JANUARY 1960

RADIO Retailing

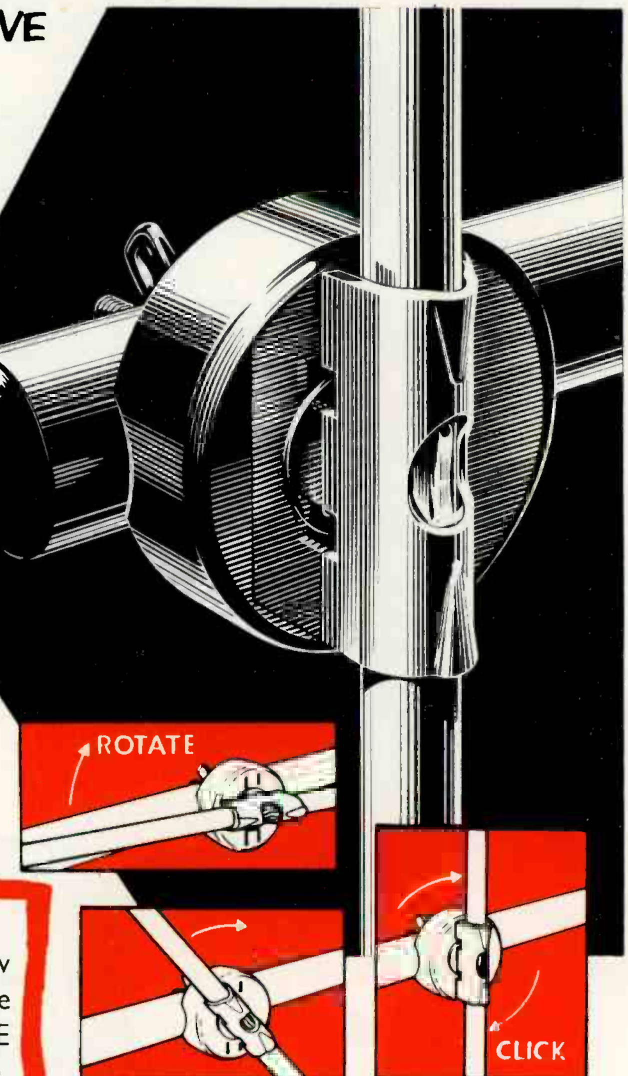
SERVICE ENGINEER

Radio, Television and Audio Servicing

RotaClik

* THE NEW AND EXCLUSIVE DESIGN FEATURE —
* NOW FITTED TO ALL BAND III, HILO AND ANTEX-PLUS AERIALS —
* MAKING AERIAL ASSEMBLY EASIER THAN EVER BEFORE

Once again Antiference are streets ahead of the others with this unique pre-assembly device—designed for accurate speedy aerial installation.



and

Many important price reductions now applying throughout the Antiference aerial range—giving as always —MORE VALUE FOR MONEY to the Trade.

ANTIFERENCE LIMITED

AYLESBURY, BUCKS Tel. Aylesbury 2511 (6 lines)

SERVICE ENGINEER

Vol 2. No. 8. January, 1960

Edited by W. Norman Stevens

Issued as a special supplement with "Radio Retailing"

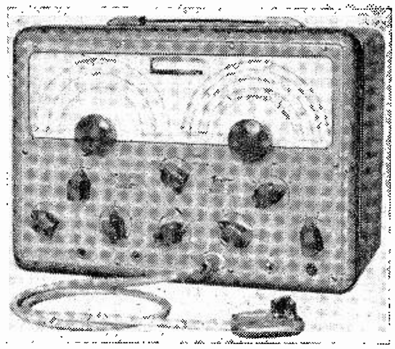
In this issue:

Taylor Introduce the 61A Signal Generator

This new signal generator is designed mainly for the servicing of a.m. and f.m. receivers and the intercarrier i.f. stages of TV receivers. It provides, in conjunction with an oscilloscope, complete facilities for the sweep alignment of the r.f., i.f. and discriminator or ratio detector stages. The speedy and accurate method of ratio detector alignment, using simultaneous a.m. and sweep signals, is available.

The a.m. generator covers 4–120 Mc/s in 5 bands, all on fundamentals. The f.m. and sweep section also operates only on fundamentals, avoiding the confusion and poor frequency accuracy often inherent in the frequency difference method. The f.m. and sweep bands cover the range 4–12 Mc/s and 70–120 Mc/s in three bands. The a.m. generator may be used as a marker during sweep alignment. A variable phasing network is incorporated and retrace blanking is provided.

Deviation on f.m. is variable up to 100 kc/s from the mean carrier frequency at a modulation rate of 400 c/s. The sweep covers a total bandwidth of 1 Mc/s at power line frequency. A crystal calibrator circuit, with switch selection at any one of three internally mounted crystals, is incorporated. A 5 Mc/s crystal is normally supplied, but other crystals, which may be selected in the frequency range 1–11 Mc/s, can be supplied as optional extras.



All the facilities offered in the Model 61A may be selected by internal switching, no cross connections external to the instrument being necessary. There is a choice of c.w., a.m., f.m., sweep plus c.w. or sweep plus a.m., all by internal switching. When using the sweep facility, the marker level may be continuously varied.

A 5-section attenuator with a non-inductive potentiometer provides attenuation over the whole frequency range. R.f. leakage has been reduced to a minimum by careful shielding of both attenuator and oscillator sections. The input to the attenuator system is monitored by an internal crystal rectifier voltmeter. An added facility in the servicing of audio stages is provided by a variable level 400 c/s signal.

Model 61A sells at £45 net trade.

LONGER C.R.T. GUARANTEE

C.R.T. Ltd., who introduced rescreening and realuminising (at no extra charge) some months ago, now announce that all c.r.t.'s fitted by them will automatically carry a guarantee of 18 months instead of 12 months.

TELESURANCE AGENTS GET ALLOWANCE

As a result of negotiations with c.r.t. manufacturers, Telesurance will now be making an allowance to their agents equivalent to the normal retail margin on all tubes replaced by manufacturers under guarantee.

Tubes will be submitted to the makers in the usual way and when replaced a claim form submitted to Telesurance showing the retail margin. The manufacturers' service report must accompany the claim, together with the guarantee card for the new tube.

In the case of Mullard and Cossor out-of-guarantee tube replacements, the glass allowance voucher issued with the new tube must be detatched from the carton and sent to Telesurance with the guarantee card and claim form. If the voucher is not sent, a deduction from the amount of the claim will be made.

In the London area, all faulty and condemned tubes will in future be collected by Telesurance technical representatives.

Direct TV Replacements—new charts

A new set of charts, supplementary to their existing handbook, has been issued by Direct TV Replacements Ltd. This new publication concentrates entirely on timebase components and the company's claim that it is the most comprehensive guide ever to be published in this country seems to be borne out by the sample copy we have received.

The charts themselves are attractively and clearly laid out and are contained within a stiff cover by means of a punched-hole-and-cord loose leaf fixing. Sets are listed according to manufacturer, alphabetically, with columns alongside for part numbers of scan coils, line output transformers, frame output transformers, line oscillator transformers and frame oscillator transformers. There is also a column for useful "remarks" dealing with specific points of interest appertaining to particular models.

From the charts, it can be seen that a certain make and model number does not necessarily use the same line output transformer, for example, in every set bearing those numbers. Sometimes there is a variation, depending on the serial number of the type of valve used in a particular stage. This has always proved a difficulty to the service engineer and often results in a set being out of action while a part is being ordered; then a further delay occurs when the incorrect part arrives, due to such variations. These charts should help to avoid such incidents.

A set of these charts will be supplied free to any customer ordering components (of any kind made by the company) to the value of £3 or more, or may be obtained if a remittance of 7s. 6d. is sent to Direct TV Replacements, 138 Lewisham Way, London, S.E.14. The charts will be available to the trade only.

Direct TV are also now manufacturing their own replacement transformer for Ferguson Models 306T and 308T, this component also covering HMV Models 1865 and 1869 and Marconiphone Model VT155.

No electrical or mechanical modifications are necessary to fit the component, which is a direct replacement for the original. It is for use where either an EY86 or TY86F valve has been fitted.

Known as the L1713, it is priced at £1 18s. 6d. net trade, plus 2s. 6d. postage and packing.

Service Viewpoint

The results of the 1959 Radio Servicing and Television Servicing Examinations were announced in last month's issue, but it may be informative to dig beneath the statistics here and see what they imply.

Of the record entry for the Radio Certificate, 1,869 candidates as compared with last year's list of 1,498, only 547 were successful. Two hundred and ninety-one were referred in the practical test and a surprisingly large percentage of the total—54 per cent, in fact—failed to secure a pass. This figure of

High Failure Rate

1,009 failures is the highest proportion since the RTEB began these examinations in 1944.

The cause of the high failure rate was not, as some authorities had predicted, the *Trainer-Tester* system of simulated practical tests. The RTEB inform us that the stumbling block was undoubtedly the second written paper.

This underlines the complaint of some of our educationalists that training has not kept abreast of modern developments. Many optimistic candidates had followed a course that would have suited them admirably for a pre-war test, but which skated only roughly over the thin ice of, for example, Frequency Modulation.

The more encouraging results of the Television Servicing Examination, in which the failure rate was 33 per cent, augments this conclusion. The man who has reached the stage of applying for the TV certificate has a better groundwork of electronic knowledge. He has to concentrate on the finer points, many of which he will usually meet in his daily work.

It is a sad fact that a large majority of practising servicemen do not consider it worth their while to "mug up" their basic theory to examination standard. In this country, where rates of pay are largely above the "standard", there is not the pressure upon engineers to become certificated. The recent proposals of the RTRA for an agreed scale of wages, in step with AREE standards, are an indication of employers' hopes that more servicemen will qualify.

But against this is the ETU statement that very quickly followed the RTRA announcement of new pay scales. "*The agreement fails to face up to the fact that the overwhelming majority of skilled TV servicing is carried out by highly-skilled but nevertheless uncertificated engineers.*"

Servicemen should not be too complacent about this. The face of the radio trade is changing. Equipment is becoming more complex—much more difficult to service with no more than a "wet finger" approach. A self-imposed course of study is no bad thing. **It is surely better than finding oneself out on a limb when licensing of servicemen comes—as one day it must.**

talking shop

Letters to the Editor

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

Not so Good?

IT annoys me to hear some of my older colleagues talking about the "good old days". And your correspondent, H. W. Hellyer, seems to hark back to them rather a lot.

As far as I can see, the only thing good about them was the fact that the engineer could concentrate pretty well on radio. Nowadays he is expected to handle radio, TV, high fidelity audio equipment, quite complicated radiograms and now the mechanical mess of tape recorders.

I foresee a subdivision into radio (electrical) and radio (mechanical) in the not-too-distant future. The modern radio engineer has to be a much more versatile fellow to hold down his job than he was in the so-called "good old days".—V. Williams, *London, N.W.*10.

Speak Up!

WHY don't the programme companies consider the poor engineer? For whole whacks of precious time they transmit morning test programmes on reduced power. That's all right—we can manage. But it would help if they would make an occasional *aural* announcement.

