MARCH 1960

RADIO Retailing

SERVICE ENGINEER

Radio, Television and Audio Servicing

GOOD NEWS FOR SERVICE ENGINEERS

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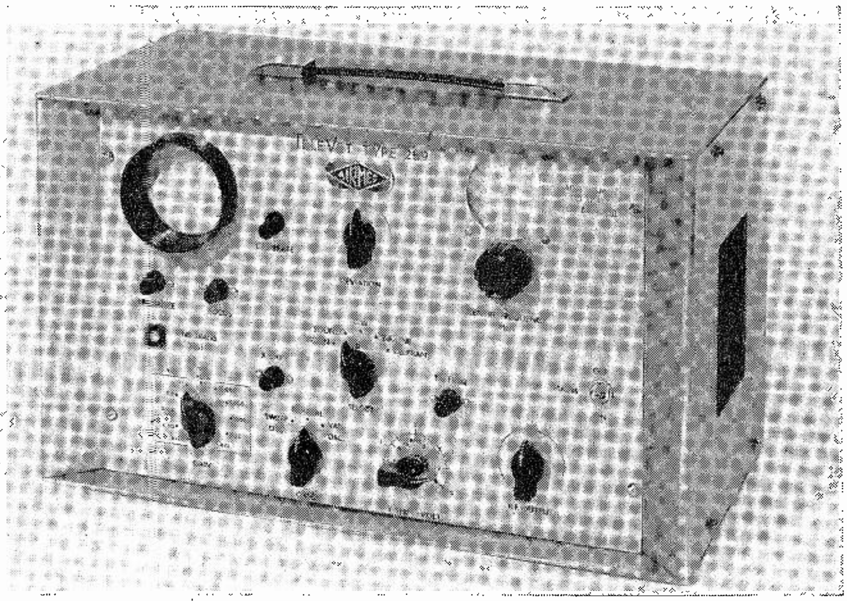

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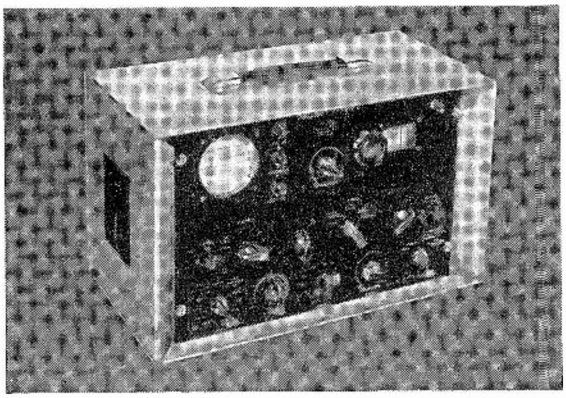

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SERVICE ENGINEER

Vol 2. No. 10. March, 1960

Edited by W. Norman Stevens

Issued as a special supplement with "Radio Retailing"

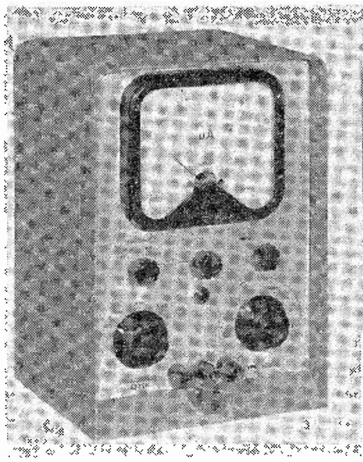
In this issue:

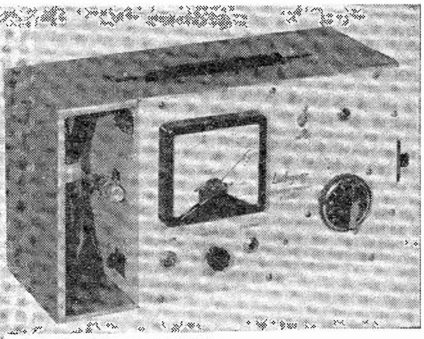
Radiospares Addition

Radiospares have introduced two transistor transformers, type T/T1 driver transformer suitable for matching an OC71 into two OC72's in Class B push-pull (price 7s. 6d.) and type T/T2 output transformer suitable for matching two OC72's into a 3-speech coil (price 6s. 6d.). The transformers feature clamp construction with twist type mounting tags which may be soldered into printed circuits. Windings are wax impregnated with connections by flexible leads.

Steadfast Screwdriver

A new ratchet screwdriver is being marketed by J. Stead & Co which has some unusual features. The handle is shaped in a pistol grip fashion thereby giving greater efficiency for turning power and speed, and also making it a very comfortable tool to handle. Made in transluscent amber plastic, the handle is insulated and virtually unbreakable. The blade is chromium-plated and 6 in. long; it has a robust and positive ratchet action. The price of this new *Steadfast* screwdriver, obtainable from most tool dealers and ironmongers, is 10s. 6d.





NEW FROM LABGEAR

Signal Strength Meter
Transistor Tester

New from Labgear is a signal strength meter covering Bands I, II and III and featuring a 4 in. meter on which the signal intensity is directly calibrated. A 20dB attenuator pad is also supplied, which (when fitted) multiplies the scale reading by 10 times, so giving a coverage of from 10μV to 10mV.

The standard TV tuner employed in the instrument obviates the need of knowing the frequency of any particular TV or f.m. channel and makes setting up a very simple matter. The instrument, Model E5107/A is priced at £35 net trade.

Also newly introduced by Labgear is a transistor tester. It provides for the measurement of the d.c. characteristics, large signal current gain, collector leakage current and collector turnover voltage. The tester is primarily intended for use in TV and radio service departments but it will also provide a useful laboratory facility, particularly for matching pairs of transistors for push-pull stages and d.c. differential amplifiers and measurement of current gain fall-off. The instrument retails at 25 gns.

COSSOR INSTRUMENTS

Three New Models

From Cossor Instruments comes three pieces of equipment of interest to the service department. Model 1450 is an inexpensive general-purpose signal generator, selling at £18 10s. 0d. It covers from 150 kc/s to 390 Mc/s in seven ranges with a calibration accuracy of ± 1 per cent (or ± 2 per cent on the ranges above 33 Mc/s). The signal is available unmodulated, or modulated internally or externally, depth of modulation being controllable up to 50 per cent when using the internal oscillator. With external modulation, the oscillator becomes an amplifier and permits 30 per cent modulation for an input of only 3V r.m.s. to the audio In-Out terminals. The internal 1 kc/s modulation signal is available from the audio In-Out terminals and is controlled, up to a maximum of 10V r.m.s., by the a.f. mod-output potentiometer.

Model 1091 is double beam oscilloscope based on the Model 1071K but having calibrated timebase speeds extending to very low sweep velocities and a more robust casing. For vertical deflection there are two identical amplifiers with a pulse-corrected response from d.c. to 3 Mc/s and compensated attenuators giving sensitivity ranges from 50V/cm to 0·5V/cm. Provision is made for checking and adjusting sensitivity while in use so that voltage measurements can be made with fair accuracy.

A preamplifier in the Y1 channel increases sensitivity to a maximum of 5mV/cm, with a frequency response of 5 c/s to 500 kc/s. The time base is adjustable for either triggered or repetitive operation with calibrated sweep speeds from 0·2μS/cm to 5S/cm. Continuously variable uncalibrated ranges with repetition rates from about 0·25 c/s to 200 kc/s are also available.

The X amplifier gives, on the calibrated ranges, x1 or x5 expansion, while on the uncalibrated ranges expansion is continuously variable over a greater range. Provision is made for feeding external sweep signals and the sensitivity is adjustable from 0·25V/cm to 3V/cm. Intensity modulation may be applied via a time constant of 20mS to the c.r.t. grid and flyback is blacked out on all ranges. The c.r.t. is 4 in. diameter. Price, £80.

The third newcomer is Model 1446, an LCR bridge covering 10μH to 10H in six ranges, 10pF to 100μF in seven ranges and 1Ω to 10MΩ in seven ranges, indication being by means of a 1 in. c.r.t. Inductance and capacitance are measured at 2 kc/s and resistance at d.c. For the main balance, a large scale is engraved on the escutcheon; the ranges are conveniently arranged in decades. Price is £50.

Service Viewpoint

IN January we bemoaned the "sad fact" that a large majority of practising servicemen do not consider it worth while to "mug up" basic theory to examination standard.

Since then, important alterations have been made in the plans of the Radio Trades Examination Board. Instead of the separate Radio and Television Servicing Certificate, there will be a combined examination with a comprehensive coverage.

This may tempt a few more servicemen to take the examination. Many engineers would like to go straight ahead with the final—considering themselves capable (not always justifiably!)—and dispensing with the necessity for taking a minor exam and a twelve-month "probation period".

But the trend is not toward making things easier for the old-stager. The new examinations will be the climax of a proposed five-year course of study, with an intermediate servicing exam at the end of three years.

Just how this will affect the "private study" entrant is not yet known. Certainly, the strictures we made in January will still apply. Many servicemen are reluctant to undertake a course of study.

Some think the preliminary stages beneath them. Several have written to tell us of their disillusionment with postal courses, for example. Commencing with high hopes, they get bogged down with baby-stuff and drop the whole idea. It is not likely that such faint hearts will give the RTEB the benefit of their custom.

