING OF TYPICAL TV DETECTOR CIRCUITS

**O**F all the circuits in a modern television receiver the one which superficially appears to be among the simplest is the vision diode detector stage with its associated feed circuit to the grid of the v.f. amplifier valve. While comparatively few components are incorporated in this section, their precise values are of great importance as they govern the video frequency range of the entire receiver.

The diode is invariably chosen as the detector because it gives reliable and efficient operation over a wide range of inputs with no d.c. voltage supply as is required when multi-electrode valves are used.

### The Basic Diode

Before analysing the TV diode detector circuit it may be worth while to outline the basic operation of the diode detector or rectifier. Referring to Fig. 1, the current circulating in the secondary winding of the transformer charges up the condenser C to the peak value of its amplitude after which no further conduction occurs and the transformer is to all intents completely unloaded.

The time taken to charge this condenser will depend on the time constant CR, where C is the capacity in farads and R is the anode characteristic resistance of the diode in ohms. It will obviously be a very small fraction of a second.

The circuit as it stands is completely unworkable and a resistor must be connected across the condenser to drain off this charge. The value of the resistor determines the time taken for the condenser to discharge, and in this particular example, assuming values of  $0.01\mu\text{F}$  and 1 megohm, the time constant will be one-hundredth of a second.

Thus assuming that the r.f. signal is modulated with a pure 10 kc/s note, the charge produced on the condenser by the first positive half-cycle will not have had time to leak away before another half-cycle arrives. Consequently, the voltage developed across the resistor will not be a faithful replica of the modulation.

In fact, the a.c. component will have been virtually smoothed out altogether as in the conventional power rectifier circuit with its reservoir condenser.

The time constant of this particular CR combination is, of course, far too long to enable it satisfactorily to

detect audio frequencies. In practice, where a one-megohm volume control is used as the load resistor, its associated capacitor is usually of picofarad value only, as otherwise the top note response of the stage would be drastically attenuated.

### Video Bandwidth

When dealing with video frequencies approaching 3 Mc/s the TV vision detector must have a very small time constant indeed. The capacity of the condenser must not be too small, however, or an undue proportion of the available r.f. signal will be developed across it; in practice it is usually about 5 picofarads which, in conjunction with the stray circuit capacitance, presents only a moderate impedance to the average TV i.f. frequency. The exact impedance will, of course, be equivalent to  $10^6/2\pi fC$  where C is in microfarads and frequency in c/s.

Having established the minimum value of capacitor required and noting that the time constant must be very small if the high video frequencies are to be faithfully reproduced, it becomes obvious that the required value of the resistor R must also be small.

Unfortunately, the smaller R becomes the less the video signal that will

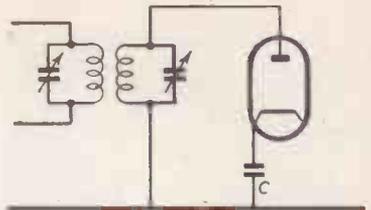


Fig. 1—Basic detector or rectifier circuit. Condenser C will charge up to its peak value unless shunted by a resistor.

be developed across it. Since it is in series with the diode the ratio  $R/R+Ra$  determines what proportion of the available signal can be utilised and fed to the video amplifying grid.

### Valve Resistance

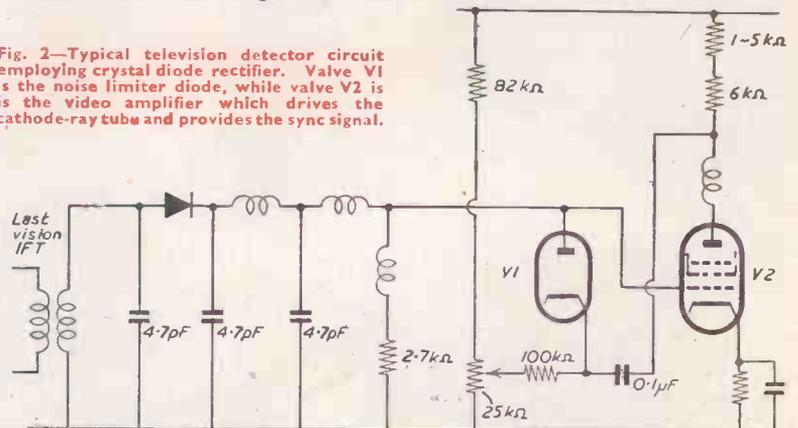
However, the requirements of adequate frequency response come before gain, and in practice a load resistor of around 5,000 ohms is chosen which, in conjunction with the specified capacity, gives a very brief time constant. The a.c. resistance of the diode, however, will be considerable, so that the midget types are desirable if any degree of efficiency is to be attained.

The a.c. resistance of these valves is made low by close spacing of the electrodes, but, naturally, too close spacing increases the internal capacity of the diode and the rectifying properties of the circuit are impaired.

The entire video detector circuit is essentially a balance of conflicting requirements, and design values are dictated by the overall requirements of the receiver. For instance, in fringe-area models which may have a restricted video bandwidth, additional gain may be obtained by increasing the value of R, for if the video frequencies are curtailed there is no point in having a detector stage efficient above the frequency cut-off point at the cost of gain, which naturally assumes more importance in the fringe model.

(continued on page 753)

Fig. 2—Typical television detector circuit employing crystal diode rectifier. Valve V1 is the noise limiter diode, while valve V2 is the video amplifier which drives the cathode-ray tube and provides the sync signal.



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Electric and Musical Industries, Ltd., report that at their board meeting recently Sir Alexander Aikman indicated his desire not to stand for re-election as chairman. J. F. Lockwood was appointed chairman in his place. Sir Alexander remains a member of the Board.

The award of the M.B.E. is announced in the New Year's Honours List to J. J. (Jack) Sarche, who has been with Ultra for 33 years, joining the firm in 1922. Mr. Sarche is now chief inspector at the company's Western Avenue Factory.

E. B. Rogers, manager of the service department of the Valve Division of Mullard, Ltd., has retired after being with the department for 28 years. He is succeeded by F. E. Debenham,



who has been deputy manager for the past three years. Mr. Debenham, who has been associated with the Mullard group of companies since 1929, spent some of his time with Valve Sales

department before the war and was, for some years during the late war, production manager at the Mullard Valve Factory, Blackburn.

Twelve youths were successful in obtaining apprenticeships with E. K. Cole, Ltd., during 1954, and, after having satisfactorily completed a probationary period, they recently signed their agreements.



At the tenth post-war Radiospares sales conference held recently in London a presentation of a handsome engraved silver cigarette box was made to P. M. Sebestyen (managing director) and also to J. H. Waring (director) by the Radiospares Sales Force as a token of their esteem. Picture shows Mr. Waring (left) and Mr. Sebestyen (right) after the presentation. During the conference the results of the Radiospares Sales Trophy Competition were announced, the winners being: W. I. Morgan (Hants) 1st Division; J. S. Gingell (Surrey) 2nd Division; R. B. Ward (Devon and Cornwall) 3rd Division. They were presented with cup replicas. During the evening 250 members of the staff enjoyed a dinner and dance.



At a recent ceremony held at the Ultra Factory Mr. E. E. Rosen, Chairman and Managing Director of Ultra Electric Ltd., presented gold wristlet watches, suitably inscribed, to seven employees, including one lady, who have completed 25 years' service with the company. Picture shows, from left to right: J. H. Print, Transport Department; W. F. D. Knight, Coil Winding Department; Mrs. E. Joyce, Radio and Television Development Department; E. E. Rosen, W. J. Tilby, Despatch and Transport Manager; L. L. Newman, Transport Department; J. F. Rowe, Inspection Department; J. J. Begley, Despatch Department.



E. Cassleton Elliott, F.S.A.A., chairman of Kerrys (Great Britain), Ltd., was awarded the C.B.E. in the recent New Year Honours List. Mr. Cassleton Elliott is a past president of the Society of Incorporated Accountants and joined the Board of Kerrys in 1937, later becoming deputy chairman. He was appointed chairman in 1954.

The honour was conferred for his services as chairman of the interdepartmental committee on distribution of remuneration to general practitioners.

James Guthrie joins Regentone Radio & Television, Ltd., as assistant sales manager to H. O. Thomas. His appointment coincides with the completion of 25 years in the electronics industry. During the War he attained the rank of Major, and was a specialist with the Royal Corps of Signals (India), acting as advisor to Military Intelligence Directorate on radio matters.

It is announced with regret that Howard Foulds, F.C.I.S., who was for 26 years secretary of the former Callender's Cable & Construction Co., Ltd., has died in his 86th year.

The Council of the Television Society have appointed Miss A. M. Lane as assistant secretary of the Society in succession to Mrs. J. Foulds. Miss Lane is now in charge of the London Office and in the absence of the honorary secretary will deal with correspondence and queries.

At the recent annual general meeting of the Radio Society of Great Britain in London, John Clarricoats (general secretary) was presented with an illuminated address on vellum, a hand-made pigskin brief case and a

cheque in recognition of his 25 years of service to the society. Mr. Clarricoats is an Alderman of the Borough of Southgate, and was awarded the O.B.E. in the New Year's Honours List.

H. J. Hughes has been appointed commercial manager of the Records Division of Philips Electrical Limited. Since 1946 Mr. Hughes has been general sales manager of Fortiphone, Ltd. He is no stranger to the Philips concern, as he was on the technical-commercial side of their Electro-Acoustical Department from 1933 until he left to join Fortiphone.



Reinforcing the Coscor sales force is A. P. McPherson, who has taken over territories in South-West Scotland. Before the war, he worked in the Coscor Glasgow depot.

David Leighton Davies, B.Sc. (Hons.) Wales, G.I.E.E., has been appointed chief electronic engineer of Winston Electronics, Ltd. Mr. Davies

(continued on page 779)



To commemorate their great win over the Hungarian football team Honved, Wolverhampton Wanderers were recently presented with a Masteradio 17-inch television receiver. Picture shows H. Burns, managing director of the company, making the presentation. A spokesman of Masteradio said that these great international sporting events are a useful sales stimulus and a great help to the TV Industry.

# Sales through the Mails

## Part 3 — Country-style Selling



FOR DEALERS IN THE SMALLER TOWNS THERE IS PLENTY OF SCOPE AND POTENTIAL TURN-OVER IN SELLING RADIO AND TV TO COUNTRY CLIENTS. HERE AGAIN THE DIRECT MAILING SHOT IS AN IMPORTANT PRELIMINARY TO A PROPERLY ORGANISED SALES CAMPAIGN. IN THIS ARTICLE, THE LAST OF THE PRESENT SERIES, THE AUTHOR DISCUSSES SOME ASPECTS OF SELLING IN COUNTRY-STYLE

by **H. J. Campbell**

**F**ISHERMEN know that within limits the wider they cast their nets the bigger is their catch. There is nothing special about fish, and this general law will apply equally well to the business of catching customers too—though the parallel should not be stressed in their presence!