I've been reduced to nail-biting anguish several times, confronted with a picture barely visible, unable to distinguish the words "Reduced Power" for ghosting and noise, and wondering whether I really have a receiver fault. Just a word or two in our ears would help. . . .—F. Jones, *Pontypridd.*

Thank You

The response from service engineers and apprentices to our recent questionnaire has been very encouraging and the comments and suggestions relating to *Service Engineer* and service sheets will be of great value in formulating future plans.

New Books

"TV Repair and Maintenance" by Robert Hertzberg, published by Fawcett Publications, Inc., Greenwich, Connecticut, USA. Distributed in UK by Frederick Muller Ltd., at 5s.

THERE are some fields in which the handyman can potter with complete success. He may rip the family car to bits, may even re-assemble it unaided. He may build a hen-coop, unstop a drain, carpenter a complicated suite.

But what of the little slips twixt hammer and thumb? In most pursuits they are painful or discomfiting. The blackened nail, the chiselled scar, the gap between the bureau drawers—we chalk them up to experience.

In TV they can be the end of experience. *The little slip can kill!*

This Fawcett How-To book, from the famous Mechanix stable, although admirably compiled, full of hints and tips, the maximum of illustration and the minimum of disturbing mathematics, is just the sort of stimulus that jolts the handyman into fatal exploration.

There is, for example, a piece of advice on repairing the damaged insulation of a mains lead. ". . . . White adhesive tape, borrowed from the medicine chest . . ." is fine for this job, asserts Mr. Hertzberg.

Admittedly, the book, revised and re-written, was aimed at an American public, where mains voltages are only half ours. But Death doesn't need as much as half a chance.

Other advice, although not lethal, is a temptation to chaos. "Don't be afraid to experiment with the screwdriver adjustments on the back of the receiver," the reader is told, "That's why they are there." Elsewhere the handyman is advised to "search out the hidden controls" to save himself the price of a service call. He is told that pounding on the set will cure-or-kill. He is told that the commercial cackle can be cut by inserting a switch in the loudspeaker leads to open-circuit it.

Some chapters are excellent, notably those on the TV signal (American), illustrated fault symptoms, meters and soldering. The magazine-type publications is filled with fine photographs, the guinea-pig set being a 12-in. Westinghouse.

At a time when the British Book Trade is alarmed at the lifting of import restrictions and the threatened dumping of American "remainder copies" this book makes a regrettable entry. But the handyman will be pleased—until he burns his fingers.—H.W.H.

More Trade Notes on Page 119

Electrostatic Speakers

By V. D. Capel

The full-range electrostatic speaker, although unlikely to be encountered in domestic radio receivers for some time, even in modified form, overcomes some of the inherent disadvantages of the moving coil system and will undoubtedly become more widely encountered with hi-fi equipment.

FOR over thirty years the moving coil loudspeaker has been the principal and unrivalled means of converting electrical signals into sound. Cabinets and enclosures have appeared in all sorts of shapes and sizes, embodying many different principles, details of speaker design have varied, but the basic moving coil movement is the same as when first introduced in 1925.

With the coming of hi-fi, no new principle was evolved to reproduce sound, only improvements and modifications to the moving coil system, and today it stands more firmly than ever as the sole sound reproducer.

In recent years, however, a loudspeaker has appeared which utilises a completely different means of producing sound; i.e., the full range electrostatic loudspeaker. Electrostatic loudspeakers have been in existence for almost as long as the moving coil, but hitherto have been used with a suitable filter to reproduce only the higher frequencies. Even then the best quality obtainable with such units left much to be desired. The full range electrostatic is a development from these.

Capacitor Principle

In essence, the electrostatic speaker is nothing more than a capacitor with one moveable plate. It works on the principle of electrostatic attraction. When a charge is put across a pair of capacitor electrodes, as the charge on each is of opposite polarity to the other, they are physically attracted to each other. If the dielectric were air and the plates were free to move without restraint and the charge sufficient to overcome the mechanical inertia, then they would come together and the charge would be short circuited.

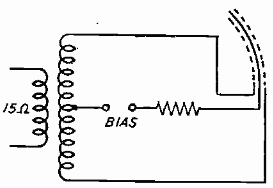
With the ordinary electrostatic, one is mounted rigidly and the other takes the form of a diaphragm which is mounted, fixed by its edges and spaced by suitable insulated spacers from the first. If a signal voltage is applied as it stands, the positive-going half of the waveform causes an attraction, hence movement of the diaphragm toward the fixed plate. The negative-going half, however, will not produce a repulsion as the charge on the opposite plate will now be positive.

They are both still opposite even though polarity has changed, hence the effect will again be attraction, and movement toward the fixed member. Thus severe distortion would result. To overcome this a fixed voltage must be applied across the plates so that the diaphragm is always attracted towards the fixed electrode.

If the signal is now added, the attraction will be either more or less as the waveform adds or subtracts from the fixed bias, hence the movement of the diaphragm will follow more faithfully the applied waveform. The principle is similar to the magnetic bias used in earphones which keeps the metal diaphragm in a state of constant attraction.

Disadvantages

There are a number of disadvantages with the simple single-sided type of electrostatic speaker described. A certain volume of air will be trapped between the two plates. This will have a resonant frequency and will produce a resonance in the speaker's frequency curve. The movement (hence power handling capacity) is very limited, as the distortion increases sharply if the excursions of the moving member exceeds certain narrow limits.



Theoretical representation of a push-pull electrostatic loudspeaker.

The moving plate, usually a sheet of metal foil, introduces difficulties of its own. As it is always under tension when the bias is applied it must be of sufficient mechanical rigidity to prevent it totally collapsing. This will increase its inertia to the detriment of its transient response. Its construction and spacing from the fixed member precludes its use for low frequencies where large amplitudes are encountered, thus its use is confined to that of a tweeter.

The full range electrostatic consists not of two but three members. A sandwich is made with the moving electrode positioned between two fixed, one on either side of it. To facilitate the passage of the sound from the moving member, the fixed ones are not solid, but perforated, and the sound emanates from both sides of the speaker. Thus there is no sandwich of air trapped between the members to introduce undesirable resonances as with the ordinary type.

Push-pull

The matching transformer has a tapped secondary which is connected to the centre moving electrode through the bias supply and a high resistance limiting resistor. The fixed outer electrodes are connected to the outers of the secondary. It can be seen from this, that the speaker works on a push-pull principle, the moving member being attracted to each fixed plate alternately, hence a certain degree of cancellation of internally generated harmonics will occur.

When the standing bias is applied, the charge from the centre member to each of the fixed ones is equal, therefore it is not strained out of its resting position as with the ordinary single sided type. The diaphragm is virtually held fixed in the central position by the charge until signal voltages cause to make its excursions. Thus one of the principle snags and sources of distortion with the single-sided speakers is overcome.

The diaphragm or moving member itself is not made of metal foil but of a plastic material which is coated with a layer of conductive material. It is less than one thousandth of an inch thick and weighs about 0·7 milligrams per square centimetre. This is about a third of the weight of the layer of air one centimetre thick laying on either side of the diaphragm. This extreme lightness will give a rapid response to transients.

Cone Resonance

So much then for the basic details of principle and construction, but what are the advantages in using the full range electrostatic over the conventional moving coil speaker? A speaker retailing at £52 is certainly more expensive than

Now

A VALVE VOLTMETER FROM *Advance*

with these

OUTSTANDING FEATURES

EXTREME SENSITIVITY
accurate measurements are possible down to 100μV

WIDE VOLTAGE RANGES
1mV. to 300 Volts F.S.D

WIDE FREQUENCY RANGE
15c/s to 4.5Mc/s

METER SCALE CALIBRATED IN VOLTS AND dB

CAN BE USED AS A NULL DETECTOR AND INDICATOR FROM 10c/s to 10Mc/s

CAN BE USED AS AN AMPLIFIER FROM 10c/s to 10Mc/s

INCORPORATES ITS OWN H.T. STABILIZER

SMALL COMPACT SIZE AND ROBUST CONSTRUCTION

at this price . . .

£50 nett in U.K

(including very low capacity screened leads and probe)

with this backing . . .

Behind this, the most modern instrument in its sphere, is that specialist instrumentation skill and experience which has earned for all 'Advance' products a reputation second to none throughout the Industry. From our up-to-the-minute factory at Hainault comes this latest addition to the world-famous 'Advance' range of instruments.

Full technical details of the 'Advac' in leaflet B50

THE *Advac*

Size $4\frac{3}{4}'' \times 7\frac{1}{2}'' \times 6\frac{3}{4}''$
Weight . 7 lb.

Advance COMPONENTS LIMITED
INSTRUMENTS DIVISION
ROEBUCK ROAD • HAINAULT • ILFORD • ESSEX TELEPHONE : HAINAULT 4444

GD.64

the average hi-fi speaker installation, although there are some which exceed this figure.

The sound in a moving coil speaker is produced by the cone being actuated by a relatively small area at its centre. This gives rise to all sorts of bad effects. The cone can buckle and stretch when transients are being reproduced and sometimes one part of the cone can be moving in an opposite direction to another. So although the centre of the cone may be moving faithfully in accord with the applied signal, the rest of it is probably doing anything but that!

In order to attain sufficient rigidity to minimise these effects, weight and inertia is increased with a corresponding limiting of the transient and frequency response. Although a figure is often quoted by manufacturers for the cone resonance, as though there were only one, tests show that resonances exist right the way through its frequency range, the quoted one just being the worst.

Flat Response

The plastic conductive sheet employed as the moving member in the electrostatic speaker is not actuated just at one point, but over the whole area, as all of it comes under the electrostatic field existing between itself and the fixed members. Thus it moves as a whole in accord with the applied signal voltage.

Virtually no resonances exist and the response is flat throughout its range. Owing to the lightness, the upper limits of the frequency range is much greater than that of a moving coil speaker, being flat to about 18 kc/s, extending even higher but with a falling response.

Such a performance can only be attained by conventional means with the use of tweeters and a cross over network and even then without the smoothness of response.

A moving coil speaker must be mounted on a suitable baffle and for convenience in size, this is usually folded up to form an enclosure. Although the design of enclosures today has become a fine art, disadvantages still exist. Any enclosure will have its own resonant frequency to add to those of the speaker. For a satisfactory response at the lower end of the register it has to be large and heavy. Some enthusiasts use sand-filled enclosure walls and some even using brick enclosures.

The full range electrostatic speaker, on the other hand, does not need such an enclosure and therefore is far more convenient in use and storage. In appearance it resembles a fire screen, presenting a large flat area mounted on three short legs. It is $2\frac{1}{4}$ in. thick but owing to a slight backward curve its overall depth is $10\frac{1}{2}$ in. It stands 31 in. high and is $34\frac{1}{2}$ in. wide, the legs being $3\frac{1}{2}$ in. in length. The weight is 35 lb.

A conventional moving coil speaker will introduce a greater degree of distortion as the power it is handling is increased, until the overloading point is reached where distortion is most objectionable. The electrostatic, however, does not introduce any appreciable distortion throughout its power handling capacity right up until the overload point is reached. Thus high volume levels can be handled with no more distress than low levels.