The Examination Bogey

The 1959 RTEB Servicing Examinations showed one thing clearly. It is not the practical test over which the average chap stumbles, but the basic radio theory. He may think he knows it, and is shocked to discover that he cannot put his "knowledge" into words. A course of training is the best way of preparing for any exam.

There is another aspect of this "learning as you go along" fallacy that is sometimes overlooked. Modern equipment is pretty foolproof. Many faults are capable of cure by rough-shod methods. No great theoretical diagnosis is required. For example, how many servicemen have really had to *think* about the fundamentals of f.m. in their daily work? Yet they repair a fair number of v.h.f. receivers.

Transistors are another case in point. Having once mastered the fundamental differences in practical circuitry, the repairman can bumble along by "rule-of-thumb" with surprising success. You don't need a science degree to tell when a battery is flat.

But the serviceman who is worth his salt will not be content to bumble along. He has an inquiring mind. Let us hope that the RTEB will consider not only the up-and-coming youngsters when they formulate their rules. Let's hope, indeed, that the original purpose of instigating a Servicing Examination will not be forgotten. If the practical man can be tempted to enter the examination room, he will possibly consider the advantage of "mugging-up" his theory. If he is deterred by the prospect of a protracted course of study, the trade is ultimately the loser.

The present Certificates are held in high esteem. Many employers look askance at technical qualifications. "We want men who can do the work," they say. If the RTEB accolade becomes more "academic" it will lose something in the final assessment. We are all for encouraging the practical man—provided he will mug up his theory!

TRADE TOPICS *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.

STILL LIFE

WITH reference to the letter (November) concerning the annoying alternating of test card and still picture, I wish to endorse all that E. Clarke said. Further, I would point out that I have never met an engineer yet who disagreed with Mr. Clarke's views.

It would be interesting to know if the people responsible realise the inconvenience caused to engineers over this matter. From the salesman's point of view it has been my experience that the customer always prefers to return to see the normal programmes, being unsatisfied with the still picture. —**D. McLeod,** *Lochgilphead.*

THOSE GOOD OLD DAYS

AS an engineer engaged in all kinds of service work, I feel bound to answer Mr. Williams (January) and say that although I am only 31, I have seen a lot of the "good old days" and it has been my lot to have to extend my knowledge to embrace all classes of work. One thing I would like to know is: is there a future for the chap who likes to stick to one line?

I would like to know whether the percentage of radio and TV engineers who have to supervise and help in the erection of aerials in addition to their normal work is very high. I realise that this applies to the small shops such as the one in which I work, where the workshop staff usually consists of one or two engineers and two apprentices. —**W. Smith,** *Warminster.*

UNKIND TO AUTHOR?

YOUR book review on page 106 (January) is rather hard on the do-it-yourselfer. Perhaps the reviewer does not remember the days when he too used to "dabble in radio". Did he learn his trade at an accredited college or in the hard school of experience?

Books like *TV Repair and Maintenance*, read intelligently, can help the would-be dabbler from burning his fingers. Let us not begrudge him a little technical information. After all, it is his own set he is playing with!—**J. Robertson,** *Manchester.*

(**H.W.H., replies:** *The point is appreciated. I do not despise the do-it-yourselfer, but deprecate the type of book that could lead him into dabbling in dangerous equipment, with inadequate knowledge to guide him. Unfortunately, the author cannot force his reader to take in every word and some of the important strictures are lost on the dabbler who hastily thumbs the pages, looking only for what he expects to see. Too late when he has ruined the set, or his health, to read the chapter again.*

Finally, it is not always his own set he is playing with! This is amply evidenced by the number of times engineers get called in to repair a receiver that has been scotched by the "fellow down the road").

STORAGE CABINETS FOR THE WORKSHOP

A range of compact cabinets suitable for storing small tools or components is being marketed by General Trade Equipment of 82–90 Seymour Place, London, W.1.

Constructed throughout from $\frac{5}{8}$ in. solid pine, the drawers measure $8 \times 3\frac{1}{4} \times 1\frac{1}{8}$ in. and are made from beech with plywood bases and fitted with black plastic handles. Four sizes are available; the smallest, with 18 drawers, measures overall $14 \times 9 \times 9$ in. and costs £3 1s. 6d. (carriage 5s.); the largest, with 40 drawers, measures overall $23 \times 12 \times 9$ in. and costs £9 19s. 6d. (carriage 7s.).

Also available is the *Wallmaster* cabinet which can be quickly and easily fixed to the wall if desired. Each drawer is plated in non-corrosive, rust-proof Zyntax and the frame is finished in blue hammered stove enamel. It has 12 drawers 1 in. deep, 18 drawers $\frac{3}{4}$ in. deep and 20 drawers $\frac{1}{2}$ in. deep. All measure $6\frac{9}{16}$ in. long and 3 in. wide. Ideal for storing a variety of small objects, it costs 10 guineas.

The 40-drawer version of the compact workshop holdall described above.

REPAIRING INTERMITTENTS

PART TWO

FOR WASTE OF TIME AND FRUSTRATION THE INTERMITTENT FAULT REIGNS SUPREME. IN THIS TWO-PART ARTICLE, THE AUTHOR DISCUSSES THE TYPES AND CAUSES OF INTERMITTENTS AND DESCRIBES WAYS OF CUTTING DOWN TIME SPENT IN SEARCHING FOR THESE ELUSIVE FAULTS

by C. R. TAYLOR

NOT all intermittent faults that take time to appear are produced by heat. Many are, however, and can be stimulated by raising the temperature as discussed in Part 1. Some components partially breakdown due to a voltage across them, without any heating effect resulting from current flow caused by this voltage. Many capacitors, for example, break down when connected in a circuit where d.c. only is present.

Often breakdown of the component will not occur until a certain voltage is exceeded and sometimes only after it has been applied for a certain period. To accelerate the appearance of the fault the h.t. rail voltage may be increased.

Mains Adjustment

The mains adjustment on most receivers consists of two parts, one tapping affecting the heater circuit and one the h.t. In such cases, the h.t. adjustment can be taken down to about twenty volts lower on the mains tap, which will produce a correspondingly higher h.t. voltage.

Where the heater and h.t. adjustments are not independent, such as on a transformer fed a.c. receiver, the tapping can reduced in the same way, as the heaters would be over-run by less than 10 per cent and should not do any harm for short periods. Where the receiver is already on the lowest tap, then an auto transformer should be used to increase the voltage.

As with normal faults, taking voltage measurements can lead to the localisation and diagnosis of a great many intermittent faults. In fact the intermittent has an advantage in that voltages can be checked with both the fault on and off, whereas with the permanent fault there is no direct comparison.

True, most service manuals give voltage readings on the valve bases but these vary by a few per cent from one receiver to another and with the use of different meters.

Comparative Readings

While the fault is off, then, it is a good thing to take and write down a set of voltage readings on all the electrodes of the suspected stages. When, as a result of the methods described above, the fault comes on, the voltages can be again taken. Speed is important in doing this as faults often stay on only for brief periods before clearing again.

Therefore do not stop to interpret any differences which may come to light. Take as many readings as you can, writing them down alongside the previous set. Later is the time to compare and consider possible causes for any differences.

It sometimes happens that the connection of the meter test prod causes a surge which clears the fault. For this reason it is wise to get the low potential readings first, such as cathode and grid voltages, as these are less likely to cause a heavy surge as the high potential electrodes.

The screen grid voltages can be taken next as these are probably decoupled or at h.t. rail potential, and finally the anodes, the most likely places to set up a surge. When taking the readings, try to place the probe quickly and firmly on the appropriate tag, a light or rubbing contact can set up a whole train of spiky waveforms which would very probably cause the fault to clear.

Effect of Controls

Another quick test which should be tried when the fault appears, is the effect of various controls on the fault. These will, of course, be appropriate to the fault. If, for example, it is in the time bases, then the hold, amplitude and linearity controls can be operated. If it is a vision fault, sensitivity, contrast and interference limiter controls can be tried.

It may be found that one control has little or no effect, indicating that it or its associated circuitry is defective, or it may be found that the effect is different to what would normally be expected. Again, try the effect of all the appropriate controls before interpreting the effect of any one, otherwise the fault may clear before the test is finished.

Try to collect as much relevant and useful data as possible while the fault is on as it may not stay for very long.

It is as well to have on hand a few capacitors of the same values as found in the suspected part of the circuit. Then, when the fault occurs the suspects can be quickly bridged to check for possible open circuit faults. If the engineer has to go and look for these when the fault comes on, he will be wasting valuable time and may find the set normal when he returns.

To facilitate the bridging of such components, in view of the difficulty sometimes experienced in getting the two wires to make good contact on the right places without slipping or shorting to an adjacent tag and at the same time watching for the effect on the picture, it is a good idea to temporarily solder one wire of the test components in place before hand. Then when the fault comes on there will be only one wire to contend with.

Although this will not conclusively prove the goodness of the capacitor, as it may have a leak or short circuit, it will put one possibility out of the way and may reveal the fault.