In the previous two articles in this series we talked about finding and approaching the local shoals; now we are steaming on to deeper waters where—who knows?—there may be fatter fish. All this probably applies in the main to dealers in rural areas, but that is no reason why city slickers should turn the page; they may learn something from hayseed technique.

So, we have our dealer, installed pleasurably in some small country town or village. With the wisdom of the soil, he has applied the teachings of my last two articles and done a nice bit of business with the equally wise local inhabitants.

Now he is lifting up his eyes unto the hills. A cottage beside a field of grain; a bungalow nestling beneath some kind of tree; a mansion choking itself with rhododendrons; and—without fail—an ivy-covered farmhouse—all these can be taken in by the sweep of his net. That, at least, is what we are hoping.

So many radio dealers do nothing but sit inside their shops waiting for customers to drop in. People who habitually and leisurely pass by may do so, but there are many others who come into town from a distance, and they usually have some specific purpose to their visit.

They haven't got time to stare into shop windows and casually stroll inside with a view to asking vague questions about radios and television sets. They know that if they miss the bus they may have an hour to wait for the next

one. So they dash about the town, doing their jobs as speedily as possible, with very few side issues coming in. Because of this, you must make them put your shop on their visiting list, so that they make a definite point of looking you up.



### postman's knock

The way to do it is through the mail. Don't go calling on them, bright and cheerful, with all your merry sales talk spilling out among the roses. Busy country people like few things less than having to stop what they are doing with the chickens or the jam and open the door to a gushing young man trying to sell them things. The direct approach is out—as the customers may be if they catch sight of you through the curtains!

*Only the letter will do the trick. Once again, no leaflets please, unless you have a genuine desire to assist in the lighting of the kitchen boiler. A personal, signed letter every time is what is required. None of this cheap, ineffective duplicated stuff.*

In the country it is usually easy enough to find out the names of the people living in the district. A visit

to the voting register will certainly supply this information. But the mere names are not enough—as we have said before. For the best mail-selling results you *must* know what the customer does for a living and what his social class is. The more you know about your potential customers, the surer will be your approach and the more likely will be a sale.

Country people can be divided into farmers, professional types (doctors, vets, etc.), shopkeepers, postmen, policemen, and "ordinary" types—those who do a multiplicity of unskilled or semi-skilled work. They are not really different from their urban equivalents and they can be approached in much the same way as was described last month.

There is a psychological reason why rural and country people should be more interested in radio and TV than townfolk. They are not surrounded by cinemas and theatres and dance halls and other centres of entertainment, and they are obliged, largely by environment, to find their own entertainment at home. To a great extent they rely on radio and TV and records.

These people, then, are a natural market for the enterprising dealer. For them broadcasting is something of a necessity, and they are far more likely to respond to a serious approach which takes this fundamental fact into consideration.

There may be snags, however. In certain districts TV reception may be unreliable due to the distance from the transmitter or the nature of the terrain. Similarly, radio reception may be poor and subject to interference.

This is the wise dealer's big chance, for he is the expert, and he is in a position to be both guide and counsellor

to those of his clients who have doubts about the success of running a TV set. He should make sure that all the peculiarities of local reception are known to him, and have answers ready for the inevitable questions that will be fired at him. Which type of set, what kind of aerial, pre-amplifier or not...? And so on.

*In the initial mailing shot it is important to stress that TV installation in fringe areas requires individual expert knowledge based on local experience. Offer a free demonstration. The time spent in rigging up a temporary directional aerial will be more than repaid if the sale is clinched.*



## percentage viewing

But if your area is a difficult one, don't lead the customer up the garden path. Point out the snags, and give a fair picture of the kind of performance that is likely to be achieved. Even if 10 per cent. of the programme time is unwatchable because of fading and other effects, the remaining 90 per cent. still has a solid entertainment value that must be worth while to people who live far from the bright city lights.

In the case of sound radio, much may depend on the kind of aerial attached to the set. Make a point of specialising in ambitious radio aerials; the difference in reception is in many cases impressive. You will rapidly build up a reputation for being an expert with a gimmick—the trade equivalent of green fingers.

And don't neglect records and record players, and, of course, tape recorders. Where radio and TV prospects are bleak, the demand for other kinds of home entertainment will be all the greater in proportion. The shrewd dealer will be ready to sell any particular line in his field and at the same time appear as an expert in each.

There are still country districts not powered by the national grid, and therefore cut off from electricity. Here the needs of the people, mainly farming communities, are the same, but the problems are greater. The battery radio is one obvious answer, of course. Battery radiograms are available too. But there is, to date, no battery TV.

There are, however, a number of petrol or oil driven generating plants specially designed for such applications, and one or two manufacturers have demonstrated (at the Radio Show, for example) that a television set can be run from a small generator in an

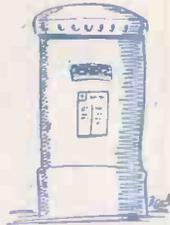
entirely satisfactory manner. This is a specialised field that can be profitable to the dealer who is prepared to master it. Once again the importance of publicity cannot be overstressed. People won't buy from you unless they know, and they won't know unless you tell them. Use the G.P.O. to put your sales message across.

Additionally, you can arrange a demonstration of "petrol-driven" TV either in your shop or in some suitable premises and invite the local paper to send a reporter along. Activity of this kind, which has a local news angle, will almost certainly guarantee a story—perhaps illustrated. Some manufacturers are willing to co-operate with live-wire dealers in organising and staging demonstrations and exhibitions of this kind.

Don't forget to let potential customers know in advance just where and when you intend to hold the demonstration. It is a good scheme to have some invitation cards printed which can be sent out to your mailing list together with an explanatory letter. There should be no sales blurb on the card: it should be a straightforward invitation to Mr..... (leave a blank line on which your guest's name can be written or typed) requesting the pleasure of his company at a special demonstration of whatever-it-might-be on such-and-such-a-date at this-or-that-place. The selling message should be outlined in the letter, and detailed at the actual demonstration.

*The advantage of this is that each recipient of your card instinctively regards it as a personal invitation. This tends to flatter him and builds up an invisible liaison between customer and dealer even before he has had time to make up his mind whether he will attend or not.*

And, incidentally, it is always a good plan at a demonstration of this kind to provide some refreshment—tea or coffee and biscuits—particularly for visitors who might have travelled quite a distance. It creates goodwill and compensates them for money spent on bus fares—a not inconsiderable item nowadays.



## personal touch

In all selling there are two things that the dealer must do. He must get the customer interested in his wares,

and he must get the customer interested in *him*. To make a customer interested in radio ware but indifferent or unfriendly to *you* is to make business for your rivals in the trade.

You don't only want them to buy the type of things you sell; you want them to buy from you. In the country especially, this atmosphere of friendship and mutual interest is most important. You won't get far without it.

And it costs so little in time, energy and money. Your customers are perfectly well acquainted with barns; there is no need to make your shop like one. A chair here and there. Somewhere to write on. An arrangement where they can move without knocking things over. And a general air of homeliness. These things are essential to an efficiently run country business.

Once you've got the place reorganised along these lines, have a good photographer take a picture of the interior and run you off a couple of dozen small prints. Then you can enclose a print with each letter, giving the customer an idea of what a pleasant sort of establishment you are asking him to come to.



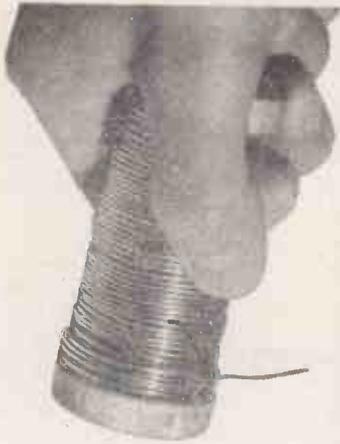
## pleasant time

Your whole approach should be planned to give the customer the idea not only that he might buy something from you that he really needs, but that he'll have a really pleasant time while he's doing it. And see that he actually does, for then he'll go around telling everybody.

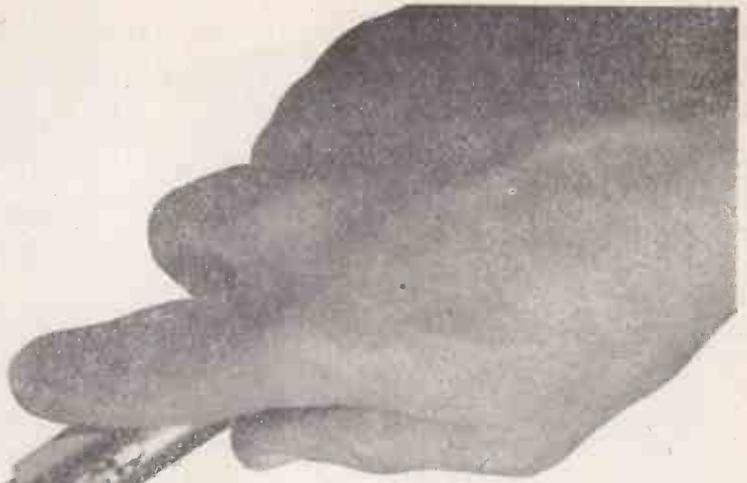
*Whatever you do, don't let him go away feeling that he's had an uncomfortable session under high-pressure salesmanship. Take it quietly and smoothly and slowly. The days are over when fast talk in clipped sentences of "clever" prose did any good. Nowadays they put the customer off and spread no end of illwill—and illwill can kill a business quicker than the tax collector.*

In other words, while personal attention should be the keynote of all salesmanship whether in town or country, the very nature of rural relationships makes it an essential part of retail psychology, and it should never be neglected.

Your mailing shot, if it achieves response, is your introduction. From then on it's up-to-you to convert the contact into a lasting friendly customer-dealer relationship.



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# Transistors and Crystal Diodes

## Part 3

THE PREPARATION AND ASSEMBLY OF THE COMPONENT PARTS OF A SEMI-CONDUCTOR DEVICE DEMANDS SKILL AND CARE. THE SEQUENCE OF OPERATIONS AND TESTS THAT GOES INTO THE MAKING OF A WELL KNOWN COMMERCIAL TRANSISTOR ARE DESCRIBED IN THIS ARTICLE, WHICH ALSO INCLUDES A BRIEF SURVEY OF AVAILABLE TYPES.