Three Planes

A further advantage is in the actual sound distribution. The moving coil speaker in its enclosure excites resonances in three different planes.

The result is that room coloration takes place and the reproduction sounds like what it is, a loudspeaker operating in a room. The electrostatic on the other hand can excite resonances only in one plane thereby reducing greatly the effects of the acoustics of the listening room. The result will be much more natural.

We can see from these points, then, that the full range electrostatic speaker is not just another hi-fi gimmick, but is a definite advance over other methods of sound reproduction. All who are engaged in either selling or servicing audio equipment should be familiar with its various features as more enquiries are bound to come from prospective customers as time goes on.

A number of questions may arise, therefore, as to possible limitations or disadvantages of this type of speaker.

★

As the diaphragm is virtually just a thin sheet suspended very close to the fixed electrodes either side, what would be the effect of temperature on the speaker?

The manufacturers, the Acoustical Manufacturing Co. Ltd., state that the unit has been given prolonged tests at temperatures up to 30°C. with no effect. Soak testing at even higher temperatures is being carried out but the results are not yet available.

No trouble can be anticipated with normal air or room temperatures in this country or temperatures that are likely to be encountered in hotter climates. A warning is given, however, that prolonged subjection to some tropical conditions may result in damage.

Many engineers being familiar with the dust collecting properties of e.h.t. in television receivers, will wonder if the high voltage bias may give rise to a similar attraction and result in the speaker being soon choked with dust. Also, it may be asked, what effect will moisture and high humidity have? Tests have been made at humidities up to 90 per cent for indefinite periods and even to 100 per cent for short periods with no bad effect. Dust is completely precluded because the speaker is sealed in a plastic film and therefore less likely to suffer from these causes than many conventional moving coil speakers.

★

From where can the necessary h.t. bias be derived?

The speaker has its own built-in supply to take care of this. It does, however, need an a.c. mains supply ranging from 100 to 250 volts, 50–60 cycles. The current needed is negligible. Arrangements must be made when installing one of these speakers to see that the mains supply is switched off with the amplifier, otherwise if left to be switched separately, more than likely, the amplifier would be switched off and the speaker left on.

The most convenient way of doing this is to fit an auxiliary mains socket on the power pack or amplifier which is connected to the amplifier side of the on/off switch. A four core cable can then be fitted between the amplifier and speaker, the other two wires being the speaker leads themselves.

★

As the speaker has no continuity will it properly load the amplifier driving it and will a matching transformer be necessary?

The speaker is virtually a capacitor and will therefore present a complete circuit to the audio signals. Its reactance will be high; however, and therefore would need matching to the low impedance output of an amplifier.

A matching transformer is incorporated in the speaker which also takes care of the push-pull drive which is necessary, having a tapped secondary. This transformer will match the speaker to a 15Ω amplifier output, so all that is necessary is to connect the speaker directly to the amplifier output sockets.

★

How does the speaker compare in sensitivity with that of a high quality moving coil speaker?

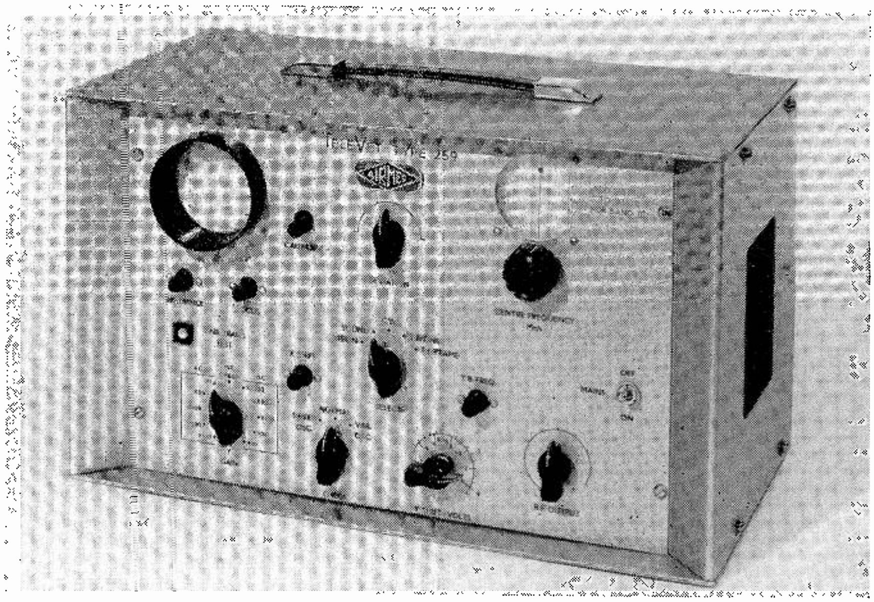
The sensitivity is in fact lower than that of a conventional speaker system. While this in no way affects the quality obtainable, it means that the volume level for a given power input will be less. For many high quality amplifiers this will be no disadvantage as they have a large reserve of power and would never in domestic surroundings be operated at anything like full power.

In such case the only difference will be that the volume control will have to be turned up to a higher position than normal. For the sake of comparison, a 15-watt amplifier working at its maximum power would give a volume level comparable with an 8- to 10-watt

(Continued on page 119)

GOOD NEWS FOR SERVICE ENGINEERS

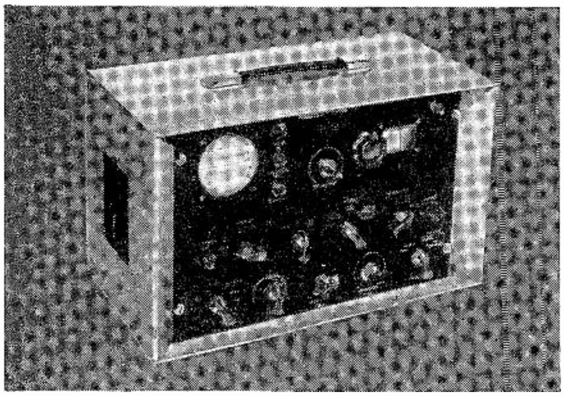
here's the NEW TELEVET 259



The new Airmec Televet incorporates all the facilities provided by the well-known Televet type 877, PLUS these greatly improved features.

Send for leaflet No. 202

- **Improved pattern—locks on all types of set.**
- **Wider band width oscilloscope—D.C. to 700 kc/s.**
- **New spiral tuning scale over 4 ft. in length—calibrated every 100 kc/s.**
- **Line transformer test incorporated.**



The AIRMEC RADIVET

The AIRMEC RADIVET, the complete Broadcast Receiver Tester, providing every facility for completely checking, repairing and aligning any Radio Receiver. Particularly useful for VHF testing. Covers Long, Medium and Short Waves, and Band II, crystal calibration, linear tuning scale, pre-emphasised signal available, usable with both a.c. and a.c.-d.c. Type Receivers. Fully portable. H.P. terms available.

Airmec

Send for fully descriptive literature:

AIRMEC LIMITED · HIGH WYCOMBE · BUCKS

Tel.: High Wycombe 2060

TECHNICAL GEN for SERVICING MEN

RADIO, TELEVISION and AUDIO FAULT FINDING

PRESENTING DETAILS OF FAULTS ENCOUNTERED, DIAGNOSED AND CURED BY SERVICE ENGINEERS ON RADIO, TELEVISION AND AUDIO EQUIPMENT, TOGETHER WITH HINTS AND TIPS OF USE TO OTHER SERVICEMEN IN DEALING WITH DAY-TO-DAY SERVICE WORK.

Pam 501, 517, 521

Line Tear Fault

One of these receivers was brought into the workshop with a complaint of intermittent line tearing. The set was put on test and it soon became apparent that the line tearing was being caused by corona discharge. On examining the line output transformer and the e.h.t. rectifier valve holder, both were found to be heavily covered in dust which was carefully cleaned off.

The set was tried again but corona still occurred, particularly around the line transformer. A replacement transformer was fitted and cured most of the discharge but the line tearing was as bad as ever. There still seemed to be a heavy leak on the line output circuit.

Suspicion fell on the scan coils but these appeared to be quite normal, as did the line linearity and width control coils. An examination of all the wiring in the line output circuit was to no avail and then we found the cause of the trouble.

In this line output circuit, the line transformer is tuned to approximately the line frequency by a 280pF, 5kV, ceramic capacitor connected across the efficiency diode winding. On test this capacitor was found to have a leak of 5MΩ on our 500V Megger. Obviously this capacitor had been causing the fault by arcing internally. Needless to say, a replacement cured the fault.—C.S., Bicester (656).

Pye FV4CDL

Vision Goes Off

This receiver was brought in with the complaint that vision disappeared after three-quarters of an hour. After a time the raster collapsed to a thin vertical line which then faded out. The h.t. on the anode of the PL81 line output valve was low and so a heavy current drain through the valve was suspected. Grid drive was checked and found to be adequate. The valve was changed and the old one checked for inter-electrode shorts, but with no results.

When taking further voltage measurements it was found that the boost rail was at full h.t. potential whereas normally, if the line output stage is taking excessive current, the boost voltage drops due to the internal resistance of the boost rectifier.

It was then found that the voltage on the PL81 anode lead to the line output transformer was at full h.t. value. This quickly led to a check on the 47Ω anode stopper to the PL81 top cap. It was found to be intermittently going high. Replacement restored normal operation. —V.D.C., Bristol (670).

Masteradio TG7T

Hum on Sound

We have had three cases of objectionable hum on sound, lately, caused by the same fault. The grid of the sound output pentode (section of PCL82), is loaded with a 4·7MΩ resistor. In the three we repaired, this was an $\frac{1}{8}$-watt component, which was running warm, being inadequate to dissipate the audio power.

Replacing the resistor with a $\frac{1}{2}$-watt 4·7 MΩ proved a cure in each case, although the faulty component was only slightly high when measured on the bridge.

On this model, too, we have had a number of complaints of over-contrasting. Investigation proves that the real fault is a lack of brilliance, which the customer compensates for by increasing contrast, obtaining a "soot and whitewash" picture. The cause is, almost invariably, excessive first anode current drain by the CRT.

The first anode is fed from the boost line via a 2MΩ resistor. Temporarily shorting this resistor with a pair of long-nosed pliers (keep your other hand in your pocket!) sometimes brings the tube back to normal. At other times it may be necessary to reduce this filter resistor, paralleling it with a 1MΩ. But the textbook cure is to replace the c.r.t. . . . if the customer can afford it.—M.A.Q., Gilfach (660).

Items for publication

in this feature are welcome, particularly in regard to the more unusual type of faults. All contributions used will be paid for at our usual rates.

When sending in items for Technical Gen, please write (or type) on one side of paper only, adding rough sketches (where considered necessary) on a separate sheet of paper. Correspondence should be addressed to — RR Sevice Engineer, 46 Chancery Lane, London, W.C.2.

Masteradio TG4T

Frame Roll Fault

Persistent frame rolling appears to be common on this model. It is sometimes necessary to try several PCL82 osc plus output valves before a suitable one is found. Occasionally the root of the trouble has been traced to poor sync, and the ECL80 sync separator was the culprit.