Fault Simulation

Sometimes an intermittent will come on for just a few seconds and then clear and will not appear again for hours or even days. All attempts to encourage it to show itself or stay longer are of no avail. If it has been witnessed in the workshop, and the effect of appropriate controls noted, another method of fault finding can be tried. This is fault simulation. This means the doctoring, temporarily, of suspected components in order to produce the identical symptoms.

If a capacitor is suspected of going open circuit, disconnect it. If the effect is the same, it is a possible culprit, but if the effect is nothing like the fault then it will prove that the suspicion was incorrect.

The capacitor should not be actually removed, especially if it is in an r.f. or i.f. stage, as the physical presence may have an effect on the symptoms by acting as a capacitance from one of the points it is connected to chassis.

If faulty it will not be known which end of the capacitor is open, and which is still connected to its plates. Therefore to make sure when employing this fault simulation method it is as well to disconnect one wire at a time, leaving the other connected, and observe the effect in both cases, otherwise the result may be misleading.

Take as an example a case of intermittent instability. The i.f. stage decoupling capacitors are suspected and they are disconnected in turn in each stage. In one case, perhaps, instability ensued but of a different frequency and severity than the observed fault. In the next case, loss of gain was the only symptom due to negative rather than positive feedback taking place.

Sometimes instability in the sound i.f's. can give symptoms similar to vision instability owing to feedback to the common i.f. where used. So next the sound i.f. decoupling capacitors are disconnected, but in this case only the sound is affected with a slight patterning on vision.

The i.f. bypass capacitors at the vision detector are now tried and it is found that exactly the same symptoms are produced. A replacement is made, and a soak test confirms that the fault has been cleared.

Which One?

If it is found, as it sometimes is, that two or even three components produce symptoms identical to the fault, it is advisable to replace them all, providing they are not expensive items.

With ordinary paper, mica or small electrolytic capacitors it would actually be cheaper to replace several suspects than to spend time (probably several hours) trying to isolate the actual culprit.

True, it gives more satisfaction to the engineer to feel that he has succeeded in tracing the offender and to gloat over it lying on the bench afterwards but speed and economics dictate otherwise!

Not all faulty capacitors go open circuit, however, as all engineers will be only too well aware. Some go partially o/c, while others develop leaks ranging from several megohms to a dead short. While this limits the usefulness of this method, with a little care and forethought a rough simulation can be made.

The partial open circuit can be simulated by substitution with a capacitor of lower value. Usually a capacitor with a partial open circuit loses the greater part of its capacitance so a much lower value would be needed to give a near effect of the fault. A tenth of the original value is a good one to try.

A leaky capacitor can be faked by connecting a resistor across it. About 1 megohm should be sufficient to approximate the effect in most cases, although the actual resistance of a leaky capacitor can vary over a wide range.

A short circuit capacitor can be simulated in the obvious way, but when doing this care must be taken that damage to other components will not result by shorting it out. The circuit diagram should be first consulted to see if a heavy h.t. current would flow, as in the case of a screen decoupler. If h.t. is not involved or if there is series resistance in the particular circuit sufficient to limit the current, the short circuit can be simulated.

If a s/c capacitor is suspected and is found in an h.t. circuit, it would be better to examine feed resistors for signs of stress or discolouration. In fact, when looking for intermittents it is always a good idea to carefully scrutinize all carbon resistors in the appropriate circuit for such tell-tale signs. *It can lead to a rapid diagnosis and cure without even seeing the fault condition.*

Using Theory

It would take quite a while to simulate an open circuit, partial open circuit, leaky or short circuit on every capacitor in the affected receiver section. In conjunction with the circuit diagram it should be worked out in theory what condition existing in which capacitors would be likely to give the fault symptoms. If after simulating these, the symptoms are not reproduced, then other likely capacitors can be tried.

The same principle can be applied to resistors by disconnecting to simulate open circuit, bridging with another to simulate one gone "low" and connecting another in series to give the effect of one gone "high". *Resistors normally go low when they have become overheated, so this possibility will be remote unless the familiar signs of overheating are present.*

The Oscilloscope

Intermittent faults can often be localised by the use of the 'scope, when they last only for a short time. The 'scope can be connected to a strategic point in the circuit and left running. The waveform and amplitude can be carefully noted, and when the fault comes on a comparison of the trace will enable deductions to be drawn.

Thus with a timebase fault the 'scope could be connected to the output of the generator and if there was no change in waveform, the fault would be confined to the output stage. Where a double beam scope is available, two points can be monitored at the same time thus giving a greater degree of isolation to the fault.

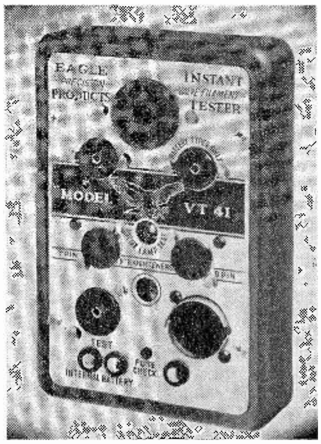
The snag with using a 'scope for this purpose, is that it will be tied up for what might be a considerable period, and would be unavailable for other servicing, few service departments having two such instruments. However, if its use is not likely to be needed for a time, it can be profitably used in tracing the intermittent.

The finding of intermittent faults is, and probably always will be, a mixture of experience, theory, guesswork and luck. No hard and fast rules can be laid down for their investigation. By using systematic methods, however, as we have suggested, plus a deal of good judgement, it will be possible to take much of the headache out of tracing intermittents.

Valve Filament Tester

Eagle Products, (32A Coptic Street, London, W.C.1.) have recently introduced their model VT41 multipurpose valve filament tester which has been designed to give instant tests to all current valves, including mains and battery types, fuses, pilot bulbs and circuit continuity. Also incorporated are B9 and B7 valve pin straighteners, together with provision for testing the internal batteries. Each component is instantly shown "good" or "faulty" on a panel indicator.

The VT41 is housed in a grey hammer case with a gold front panel printed in black. It is pocket size, measuring only $5\frac{1}{2} \times 3\frac{3}{4} \times 1$ in. and is supplied complete with batteries and instructions at a price of 30s. 0d.



NEW SHOWROOM FOR AIRMEC

Airmec have opened a new showroom at 11 Union House, Union Drive, Sutton Coldfield. The comprehensive stock of equipment will be in the charge of the company's Midlands technical representative, Mr. D. T. Wilson. Requests for demonstrations will be welcomed and should be addressed to head office at High Wycombe, Bucks.

TV PREMIUM

In order to encourage the presentation of original papers on various aspects of television, Mullard Ltd. are offering the Television Society a new yearly premium of £20. This will be awarded by the Council of the Society to the author of the best paper submitted during the year and subsequently published in their journal.

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.

Pye C17

Poor on I.T.A.

The reported fault on this set was poor Band III, but satisfactory Band I reception. A check on sensitivity in the workshop revealed that both channels were affected but owing to the lower signal strength of the Band III signal, the effect was more noticeable on this band. The Band I picture manifested a grainy appearance indicating a fault in the front end of the receiver due to the i.f. amplifiers working flat out on little signal.

A quick disturbance test in the i.f. strip confirmed this diagnosis. Both tuner valves were changed, but without improvement. Electrode voltages in the tuner were all checked satisfactorily. A signal from the generator was injected into the grid circuit of the mixer valve and indicated that this was functioning properly.

Finally, attention was turned to the r.f. amplifier stage. An injected signal showed that the stage had a gain of about two. The grounded grid in the second half of the double-triode cascode amplifier is fed in the normal way through an h.t. potentiometer of two resistors to hold it to a fixed bias point relative to the cathode. It is decoupled by an 800pF ceramic capacitor and this was found to be o/c. A replacement effected a complete cure.—V.D.C., Bristol (671).

Japanese Portable

Transistor Portable Trouble

A standard Japanese 6-transistor portable came in for repair with the complaint of poor reproduction, the customer remarking that the batteries were OK as they had just been replaced. However, after switching on and hearing the reproduction, it was decided to test the batteries. They were down to 1V per cell.

A new set of batteries was fitted and results were very much better, but it sounded as though only half the push-pull output stage was operating. After a short run, results fell off very badly and on checking the batteries it was found that they too had dropped to 1V each. Another set of batteries was fitted and the current consumption checked; this varied between 60–100mA.

Not having any service data, the circuit was examined and it was found that on each of the two output transistors a 0·01µF capacitor was taken from collector to earth. Bearing in mind the poor reproduction it was decided to unsolder and check these and one was found to have a resistance of 50Ω. A replacement restored normal operation.—H.W.G., Folkestone (693).

Invicta 5370

Loss of Picture

The trouble here, which could also apply to Pam Models 600S, 606S and 690, was intermittent loss of picture. The picture would collapse to a vertical line, then the screen would go blank. After switching off and on again from cold, the set would work for 3 or 4 days before the fault occurred again.

During fault condition, the PL81 screen glowed red, indicating wrong bias conditions, which could have been due to lack of drive from the oscillator. The PL81 grid is connected via a stopper resistor R95 to tag 7 on a tagstrip. Checking with the 'scope at grid pin there was no oscillator drive but as soon as the probe was connected to tag 7 on the strip the timebase started operating and remained so long as the probe was attached. On removing the probe the raster collapsed again.