By Norman Stevens



A view of the G.E.C. laboratories, where the electrical characteristics of experimental transistors are being measured in a moisture-free box. The right-hand operator is measuring the back current of the collector and current gain, observing characteristics on an oscilloscope.

**I**N the last article the preparation and processing of the raw material for semi-conductor devices was described. This is but the first stage of development, for in order to produce the final product a series of precise and critical operations has to be performed, operations often requiring delicate adjustment and considerable skill and experience from the operator.

Elaborate precautions are observed to maintain an extremely high degree of cleanliness, for the presence of dirt, moisture or chemical contamination would be seriously detrimental to the electrical properties of the material. Component parts and sub-assemblies are chemically washed after each operation and are then stored in dust-proof containers and desiccators to exclude them from contamination by atmospheric impurities. And, additionally, the storage time of the sub-assemblies is kept to a minimum as a further precaution against deterioration.

The manufacturing and testing technique about to be described is that developed by the General Electric Co., Ltd., in connection with their single-crystal point contact transistor GET-1.

### Cutting the Crystal

Since the germanium used in the device must be of the highest quality, single crystal material is used. The germanium is obtained by growing a crystal with a uniform lattice from molten germanium similar to the slow-cooled material used in the manufacture of diodes.

Having passed rigorous physical and electrical tests the germanium is cut into slices and then ground to a pre-determined thickness. The slices are then cut into small wafers with sides 0.040in. long.

The cutting and grinding operations are extremely critical since even the edges of the crystal (which are remote from the points of contact) must be free from splintering. Each wafer is then pure tin soldered at a controlled temperature to a nickel stub which has been swaged to form a lead-out connection and which forms the base terminal of the triode.

Structural disformation of the crystal surface takes place during the machining and grinding processes and so the germanium layer thus affected is removed by chemical means to expose the true crystal structure. This is accomplished by a very active chemical etch, after which the crystal is inspected under a high-power microscope for correct crystalline formation and complete cleanliness. After this treatment, strict precautions are taken to ensure that no subsequent contamination or damage to the surface of the crystal can occur. It is stored in a desiccator and used within a few hours of etching.

The triode is constructed in such a manner as to be small and resistant to mechanical shock, corrosion and humidity. A centre tube of nickel is embedded in a high-grade phenolic moulding, chosen for its low water-absorption and low thermal expansion. Two tinned copper support wires, reinforced by small nickel eyelets and bounded into two holes in the plastic moulding. The

wires are then soldered to the eyelets and the eyelets are fixed into the moulding by a synthetic resin of high mechanical strength and adhesive power.

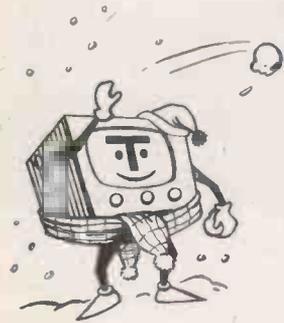
### Forming the Whiskers

The next stage is the preparation of the whiskers. Two whiskers are cut and formed from 0.006in. diameter wire, the collector whisker from phosphor-bronze and the emitter whisker from beryllium copper. This is an important operation because the shape of the whiskers is extremely critical and great care is needed in cutting them to ensure the very sharp chisel point which is essential for the intimate contact between the whisker and the germanium crystal material. The shape and orientation of the points is performed in a cutting and bending jig, requiring delicate operation.

When the whiskers have been cut and bent to shape they are washed chemically and treated to a very thin coating of an anti-corrosive grease to ensure that the chisel point is not blunted due to the effect of the atmospheric impurities. After this the whiskers are assembled to the body of the device.

It is absolutely essential that the whiskers are accurately spaced 0.003in. apart on the surface of the crystal to obtain correct operation of the finished triode. Thus, the assembly of the whiskers to the body and the presetting of the tiny gap between the chisel point

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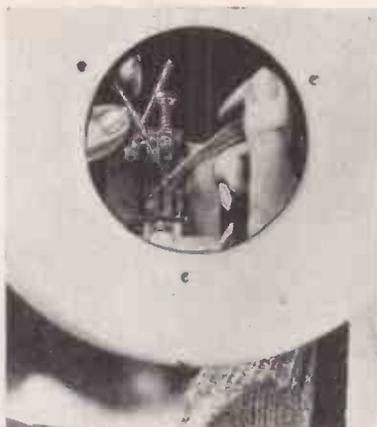
is hypercritical and requires considerable experience and skill on the part of the operator of the very delicately adjusted jig. Whilst in the jig, the whiskers are soldered to the support wires and this operation is doubly critical since no strain must be imposed on the whiskers otherwise they may exhibit deformation when the assembly is removed from the jig.

After the whiskers and support wires have been soldered together, the assembly is subjected to a chemical washing. Then a shadow-graph with a high magnification is used to inspect the whisker gap to check that the assembly operation has been satisfactorily carried out.

There are two remaining holes in the body of the moulding, and through these the whisker support wires are then fed in such a way that they are folded back on themselves. The manner of the fold prevents mechanical shocks or heat encountered by the lead-out portions of the wire from being transmitted directly to the whiskers. This also conveniently brings the emitter and collector leads opposite to the base lead, a practical advantage which makes the transistor substantially easier for wiring-up purposes.

#### Sealing the Triode

The next operation concerns the fitting of the washers and eyelets. Neoprene-phenolic washers are fitted



This shows the jig used for cutting and bending the whiskers for the GET-1 germanium transistor.

to each end of the body, the object of which is to seal the ends of the triode. Brass eyelets are then embedded in the washers, the ends of the eyelets being turned down to dig into the neoprene washer thereby forming a moisture-proof seal. Next, the emitter and collector leads are threaded through the eyelets and soldered to them and, finally, the eyelet in the other washer is then soldered to the nickel tube which, as already mentioned, is moulded into the body.

At this stage in the manufacture, the assembly is ready to receive the crystal, already mounted on its stub. The nickel stub is inserted into the centre tube by means of a micrometer-head until it reaches the point where the two whiskers make contact with the germanium crystal. When satisfactory contact has been established, the germanium crystal is advanced a predetermined amount, in conjunction with special apparatus, to ensure the correct contact pressure between the whiskers and crystal which is essential for efficient electrical performance and mechanical stability. As may be expected, this is another very critical operation.

The surface of the crystal is then coated with an adhesive cement in order to render the contact immune from mechanical vibration. The cement is then polymerised to strengthen the mechanical joint between the whiskers and the crystal face. And then comes the final stage in the series of assembly operations. The triode is hermetically sealed. The body of the assembly is enclosed in an aluminium tube and the edges are embedded into the neoprene-phenolic washers. The final operation is to solder the joint between the base lead and its associated eyelet. The sealing is then complete and the triode

transistor is ready for the final treatments—electro-forming and general testing.

#### Final Checks

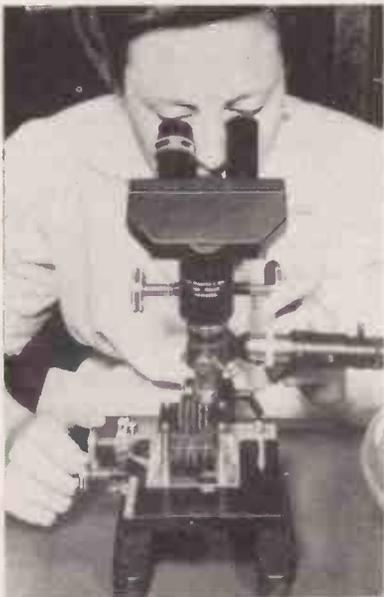
The collector is subjected to selective electro-forming to ensure good characteristics and stability. This electro-forming is progressively increased until the following conditions are achieved: with a current of 1mA flowing through the emitter, the collector voltage for a collector current of 2mA is below 3 volts. When this has been achieved, the following three parameters are checked:—

(1) At  $-10$  volts applied to the collector, the collector current must change by more than 2mA for a 0.1mA change in emitter current. That is, a current gain in excess of 2.

(2) Collector current at  $-30$  volts with no emitter current flowing must be less than 2mA.

(3) A collector voltage of at least  $-30$  volts must be possible without instability when the emitter is short-circuited to base.

Having concluded the electro-forming and attained the specification given above, the triode transistor is then subjected to various stability tests. Firstly, it is temperature-cycled several times between room temperature and  $60^{\circ}\text{C}$ . It is then given a rigorous running test by being operated at a collector dissipation in excess of the rated figure for several days. As a



After machining and etching, the germanium crystals are inspected under a high-power microscope, correct crystalline formation and complete cleanliness being essential for the successful operation of the GET-1 transistor.



The whiskers of the GET-1 are soldered to the support wires in a delicately adjusted jig, every care being taken to ensure that no strain is imposed on the whiskers during this operation.

final safety measure, the transistor is left in storage for a considerable period after which it is re-checked for the above mentioned parameters prior to despatch. So it will be seen that the triode undergoes intensive heat, operation and shelf tests before being released for distribution.



The emitter and collector leads of the GET-1 are threaded through the brass eyelets and then soldered to them.

#### Commercial Types

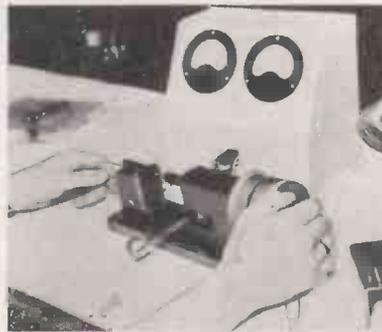
A range of transistors in reasonable quantities is now available commercially, mainly for experimental use in gaining a background of practical knowledge and experience of circuitry upon which the future successful commercial use of these devices depends.

Transistors at present available in the Mullard range include the two-point contact types (OC50 and OC51) and three junction types (OC10, OC11, OC12), plus the recently introduced junction triodes OC70 and OC71.

The OC50 and OC51 are available for experimental purposes at a price comparable with that of mains subminiature valves. In these types, point spacing

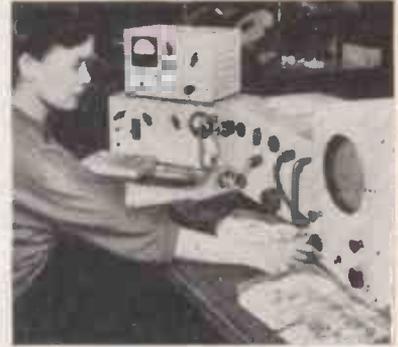
has been varied to produce two transistors of markedly different characteristics thus enabling engineers to adapt many of the circuits described in existing literature to their own requirements and to create new transistor circuits of their own design. The OC51 has a better high frequency characteristic and a shorter turn-off time than the OC52. The OC50, however, operates more satisfactorily than the OC51 at collector-bottomed condition in which the "fully-on" transistor of extremely low impedance passes a current determined almost entirely by the external lead.