But one model we had in for repair exhibited much touchier symptoms. This one rolled when loud sounds were being broadcast!

It was not, as we first suspected, a simple case of mistuning, with the attendant trouble of erratic sync. The faulty part turned out to be the cathode bypass capacitor, 12μF electrolytic, of the PCL82 sound output valve.

This had developed a leak sufficient to push up the anode current of the valve considerably on peaks, with a resultant drop in the already low h.t., and an upsetting of the frame oscillator—never very stable, even with good rail voltage. —G.L.A., Bargoed (659).

Vidor CN4207

Lack of Vision

Complaint was no vision, sound normal. On test it was found that although there was a raster, no trace of modulation could be seen. The raster was clean, with no valve noise, so it was decided to investigate the video output stage. The EF91 valve was changed as a preliminary gambit but with no result.

Voltages were checked on the valve electrodes and it was found that both screen and anode were at the same potential, which was that of the h.t. line. This seemed to indicate that no

(*Continued on page 113*)

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

Complete your library of

SERVICE DATA SHEETS

THE DATA SHEETS LISTED BELOW ARE STILL AVAILABLE FROM STOCK TO SUBSCRIBERS, POST FREE, AT THE PRICES QUOTED. A COMPLETE INDEX TO ALL DATA SHEETS PUBLISHED UP TO DECEMBER 1959 IS AVAILABLE AT 9d.

(Please send cash with order)

★ *DATA SHEET BINDERS are available from stock for trouble-free filing of your own Data Sheets. Simple spring-clip action. Small size, 10s. 6d. post free. Large size, 12s. 6d. post free.* ★

NOTE THAT the following list of Data Sheets is correct at the time of going to press, but certain issues may soon be out of print. When ordering, therefore, please state alternatives to be sent in the event of any particular Data Sheets being no longer available. Please quote R or TV serial number of each Data Sheet in your order.

Price 1s. each

Ace "Astra" Mk. II Model 553 (TV52, May, 54).
Alba T655 TV (TV130, Dec., 58).
Baird P1812/14/15 and C1815 (TV39, Apr., 53)
B.S.R. UA8 autochanger (S7, March, 57).
Bush T36 series TV receivers (TV83, Apr., 56).
Bush TV22 series TV receivers (TV67, Jun., 55).
Bush TV53 series TV receivers (TV101, Feb., 57).
Bush TV63 series TV (TV118, April, 58).
Cossor 927 television receiver (TV42, July, 53).
Cossor 930 series TV receivers (TV62, Feb., 55).
Cossor 937, 938 and 939 (TV90, July, 56).
Cossor 943 TV (TV127, Oct., 58).
Cossor 945 (TV112, Nov., 57).
Cossor 946 TV (TV104, May, 57).
Cossor 947 TV receiver (TV114, Jan., 58).
Cossor 948, 949 series (TV133, Jan., 59).
Ferranti 14T2 and 1225 (TV45, Nov., 53).
Ferguson 204T series TV receivers (TV87, June, 56).
Ferguson 306T/308T TV receivers (TV97, Nov., 56).
G.E.C. BT1252 series TV receivers (TV96, Oct., 56).
G.E.C. BT1746 series TV (TV81, Mar., 56).
G.E.C. BT7092 and BT7094 (TV44, Oct., 53).
Grundig 500L and 700L/C *Reporter* tape recorder (S3, Dec., 53).
H.M.V. 1840 series TV receivers (TV109, Sept., 57).
Kolster-Brandes FV30, FV40 and FV50 (TV23, Feb., 52).
Kolster-Brandes HF40 series TV (TV70, Aug., 55).
Kolster-Brandes MV30 and MV50 television receivers (TV91, Aug., 56).
Kolster-Brandes NV40 series (TV115, Feb., 58).
Marconiphone VC59DA/VT59DA television receivers (TV100, Jan., 57).
Marconiphone VC60DA console television receivers (TV61, Jan., 55).
Marconiphone VT68DA/VT69DA television receivers (TV84, May, 56).
McMichael 55 series TV receivers (TV79, Feb., 56).
Murphy V214/V216 TV receivers (TV78, Jan., 56).
Murphy V230 portable TV (TV103, April, 57).
Murphy V240/V250 TV (TV105, June, 57).
Murphy V270/V270C TV (TV120, May, 58).
Murphy V270A TV receiver (TV140, July, 59).
Murphy V280/V300C TV (TV124, Aug., 58).
Murphy V280A series (TV134, March, 59).
Murphy V310 TV receiver (TV145, Dec., 59)
Pam 500 TV receiver (TV108, Aug., 57).
Pam 600S, 606S, 690 (TV144, Nov., 59).
Peto Scott TV 1411 series (TV65, Apr., 55).
Peto Scott 1412 and 1712 television receivers (TV54, July, 54).
Peto Scott 1418T TV receiver (TV106, July, 57).
Philco BT1412 and BT1551 (TV71, Sept., 55).
Philco 1000 *Slender Seventeener* (TV139, June, 59).
Philco A1960/1, A2060/1 (TV137, May, 59).
Philco A1962M/A1967M (TV142, Oct., 59).
Philips 1458U series (TV129, Nov., 58).
Philips 1756U series TV (TV111, Oct., 57).
Philips 1768U/2168U (TV117, March, 58).
Pilot TV84/87 television series (TV59, Nov., 54).
Pye PTV portable TV (TV113, Dec., 57).
Pye CW17 series TV (TV122, June, 58).
Pye CTM17S series (TV131, Feb., 59).
Regentone "Big 15/5," T and C television receivers (TV48, Feb., 54).
R.G.D. 1455 and 1456 TV receivers (TV99, Dec., 56).
Ultra VA72, YA72/73 series (TV38, March, 58).
Ultra V84 and Y84 TV receivers (TV47, Jan., 54).
Ultra 81 series TV receivers (TV74, Nov., 55).
Ultra 915 and 917 TV receivers (TV93, Sept., 56).
Ultra 50 series TV (TV123, July, 58).
Ultra 52 series TV (TV135, April, 59)
Ultra 60 series TV (TV126, Sept., 58).
Ultra 62 series TV receivers (TV141, Sept., 59).
Vidor CN4217/8 TV receivers (TV57, Oct. 54).

Price 9d. each

Alba T717 and T721 (TV143, Nov., 59).
Alba T744FM TV series (TV121, June, 58).
Ambassador-Baird TV 19-20 series (TV119, May, 58).
Ambassador TV4 and TV5 (TV32, Sept., 52).
Argosy 1412L/1412B (TV19, Aug., 51).
Argosy Model T2 TV receiver (TV53, June, 54).
Baird TV receivers, P/T 167 (TV35, Dec., 52).
Beethoven B94, 95, 98 and 99 television receivers (TV92, Aug., 56).
Bush BE15 battery radio (R51, Mar., 54).
Bush RC94 AC radiogram (R34, Nov., 52).
Bush VHF54/VHF55 receivers (R94, Jan., 57).
Bush VHF61 a.m.-f.m. radio (R134, Oct., 59).
Bush VHF64/RG66 radios (R116, July, 58).
Collaro RC54 record changer (S6, Oct., 55).
Cossor 500 series radios (R95, Feb., 57).
Cossor 522/523 a.m.-f.m. radio (R72, May, 55).
Cossor 524 *Melody Maker* (R85, Mar., 56).
Cossor TV Model 926 (TV37, Feb., 53).
Decca SG177/SG188 Stereograms (S12, Oct., 58).
Decca *Double Decca* Model 51 (R65 Dec., 54).
Deccalian radiograms 91 and 92 (R23, Dec., 51).
Deccalian Model 90, radiogram (R21, Nov., 51).
Etronic ECS2231 projection TV (TV46, Dec., 53).
Etronic ETA632 radio receiver (R43, Aug., 53).
Ever Ready *Sky Monarch* (R104, July, 57).
Ever Ready *Sky King, Queen, Prince* (R106, Sept., 57).
Ferguson type A, B, B1 and C television tuner units (TV85, May, 56).
Ferguson 300RG autogram (R78, Aug., 55).
Ferguson 382U series (R124, Jan., 59).
Ferguson 341BU portable radio (R67, Jan., 55).
Ferguson 968T series TV (TV60, Dec., 54).
Ferranti radio receiver Models 005 and 105 radiogram Model 405 (R36, Jan., 53).
Ferranti 147 series radio receivers (R81, Nov., 55).
Ferranti 255, 355, 455, radios (R107, Oct., 57)
Ferranti 1325/1825 TV receivers (TV95, Oct., 56).
G.E.C. BT1449/BT2448 TV receivers (TV102, March, 57).
Kolster-Brandes HG30 radiogram (R53, Apr 54).
Marconiphone T24A series (R98, April, 57).
Marconiphone T/C10A radio (R41, June, 53).
Marconiphone VT64DA/VT65DA television receivers (TV76, Dec., 55).
Masteradio D154 "Ripon" series radio receivers (R84, Feb., 56).
Masteradio Model T853 (TV36, Jan., 53).
Masteradio TD4T and TD7T/C television receivers (TV58, Nov., 54).
Masteradio TE series (TV128, Nov., 58).
McMichael *Clubman* Model 535 (R62, Oct., 54).
McMichael FM55 a.m.-f.m. radio (R82, Dec., 55).
Murphy A146CM baffle radio (R75, June, 55).
Murphy V114C/V118C TV (TV98, Nov., 56).
Murphy V200 TV receiver (TV72, Sept., 55).
Pam 701, 702, 714, radios (R100, May, 57).
Peto Scott 16 series TV receivers (TV86, June, 56).
Peto Scott 19 series TV (TV116, March, 58).
Philips 141U portable radio (R56, June, 54).
Philips 643 series a.m.-f.m. radio (R87, July, 56).
Philips G62A series a.m.-f.m. radios (R131, July, 59).
Pilot TM/CM54 TV receiver (TV41, June, 53).
Pilot TV94 series TV receivers (TV107, Aug., 57).
Pilot VS9 console TV receiver (TV34, Nov., 52).
Pye P23CR and P24CR (R48, Jan., 54).
Pye P29UBQ (R37, Feb., 53).
Pye *FenMan* I and IRG (R109, Nov., 57).
Pye *FenMan* II and IIRG (R112, Jan., 58).
Raymond F46 radio receiver (R69, Feb., 55).
Regentone TR177 series (TV132, Feb., 59).
Regentone ARG81 series (R127, March, 59).
Regentone RT50 tape recorder (S14, Sept., 59).
R.G.D. T14 transportable VT (TV138, June, 59).
Sobell 516AC/U radio (R57, July 54.
Sobell TS17 and T346 TV (TV94,Se).pt., 56).
Sobell 626 Series a.m.-f.m. radios (R102, June, 57)
Sound A20 tape recorder (S9, Feb., 58).
Stella ST151A radio (R66, Jan., 55).
Stella TV receiver ST1480U (TV25, Apr., 52).
Stella ST8314U TV receiver (TV55, Aug., 54).
Strad Model 510 table receiver (R35, Dec., 52).
Taylor Electronic testmeter Type 171A (T16, Aug., 54).
Ultra ARG891 "Ultragram" (R83, Jan., 56).
Ultra "Troubadour" U696 (R44, Aug., 53).
Ultra "Twin" portable radio (R55, June, 54).
Ultra U930/U940 *Minstrels* (R119, Aug., 58).
Vidor CN4213 and CN4215 TV (TV28, June, 52).
Vidor CN4228/9 TV receivers (TV136, May, 59).
Vidor CN4230/1 TV receivers (TV125, Sept., 58).
Waveforms *Radar* 405D pattern generator (T.I.7, Apr., 56).