It was thought that the probe might be acting as a capacitance and various capacitors were checked, but to no avail. Realising that it must be the tag strip itself this was closely examined and this brought to light a thin strand of wire from tag 8 (chassis) to which the outer screening wire leading to the line hold control is connected. This strand was making intermittent contact with tag 7, thus shorting the oscillator output. The action of touching tag 7 with the probe was sufficient to temporarily disconnect the thin wire.—S.W., Buckingham (646).

Items for publication

in this feature are welcome, particulary 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 Service Engineer, 46 Chancery Lane, London, W.C.2.

H.M.V. 1893

Weak, Negative Picture

Picture modulation was just visible and very much negative. Sound was normal. Checking the a.g.c. lines showed about two volts, this being positive instead of negative. The two a.g.c. delay diodes (one unit) were found to be o/c having no forward or backward resistances, hence the positive voltage on the a.g.c. lines via the h.t.-connected contrast control.

The diode unit was replaced, giving about half a volt negative on the a.g.c. lines, but the effect on the screen was the same. Oscilloscope tests showed that the video signal reaching the sync separator V5B was negligible and so not providing more negative a.g.c. volts through the functioning of the sync separator.

Further 'scope tracing revealed the faulty component as L38, a video compensating inductor between the detector and video amplifier. It was o/c, and after repair the receiver worked normally.—G.H., Harrogate (697).

Ultra V17–53

Sound on Vision

The trouble here was severe sound-on-vision. The tuner, i.f. amplifier and sound rejector circuit tuning were checked and found to be normal and it was assumed that the trouble was due to intermodulation between the sound and vision signals. Noting from the service information that the wrong setting of the pre-set noise control could cause this trouble,

(Continued on page 143)

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

21 years' Experience in Instrument Design—

Another Taylor Success!

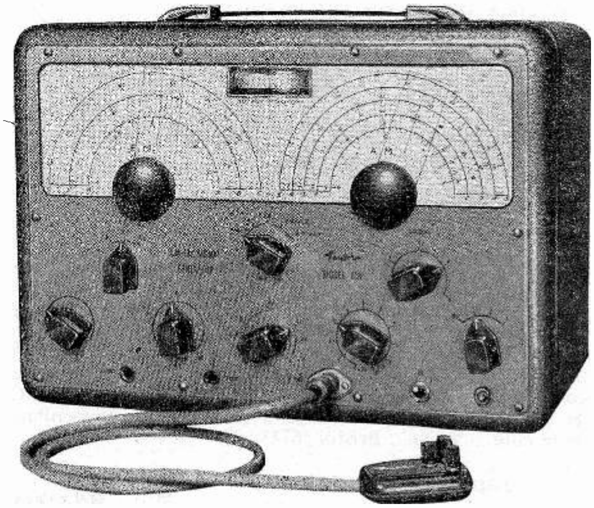
NEW —Just released, 5 instruments in one!

On the occasion of our 21st Anniversary we are proud to announce the release of an instrument with facilities engineers have been awaiting for a long time.

The instrument is an A.M./F.M. Signal Generator with Sweep and Crystal Calibrator.

A.M./F.M. Signal Generator

MODEL 61A



Dimensions of hammer finish case: 13″ × 9″ × 8″

1. A.M. GENERATOR

Frequency ranges:	4 – 120 Mc/s. in 5 bands.
R.F. Out-put:	100 mV. Monitored by crystal diode voltmeter.
Calibration Accuracy:	± 1%

2. F.M. GENERATOR

Frequency ranges:	4 – 7, 7 – 12, 70 – 120 Mc/s. 3 bands.
Calibration Accuracy:	± 2%.
Deviation:	Variable to ± 100 Kc/s at 400 c/s.
Attendant A.M.:	Not greater than 1 dB, at 100 Kc/s deviation.
R.F. Out-put:	100 mV. monitored by crystal diode voltmeter.

3. SWEEP GENERATOR

Frequency ranges:	4–7, 7–12, 70–120 Mc/s. 3 Bands.
Band Width:	Variable up to 1 Mc/s.
Blanking:	A switch is provided for blanked or unblanked operation.
Attendant A.M.:	Less than 2dB.
R.F. Out-Put:	100 mV.

4. CRYSTAL CALIBRATOR

Crystal Socket may be selected by a front panel switch to allow the C.W. or A.M. generator section to be aurally checked. Crystals from 1–11 Mc/s. can be supplied.

5. AUDIO OUT-PUT

Approx.: 1v. R.M.S. at 400 c/s.

TRADE PRICE £46.15.0

or 9 monthly payments of £5.13.8

Alternative version, without R.F. Monitor:

TRADE PRICE, £42.5.9

Write for full details to:

TAYLOR ELECTRICAL INSTRUMENTS LIMITED

Montrose Avenue, Slough, Bucks. *Telephone:* Slough 21381 *Cables:* TAYLINS, SLOUGH

Member of the M METAL INDUSTRIES GROUP OF COMPANIES

TECHNICAL GEN *continued*

this was checked but appeared to be correctly adjusted.

However, on checking the common i.f. amplifier valve voltages, the valve appeared to be almost cut off due to a large a.g.c. voltage and accordingly the a.g.c. circuit was investigated. The components were checked individually and eventually C10 (0·1μF) was found to have a leakage of a few thousand ohms.

This had upset the distribution of the a.g.c. control voltage so that the tuner was working near maximum gain, while the common i.f. amplifier V3 was almost cut off and overloaded, causing the intermodulation distortion. Replacing C10 completely cured the fault.—E.L., Blackburn (650).

Marconiphone T69DA

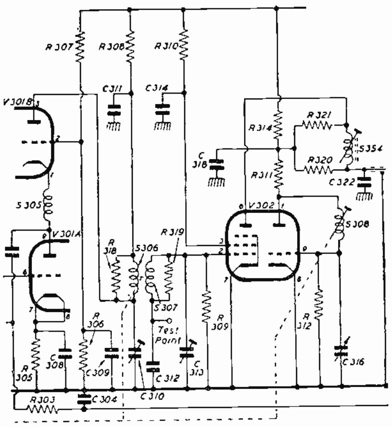
Poor on F.M. Symptoms: weak signals and poor sensitivity on f.m. when using the receiver's internal aerial, although both medium-wave and long-wave reception is satisfactory. This fault has been experienced on several new receivers while testing after unpacking and on the first occasion this meant a lot of wasted effort. Incidentally, the Philco 102 has a similar chassis.

Before delving into the f.m. tuner, as one is tempted to do, just reverse the leads from the tuner to the external f.m. aerial sockets and the fault is cured! The reason is that the internal aerial is soldered to the smaller of the sockets, but due to reverse connection at the factory of the twin feeder joining the tuner to the sockets, the internal aerial is connected to the earthy side of the input coil instead of the hot side. —I.C., Duffield (698).

Philips 1768U

Tuner Unit Trouble One of these sets came into the workshop with low sensitivity as the fault. Symptoms gave every indication of being due to a tuner fault, but replacement of tuner valves gave no improvement. Coils were removed and R311 checked but was found OK (reason for checking this first was that we have had quite a number of "highs" and o/c's on this component).

A voltage check was then made on pin 2 of V301B valve which should have been 84V but which was down to approx. 40V. This point is supplied from a potentiometer across the h.t. which is formed by two 470kΩ resistors (R307 and R306) but both of them were satisfactory when checked. The junction of these resistors is, however, decoupled by feedthrough capacitor C309 and this was found to have a leak to chassis of 100kΩ. Replacement effected a cure. (Note: Voltages on this section must be taken with a high resistance meter.)—H.W.G., Folkestone (674).



Pye CTM4

Fun and Games On this set, the picture and sound suddenly faded out and quickly switching off and on again would restore normal operation for about 1½ minutes. When the set was operating normally (as it would do for hours on end), the frame hold was very poor.

It was not possible to make the set "go off" in the workshop, but the frame hold was certainly poor and the only way to get good frame sync was to reduce the contrast control to a very low level. If the contrast was advanced beyond this point a negative shadow came from the left side of the raster across the picture.

It was decided to firstly tackle the frame lock trouble. Sync and frame valves, voltages and components (including the interlace diodes) were all checked and found to be normal. We then tackled the contrast circuit and found voltages and valve normal.

The frame and line sync is taken from the cathode follower V9A cathode resistor R33 and is applied to the sync separator grid via R85 (10kΩ) and a 0·1μF capacitor. These were all OK. It was thought possible that the signal to the video amplifier V8 might be going down to chassis partially before reaching this valve because picture quality was not up to standard, and accordingly the overload diode V7 and detector diode were checked.

On removing the overload diode, while the set was in operation, the frame immediately locked and the negative shadow disappeared. We heaved a sigh of relief. But this was short lived

(*Continued on page 145*)

Brainless Bertie

Set designers, please,
Note this mild reproof;
Dainty little plastic knobs
Should be Bertie-proof.

Feste

RECEIVER ● SPOT ● CHECKS

No. 52: ULTRA V17-50 and V21-50

Low Gain: Check R9 (390kΩ), part of V1B grid bias potential divider, for o/c or h.r.

No Sound or Vision: Check R26 (47Ω) o/c due to s/c on C22 or C17. Check R8 (2·7kΩ) for o/c due to s/c on C14 or C13. Check C24 for leakage, which would damage V2B and R20.