The junction transistors (OC10, OC11, OC12) are designed for economical power consumption and, in both amplifier and oscillator applications, will operate satisfactorily from h.t. supplies as low as 1.5 volts, and with current consumptions of a correspondingly low order. Under suitable conditions they will even operate with an h.t. supply of only a fraction of a volt.



The germanium crystal, on its nickel stub, is shown being introduced to the body of the triode.

The OC11 is a general-purpose amplifier which, in a grounded emitter circuit, gives a current amplification factor of 17. Under similar conditions,



Here, the collector in the GET-1 transistor is being subjected to selective electroforming to ensure good characteristics and stability.

the OC12 gives a current amplification factor of 30 and is intended primarily as an output transistor (though, of course, it can be used in amplifier circuits). The OC10 is a low-noise version of the OC11 and is intended for use in the early stages of high gain amplifiers.

#### New Junction Transistors

Mullard have devoted considerable research to obtain uniformity of performance and properties in the quantity production of such items and their two new junction transistors (OC70 and OC71) are the successful outcome of his work. These two devices are now available in large quantities and a degree of consistency hitherto unobtainable is claimed for them. They are low-power transistors and whilst the OC70 is intended for use in microphone input and amplifying stages, the OC71 can also be used as an output stage for telephone earpieces and hearing aids. A special process of fusion sealing provides an all-glass fully hermetically sealed envelope.

The General Electric Company have two point contact triode transistors and a range of point contact diodes. The GET-1 transistor (the assembly of which has been previously described) is hermetically sealed in a metal can, insulated from all electrodes, which can be earthed when necessary. The current gain is 2-2.5 and the characteristic curve shows that the "knee" voltage is less than 3. The collector current at -30V (with emitter bias zero, i.e., grounded) is below 2 mA but it may be operated at a maximum of -50 on the collector.

The GET-2 is a similar device,

(continued on page 773)

#### Maximum Ratings

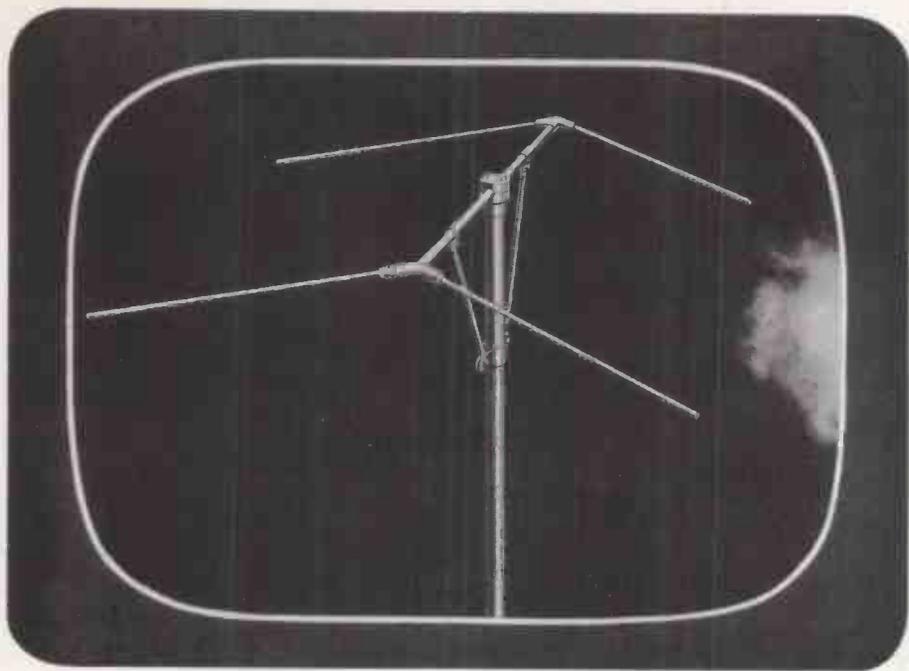
Negative emitter voltage	30 V
Emitter current	30 mA
Negative collector voltage	50 V
Negative collector current	30 mA
Dissipation	150 mW
Recommended max. case temperature	45 °C
Storage temperature	75 °C

#### Characteristics

These are measured at a temperature between 15°C and 25°C.

Current gain with emitter current 0.75 mA and collector voltage—20 V	2 min. 5 max.
Base to collector current with emitter open circuited and collector voltage—20 V	2 mA max.
Base to collector current with emitter current 1 mA and collector voltage—20 V	2 mA min. 7 mA max.
Negative collector voltage with emitter current 3 mA and collector current—5 mA	4 V max.

Ratings and characteristics of the Standard Telephones & Cables point contact transistor 3X/101N.



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# TRANSISTORS—

*continued from page 770*

designed specially for low voltage operation and, like the GET-1, is suitable for amplifier, oscillator or switching operation. The characteristics show that a current gain of 3.8 is typical, with a 2.5 minimum, and that the collector current at -25V (emitter bias zero) is 1.25 maximum (0.75 being typical). Maximum d.c. collector voltage is -30 and the knee voltage is less than 1.

There are 12 crystal diodes in the GEX-series of both high back voltage and special low resistance types. The high back voltage types are differentiated mainly by their turnover voltage and back resistance figures which are the most important factors when considering their applications.

Standard Telephones and Cables Ltd. have made available two point contact transistors (3X/100N and 3X/101N) and three junction transistors (3X/300N, 3X/301N and 3X/302N). The 3X/100N is particularly suitable in control and switching circuits, working reliably at any frequency below 100 kc/s. It gives a minimum current gain of 2 with a collector voltage of -20 and emitter current of 0.05 mA. The 3X/101N is suitable for use as an

amplifier or oscillator, giving a maximum current gain of .5. The frequency response, measured at emitter current of 0.75 mA and collector voltage of -20, is such that at 500 kc/s the current gain is not less than 0.7 of the current gain at 10 Mc/s. The typical frequency at which the current gain drops to 0.7 of its low frequency value is 2 Mc/s.

The three junction transistors are p-n-p alloyed junction triodes intended for low power a.f. applications giving a minimum current gain at 1 kc/s in common emitter connection of 10, 30 and 50 respectively. There are also five germanium diodes in the series 2X/102G-2X/106G.

## Power Rectifier and Photo Cell

S.T.C. also produce germanium junction power rectifiers and photo electric cells. The rectifiers, types R50A and R50B, are similar electrically but differ in the form of construction. They are of p-n junction type which, due to its larger contact area, has a much lower forward resistance than the point-contact type and is therefore able to handle a greater power with high efficiency. The reverse voltage current characteristic is unusual for metal rectifiers in that the reverse current is constant at a low value from approximately 1-50 volts. Above this voltage the reverse current increases progressively. The germanium element is hermetically sealed with glass-to-metal

seals and by virtue of the sealing and robust construction the germanium power rectifier has a long life and stable characteristics.

The germanium junction photo electric cell consists of a p-n junction which, if suitably biased in the reverse or high impedance direction (between 1-50 volts), passes a saturation current which is practically independent of the applied voltage.

When the junction is illuminated, this current increases by an amount directly proportional to the illumination. The device has characteristics which are therefore generally similar to those of vacuum and gas-filled cells, as distinct from the selenium photo voltaic cell. It is extremely small and far more sensitive to normal light from a tungsten filament lamp than the vacuum or gas-filled types.

The unit is eminently suitable for use as an on/off device energised from tungsten filament lamps such as might be used for industrial counters, electronic sensing in digital computers and similar applications.

The small germanium element is mounted in a cylindrical metal case with a glass window at one end to admit the light and a connecting wire at the opposite end which is joined to the germanium element through a glass-to-metal seal, thus ensuring that the element is hermetically sealed.

Owing to the small working area of the germanium junction this type of photo-cell is insensitive to ambient light and is therefore not suitable for use in a photographic exposure meter. For best results the incident light should be focused on to as small an area as possible. Due to the large current or voltage output, a relay or cold cathode trigger tube may be operated directly from the cell and because of its sensitivity and linear characteristics it is suitable for use at low levels and for a.c. applications.

## Characteristics.

On this and the previous page, details are given of the characteristics and ratings of various germanium semi-conductor devices as a guide to what may be expected from such components. Although the figures cannot fairly be called typical of such devices as a whole, due to the wide variation in commercial types and the improvements slowly being made, they may serve to give some indication of the possibilities (and present limitations) of germanium semi-conductors.

Maximum Ratings	OC10	OC11	OC12
Max negative collector-to-emitter voltage (V)	4	4	4
Max. collector current (grounded emitter) (mA)	-5	-5	-5
Max. ambient temperature (°C)	45	45	45
Typical collector voltage (V)	2	2	2
Typical collector current (mA)	-0.5	-0.5	-2
Current amplification factor ( $\alpha$ ) with grounded emitter	17	17	30
Output resistance with infinite a.c. source impedance (grounded base) (k $\Omega$ )	700	700	500

Details of three Mullard junction transistors which are designed for economical power consumption in amplifier or oscillator applications.

Circuit	Half Wave Resistive Load	Half Wave Capacitive Load
Maximum r.m.s. input voltage (V)	100	50
Maximum peak inverse voltage (V)	140	140
Maximum mean d.c. output current (mA)	100	75
Mean forward voltage drop	0.5 V	
Capacitance at approx. zero voltage	0.003 $\mu$ F	
Weight	0.26 oz (7.5 g)	

Tentative ratings for the Standard Telephones & Cables germanium junction power rectifier R50A, based on an ambient temperature not exceeding 35°C.