Price 6d. each

Alba 69 series radiograms (R120, Sept., 58).
Alba 3211 series (R126, Feb., 59).
Baird baffle radio receiver (R61, Oct., 54).
Bush TC184 television tuner (TV75, Nov., 55).
Cossor Model 466 car radio (R71, Apr., 55).
Cossor radio Model 494U (R38, Mar., 53).
Cossor *Melody Portable* 543 (R92, Dec., 56).
Cossor 546 transistor portable (R115, May, 58).
Cossor 551/552 portables (R117, July, 58).
Cossor 580 stereo player (S13, April, 59).
Cossor 581 and 569 portables (R137, Nov., 59).
Decca *Deccalian* 88 player (S10, March, 58).
Decca RG200 radiogram (R125, Jan., 59).
Deccalian Model 81 (R29, Apr., 52).
Defiant MSH953 AC radio (R40, May, 53).
Defiant RSGH89AC radio (R70, Mar., 55).
English Electric *Rotamatic* TV tuner (TV82, Mar., 56)
Etronic EPZ4213 portable radio (R52, Mar., 54).
Etronic radio Model ETU5329 (R39, Apr., 53).
Ever Ready Model "C" radio (R50, Feb., 54).
Ever Ready *Sky Baby* and *Sky Princess* portables (R99, May, 57).
Ferranti 13-channel TV tuner (TV73, Oct., 55).
Ferranti 525 radio receiver (R58, Aug., 54).
Ferranti Model 546 radio (R45, Sept., 53).
Ferranti U1003/RP1008 (R123, Dec., 58).
H.M.V. radio Model 1122 (R54, May, 54).
H.M.V. radio Model 1356 (R42, July, 53).
H.M.V. 1252 f.m. adaptor (R111, Jan., 58).
Invicta 26 "Vicki" portable (R93, Jan., 57).
Invicta 33 series radio receivers (R89, Sept., 56).
Invicta Models 37 and 59RG (R86, May, 56).
Invicta Model 55 portable (R46, Oct., 53).
Kolster-Brandes TV converter (TV77, Jan., 56).
Kolster-Brandes FB10 portable (R32, Sept., 52).
Kolster-Brandes MP151/2, PP251 portables (R135 Oct., 59).
Kolster-Brandes NG20/NR30 (R113, Feb., 58).
Kolster-Brandes OP21 (R122, Nov., 58).
Kolster-Brandes PP11, PP21, PP31 portables (R130, June, 59).
Marconiphone P17B portable (R49, Jan., 54).
Marconiphone T2211 converter (TV30, Feb., 56).
Marconiphone T24DAB (R77, Aug., 55).
McMichael 153 table radio (R75, July, 55).
McMichael 493 portable radio (R47, Nov., 53).
McMichael 554 radiogram (R96, Feb., 57).
McMichael 855 table radio (R91, Nov., 56).
Masteradio D155 series (R108, Nov., 57).
Pam 706 *Pixie* portable (R97, March, 57).
Pam 710 portable (R90, Oct., 56).
Pam 955 series radios (R103, July, 57).
Portogram "Junior 8" reproducer (S5, July, 54).
Portogram "Preil 20" amplifier (S4, May, 54).
Philco A 536 W/M radio receivers (R68, Feb., 55).
Philips television tuners (TV88, June, 56).
Philips G77B, G81U, G83B (R137, Dec., 59).
Pilot television tuners (TV89, July, 56).
Pye HF25/25A hi-fi amplifiers (S11, June, 58).
Pye P131MBQ portable (R121, Oct., 58).
Pye P43 radio receiver (R63, Nov., 54).
Pye 13-channel tuner unit (TV66, May, 55).
Pye *Pipers* P115U/P116U (R110, Dec., 57).
Pye *Black Box* record reproducers (S8, Sept., 57).
Pye 841130 series TV tuners (TV110, Oct., 57).
Raymond F55 table radio (R74, June, 55).
R.G.D. B56 portable radio (R132, July, 59).
Roberts CR portable radio (R80, Oct., 55).
Roberts "Junior" portable (R26, Feb., 52).
Roberts P5A portable radio (R73, May, 55).
Roberts R66 portable radio (R88, Aug., 56).
Roberts R77 portable (R105, Aug., 57).
Roberts RT1 transistor portable (R118, Aug., 58).
Sobell FMG57/FMG708 radios (R114, April, 58).
Taylor Electrical "Windsor" circuit analyser Model 20B (T.I.5, Sept., 52).
Ultra FM950 f.m. radio (R129, May, 59).
Ultra TR100 portable (R128, March, 59).
Ultra U960 portable radio (R133, Sept., 59).
Vidor Model CN414 portable (R28, Apr., 52).
Vidor CN420A portable radio (R64, Dec., 54).
Vidor CN421 portable radio (R79, Sept., 55).

Order Now from **RADIO RETAILING, 46 Chancery Lane, London, W.C.2**

TECHNICAL GEN
continued

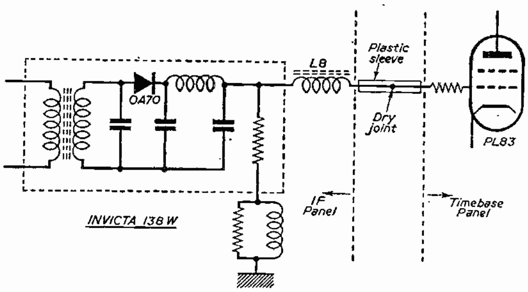
current was passing through the valve, so the cathode and grid circuits were examined but found to be normal. Further it was found that the valve seemed to be getting abnormally hot as though it were passing excess current.

A resistance reading was taken from the anode to screen pins or effectively across the anode load, and the result was a zero indication. The anode was, in fact, connected directly to the h.t. line minus its load! A further check of the wiring brought to light the fact that the anode lead to pin 5 was strained around pin 9 (screen pin). The metal had cut through the plastic insulation and effectively shorted out the anode load. Separation and re-dressing brought back normal vision.—V.D.C., Bristol (668).

Invicta 138W

Hum on Raster The trouble on this set, a fringe version similar to the Pye CTL58F, was a 50 c/s hum bar on screen, no picture modulation and sound normal, intermittent behaviour. The set was soak tested for over a week but as fault did not appear it was returned to the customer but a few days later it was reported that the fault has occurred and was now permanent.

On switching on there was no modulation and on the raster was a dark band covering about a third of the raster and moving from bottom to top. This looked like a cathode-heater s/c or leak in a vision valve or the c.r.t. but these all checked OK, so the oscilloscope was brought into use.



Cathode of c.r.t. and anode and grid of video amplifier all showed a strong 50 c/s hum waveform but no signs of picture modulation. Checking back, it was found that at the choke L8 (see diagram) picture waveform was present with no sign of hum.

There is a wire from L8 on the i.f. printed panel and a wire from the time-base printed panel which includes the video amplifier, these two wires being soldered together and the joint covered with a white plastic sleeve. The trouble was due to an o/c dry joint and the picture could be brought on by tapping this joint. The cause of the hum bar and no picture modulation was the floating grid wire to the PL83 video amplifier. I wired one complete lead between these two panels.—S.W., Buckingham (662).

Regentone TR177

Trouble with Contrast After about half an hour the contrast suddenly reduced. It did not fade, and the symptoms reminded us of previous trouble encountered with the a.g.c. circuit of this model. But this time the trouble lay a lot deeper.

Eventually we were forced to stage checking, and noted that the loss of signal occurred at the first vision i.f. input. Applying the signal generator probe to the EF80 grid, pin 2, temporarily cured the lack of contrast. We looked more closely.

The short lead to the input transformer from pin 2 of this valve passes across the cathode resistor, which is returned from pin 1. As the receiver heated up, the contact between the two increased until an effective grid/cathode leak was formed, cutting the gain drastically.

The grid lead was too short to redress and had to be replaced, this time clear of the bias resistor.—M.A.Q., Gilfach (658).

Brainless Bertie

Bertie's calculations
Take him half the night . . .
Unlike another (more famous) B.B.,
His figures so seldom look right.

Feste

Bush TV36C

Band III Frame Jumping Good Band I, with vertical jumping on Band III, on one of these sets was dealt within the service department by a routine service of the vertical circuit which tends to jitter. After obtaining good results on both bands it was returned to the customer, only to discover that Band III still tended to jump occasionally.

The Band III input was strong and was fed separately to the set from the loft via twin cable. The Band I aerial, however, was chimney mounted giving a good flutter-free picture via coaxial cable to a separate aerial socket. A test with an indoor aerial gave a steady Band III picture with no instability, but the loft aerial when checked was found normal.

Examination of the downleads showed them running adjacent down and long the outside wall for about ten yards. On separating them, the fault cleared. Re-routing the lead cleared the trouble permanently.—L.E.H., Edgware (619).

Philips 1400

Projection Receiver Fault The fault was no picture and excessive brilliance, which could not be reduced below a certain level. Voltages were taken on the tube electrodes and it was found that while the grid volts were normal and varied with the operation of the brilliance control, the cathode voltage was non-existent. Tracing back to the video stage, it was found that there was no anode voltage on the video output valve and a check on the anode load resistor (3·3kΩ wire-wound) showed that it was o/c.

Replacement resulted in the appearance of a picture but it would defocus with every change in the brilliance level, indicating poor e.h.t. regulation. The

(Continued on page 115)

RECEIVER ● SPOT ● CHECKS

No. 50: EKCO T342

No Sound or Vision: Check R52 100Ω for o/c due to s/c of C14 (0·001μF) located in the tuner, or s/c of C24 (16μF) or C51 (0·001μF) decoupling capacitor.

No vision: Check for s/c on C31, C43, C50. Check for o/c on L26 or L27. Check CD1 detector diode for fault, and V9A interference limiter diode for heater-cathode s/c. Check R42 (6·8kΩ) for o/c and c.r.t. for grid-cathode s/c which would also cause uncontrollable brightness.

No Sound: Check C34, C41, C42, C80 for s/c, R47 (1·8MΩ) for o/c and C63 (0·02μF) for o/c or s/c.