Patterning: Check C31, C32 and C37 for o/c.

No Vision: Check C31, C32, C37 and C43 for s/c, L25 and L27 for o/c and check for faulty XL1.

No raster: Check for faulty e.h.t. rectifier V8, for o/c brightness control P6 or faulty c.r.t. If line timebase inoperative, check for C55 (0·5μF) o/c or s/c C106 (120pF) for o/c or leakage, R46 (1MΩ) or R95 (4·7kΩ) for o/c, C54 (0·01μF) for o/c or leakage, faulty T3 (s/c turns or o/c overwind).

Poor Sync: Check V6A for low emission, R43 (1MΩ) for o/c or h.r. and C48 for low capacitance or leakage.

No Line Sync: Check C53 (6·8pF) for o/c.

No Frame Sync: Check C51 (150pF) for o/c, or C52 (0·02μF) for s/c.

No Frame Scan: In many cases this is due to faulty 30PL1, which develops lack of emission on pentode section. Oddly enough this valve rarely seems to develop a similar fault when used in the sound output stage. If oscillator stage inoperative, check for faulty C89, C90 or C91. Check for o/c R82 (3·3MΩ) or C98 coupling capacitor, Check T2 for o/c primary.

No Sound: Check R59 or R69 (both 2·7kΩ) for o/c, C69, C76 or C94 for s/c, C84 or C86 for o/c.—E.L., Long Eaton (626B).

TECHNICAL GEN

continued

because on checking the diode it was found to be satisfactory!

The diode is connected to the line output valve suppressor grid and this in turn is connected to the bias resistor R128 and C103 (25μF). On test it was found that C103 had dried up and replacing it put the matter right.

After all this, the picture and sound went off intermittently and this was proved to be instability and was cured by realignment of the final vision i.f. transformer which had apparently drifted off tune. As a test it was found that on either side of the correct tuning point on the coil, instability resulted if mistuned. We were glad when this job was off the bench.—H.W.G., Folkestone (689).

Ekco T231

Focus Ring Fault

This receiver was accepted for servicing after a do-it-yourself customer had given up in desperation. A new tube had been installed by the owner and since this gave indications of a low emission tube he suspected that he had purchased an unserviceable one.

The usual checks on ion trap, e.h.t. and tube base potentials were made. Voltages agreed with the maker's ratings. Movement of the ion trap revealed nothing but a very dimly illuminated and defocused portion of the screen. A substitution check on the tube followed, but results were no different.

However, on removal and subsequent inspection of the focus magnet assembly a hairline crack was observed in one of the Magnudur rings; this was proved to be a fracture. This was at first thought to be the trouble but on reflection, and working from first principles of electron optics, I realised that a small fracture representing a very fine air gap in the magnetic path should not make such a great difference.

On further examination it was found that the two rings were mounted such that they were in a state of magnetic repulsion. The field associated with this configuration could not have any focusing effect. Reversing one magnet gave the correct focusing field.

It was now obvious that the owner had tampered with this unit, possibly dismantling it during the tube replacement. Rough handling could have dislodged the magnet in question from its seating, whereupon it was unwittingly replaced in reverse. The owner, however, denied this and the mystery remains.—E.J.R., Nottingham (649).

SERVICE BRIEFS

Ekco T221: Original fault was no raster, which was cured by replacing the 20P4. After two months, customer complained of loss of width; again a new 20P4 cleared the trouble. A week later loss of width was again experienced. A replacement 20P4 cleared the trouble but on checking it was found that the screen voltage was 150V instead of 90V. The 4·7kΩ feed resistor was down to 300Ω. A new resistor gave normal width with both valves.—A.H., Barnsley (535).

Ultra V17-60: Complaint was no frame hold. Frame valves were replaced without success, so waveforms were checked. These were found to be of reduced amplitude on the grid and anode of the 1st sync separator V12A. A voltage check showed that anode voltage was 140 instead of 70 and the screen had no voltage instead of 20. Trouble was the screen decoupling capacitor C112 had a 4kΩ leak. Although this fault was in the sync circuit it had no effect on the line timebase.—R.R., Mansfield (559).

Bush TV75: Symptoms—no e.h.t., sound normal. During warming-up period, the timebase will start to oscillate and may even allow the e.h.t. rectifier filament to glow, then the timebase will cease operating abruptly. The fault is due to o/c C62 (0·25μF). This is a difficult fault to locate as the chassis has to be removed to gain access to C62 and it is easy to wrongly diagnose the line output transformer. The time factor gives a clue, as a study of the circuit will show.—G.B., Crawley (531).

Pye Luxury 17: Complaint was of a very small picture and this was soon cleared by fitting a new metal rectifier. While the job card was being filled in, the set was left running and a narrow vertical white line appeared on the right-hand side of the raster which got broader as the set remained running. The obvious things like valves were first checked but found normal. Eventually the cause of the trouble was found to be the screen dropper to the PL81 which, incidentally, tested OK on a testmeter warm or cold.—T.E.J., Bangor (545).

B.S.R. UA8: Complaint—never dropping in same position on different records. Also on 7 in. the pickup arm moved directly to centre of turntable, then being knocked backwards to edge of record. The riveted reset pin on the main slide was found to be loose so that the stepped stop plate and the pickup spindle bracket were not moved equally, thus the tongue on the stop plate was not in line with the notch on the spindle bracket which during the pickup arm rising and lowering part of the cycle move into each other. The reset pin was replaced by a 4BA nut, bolt and washer, but this meant that the pickup dropping position was at an extreme setting. This was cured by fitting a collar to the bolt.—A.A.S., Mansfield (564).

Queer Customers

WE ushered in to do a TV job by an harassed housewife who indicated the "dead" receiver and then bustled briskly off to "finish her bake". Imagine our surprise when an ageing crone by the fireplace grabbed our sleeve and said in a conspiratorial whisper "Tek it away!"

We blinked, then asked why she did not want us to repair the set on the spot. She shook her head and explained that she was "afeard on it". Further questioning elicited the information that she could not move from her chair without assistance—"and how would you like to be watched every morsel moment?" she concluded.

We thought it easier to take the set in for repair for a day or two than to explain that the Idiot's Lantern is strictly a one-way-only device.—M.A.Q., Bargoed (608).

Grundig TK20

Recorder Doesn't Play back

The complaint was no playback when switched to this function, capstan wheel and take-up spool rotating normally, with a rushing noise breaking into a high pitched continuous "squeak" determined by the setting of the tone control. This seemed like instability in the playback amplifier but after checking valves, decoupling and screening no fault could be found. Also, the connection of a crystal microphone across the grid of the first audio amplifier gave a good output.

On checking the playback head connections, odd hum effects were experienced but there was no output even

(Continued from page 147)

TECHNICAL GEN continued

with the microphone substituted for the playback head. But on checking back the playback head leads, the relay (which is used to simplify switching) was found to be in the unenergised position. Pushing down the armature restored normal working.

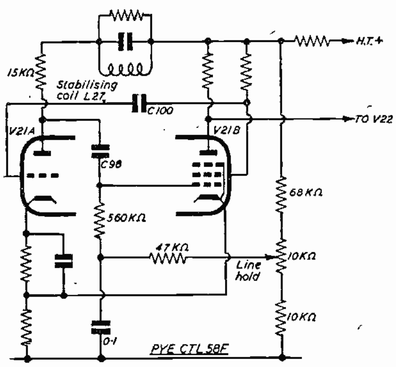
The missing energising current was found to be due to a faulty 11kΩ wire-wound resistor feeding d.c. from the h.t. line to the relay coil. The relay contacts not completing the input circuit caused part of the stray output to be fed back to the incorrectly connected input, causing the instability effect.—L.E.H., Edgware (686).

Pye CTL58F

Line Osc. Drift

One of the later versions of this model was brought in for service with a complaint of poor line hold. The line would suddenly drift completely out of sync after a two-hour run. Adjustment of the line hold control showed that the line oscillator was well off correct frequency. The pre-set line hold trimmer was adjusted and it was found that by screwing it home tightly the picture could just be made to lock, although even then it was erratic and the picture would jerk bodily from side to side.

Routine voltage checking revealed little but it was noticed that the V21A anode voltage was slightly low. C98 and C100 were satisfactory, as were all other capacitors and resistors. After checking for dry joints, a resistance check was made on the stabilising coil L27. It was found to have a very high resistance (more than 20kΩ). Since the preliminary service information did not give the correct d.c. resistance reading for L27 we assumed it had gone high and obtained a replacement. This was fitted and the fault cleared.—C.S., Bicester (652).



odd spot

This trouble appeared on several sets as a narrow white band about six or seven lines thick across the picture. Inside this band was a very delicate and intricate pattern of dark lines reminding one almost of a wall-paper border. No sound hum accompanied this visual effect.

After much searching this was traced to a 60-watt coiled filament lamp. The interference appeared to be radiated directly by the lamp and picked up at the aerial as it did not seem to be travelling along the mains wiring to the set.—W.D.G., Prestwick (567).

Some Post-Production Modifications

by B. R. GOOD

Cossor 947

To add a.g.c. to the sound intermediate frequency amplifier

Disconnect earthy end of L8, in grid circuit of V6, 6BX6 sound i.f. amplifier.