To be concluded

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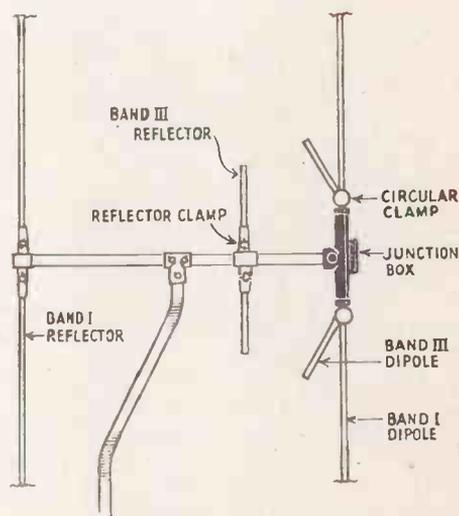
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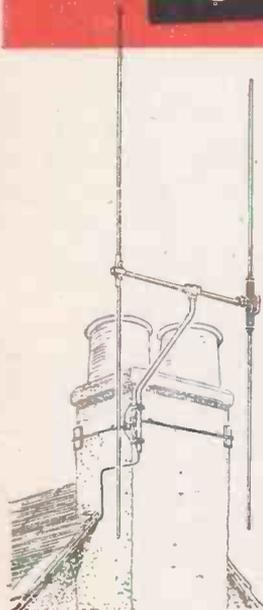
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You can continue to stock and install these aerials with confidence that at any time they can be converted for 2-station reception.

Prompt delivery for all Channels. Have you had the Wolsey map showing the anticipated Band III service area of the London transmitter? If not, ask for a copy.



The diagram illustrates the simplicity of adding the Conversion Kit to any Wolsey Band I "H" aerial. The small Band III dipole rods are clamped to the Band I dipole as close as possible to the Junction Box. The small Band III reflector rods are clamped to the square cross-arm by fastening two wing nuts. It is unnecessary to dismantle any part of the Band I aerial and no extra downlead is required.



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# Transatlantic View \* by Michael Lorant

## Two with a View

REPRODUCED BY PERMISSION OF DUMONT LABORATORIES

THE LATEST DUMONT TV SET HAS TWO INDEPENDENT PICTURES ON ONE SCREEN — ILLUSTRATED AT RIGHT.



**S**OMETHING new in home TV—a receiver that shows two pictures simultaneously on the same screen—is now being produced by America's DuMont Laboratories. Known as the *Duosopic*, the set combines two receivers in one, and solves the thorny domestic problem that might arise when viewers want to watch different programmes.

Looking at the receiver with the naked eye, the viewer sees two superimposed pictures. He eliminates one or the other by peering through polaroid filters (placed on a stand in front of the set), or by wearing reversible polaroid glasses. These glasses enable only one programme to be viewed, but when the

glasses are reversed, the televiewer is looking at — and sees only — the other programme.

The incoming pictures are received by independent circuits and displayed on separate cathode-ray tubes. A half-silvered combining mirror superimposes the pictures and the images are polarised through filters. Complementary filters are, of course, used by the viewer

to select the desired programme. A similar technical arrangement was used by Pye, Ltd., to demonstrate stereoscopic television to the public at the last Radio Show in London.

Tuning the set presents no problem. The receiver has standard controls mounted in its single cabinet. It is possible to tune in one picture only, so that the programme can be viewed without glasses as with a standard set.

The receiver has two separate sound systems and each speaker can be turned on or off independently of the other. A remote audio control unit houses outlets for personal ear pieces as illustrated. Each outlet can receive sound from either sound system.

## TV through the microscope

**T**ELEVISION is helping scientists to observe vital processes in living cells which can normally only be studied under microscopes after fatal staining of the specimens.

This new application of television in conjunction with conventional light and ultra-violet microscopes, was recently demonstrated at the annual convention of the Federation of American Societies for Experimental Biology, by R.C.A.

The technique employs experimental industrial television pick-up equipment fitted with special colour-sensitive camera tubes to bring out details of cell structure without the necessity of staining. Staining often kills a specimen, and in some instances a specimen must be killed before it will absorb the stain.



Telemicrograph of influenza virus (shadowed) magnified 35,000 times. (Photo by courtesy of U.S. National Institute of Health).

For televised microscopy, the R.C.A. *Vidicon* pick-up tube is sensitized with materials which make it receptive to a particular narrow band of colour wavelengths, e.g., infra-red and ultra-violet.

The microscope can be equipped with a binocular viewer and used with two TV cameras, so that two different colour-selective tubes can scan the microscopic scene simultaneously, producing a screen image of sharp contrast, at magnifications of 4,000 to 20,000 times.

## SILENT SPOT

**T**HE quietest place on earth—an ultra-soundproof room which has recently been constructed at the American Bell Telephone Laboratories, New Jersey, in the interests of improved sound service. Even the beat of your heart breaks the silence in this completely sealed but carefully air-conditioned chamber. Engineers will use it in fundamental acoustical research. To eliminate all surface that would reflect sound, the walls, ceiling and sub-floor are lined with saw-tooth wedges of fibreglass to a depth of five feet, which absorbs 99.98 per cent of all incidental sound energy. The unique working floor resembles the hitting surface of a tennis racket and consists of high-strength steel cables only eight-hundredths of an inch thick, but capable of supporting tons of equipment, strung under high tension in two-inch mesh from the walls.

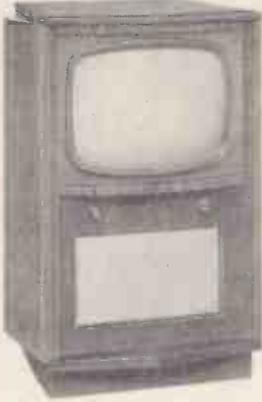
## Setting the Pace

**R**EPORTING on European TV development, E. A. Marx, director of the International Division, of Du Mont Labs, on his return from a factfinding survey of the television situation in Europe said that "foreign TV does not compare in picture quality with that in the U.S." He singled out Italy and Germany as having set the pace in TV progress.

Marx further stated that Italy has a chain of nine TV stations that runs from near the Swiss border south to Rome, with plans under way to extend this network as far as Naples and to Sicily in the near future. Germany is rapidly expanding her television network with the continuous building of television stations. The Federal German Republic may soon have 28 TV stations.



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17 inch Table T.V. Model TE7T/3 with 13 channel tuning 79 gns (tax paid) Model TE7T 5 channel only 74 gns (tax paid)

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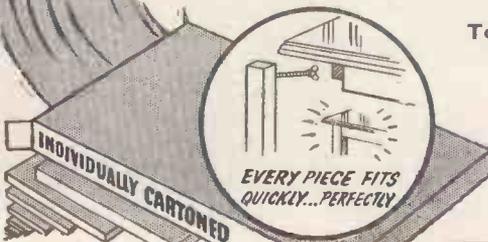
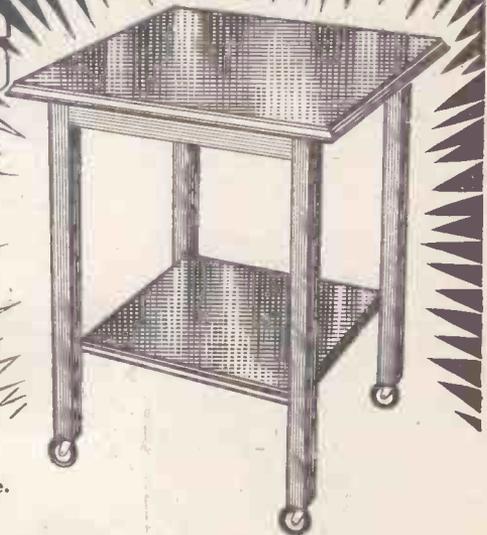
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**TRANSATLANTIC VIEW**

—continued

**Coming round  
the mountain**

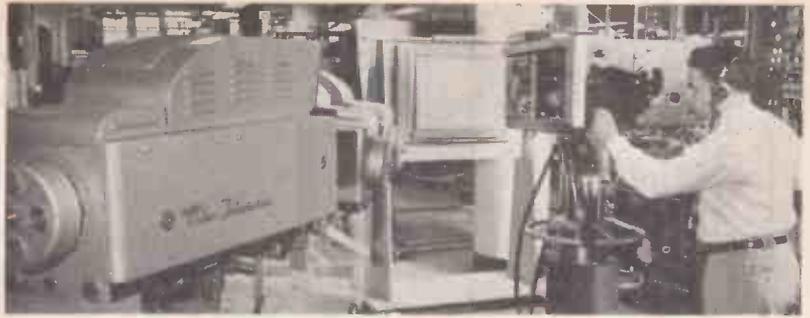
**E**NGINEERS of the American Westinghouse Co. have recently adapted a billiard-shot technique to solve a problem of "mountain-moving" for the Pennsylvania Electric Co. at Johnstown, Pennsylvania.

The utility company was seeking an all-weather means of communication between its generating plant at Seward and an important sub-station located on a hill-top near Johnstown, some 12 miles away. The problems involved in erecting and maintaining a telephone line appeared formidable.

Microwaves seemed to be the solution. There was only one trouble—the mountains situated between the generating plant and the sub-station.

After weeks of searching the engineers found a mountain-top that was in "line-of-sight" of both the generating plant and the sub-station. On this peak they erected a large, perforated aluminium sheet, which reflected the microwaves much as a mirror reflects light.

The waves are beamed directly at the 20ft. square aluminium reflector sheet about two miles away. After striking the sheet, the waves bounce off at just the right angle—like a well-aimed billiard shot—and travel some 12 miles through a narrow valley to carry their message to the sub-station. Thus the mountains are detoured.



**Mass Producing Colour Cameras**

**C**AMERAS, studio and transmitting equipment for colour TV are now being made by R.C.A. on a regular production schedule for sale at standard commercial terms.

R.C.A. recently began shipments of studio-type colour cameras, permitting local pick-up of colour programmes. These cameras are being produced on a custom-built basis for stations WKY, Oklahoma City; WBAP, Fort Worth; WBN, Buffalo; WTMJ, Milwaukee; WOOL, Minneapolis; and KTLA, Los Angeles; for the National Broadcasting Company studios, and for the Columbia Broadcasting System, which

recently increased its order to cover 12 complete studio camera chains and associated equipment.

Installation of equipment for transmitting colour network programmes has already been completed in 26 TV stations in 20 cities, while 50 additional equipments will be shipped soon.

To help broadcast station personnel to operate the new equipment at peak efficiency, R.C.A. are also conducting a series of technical courses on colour TV studio and transmitting equipment. The company's production programme has been accelerated to ensure that stations throughout the U.S.A. will be able to broadcast colour programmes by the time network colour lines are available to the stations.

**SIR ROBERT WATSON-WATT**, the noted radar pioneer, was recently fined \$12.50 by Kingston, Ontario authorities, for speeding. The police had clocked Sir Robert's car—with radar.