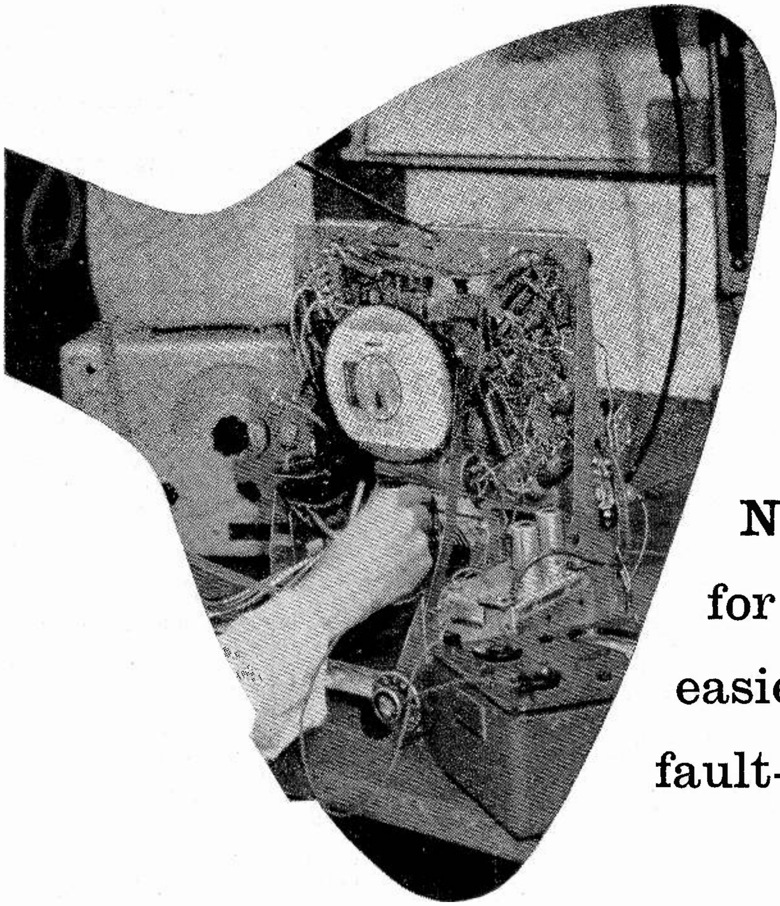
Patterning: Check C17, C28, C31, C43, C44 for o/c.

Line Timebase Inoperative: Check 500mA fuse F1 for o/c, C85 (0·5μF) for o/c or s/c, R79 (4·7kΩ) for o/c, C94 (0·01μF) for leakage or o/c, C90 (15pF) or C89 (47pF) for leakage.

Frame Timebase Inoperative: Check T4 for o/c primary, C87 (0·1μF) for o/c or s/c, R80 for o/c.

Poor Frame Linearity: Check C77 or C83 and C78 (500μF) cathode bypass capacitor for low capacitance.

Poor Frame Sync: Check C101 (2μF) for o/c and MR1 for fault.—E.L., Long Eaton (627B).

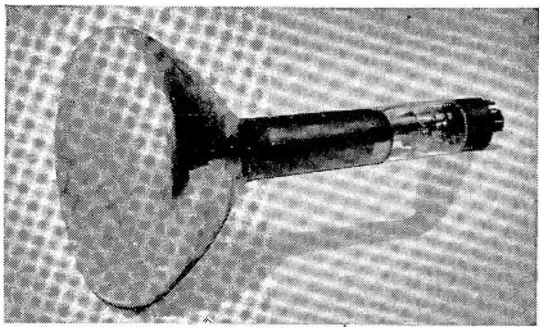


New for easier fault-finding...

The new GEC 1668VMM 'Setting Up' Tube is designed to simplify diagnosis for hard-pressed TV Service Engineers.

Compact and light enough to fit into your servicing kit, this invaluable 'extra arm' can be plugged into most modern popular receivers for test either on the bench or in your customer's home.

Use it to avoid handling bulky picture tubes during test, to locate chassis faults where picture tube has been suspect, to obviate risk of removing cabinet-mounted picture tubes, to gain greater accessibility to components where picture tube is chassis-mounted. Also invaluable on manufacturer's assembly line in place of the final large picture tube.



The 6″ 1668VMM is magnetically deflected and focussed. £7.10.0 net.
An alternative tube, type 1668VTM is available with electrostatic focussing. £9.0.0 net.
Specially designed storage and carrying case £1.5.0 net.
Write for information sheet OV4296

G.E.C. 'Setting up' tubes

DOMESTIC SALES DEPARTMENT
THE M-O VALVE COMPANY LIMITED · BROOK GREEN · HAMMERSMITH · LONDON · W.6
a subsidiary of the General Electric Company Limited

TECHNICAL GEN
continued

e.h.t. driver valve was changed and the stabilising circuit checked but all seemed to be in order. The tripler unit was changed but again with no improvement. Eventually the fault was traced to the c.r.t. itself which was slightly soft and drawing excess current at high brilliance levels. A new tube restored regulation to what is normally expected in these projection receivers.—V.D.C., Bristol (669).

G.E.C. BT1252A

Some Common Faults This could also apply to models BT2745RA, BT5248A, BT5347A and BT8245A. The complaint was no sound or vision on both bands. V1 and V2 in the tuner unit were tested and passed as satisfactory. After detaching tuner from main deck, inspection of wiring and components revealed that R13 (10kΩ oscillator grid resistor) was charred and had decreased in value to 100Ω. Cause of the trouble was traced to C20 (33pF ceramic) which had developed an intermittent s/c.

It was noticed that the h.t. decoupling resistors R11 and R12 were slightly discoloured, but suffered no damage, also oscillator coils L15, L16 and L17 were found satisfactory. Consequent replacement of C20 and R13 restored sound and vision but due to unavoidable disturbance of components a slight adjustment of the oscillator core was necessary.

Incidentally, similar symptoms of no sound or vision may be caused by the feedthrough capacitor C8 going s/c resulting in destruction of R5 and lack of d.c. potential on pins 1, 3 and 9 of V1.

On these sets, for no Band I (normal Band III) check C21 (8·2pF) for s/c or o/c. For pale picture and poor sync, check the video detector diode (GEX35). If line oscillator is inoperative, try C63 (0·01μF) for s/c, which results in lack of d.c. potential on the oscillator screen of V18.

For no raster, check C64 for o/c or s/c, R61 for o/c, C83 for o/c or s/c resulting in lack of boost voltage, TR3 for s/c overwind turns. Frame faults: vertical hold at one end, check R81 for h.r.; no frame sync, check C81 for o/c; no frame scan, check C87 and C90 in the multivibrator circuit, C91 for o/c and TR4 primary for o/c; insufficient height, check R78 for h.r., V15 and V16 for loss of emission, C93 for low capacitance and C95 for leakage which would also produce cramping at the bottom.—E.L., Long Eaton (540).

Pye VT17

Trouble with Verticals The fault with this receiver was bent verticals. All smoothing capacitors in the line timebase and flywheel sync circuits were checked and found satisfactory. The main smoothing was also checked, by connecting a similar known good capacitor across the original and the fault cleared a little, but this proved to be due to the increased smoothing capacitance only.

On inspection of the service sheet it was noticed that the h.t. line feeding the flywheel sync and line oscillator circuits should be 165V, but in this case there was just over 200V. Closer examination of the receiver showed that one of the h.t. feed resistors (4·7kΩ) had gone down in value to 50Ω. Replacement with a new 4·7kΩ resistor cured the fault.

This fault could be most misleading to an engineer without service information, as a 200V h.t. line would appear normal.—J.C., Uttoxeter (673).

SERVICE BRIEFS

Murphy V250: This set was brought into the workshop with the complaint that sometimes the picture would disappear and a bright "tadpole" appear at the top of the screen in the centre. The receiver was put on soak test and eventually the fault appeared. It was traced to an intermittent heater-cathode leak in the U329 efficiency diode.—J.Y., Bacup (514).

Philips TG1796U: A week after being installed, vision became very weak on both channels, sound remaining normal. On checking voltages it was seen that there was no voltage on the anode of V6. It was found that the 33pF screen decoupling capacitor C40 was leaking to 3kΩ. Since then another 1796U has come in with exactly the same trouble.—D.McL., Lochgilphead (522).

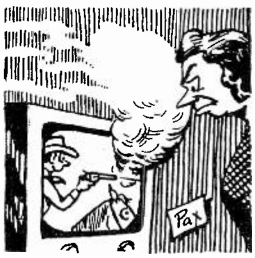
Philips 1756U: Line scan was collapsing at about 100 c/s, causing a loud humming noise to be emitted from the line output transformer. At first this was thought to be the cause of the trouble, but replacement did not effect a cure. It was then noticed that adjustment of the line hold control varied slightly the rate of collapse. The trouble was due to the oscillator grid resistor R82 which had increased from 3·3MΩ to 20MΩ and was causing the grid coupling capacitor to hold its charge, self biasing the valve beyond cut-off.—D.E.B., Mansfield (501).

Ekco T164: These sets having reclaim rectifier fed from mains transformer, this winding breaks down to laminations. By using a later type rectifier U301 which has a high heater to cathode insulation. The only modification needed is to reverse the anode and cathode connections. The heater winding should then be returned to chassis via a 1kΩ $\frac{1}{2}$-watt resistor. The 2V difference in heaters can be ignored.—D.M., Higher Poynton (518).

Philips 1446U/1746U: A common fault is weak line sync. The sync anode load of the clipper on these models increases in value. Replace the 220kΩ resistor with a 100kΩ resistor and cut out the 47kΩ resistor which returns to chassis.—D.M., Higher Poynton (519).

Pye 17-21F: The set came in with what at first appeared to be an a.p.c. fault. Whatever changes were made to the brightness or contrast control settings, after a few seconds the picture returned to the same brightness level. This suggested a long time constant in the a.p.c. smoothing circuit, but the fault was traced to R33 which was o/c. This forms part of an anti-flutter filter in conjunction with C27 and being o/c had broken the d.c. coupling to the c.r.t., the only coupling being a.c. via C27, giving a brightness determined by the average picture content of the signal.—D.E.B., Mansfield (504).

Queer Customers



TWO of these have come my way recently. In the first case, which happened shortly after the local ITA station had opened, I had called to repair a vision fault which had caused loss of Band III picture but had not effected the much stronger Band I signal. The customer complained bitterly about the set having broken down so soon.

I pointed out that the set had been installed over two years previously and had given no trouble at all. "Yes," said the customer, "but that was on BBC. The ITA part has only been working a week and has broken down already".

The second experience also happened on a service call when I was asked by the customer for the cause of the dark patches on the tube face. I explained that this was caused mainly by smoke. Whereupon she rapped out "I told them they were having too many cowboy films on."

I'm still wondering whether this remark was as naive as it sounded, or whether I was having my leg pulled.—A.D.B., Merthyr Tydfil (591).

No. 10

The Apprentice Engineer

AT THE BENCH

by G. L. A. MORGAN

A page of practical advice, hints and tips, short-cuts and workshop notes for the apprentice.

CONTINUING our discussion of "theory in practice", and deciding which radio formulae are most necessary for day-to-day use, we come next to the equation for determining the turns ratio of an audio output transformer.

There have been several queries about this, mainly because of some confusion between the a.c. resistance of the output valve and the anode load resistance. In transformer coupling, this latter is the effective resistance of the transformer, referred to the primary.

In other words, it is not enough to consider the windings of the transformer separately: the reflected impedance from secondary and the effect of the load all influence the calculation.