Insert 0·001μF and 0·05μF in parallel from the lower end of L8 to chassis.

Add a 1MΩ resistor from the junction of L8 and the new capacitors to the junction of R46, C45, C46.

Cossor 945A

To cure critical line hold.

Increase the value of the sync. separator capacitor, situated between pins 1 and 6 of V8, from 10pf to 33pf.

Reduce R31, situated across frame blocking oscillator transformer, from 100kΩ to 68kΩ.

To reduce e.h.t. where arcing occurs under no-signal conditions.

Add (insert) 60Ω resistor in cathode of line output valve, PL81.

Cossor 947A and 947F

To cure audio hum caused by pickup in the grid of the triode section of the PCL82 sound amplifier and output valve, more noticeable at certain volume control settings.

Some models have the volume control in the pentode grid circuit. Others have been factory-modified, using triode grid control. Where hum occurs, check the following points:

(a) Screen the lead to the volume control slider.

(b) Earth the volume control casing and the lower tag direct to chassis. Some sets have this connection taken to the earth tag of the smoothing capacitor C74/75.

(c) Fit extra decoupling in the triode anode circuit of the PCL82 as follows: insert 4·7kΩ resistor between R54, 100kΩ anode load, and h.t. Decouple with 16μF electrolytic, 250V wkg., from this junction of the two resistors and chassis.

Note: A certain amount of frame pickup can cause a similar effect, but is identifiable by alteration of the pitch of the hum as frame frequency is varied.

The cure is to screen the PCL82 from the frame output transformer with an L-shaped screen. (A conventional valve screen will cause overheating of the PCL82).

Pye 17-21S chassis

To fit flyback suppression to those earlier models where necessary.

From the upper end of the Frame Output Transformer secondary fit a 470Ω resistor and 0·1μF capacitor in series to chassis. From the junction, take a 0·05μF capacitor to Pin 2, control grid of the cathode ray tube.

Trace 47kΩ resistor which goes to the c.r.t. control grid from the slider of the brightness control. A 0·1μF capacitor will be found decoupling this resistor at the grid end. Disconnect, and reconnect to the slider end of the 47kΩ resistor.

RTEB Annual Report

In the fifteenth annual report of the Radio Trades Examination Board, it is recorded that although a total of 2,310 candidates sat the 1959 radio and television servicing examinations (an increase of 33 per cent on the 1958 total) the number qualifying dropped considerably. The breakdown is given below (1958 figures given in brackets).

	Radio	Television
Number of candidates	1847 (1498)	463 (314)
Passed	547 (622)	209 (119)
Referred	291 (419)	94 (43)
Failed	1009 (457)	160 (152)
Percentage pass	30 (42)	45 (38)

Written papers were very much below the normal standard and were the main cause of failure; this inability to cope with theory undoubtedly resulted in many failing the practical test.

During the year a complete revision of the two syllabuses took place and the radio and TV subject matter was welded together. Thus the Board will now provide an intermediate examination in radio and TV servicing at the end of the third year of the part-time course and a final examination at the end of the fifth year. This will permit a much closer link between theoretical and practical training.

The scheme for candidates engaged on servicing, installation and maintenance of electronic equipment has reached a stage whereby a syllabus is nearing approval. The syllabus for the first two years is common with that of radio and TV servicing. Separate intermediate and final examinations in electronics are to be held. The first examinations in this scheme will be held at the intermediate level in 1961.

RTEB WRITTEN PAPERS

Some suggestions for prospective candidates

by JOHN P. BOLD

THE City and Guilds of London Institute and Radio Trades Examination Board's Radio Servicing Examination is to be held on 3rd and 5th May, 1960. These notes have been prepared to help candidates taking the written papers.

As well as a sound knowledge of the theory outlined in the syllabus published by the RTEB some "know how" of examination procedure is helpful.

It is suggested that studies should finish at least three or four days before the day of examination, to keep the mind fresh for the great day. On the day of the examination every attempt should be made to remain relaxed. The examination is usually held between 6.30 and 9.30 p.m. so a good meal is advisable to preserve comfort during the three hours of the examination.

Candidates are normally allowed in to the examination room several minutes before the start and this time is employed completing the slip attached to the answer paper. Examination number (as issued by the Board), candidates name, address and other details are required to complete the slip. Upon completion of the details, the question papers will be given out (face down).

The Invigilator will give the word to start at the correct time, the question paper will then be turned over, and the questions read through three times. This may seem excessive, but many marks are lost by students who do not fully understand the meaning of the question, and perhaps spend 20 minutes writing about the wrong subject.

Eight questions are usually set on the question paper, six of which may be attempted. Having read through the paper, which will take about ten to fifteen minutes, divide the time left by the number of questions to be attempted (six questions may be attempted, and allowing for the fifteen minutes spent reading the question paper, approximately twenty-five minutes is available for each question).

Questions may be attempted in any order but should be clearly numbered. The number of the first question to be attempted should be inserted in the left hand margin. If the question has several parts they also should be indicated, i.e.:

1. (*a*).
1. (*b*).

Always use the numbers quoted on the question paper, never invent your own (it is done by some candidates) as this only confuses the examiner.

Spend the calculated time on the first question to be attempted and then leave it, even if unfinished. Draw a line across the paper under your answer, leaving about ten lines which may be used to complete the question if unfinished.

Proceed to answer the rest of the questions treating them in the same manner as the first; the space left between the questions, even if not used will separate them giving a neat layout. Some questions may be answered in less time than that calculated. If this is so, the time left may be used to complete any questions left unfinished. The first five or six marks of any question are easier to obtain than the remainder, so time spent trying to finish a question would be better employed attempting another question.

The inclusion of a diagram will help with a difficult description and a space of a few lines should be left above and below any such drawing (or any calculations) in order to simplify the examiner's task when marking the papers.

The above suggestions for tackling the examination will, I hope, help students taking it for the first time.

New Books

Two-Way Radio, **by Allan H. Lytel, published by McGraw-Hill, 95 Farringdon Street, London, E.C.4. Size 9 × 6 in., 291 pages, 277 illustrations. Price, 74s.**

THIS is a work in the best tradition of technical literature. Competently written (it was ten years in preparation), well produced and tastefully illustrated in line drawing and photogravure, it sets out to present the reader with a sectional view of the radio scene. Two-Way radio is here interpreted as "voice-modulated communications, covering mobile and fixed radio transmitters and receivers plus their related test equipment".

This is a larger subject than it may seem. Indeed, the (American) publisher's blurb states that there are more than 1,500,000 two-way radio systems in use today, a number which is rapidly growing.

Radio communications have been brought into action for such diverse purposes as buses, railways, highway maintenance, forestry conservation, and taxicabs, as well as the more generally accepted public services of police, fire and ambulance. In addition, the number of licensed amateur operators is on the increase, already exceeding 185,000 in the U.S.A. alone.

But whether used as a toy or a tool, radio communication provides a challenge for the technician, the author asserts in his preface. It is a rapidly growing electronic business. So perhaps it is logical that Mr. Lytel should have written a book that even the apprentice can understand. He states that: "This book is aimed at the Technical Institute Level."

Up-To-Date: Chapter 1 contains a comprehensive introduction to two-way radio. The argument for f.m. is succinctly presented as early as page 10. From thence it is treated as an accepted fact, and not until the latter half of Chapter 5 does a.m. re-assert its claims. Briefly, the problem is ether-space; the need is for narrower bandwidth. In this respect some of the newer, less conventional forms of amplitude modulation are being re-examined by several research departments. No doubt we shall soon hear more of the single-sideband, suppressed carrier communications transmissions, and the use of synchronous a.m. detection in the near future.

In the meantime, Mr. Lytel's work presents the two-way radio picture as it is today—and he is bang up-to-date in the presentation. There is even mention of the ceramic valve, incorporated in General-Electric circuits.

The second chapter deals with the principles of modulation. In 22 pages the author has packed the meat of several text-books. It makes profitable reading.

The next two chapters examine in detail the f.m. transmitters and receivers in present use. Complete circuits of typical commercial units are given. Although these are American, readers will have little trouble in mentally tuning in.

Practical Guidance: A chapter is given to aerials and their problems. Here again, thanks to some excellent illustrations, Mr. Lytel has managed to be extremely informative in small space.

In Chapter 7 we come to some of the more specific applications of two-way radio. Selective calling, digital pulse techniques, code selectors and electro-mechanical devices are discussed. As the networks grow, so will the need for more complex calling and switching systems. The technician will find a new and interesting field for study.

After a short chapter on some of the types of power supply peculiar to mobile systems, a highly practical discourse on Installation is given. Interference suppression and aerial mounting are given prominence.

Test and Repair: Chapter 10 deals with test equipment, but Mr. Lytel wisely wastes no space on discussing the run-of-the-mill test gear with which readers will presumably be familiar. He draws up a list of test equipment for an "ideal" workshop, underlines the "conventional" items and goes on to discuss the "additional" gear.

Special signal generators, grid-dip meters, wavemeters, modulation meters, field-strength and power meters are detailed. Ample advice on their use and a number of practical hints is contained in this chapter, as in the later dissertation on Servicing.