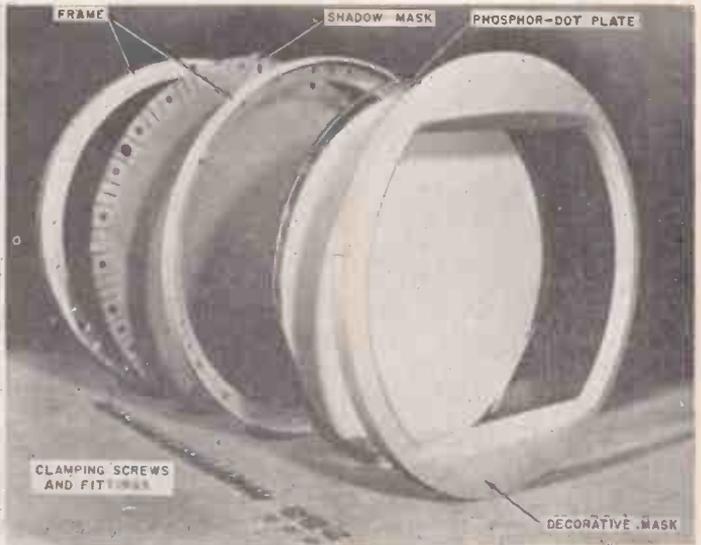
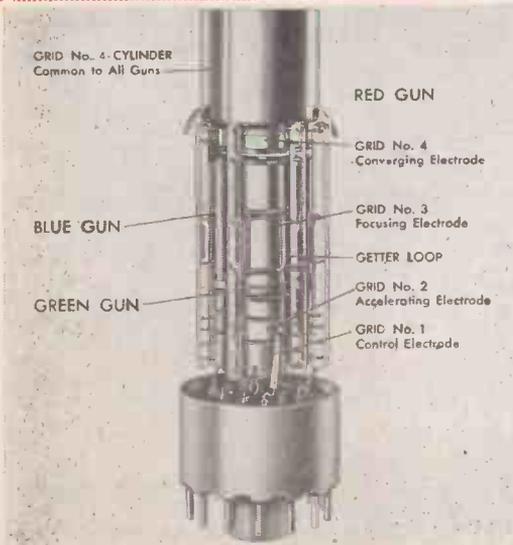
**TWO BILLION** dollars' worth of television service annually may be expected in the U.S.A. before 1959, stated Harold J. Schulman, CBS-Columbia service director, at a recent radio-TV technicians' meeting in Atlanta. The

prediction was based on the estimate that there would be more than 44,000,000 black-and-white and 18,000,000 colour receivers in use by 1959.

**SUBWAY** train radio communication was demonstrated successfully in a recent station-to-moving-train hookup. New York City's vast rapid-transit system may soon adopt this communication system wherein existing signal cables and the third, or power, rail are used to transmit frequency modulated carrier waves.

**R.C.A. TRICOLOUR TUBE**

The pictures below illustrate the complex precision structure of the R.C.A. tricolour tube for colour TV. The tube contains three electron guns and has a screen consisting of more than half-a-million phosphor dots in the three TV primary colours—red, blue and green. Each electron beam is modulated to select and activate through a perforated shadow mask the phosphor corresponding to its own appropriate colour.



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Brimar's long experience in the manufacture of special quality TRUSTWORTHY valves is now being reflected throughout the entire Brimar range. Improved production methods, new and better assembly jigs, tighter control on the composition of materials, and the closer supervision of vital processes have resulted in valves with more uniform characteristics, greater mechanical strength and a higher standard of reliability as shown in the 12AT7.

The 12AT7 is a very reliable frequency changer and is widely used in modern TV receivers, VHF and UHF communications equipment. It is also frequently employed in industrial equipment, computers, navigational aids and test equipment.

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# New Books and Trade Literature

## Radio and TV Engineers' Reference Book

FEW technical data books can claim to be so comprehensive as this 1,600-page volume recently published by Newnes, who have in the past published a number of useful books for the radio and television engineer, including the *Television Engineers' Pocket Book* and the *Radio and Television Engineers' Servicing Manual*. This new reference book is produced with the same meticulous attention to detail, and the same careful attention to layout and clarity. Paper, production and binding are robust and of high quality, and it is obvious that the publishers have designed this volume to stand up to considerable usage in the workshop and laboratory.

The contents, written by 36 specialist contributors and illustrated by more than 1,800 diagrams and tables, cover virtually every aspect of radio and television and associated fields of technology. The first chapter comprises 146 pages of fundamental radio engineering formulae and calculations with worked examples of typical problems that the technician might encounter in practice. Mathematical tables are included.

Other chapters (too numerous to list—there are 45 in all) include *Optics and Electron Optics*, *Television Transmitters*, *Radio-Frequency Transmission Lines*, *Waveguides*, *Industrial Television*, *Valves*, *Cathode-ray Tubes*, *Transistors*, *Magnetic and Disc Recording*, *Gramophone Mechanisms*, *Sound Reproduction and Distribution*, *Television Receiver Design*, *Measuring Instruments and Test Equipments*, *Radio Receiver Installation and Servicing*, *Projection Television Systems*, etc.

The various sections of the text are logically subdivided by headings, which, in conjunction with an 18-page index, make the location of any particular subject a simple matter. The book as a whole probably contains more useful practical information than the engineer might find in half-a-dozen other technical books on various radio and TV subjects combined. The sections on television receiver design and servicing are particularly important from the servicing man's point of view, and the subject of alignment is covered in detail.

A reference book of this type will, of course, find many applications in workshops and laboratories, and the publishers are to be congratulated on producing a work so ambitious in scope in so concise a format.—K.L.L.

**Radio and Television Engineers' Reference Book.** General Editor: E. Molloy; Advisory Editor: W. E. Pannett, A.M.I.E.E. Published by George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Size: 7½in. × 5in.; 1,600 pages; 1,860 diagrams and tables. Price, £3 10s.

## The Value of Good Design

THIS book is based on papers given at the Scottish Design Congress held in Edinburgh last year, and summarises the main points made by various

speakers on the subject of industrial and commercial design. While not of specific interest to the radio trade as such, it does underline many of the factors which influence the design of commodities in the radio and television field.

So closely does the question of design link up with retailing and salesmanship that dealers and manufacturers may well find that many of the observations made in the book apply accurately to the radio and TV field. For instance, Sir Walter Puckey, President of the Institution of Production Engineers, is quoted as saying: "I do not believe that a customer really does know what he wants. I think that the real skill lies in anticipating what a customer wants... that customers can be persuaded very often to accept things at what appear to be higher prices than they originally may have thought worthwhile." Few radio and TV salesmen would quarrel with that statement.

Elsewhere in the book a picture of an Ekco table radio is reproduced with the caption: "The Ekco radio... shows a restrained, a sensitive use of materials in a field where novelty has often seemed to be the criterion."—R.B.

**The Value of Good Design**, edited by Alistair Maynard, Published by the Council of Industrial Design Scottish Committee, 95 Bothwell Street, Glasgow, C.2. Size: 7½in. × 5in.; 80 pages (including 35 pages of half-tone plates). Price, 2s.

## Magnetic Alloys and Ferrites

THIS is another volume in the Newnes Electrical Engineering Progress Series, and is perhaps topical in that ferromagnetic materials have, during the past few years, come to play an increasingly important part in radio, television and electronics. Not a great deal of literature is available on the subject, and this book will be welcomed by those who require up-to-date information on the many products of this new industry.

Modern views on basic ferromagnetic theory are discussed in the first section of the book. Other chapters deal with soft magnetic materials, and ferrites, permanent magnet steels and alloys, micropowder magnets, magnetic-compensating alloys, etc., and materials for magnetic recording and magnetostriction are included.

The book is well illustrated and contains useful reference lists.—K.L.L.

**Magnetic Alloys and Ferrites**, edited by M. G. Say, Ph.D., M.Sc., M.I.E.E. Published by George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Size: 8½in. × 5½in.; 200 pages; illustrated in line and half-tone. Price, 21s.

## The Inventor of the Valve

TO coincide with the Jubilee of the invention of the thermionic valve the Television Society have published

a short autobiography of Sir Ambrose Fleming whose work was directly responsible for the sciences of electronics and radiocommunication as we know them to-day.

The biography is written by Professor J. T. MacGregor-Morris, D.Sc.(Eng.), M.I.E.E., of the University of London, who was associated with Fleming first as a student under him at University College and later as his assistant.

The Foreword is written by Prof. E. W. Marchant, D.Sc., Hon. M.I.E.E., past-president of the Institution of Electrical Engineers, and there is also an appendix of personal recollections by Arthur Blok, O.B.E.

The book is illustrated in line and half-tone, and contains several reproductions of Fleming's own handwriting (e.g., pages from his diary, a "job sheet" for an early experimental valve, etc.)

The edition is limited to 1,000 copies so that the book will not only be a unique record of Fleming's achievements but will increase in value as time goes on. Copies are obtainable direct from the Society or through any bookseller.—M.M.

**The Inventor of the Valve**, by J. T. MacGregor-Morris, D.Sc.(Eng.), M.I.E.E. Published by The Television Society, 164 Shaftesbury Avenue, London, W.C.2. Size: 8½in. × 5½in.; 142 pages; illustrated. Price, 10s.

## People in the Picture

*continued from page 763*

is 27 years of age. He joined Winston Electronics as one of several senior engineers in January, 1954. He has been particularly responsible for the design and development of the world's first pre-launch guided missile test gear.

Sir Miles Thomas, chairman of B.O.A.C., has accepted an invitation to open the third National Factory Equipment Exhibition at Earls Court on March 28, 1955.

KENNETH H. YANDELL, R.G.D. sales manager, has announced the following important appointments involving changes that have taken effect at the Romford headquarters and in area representations: STANLEY DUER, who for some time past has represented the company in the Midlands area, has been promoted to the post of assistant sales manager. The "Area 10" counties of Essex, Herts, Beds., Bucks., North Middlesex, Oxfordshire and Berkshire have been taken over by JACK LEMON. Hitherto, Mr. Lemon acted as personal assistant to Ken Yandell. R. H. P. JONES



JACK LEMON

STANLEY DUER

has left the above area to become representative for Derbyshire, Nottinghamshire, Leicestershire, Rutland and Northamptonshire. Appointed Yorkshire representative in December, 1953, C. J. LEACH has now changed his address to 581 Harrogate Road, Greengates, Bradford, Yorks. His telephone is being installed.

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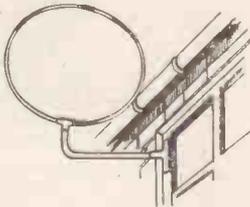


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The T.V.12 Indoor Loft Aerial. Easy 2-point fixing. Retail price, 27s. 6d. Patent No. 713571.