Normally, of course, this calculation does not bother us. If an audio output transformer fails in the average set we simply bung in a direct replacement—or fit a "standard" output transformer, as supplied by several factors.

Optimum Matching

However, the occasion arises when it is necessary to decide which tapping of the primary and secondary of a multi-ratio type is advisable for optimum matching. It is as well to know how to derive that information.

Theoretically, the maximum power transfer occurs when the anode load impedance is equal to the a.c. resistance of the valve.

In practice, the use of a transformer, with inevitable losses and reactances of primary, secondary and the speech coil it feeds all varying with frequency, some arbitrary value of load impedance must be determined.

For a triode it is possible to make $R_L = R_a$, where R_L is the load resistance and R_a the a.c. resistance of the valve.

Triodes

But even with a triode, this is not desirable, and efficiency is sacrificed by making R_L greater than R_a to reduce distortion. Different conditions obtain with the higher a.c. resistance of the tetrode and pentode valve, and R_L may be between a quarter and a tenth of R_a for optimum conditions.

Therefore, when checking the turns ratio before replacing an audio output transformer, remember that the resistance R in the formula refers to the optimum load impedance, not to the a.c. resistance of the valve.

The formula for such a step-down ratio is then $k = \sqrt{\frac{R}{Z}}$, k being the ratio and Z the speech coil impedance.

The difficulty that besets some readers appears to originate from the habit of some valve manufacturers of calling the slope resistance r_a, and the anode impedance R_a. So, when referring to published data, check that the figure given is the optimum load impedance of the output valve.

If this is not given, take the figure for anode resistance and divide it by ten for an approximate pentode load impedance.

As for the speech coil impedance, at the lower values it will approximate closely to the d.c. resistance of the winding, usually 3 or 5 ohms. The higher impedance, such as the 15-ohm speech coil, will read higher on the ohmeter by as much as 30 per cent.

Example

To put these remarks into practice: a radio using UL84 output valve had an open-circuited transformer. No direct replacement was available, but a multi-ratio "standard" type was to hand. It was a simple matter to drill one additional hole and fit the slightly larger replacement so that the core lay in the same plane as the original—a point to be noted, to avoid adverse effects of magnetic coupling—but the question was, which tapping do we use?

Reference to tables gave the anode impedance of the UL84 as $0{\cdot}024\text{M}\Omega$. Taking the optimum load impedance as a tenth of this, our speech coil being a 5Ω type, the turns ratio formula became,

$$k = \sqrt{\frac{2400}{5}}$$
$$= 22 \text{ approximately.}$$

The convenient 22 : 1 tapping was used. If there had not been such a close approximation, we should have taken the next highest tapping.

Before concluding this little homily it may be as well to say a few words about the practical side of output transformer replacement.

Care must be taken when removing the faulty component. The design of the receiver may include a negative feedback loop from the secondary of the transformer. If this is the case, reversal of the leads defeats the object of the feedback loop by reversing the phase.

Another point to be watched is the use of a tapped primary. This practice is nowadays quite common. The principle is to tap the h.t. feed from the rectifier to a point a little way down the primary of the output transformer.

Thus, through the lower section of the primary flows the valve's anode current, whilst in the upper section the h.t. current flows.

Magnetic Fields

The magnetic fields due to the two currents cancel out to a large extent and hum in the speech coil is reduced. The practical point is that the primary connections must be exact, and the replacement may not always have the same colour coding on the flyleads, or a similar disposition of tags.

If in doubt, measure the resistance of the primary sections and connect the higher ohmic value in the anode circuit of the output valve.

Obviously, if a direct replacement is not immediately available, the procedure must be to replace the transformer with a standard type to match valve and speech coil, as outlined above, then to fit a subsidiary filter component.

Reducing Hum

The difficulty with the latter procedure is to reduce hum. Normally, this type of circuit uses the section of the primary in series with a filter resistor to smooth the h.t., in conjunction with the normal reservoir and decoupling capacitors.

If the transformer is removed, the filter resistor will usually be inadequate, and may have to be increased, if there is sufficient voltage to allow this.

A better method is to leave the resistor in and replace the primary section with a small choke and additional capacitor, taking care with position of the choke. But by far the best method, always, is exact replacement.

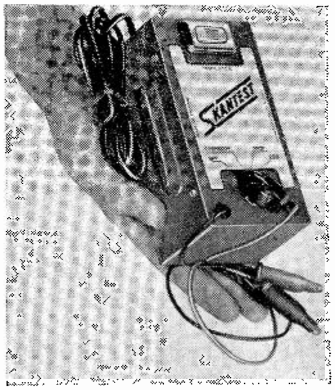
In preparing these articles, it is the author's aim to discuss matters of every-day practical interest to apprentice engineers. Suggestions for subjects suitable for coverage in this series will always be welcome and will, where practicable, be dealt with in future articles.

Service Engineer special laboratory test

DIRECT TV REPLACEMENTS

SKANTEST Shorted Turns Tester

By Gordon J. King, Assoc. Brit. I.R.E.



The *Skantest* shorted turns tester is a compact instrument, as this illustration shows.

DEFIANT of immediate diagnosis is the fault of short-circuit turns in an inductor or transformer. Such a fault can give rise to a host of symptoms, some of which are not apparently attributable to the actual cause, and can thus involve the radio and TV technician in considerable testing of circuits and components until all that is left is the suspect inductor or transformer.

Tests on these components are invariably left until last because inductance measuring instruments are rarely a feature of the radio and TV workshop. Even if they are, one first requires to know the correct inductance value of a suspect component before such a test affords assistance, and this is almost always lacking in servicing data.

In most cases, checking the suspect by direct substitution is the order of the day. This is all right where a substitute is at hand and there is not a lot of difficulty in the replacing, but is not representative of good economics where a special order is called for and it is later found that the original has to be re-installed because the symptoms remain with the new part.

The inductors and transformers associated with the line output stages of TV receivers are the worst offenders. Shorting turns are not easily revealed by a simple resistance check. Even if the exact resistance value of any winding is known, which is unlikely because of the remarkable wide spread of resistance over specific windings of different specimens of the same type transformer or inductor, one or two short-circuiting turns cannot be recorded on the average servicing ohmeter. At best a continuity check is possible.

One shorting turn will kill the effect of transformation and inductance. This can be proved on any TV set simply by winding a single turn of p.v.c. covered wired around the core of the line output transformer and then, when the set is working normally, short circuit the turn. The line amplifier will cease to operate properly, but don't prolong this experiment for danger of really killing the transformer!

RINGING EFFECT

An inductor is like a piano string—it "rings" when plucked. It rings at a frequency governed by its length and tension. An inductor rings when it is suddenly disturbed by a pulse of current. It rings at a frequency governed by the inductance and self-capacitance of the winding. It is, in fact, a tuned circuit.

If an inductor is subjected to a current pulse in range of its resonant frequency a damped oscillation will occur across the winding—we all know why this happens, of course. We can see this damped oscillation on the screen of a c.r. tube by connecting the inductor between the "Y" amplifier and earth terminals of an oscilloscope and applying to the "Y" terminal a pulse of suitable frequency from the 'scope's timebase.

This can often be obtained from the "sync" terminal. The trace will form a typical damped oscillation when the "Y" amplifier gain control has been suitably adjusted.

If a winding on a line output transformer is so connected, short-circuiting one of the other windings, such as the heater winding for the e.h.t. rectifier valve, will cause the amplitude of the waveform to diminish, or even collapse completely.

A short-circuit turn applied around the transformer core, as described previously, will reduce the waveform amplitude. In fact, the way that the amplitude of the waveform is affected is governed by the extent of the short-circuit and on the type of transformer. Unfortunately, this sort of test is not all revealing because even with a transformer having a shorting turn a reasonable ring will be displayed if plenty of "Y" gain is applied.

After exhaustive tests with a diversity of transformers, and after keeping records of the results—trace amplitude; type of transformer; "Y" gain, etc.—one may be able to give a fair diagnosis of the condition of a transformer by this means. For a rapid test in the field, however, an oscilloscope is not the best of instruments to adopt, even if it gave conclusive evidence.

THE SKANTEST

Following along the principle of "rings", Direct TV Replacements (the people with the "Ipsophone"), of 138, Lewisham Way, New Cross, London, S.E.14, have developed a truly remarkable instrument for revealing shorting turns without even removing the component from the set.

This instrument—measuring only $5\frac{1}{2} \times 3 \times 2\frac{1}{4}$ in. (almost pocket size)—is called *Skantest*. This £7 10s. worth of functional instrument uses instead of a c.r. tube a neon bulb for goodness indication. There is no doubt about this test, the bulb is either alight or not alight.

The instrument is mains operated, 200–250 volts 50 c/s, fully isolated from the mains by a transformer, and serves also as a continuity tester. The front of the case contains a neon bulb under a protective plastic cover, a four-position control and two sockets to take the test leads supplied. The switch gives positions of "off", "continuity", "high" and "low", the latter two being for shorting-turn tests.

The *Skantest* uses an oscillatory valve circuit which, being energised by alternating current, produces a very peaky pulsed output across the test terminals. If the winding to which this output is applied has a shorting turn, a very heavy damping effect occurs and the neon indicator, being a very low current device, ceases to glow.

With the *Skantest* leads disconnected the neon glow is quite distinct, and this is, in fact, an indication that the instrument is switched on and connected to the mains supply. If the switch is set to the "continuity" position, and the test leads are shorted together or applied across a winding, again the neon will be extinguished, indicating winding continuity.

When the instrument is used for shorting-turn tests, the switch is either set to "high" or "low", depending on the type of core employed in the transformer. With an iron core the winding will usually be tested in the "low" position, while a ferox type core will demand the "high" position for the most definite indication. The test leads are connected across the primary winding or, in the case of an auto-transformer, across the equivalent winding. This is followed by a test across the overwind, which gives a very sensitive indication of shorting turns, indeed.

On a good transformer the neon will remain alight, and possible glow slightly brighter than when the transformer is disconnected from the instrument. In most cases, there is also a distinct audio note emitted from the transformer under test, as is heard from a line output transformer operating in a TV set, but at a different frequency.

The sensitivity of the instrument is incredible. With a good transformer connected, a very loosely coupled shorting turn artificially applied will cause the neon to go out. A short across the e.h.t. rectifier heater winding will give the same effect, yet when the e.h.t. rectifier heater is connected there is no indication of a short and the neon remains alight—all a matter of correct loading, but proves how sensitive the instrument is in distinguishing between the two conditions—such is not possible on an oscilloscope.

ON TEST

The instrument was tested on several transformers and inductors and provided information which was almost 100 per cent conclusive, even without having good and bad transformers of the same type to compare and without compiled information on previous tests.

When a transformer or inductor is tested *in situ*, it is necessary to isolate one or two of the associated circuits to avoid conflicting indications, but this takes next to no time, and practice reveals which windings are best disconnected. It is not necessary, however, to remove the e.h.t. rectifier valve, which is a good point!

Width, linearity and scanning coils can be checked in the same way. With line scanning coils, shorting turns have the effect of reducing the neon brightness by about 20 per cent of its full brightness. If a shorting turn linearity coil is employed about the scanning coils, then this must be removed before a correct indication can be secured.