Quite properly, this chapter opens with a résumé of the stringent checks necessary on two-way radio equipment. Patching-up is not good enough for communications equipment.

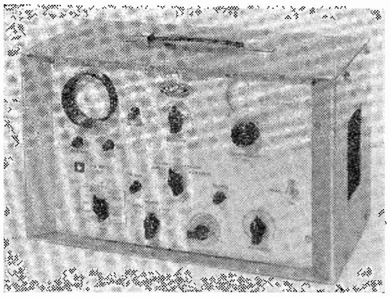
On the other hand, the standard to which this equipment is built is generally much higher than that of domestic radio and television sets. The problems are different, but, says Mr. Lytel, "Two-Way Radio is a natural field for the serviceman." This book should help him find his way, and even if he does not deal with communications equipment, its information will not be wasted.—H.W.H.

Service Engineer special laboratory test

AIRMEC TYPE 259 "TELEVET"

Composite Servicing Instrument

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



CONTAINED in a portable carrying case complete with handle, measuring only $15\frac{1}{2} \times 9\frac{1}{2} \times 8\frac{1}{2}$ in. high, are four distinctly independent TV servicing instruments comprising the *TeleVet.* Four instruments, which each provide a host of tests, for only 66 gns. net trade is, indeed, value for money.

The *TeleVet* does not claim to be a laboratory instrument, but without doubt it is a genuine, down-to-earth, functional test-set that is capable of telling the inside or outside TV service engineer pretty well all there is to know about a faulty receiver. Let us have a look at the four instruments.

SIGNAL GENERATOR

This covers the frequency bands of 8 to 70 Mc/s and 168 to 230 Mc/s. The tuning control is directly calibrated in frequency with a calibration accuracy of ± 1 Mc/s. A reduction drive of 6 to 1 is provided on the tuning capacitor, and the spiral scale, which is over four feet in effective length, is calibrated every 100 kc/s. This certainly makes for ease of resetting.

Two oscillators are used. A fixed oscillator which operates normally at 80 Mc/s, and a variable oscillator, with which the tuning capacitor is associated, which operates over the range of 88 to 150 Mc/s. The two oscillator signals are mixed in a valve, and the sum and difference frequencies which thus result are those which are fed through a coaxial cable and probe unit for application to the receiver under test. As the signals in each range are present simultaneously, no wavechange switch is required.

This method of mixing two signals is likely to produce odd spurious responses under some circumstances, but in the main they are not unduly troublesome as they are considerably smaller in amplitude than the required response. Such responses are detailed in a table which is contained in the very comprehensive manual supplied with the instrument.

The maximum r.f. output is approximately 50 mV. This output is provided on the end of a 3 ft. length of coaxial cable to which a probe embodying a switched attenuator is attached. Attenuated outputs of one tenth, one hundredth and one thousandth are provided, and in addition a variable level control on the instrument enables the output to be reduced in steps of approximately 2dB.

The signal generator may be amplitude modulated for sound channel tests. The modulation signal is of 5 kc/s and consists of a pulse waveform.

This same signal is also available "neat" and may be switched to the "L.F. Probe" for audio stage checks. The signal is approximately 2 volts peak-to-peak and is suitable for feeding direct to the grid of the a.f. valve under test, or to the top end of the volume control. A control is available for altering the level of this signal when required.

WOBBULATOR

The wobbulator uses the same set-up as already described but a frequency modulating device is switched into the tuned circuit of the fixed frequency oscillator. The "frequency modulator" consists of a capacitor across the tuned circuit of the fixed oscillator, the moving vane of which is caused to vibrate at a frequency of 50 c/s by means of a pair of coils which are energised from the 50 c/s mains supply (via a transformer) through a pair of rectifiers connected in opposition.

Such variation of this capacitance thus results in the r.f. signal being frequency modulated at 50 c/s. The maximum sweep is ± 6 Mc/s (e.g., 12 Mc/s sweep), but a "deviation control" is provided which renders the sweep variable between 4 and 12 Mc/s.

Internal adjustment is provided on the frequency modulator, or vibrator, for tuning and for centralising the moving vane between the two fixed vanes. Tuning the reed is accomplished by altering the position of a small weight on the reed.

This appears to be an excellent idea for obtaining a fixed sweep at 50 c/s. Tests show that the sweep linearity is adequate for normal service application, but there is one small disadvantage, and that is any small vibration to the instrument while a sweep alignment operation is in hand results in severe shuddering of the oscilloscope trace, particularly if excessive "Y" gain is used.

OSCILLOSCOPE

The wobbulator is used in conjunction with the inbuilt oscilloscope to give displays of response curves of the various tuned circuits of TV sets. Use is made of a $2\frac{3}{4}$-in. c.r.t., in front of which is a graticule calibrated in dB on the "Y" axis. In addition to the usual "brilliance", "focus", "X shift" and "Y shift" controls, the c.r.t. has an associated "Y" amplifier and attenuator, and sawtooth timebase generator for the "X" plates.

The sawtooth generator has two switched ranges. One is suitable for giving displays of waveforms in the frame timebase circuits of TV sets, while the other position increases the oscilloscope timebase speed to enable the observation of line timebase waveforms. An external control allows for a small range of velocity adjustment, and internal synchronization is also provided for locking the trace on the screen.

The "Y" amplifier has a frequency response from d.c. to 700 kc/s, but the response relative to 1 kc/s is approximately 6dB down at 700 kc/s. The deflection sensitivity is approximately 1·5 c.m. per volt. A 2×5-position "Y" amplifier attenuator, brought out to a front control, can be set to divide the input voltage by 1, 3, 10, 30 or 100. These five positions are duplicated to give a.c. or d.c. working.

When the oscilloscope is used in conjunction with the wobbulator, a 50 c/s voltage is applied to the c.r.t. "X" plates to obtain the horizontal deflection. Phase shift circuits are incorporated so that the limits of travel of the spot coincide with the limits of travel of the reed in the "frequency modulator". The horizontal axis of the c.r.t. then becomes a frequency axis, and the vertical axis represents gain.

The wobbulator signal is, of course, applied to the set or tuned stages under examination or adjustment and the signal so modulated, and subsequently demodulated at the set's detector, is applied to the oscilloscope's "Y" plates via the "Y" amplifier. The display is therefore the gain versus frequency characteristics of the amplifier and tuned circuits under test, in accordance with normal wobbulator-'scope application.

To avoid the display of two traces, one when the spot moves from left to right and another when it moves from right to left across the tube screen, the latter trace is suppressed by the application of a 50 c/s signal phase shifted 90 degree, by means of a capacitor-resistor network, to the grid of the c.r.t.

VOLTAGE MEASUREMENT

A very wide range of a.c. and d.c. voltages can be measured on the c.r.t. in conjunction with the calibrated "Y" attenuator and calibrated "Y" shift control. Two test probes are available with the instruments.

One, the e.h.t. probe, which allows the measurement of d.c. from 200 volts to 20 kV with an input impedance of 100 megohms. The other, called probe "C", allows the measurement of d.c. from 20 volts to 600 volts with an input impedance of 10 megohms.

Using probe "C", a.c. can be measured from 2 volts to 400 volts with an input impedance of 1 megohm. With the exception of the d.c. range from 10 kV to 20 kV, where the accuracy of measurement falls to 20 per cent, the accuracy on all the other ranges is of the order of 10 per cent. However, on a.c., the accuracy tends to fall slightly at frequencies above 200 kc/s due to the falling response of the "Y" amplifier.

On d.c. the method of measurement is first to adjust the "Y" shift control until the horizontal trace coincides with the horizontal line on the graticule and make note of the "Y" shift control setting.

The instrument is then adjusted to suit the scale of voltage to be measured, and on application of the appropriate test probe the trace will undergo a deflection, upwards if the voltage is positive and downwards if negative. The "Y" shift control is then again rotated until the trace once more coincides with the horizontal line on the graticule. The present reading on the "Y" shift control is subtracted from that reading obtained initially.

The voltage is then the difference voltage on the "Y" shift control multiplied by the factor on the "Y" gain control. For e.h.t. measurements, this voltage is again multiplied by 10.

On a.c. the exercise is much the same. The waveform trace is shifted first so that the top of the waveform coincides with the horizontal graticule line and then again to the bottom of the waveform. The difference voltage given on the "Y" shift control multiplied by the factor on the "Y" gain control gives the peak-to-peak value of the waveform. The "Y" shift control also has a scale calibrated in r.m.s. values which can be used for a.c. voltage measurements when required.

LINE OUTPUT TRANSFORMER

A socket is available on the front of the instrument which provides a pulse for injecting across the anode winding of a suspect line output transformer. The resulting "ring" which this pulse sets up in the transformer can be observed on the screen of the c.r.t. A transformer having shorting turns, or a short-circuited turn, gives a very suppressed "ring" waveform.

By comparing good transformers with faulty ones and recording the results for future use, this test can save considerable time when one is not quite sure whether or not the transformer is to blame for lack of e.h.t.

PATTERN GENERATOR

The signal generator may be amplitude modulated by a waveform which closely resembles the synchronising waveform used by the BBC. This modulated signal locks the raster and also produces either three horizontal or three vertical black lines, the pattern thus produced enabling the operation of the sync circuits and the linearity control adjustments of the TV set to be checked. The synchronising is such that a lock may be obtained on either line or frame but not on both together.