The T.V.14 Outdoor Aerial for wall, eaves, or window frame mounting. Complete with 3ft. upswept stand-off arm and fixing plate. Retail price, 37s. 6d.



The T.V.16 Outdoor Loop Aerial for chimney lashing. Fully weather-proof, and complete with all chimney lashing equipment and 4ft. 6in. cranked mast. Retail price, 59s. 6d.

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# CLASSIFIED ADVERTISEMENTS

Rates: 4d. per word (Minimum 18 words) per insertion. Box Numbers 6d. extra. Series rate on application. Copy and remittance should be sent to the Classified Advertisement Manager, British Radio and Television, 92 Fleet Street, E.C.4, before the 10th of each month preceding publication. Classified advertisements must be prepaid.

## SITUATIONS VACANT

Engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour or Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless otherwise excepted from the provisions of the Notification of Vacancies Order 1952.

**FIRST-CLASS** field engineers, fully experienced on all the popular current models, required in the following areas: Berkshire, Buckinghamshire, Coventry, Shrewsbury, Stoke-on-Trent, Surrey, West London. Attractive salary and congenial working conditions are offered to top-grade men. Apply to Personnel Manager, Belcher (Radio Services), Ltd., 59 Windsor Road, Slough, Bucks.

**REPRESENTATIVE** required by Radio Component Manufacturers and Distributors, to take over and expand existing connection with Radio Wholesalers. Area to be covered is approximately all that part of England and Wales south of the line from the River Humber to Aberystwyth. Must be car owner and fully experienced. Attractive position for keen salesman with excellent prospects. Apply stating age and career to date to Box 234.

**TV ENGINEER**—it will pay you to read advertisement on page 714.

**2 EXPERIENCED** radio TV Engineers required. Used to all makes of sets. Accommodation arranged if required. Salary, £12 15s. weekly. Payne, 11 Font Street, Coventry.

## SITUATION WANTED

**MANAGER**, experienced television sales and service seeks position in any branch of the trade, within reach Edgware or W.1. Box 232.

## TECHNICAL TRAINING

**I.P.R.E. TECHNICAL PUBLICATIONS.**—5,500 Alignment Peaks for Superhets, 5s. 9d. The Practical Radio Engineer, sample copy, 2s. Constructional data for TV aerial strength meter, 7s. 6d. Membership and examination data, 1s. Syllabus of postal courses free and post free.—Secretary, I.P.R.E., 20 Fairfield Road, London, N.8.

**FREE!** Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the Hobby Enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., and other Professional examinations. Train with the college operated by Britain's largest Electronics organisation. Moderate fees. Write to E.M.I. INSTITUTES, Dept. BRT28, London, W.4.

## FINANCE

**DISCOUNTING** facilities at fair rates up to any amount, also block discounting of H.P. agreements. Alec Morris Investments, Ltd., 1 Harman Drive N.W.2. Langham 7147-8, Gladstone 6133.

**HIRE PURCHASE** and Credit Sales. Immediate finance available to Retailers and distributors. Burlington Investments, Ltd., 1 New Burlington Street, London, W.1.

**HIRE PURCHASE** and credit sales finance available to retailers wishing to expand their sales. Apply British & F. E. Co., Ltd., 37/40 Cheapside, London, E.C.2.

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**AS SPECIFIED FOR THE HOME CONSTRUCTOR.** Kendall & Mousley instrument cases, chassis, etc. Prompt despatch, details on request. Kendall & Mousley, Ltd., 18 Melville Road, Birmingham, 16.

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**A BIG** improvement in your service when you use D.T.V. Replacements. We now cover all makes of sets including rewinding Line Output Transformers for Etronic, Ferranti, Murphy, Philips, Bush, Romac, and any others if not in stock. Send 9d. for new "Replacement and Rewind Manual," covers hundreds of models, modifications and hints. **DIRECT TV REPLACEMENTS 134-136 LEWISHAM WAY, NEW CROSS, S.E.14. TIDeway 2330-3696.**

**A SECOND-TO-NONE** rewind service—neat, clean, reliable. New Transformers, standard or to specification. Tube Heater low-loss Isolation Transformers. Radio & Electric Facilities, 137a Ashton Road, Oldham. MAIn 4141.

**ETRONIC TV REPLACEMENTS** Manuals, Circuit Diagrams, Line Transformers, Service Gen for ETV1536—7s. 6d., ETV1637 10s. 6d., R. Pearson, ex Service Manager, 156 South Ealing Road, W.5. Phone: Ealing 2087 or 0328.

**SPEAKER REPAIRS** (domestic) cones fitted, fields and clock coils wound. Guaranteed satisfaction. Prompt service. L.S. Repairs, Pluckley, Ashford, Kent.

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**TV AERIALS** installed N.E. London, Herts. and Essex. Work promptly done by experts. Contract prices arranged. Write in first instance Box 233.

## MISCELLANEOUS

**A LIMITED** number of back numbers of *British Radio and Television* are available to subscribers, price 1s. 3d. each, post free. Copies from March, 1954, up to date may be obtained and also earlier issues (details on application). These issues contain technical articles of major interest to dealers and servicing men, and are complete with Test Reports. Send cash with order to British Radio and Television 92 Fleet Street, London, E.C.4.

## WANTED

**WANTED**, Surplus, lines and part exchanged TV's and radio's, etc. Bishopsgate 0410/0419.



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**points of  
view**

*Letters to  
the Editor*

The Editor welcomes letters on subjects of general, technical or trade interest, but does not necessarily endorse the views or opinions expressed by correspondents.

**OSCILLOSCOPES**

Dear Sir,—Many thanks for recent articles on oscilloscopes and how to use them. Most dealers are now realising that a scope is essential in a TV service workshop, but many engineers are very vague about how to use a scope properly and still rely too much on the testmeter-screwdriver combination. It's about time manufacturers started giving oscillograms in their service manuals as a guide to wave-forms, especially in the scan and sync circuits. Some do, I know, but it ought to be standard practice. — K.L.K., Enfield, Middlesex.

**ELEMENTARY MATHS**

Dear Sir,—If TV is the legendary "Unstoppable Force" (*vide Tele-opinion, January issue*) then surely the B.B.C. must be the "Immovable Object." What happens when the two get together—when infinity plus meets infinity minus? The answer is zero—or at least nothing worth shouting about—which is precisely what we get. I often wonder how we dealers manage to sell TV at all. I can only conclude that the Great British Public is easily pleased. —D.B.B., London, N.11.

**AUSTERE CABINETS**

Dear Sir,—I cannot agree with H.B. (*Points of View, December*) that modern TV cabinet design is unimaginative or utilitarian or austere. The correct word (which he omits to mention) is "functional," and indeed the trend nowadays in all kinds of industrial and commercial design is towards the functional rather than the decorative.

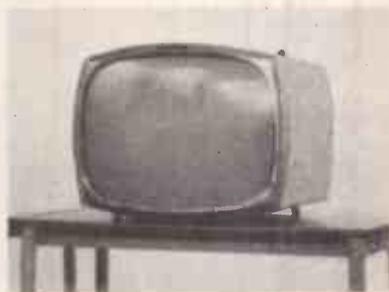
While there may be a very small minority of viewers who would like their sets to have patterned beading and elaborate carving with turned legs in a "genuine" antique fashion, they are not representative of the public as a whole. Perhaps they—the minority—have more time to devote to dusting and polishing. At all events, the manufacturers know best. It is in their

own interests to supply the type of cabinet for which there is the greatest demand, and whatever the highbrows might think, it is public taste which is the final arbiter of contemporary culture.

Television is a 20th-century invention, so let's be contemporary in designing the box into which the gadgets and gimmicks go.—P.R., Sevenoaks, Kent.

★

Dear Sir,—On the subject of "austere cabinets"—how austere can you get? The enclosed picture (*reproduced below—Editor*) shows an American Raytheon TV set which was awarded the Diploma of Honour for "its artistic and functional excellence" at the recent international industrial exhibition in Milan.



*This Raytheon TV set won a diploma for artistic style.*

The cabinet is built round the screen, and is scarcely visible. What does H.B. think of that one? For my money it's a nice job in the modern style and it is only a slightly exaggerated specimen of the modern trend in cabinet design.—R.L., Hayes, Middlesex.

**POOR QUALITY DEM FILM**

Dear Sir,—I wish to complain in the strongest possible terms about the poor quality of parts of the morning TV demonstration film, and in particular the section comprising the telerecording of the London-Paris hook-up.

This particular film is completely useless either for demonstration purposes or for receiver testing. Installations carried out while this inferior-quality film is being screened invariably result in long arguments as the dealer or engineer tries to explain to the customer why definition is so bad and why the set is nevertheless o.k.

I have taken this up with the B.B.C. engineering department who agree entirely and think the complaint is justified, but apparently they are overruled by TV executives who seem to think that the Paris telerecording has a "prestige" value. Its nuisance value is far greater and is a more serious matter to the trade and public alike.

Can nothing be done to get rid of this undesirable sequence of "low-definition" telerecorded TV so that the demonstration film does really do live up to its name and function?—H.R., London, N.12.

## Financial News

*It is pointed out that winding-up proceedings and liquidations are frequently rendered necessary for the purpose of reconstruction, extension of capital, transfer of business, etc., quite unconnected with any financial embarrassment, and the fact that companies appear in this list, therefore, must not be taken as necessarily indicating any want of solvency.*

### NEW COMPANIES

**Refrigeration Investments, Ltd.** Capital £4,000. Directors: Wm. A. G. Harden, Laurence W. Lawrence, and Arnold R. G. Cox. Solicitors: Mayo & Perkins, Eastbourne.

**Ren-Tel, Ltd.** Capital £100. Objects: To carry on the business of manufacturers of and dealers in television, radio and telephone apparatus, etc. Directors: Reginald Cussins, John P. Light, Ronald Thompson, and Wilfred D. Cussins. Secretary: J. P. Light. Registered office: Kings Square, York.

**Richard & Co. (Credits), Ltd.** Capital £100. Objects: To carry on the business of hire purchase financiers, etc. Directors: Samuel Richard, and Mrs. Annie Richard. Secretary: Mrs. Annie Richard. Solicitors: Thos. A. Sellars & Co., 24 Dale Street, Liverpool 2. Registered office: 33 The Temple, "C" Building, 24 Dale Street, Liverpool 2.

**Robinson Rentals, Ltd.** Capital £5,000. Objects: To carry on the business of manufacturers, designers, buyers, sellers, hirers, renters, repairers, distributors, agents and dealers and hire purchase financiers of wireless and television sets and apparatus, musical and other instruments etc. Directors: David Robinson, Mabel A. Robinson, and Colin R. K. Evans. Secretary: Mabel A. Robinson. Solicitors: Sharman & Trethewey, Bedford. Registered office: 47 St. Peters Street, Bedford.