Very interesting effects were found when testing width and linearity coils. The particular types tested employed a ferrite rod core and the coils were tested on the "low" position. With no core inserted in the winding, the neon gave the same results as if there had been shorting turns. If there were no shorting turns, the indicator was found to light when the core was fully inserted into the winding; in fact, the neon could be turned on or off by very slight movement of the core.

Here, then, is an instrument which is a "must" for all service departments and for field engineers. Indeed, it would also appear to have a place in manufacturers test departments, in laboratories, and should prove useful to all engaged in electronics.

Direct TV Replacements, and the designer of the *Skantest*, deserve the highest awards for providing such a useful instrument. One can be fully assured that the instrument has been very well tested, since Direct TV Replacements stock nearly every line output transformer used in British TV sets—what better foundation is there for producing an instrument of this kind?

Electrostatic Speakers

—continued

amplifier working into a moving coil system. In order to do full justice to the dynamic range of the speaker it is recommended that amplifiers with under 15 watts output not be used.

*

Will any amplifier drive the speaker providing it will deliver sufficient power?

Yes, providing it measures up to certain other requirements. Remember that the load is not inductive as with a loudspeaker of the moving coil type, but capacitative. In most cases, the negative feedback loop of an amplifier is taken from the speaker secondary of the output transformer, therefore the load becomes part of the loop. While completely stable with an inductive load, a capacitative load could bring about phase shifts which may render the amplifier unstable.

The amplifier must, then, be completely stable irrespective of the nature of the load. The nominal impedance of the output of the amplifier should be 15Ω, but the source impedance should not be greater than 6Ω over the whole range of frequencies the speaker will handle. Furthermore the amplifier should not be capable of developing more than 35 volts output over a 30Ω resistor, at any peak. This is equivalent to a power output exceeding 30 watts.

While most high quality amplifiers will fulfil these conditions a check should be made that the amplifier it is proposed to use with the speaker is up to standard in these respects otherwise inferior results would be obtained that would not do justice to the speaker.

TESTS FROM DOVER

The new channel 10 ITA station at Dover is still radiating a lengthy series of special test transmissions to establish that the signal from the main directional aerial will not cause detrimental interference in the service areas of certain French stations. The need for these tests arises out of international agreements.

For most London channel 9 viewers these tests will produce no detrimental effects but within the service area to be served by the new Dover station many favourably situated viewers receive acceptable pictures from channel 9 although well beyond the designated service area. Some of these viewers are now getting severe interference due to channel 10 breakthrough.

It is not feasible to stop these tests during the evening for several reasons; for instance propagation conditions improve at night-time and any interference on the Continent will be at its worst during this period. Also Continental stations rarely start transmitting before the evening.

These tests will stop as soon as possible and in the meantime the ITA express their regrets at any inconvenience being caused.

New Jason Wobbulator

The range of Jason test equipment, which includes a general purpose oscilloscope, valve voltmeter, audio generator and crystal calibrator, has been extended to introduce the W11 wobbulator. Three ranges are provided, 0–40 Mc/s, 35–85 Mc/s and 0–2 Mc/s. Sweep width is adjustable to 10 Mc/s on range 1 and 100 kc/s on range 3. Sweep frequency recommended is 50 c/s, the return trace being blanked to provide a reference base line.

The f.m. oscillator is operated at fixed frequency (150 Mc/s) and is beaten with the output of a variable frequency oscillator. Frequency modulation of the oscillator is achieved with one of the new variable capacity diodes.

This instrument, which is housed in a neat case to match other Jason equipment, is available as a complete unit at 19 gns. or in kit form at £14 19s.

Music While You Scream

On the American market soon—equipment for dentists which feeds music or random noise to the patient via headphones, the sound level being controlled by the victim. The idea is to block out pain sensation during drilling and in 2,000 test cases 90 per cent said the pain was killed. If the music supplied is typical of some heard today, however, perhaps patients would settle for the pain.

For the Diary

January 18–22

The Physical Society's Exhibition will be held on the above dates at the Horticultural Society's Halls, Westminster, London, S.W.1.

On the same dates, Airmec Ltd., hold their annual exhibition at Napier Hall, Hide Place, Vincent Square, London, S.W.1, where they will show the full range of Airmec equipment, including several new items. Admission is by ticket only and these are obtainable free on request to Airmec Ltd., High Wycombe, Bucks.

April 21–24

The Fifth London International Audio Fair will be held on the above dates at the Hotel Russell, Russell Square, London, W.C.1.

SERVICE WITH A GRIN by H. W. HELLYER

Half-century Up

FOUR years ago this column greeted the New Year with a parade of resolutions. It was a younger column then, having just come up for the third time, and could resolve with gusto.

This column has now chalked up the half-century, and is thinking of asking the Editor for a raise. (*Keep thinking—Ed.*) But that is the only resolution your scribe is likely to be trapped into this year. Having resolved in haste, I've been able to relent at leisure.

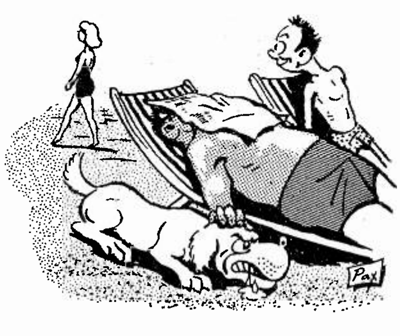
I mentioned, in that flush of '56 enthusiasm, some of the resolutions that we servicemen would like to see others make. The BBC, for instance. . . . I adjured Auntie to transmit a continuous test signal.

Hopeless—of course. There is still that mid-day gap, when mad dogs, Englishmen, and service engineers are expected to go out and sun themselves, leaving the set alone. Unfortunately, the ITA are more generous, and one is tempted to continue working on the set. The result is that a minor fault is cleared, the receiver adjusted on Band III and then left.

Naturally, life being what it is, the serviceman seldom gets away with *that*. When the customer switches on, hours later, wanting to gloat over Patricia Driscoll or brush up diction with Bill and Ben, the Band I signal hits the input like a bomb. The hapless mechanic has to recall and re-adjust, wishing he had gone without his lunch.

It would appear that those much-maligned gentlemen the set designers have gone without many a lunch. One of the resolutions I (misguidedly) made was on their behalf. On the whole, this latest batch of models shows a commendable "getatability".

But lest it be thought that this column has got sere and yellow in middle-age, let me mention a few of the latter day plaints that servicemen have agin the designer.



When mad dogs, Englishmen and service engineers go out and sun themselves. (No prize for guessing which is the service engineer.)

First—the "flimsy-whimsy". Printed circuit modules are a gift to the chap who wants to slap together a tinselled edition of a television set. So often they are scattered around the inside of a cabinet, held to a skeleton chassis former by a single, inadequate screw, or, anchored more firmly into place with a number of cross-headed p.k.'s that were inserted with a power tool and are just out of reach of a normal Philips screwdriver.

Like the housemaid's cup handles.

Chief feature of this flimsy style is the plastic knob more decorative than durable. Some, I fear, are one-shot wonders . . . they were never intended to be removed. Those that are, do—too easily and too often. Like the housemaid's cup-handles, they come off in the customers' hands. And no matter how often we tighten the grub-screws of these abominable concessions to concinnity, we may be sure that they will work themselves loose as soon as the customer switches to his favourite programme.

Then, of course, we have the additional problem of the impatient user who "tightens" the grub-screw himself. As the only means at his disposal are a kitchen knife and tenacity the outcome is often as cracked as Joe's voice, answering the phone: "What, *again*?"

Always with us, an inevitable corollary to progress, is the set that uses the latest—but Latest!—innovation. This means that for the first six months after the model is released, replacements are unobtainable. Especially replacements of the newer types of valve.

Even an illustrated lecture failed to convince him

With the inexorable certainty of a mischievous fate, it will always be those odd valves out that choose to develop the first faults.

I sometimes wonder why these advanced types ever come on to the market. Granted that they represent a measure of laboratory progress. But manufacturers can seldom be trusted to use them in circuits capable of doing them justice. The "front-end" frame grid bottle springs to mind. How often is it necessary, except in fringe areas? Yet you can bet that the next batch of new-look models will boast the PCC89 and PCF86 as well as the EF183—and to heck with the signal handling capacity, so long as the figure of merit looks good on paper.

And be sure it will look good on paper, to judge by some of the technical literature that comes with or after the set. Much of this has to be read to be believed.* Some of it appears to be written in what Ivor Brown so aptly calls "the barnacular". The rest is unashamed advertising.

Which brings us to the customer—the bloke on the other end of the big guns. I suggested a couple of resolutions for that worthy—principally that he shall learn to understand the operation of his set. Recent experiences indicate that my wish was in vain.

Only last week I had the classic recall. . . . After replacing a 30L1 that had gone heater/cathode short-circuit, then adjusting the oscillator slugs to balance Band I and Band III roughly central in the rotation of the fine tuner.

"This is all haywire," the customer grumbled. "Before you came I used to get BBC anticlockwise and ITV clockwise." Even an illustrated lecture on finetuner functions failed to convince him. Having babbled, I dropped down to my nest, leaving him the impression that I had larked about with his set! He paid his bill grudgingly.

I took the precaution, on that previous occasion, of cancelling my own resolutions. As 1960 reels in I am spared even that evasive action, for my space (like my hope of a raise), is all gone.

Roll on '61.

* *I mention this because it is my belief that few service men bother to read it!*

Published by British Radio and Television (Publishers) Ltd., 46 Chancery Lane, London, W.C.2, and Printed by Bournehall Press Ltd., Bushey, Watford

STOP!

Let's direct you to all the

TELERECTION DEPOTS

you are never far from one!

LONDON. *Mr. J. R. Dines*
Lennox House, Norfolk Street, Strand, W.C.2. TEMple Bar 5911

ASHFORD (KENT). *Mr. J. R. Dines*
The Street, Kennington, Ashford, Kent. Kennington 242

NORWICH. *Mr. J. B. Collins*
121-123 Oak Street, Norwich. Norwich 27031

NOTTINGHAM. *Mr. R. Newby (Asst. Home Sales Manager)*
36-38 Carrington Street (rear), Nottingham. Nottingham 50780

SELBY. *Mr. R. Newby*
Robert Street (off Finkle Street), Selby. Selby 946

SWANSEA. *Mr. P. Finch*
Pipe House Wharf, Swansea. Swansea 52581

CHELTENHAM. *Mr. P. Finch*
Victoria Street, Cheltenham. Cheltenham 55960

MIDDLEWICH. *Mr. J. O'Rourke*
Lower Street, Middlewich, Cheshire. Middlewich 2535

MONTROSE. *Mr. A. Moir*
64 Bridge Street, Montrose, Scotland. Montrose 631

COMBER. *Mr. F. Needham*
Bridge Street, Comber, N. Ireland. Comber 372

TELERECTION

Makers of Fine Aerials

Mr. R. P. Longhurst (Home Sales Manager)
ANTENNA WORKS, LYNCH LANE, WEYMOUTH, DORSET Tel.: Weymouth 2140