CRYSTAL CHECK AND MARKER

A 5 Mc/s crystal is incorporated in the instrument. This provides audio beat notes at all multiple frequencies of 5 Mc/s and enables the tuning scale to be set accurately at any crystal check point by means of a "calibrating trimmer" on the front of the instrument. This high setting accuracy is desirable if TV sets are to be adjusted when no transmission is taking place.

Both the fixed oscillator and the variable oscillator are checked for frequency calibration against the crystal. Adjustment is carried out in conjunction with the signal trace on the c.r.t.

The same 5 Mc/s crystal can be used to provide marker pips at 5 Mc/s intervals on the trace during sweep frequency alignment adjustments, when the wobbulator is used.

ON TEST

The instrument was subjected to exhaustive tests not only on TV receivers, but also on TV relay amplifiers and converters. As a versatile instrument for the TV service engineer, it can be thoroughly recommended and will serve adequately both in the field and on the test bench. Indeed, apart from a simple multirange meter for rapid point-to-point resistance checks (and a screwdriver!), the instrument will serve almost entirely on its own for the majority of servicing applications.

It is essentially a "personal" instrument with which an engineer would quickly become accustomed, leading to speedy and accurate fault diagnosis. It was greeted with enthusiasm by the laboratory personnel who assisted with the tests.

There are two rather interesting functional features. The instrument's earth line and chassis are isolated from true earth and the case, which means that it can safely be employed with a.c./d.c. type receivers where the chassis may inadvertently be "live" relative to earth. Also, all the leads and probes relating to the instrument are permanently connected, and stowage for these is provided in the ends of the case—no more lost leads!

The instrument operates from 200/250 volts 50 c/s supply and the consumption is approximately 80 watts. The steel case and front panel are finished in oyster hammered enamel. The total weight is 25 lbs.

The *TeleVet* Type 259 supersedes the original, well known Type 887, it now having the additional facility for testing line output transformers without their disconnection from the set. The instrument is manufactured and marketed by Airmec Limited, High Wycombe, Bucks. It partners the *RadiVet;* it would seem that there is room now for such a composite instrument for Hi-Fi applications.

by H. W. HELLYER

Piping Hot

The local council are going to be broody.

WHAT sort of signal do you enjoy? Does it come through loud and clear, like Junior bellowing into Auntie's ear-trumpet? Or is your reception as musky as the murmuration emanating from that conch-shell you picked up on the beach?

So many of the umpteen million viewers that each channel claims for its own, sit watching a picture whose quality leaves much to be desired. They are happy to get a picture at all.

I have seen installations where the casual visitor may be forgiven for settling down in front of Grandpa's home aquarium and waiting for the commercials to come on.

But the owners of the set boast that they have the best picture in the street. And, what's more, they sometimes have! In order to keep ahead of the Joneses their chimneys sprout an array of antennae like Mexican cacti reaching up for the sun.

Look along some of the streets in my parish. There is a fringe of stalagmitic rooftops. Aerials dangle from eaves and windowframes. Others lean over garden walls to poke out your eyes as you are passing. Walk up any garden path and you are in danger of being decapitated by a stray loop of coax.

There are the inevitable squabbles every time a new erection is made. Mrs. Green has "stolen away" the signal from Mrs. Brown. You stifle the temptation to misquote, "*Who steals my pulse steals trash*" and spend a vain hour tuning and titivating, decreasing i.f. bias, shorting out the a.g.c. on the turret, narrowing the bandwidth ....

The solution is so simple. Nobody is going to disagree that it is much more efficient to erect a really good mast on a well-chosen site, convert and distribute a clean signal and pipe it in to every set.

Where disagreement occurs it is over *who* is to provide the piped service, and *how*. There are always several claimants in every area, with differing ideas. Shall we have a controlled low-frequency (comparatively) feed-line, with slave units consisting of tube, time bases and power supply? Or, a mid-frequency signal which operates a converter unit in the customer's set? Or a normal-frequency aerial signal, with only a plug-in outlet for the jumper lead of the set?

Like Junior bellowing into Auntie's ear trumpet.

Each method has its advocates, and their reasons for championing a particular system are usually economic. The dealer wants to sell as many and various sets as he can. He wants a pipeline that ties nobody down. The local relay company, by contrast, is supplying a service, and would have viewers his slaves, so to speak.

Between the extremes lie a variety of amalgamations; dealer groups and "sponsored" private companies. They generally favour the system that is likely to give them the greatest return in the shortest time.

And sitting uneasily on this clutch of explosive ovoids is the local council. They are going broody over the problem of public health, roads and safety. They worry over wayleaves, concessions and future growth until they shed enough poundage to see their toes again.

Walk up any garden path and you are in danger.

Unfortunately, they are seldom disinterested. There are existing radio relay contracts on a long-term lease in most places. These pay off a percentage toward the rates. Some relay companies have gaily gone ahead "renewing" their old lines in preparation for TV. Councils fear the growth of a "spider-web" of wires if they grant new concessions to alternative contractors. They play safe by giving the relay company the go-ahead – and local dealers are wondering for whom the bell is tolling.

In one town a group of dealers has formed an association and applied for permission to instal a piped service that they do not need. That is one seaside resort where reception is reasonable. But the dealers want their claim to be in first, before the "big boys" come along!

In another place there are half-a-dozen firms cajoling the corporation. In another, where there are "shadow spots", householders have been advised to get together themselves. If a street of viewers club up and buy a single installation with communal aerial and distributors, the cost to each will be quite reasonable.

But there is always the odd reactionary who already has an aerial that gives fair results. "*Why should I tear mine down for the sake of that besom up the road*?" they say.

At the other extreme, there is the company that found its enterprise mentioned in *Hansard*. They are reaching out by pipeline to an isolated Scottish island where the BBC and GPO do not consider it worth their while to supply a signal.

Eventually, the rash of competing companies will resolve into a common service. At some time in the future, our sons will look back at our clumsy fumbling for a signal and laugh. The programmes will arrive via a pipeline laid in by the builders. Like the water, gas and electricity. And what will the serviceman do then, poor thing?

He will probably do much as he does now, where piped TV is concerned. He will shake his head sadly over the customer's set and say: "*Sorry, ma'am. Not my pigeon.*"

In my area there are a number of conversions by the local relay company, and this situation crops up quite a lot. The relay boys do not pretend to be any great shakes at diagnosis. Their technique is to change a doubtful terminal unit and put the blame on the rest of the set. We toddle along later and find that the set has a genuine fault in, say, the timebases. After repair, there is still no joy, and we are forced to call them in again to put the original unit back. At least, it *was* tuned to their i.f.

But, because the set has been cannibalised in the course of the relay conversion, we cannot even test it in the workshops. It won't work on a normal aerial.

Joe: "Then you'll have to get your workshop piped."

Myself: "Aw. Pipe down!"

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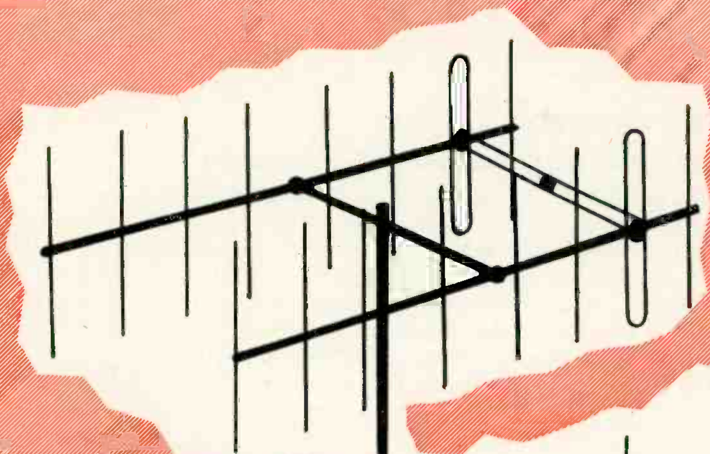

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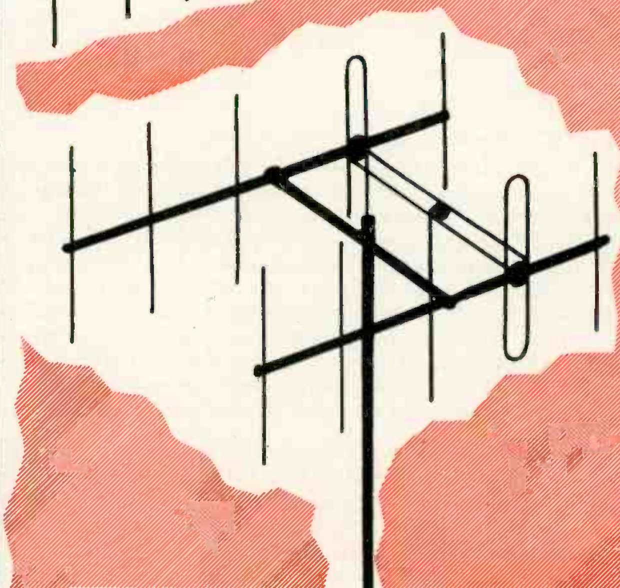

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