**Russell Constructions (Export), Ltd.** Capital £100. Objects: To carry on the business of exporters, manufacturers, merchants; general, constructional, mechanical, motor, marine, aeronautical, electrical, radio and oil fuel en-

gineers, etc. Subscribers: Justin Hurst, and Mrs. S. Hurst. Justin Hurst is the first director. Secretary: Ruby Parker. Registered office: 8 Adam Street, W.C.2.

**S. & B. Electronics, Ltd.** Capital £100. Objects: To carry on the business of manufacturers, designers and repairers of and dealers in electrical and mechanical apparatus, etc. Subscribers: M. Sands and H. Barton. Solicitors: Lucien A. Isaacs & Maxwell Simon, 185 Wardour Street, W.1. Registered office: 185 Wardour Street, W.1.

**S. T. Finance Co., Ltd.** Capital £100. Objects: To carry on the business of hire purchase financiers, etc. Directors: Mrs. Sylvia M. Tuffin, and Cecil W. Sheppard. Secretary: Sylvia M. Tuffin. Registered office: 5 Bartholomews, Brighton.

**Bernard S. Scott, Ltd.** Capital £6,000. Objects: To carry on the business of manufacturers of and dealers in wireless and television sets, gramophone records, etc. Directors: Bernard S. Scott, and Mrs. Hannah Scott. Secretary: Nancy Cornelius. Solicitors: Strick & Bellingham, Swansea. Registered office: The Glen, 48 Parc Wern Road, Sketty, Swansea.

**F. K. Smith, Ltd.** Capital £10,000. Objects: To carry on the business of electricians, electrical contractors and engineers, mechanical and radio engineers, etc. Directors: Frank K. Smith, and Harry A. Smith. Secretary: Doris M. Gaye. Solicitors: Cuff, Roberts & Co., 6 Castle Street, Liverpool. Registered office: 92-4 Whitechapel, Liverpool.

**C. A. Spooner, Ltd.** Capital £100. Objects: To carry on the business of electrical engineers and contractors, manufacturers of wireless apparatus, etc. Directors: Cyril A. Spooner,

and Mrs. Helen V. Spooner. Secretary: Thos. A. Herbert. Registered office: 2 Rowan Crescent, Streatham, S.W.16.

**Storm Electronic Equipment, Ltd.** Capital £1,000. Objects: To carry on the business of research workers, manufacturers of and dealers in electronic devices, radio valves and apparatus, ionisation chambers, etc. Directors: Leslie Urmenyi, and Francis A. Singer. Secretary: Dr. Lilly Urmenyi. Registered office: 18 Ernie Road, Wimbledon, S.W.20.

**Superb Radio Company (Edmonton), Ltd.** Capital £1,000. Directors: Gordon Spriggs and Mrs. Stella M. Spriggs. Secretary: Gordon Spriggs. Solicitors: Tackley Fall & Read, 9 Duke Street, W.1. Registered office: 424 Hertford Road, Edmonton, N.9.

**T.E.I. Pension Trust, Ltd.** Capital £100. Objects: To undertake and discharge the office and duties of trustees of Thorn Electrical Industries, Ltd., Pension Fund, etc. Subscribers: Ronald E. Davis, and Gaston J. Strowger. Thorn Electrical Industries, Ltd., may appoint and remove any director. The first directors are not named. Solicitors: Howe & Maw, W.C.2. Registered office: 105 Judd Street, W.C.1.

**T.S.I. Television Service Insurance, Ltd.** Capital £1,500. Objects: To carry on the business of maintenance and insurance of radio and television sets, etc. Subscribers: Sydney E. Hunt, and Stanley N. Scholes. The first directors are to be appointed by the subscribers. Secretary: S. E. Hunt. Registered office: 10 Beauchamp Place, S.W.3.

**Vigus & Company, Ltd.** Capital £10,000. Objects: To acquire the business of retail radio and electrical dealers and repairers now carried on by Alfred S. Vigus, Albert W. E. Vigus, Ronald F. Codling, and Sidney H. Vigus, at Sydenham Road, West Croydon; 167 Mitcham Road, Tooting; 43 Anerley Road, Croydon; 40 Grove Vale, Dulwich, and 113 Bellingden Road, Peckham, as Gem Radio & Electrical Services. Directors: Albert S. Vigus, Ronald F. Codling, Albert W. E. Vigus, and Sidney H. Vigus. Solicitors: Rayner & Co., 119 Moor-gate, E.C.2.

# TELCON

## Television

### DOWN LEADS

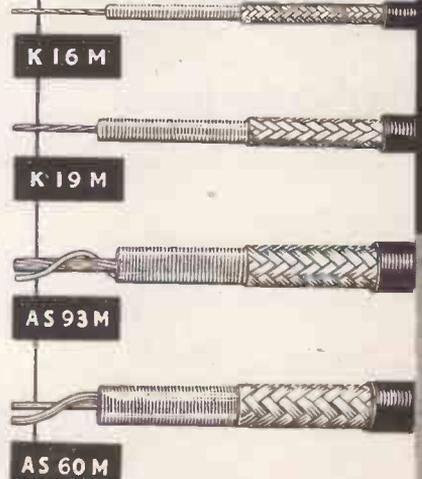
**K 16 M** 'Local' 50-ohm co-axial;  
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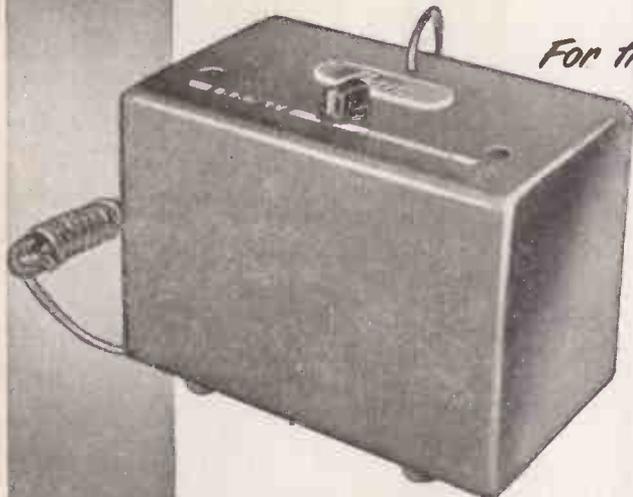
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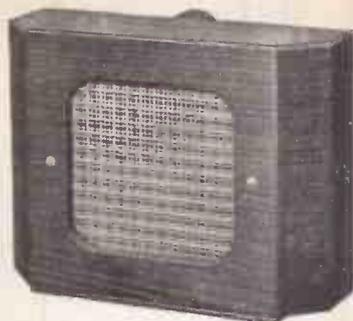
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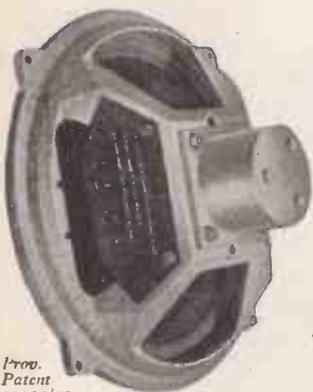


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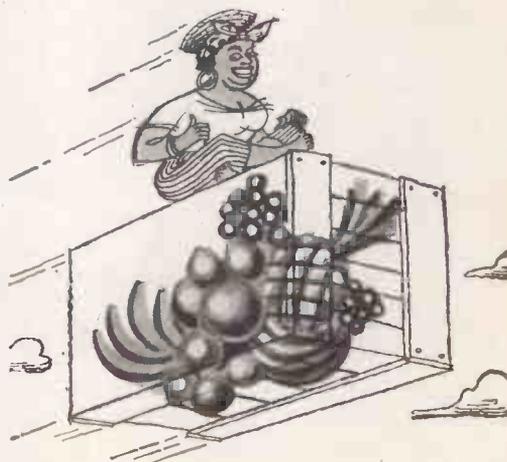
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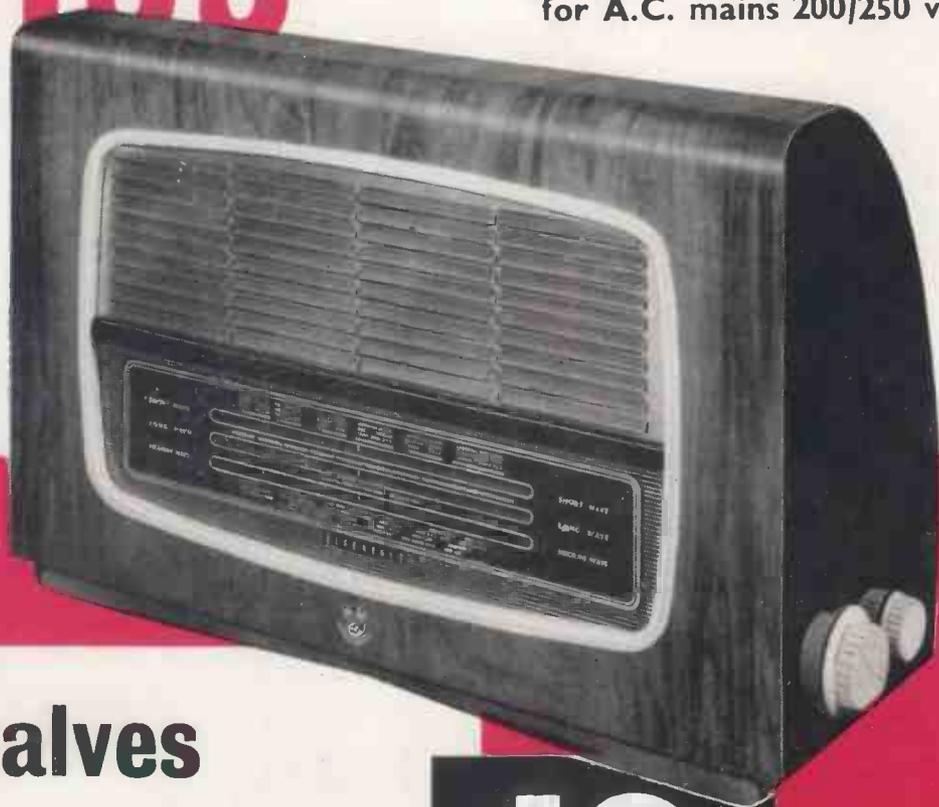
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