

AUGUST 1961

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SERVICE ENGINEER

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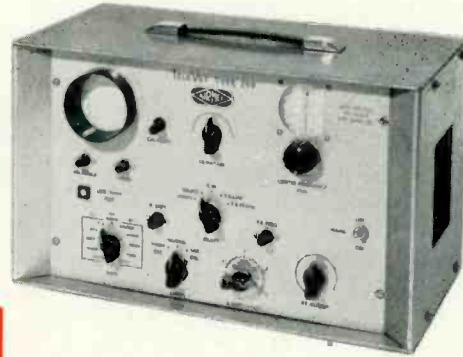
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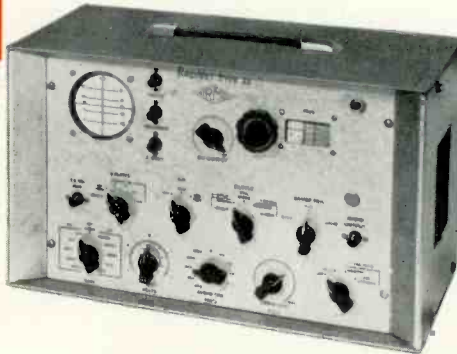
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SERVICE ENGINEER

Vol 4. No. 4 AUG., 1961

Edited by W. Norman Stevens

Issued as a special supplement with "Radio Retailing"

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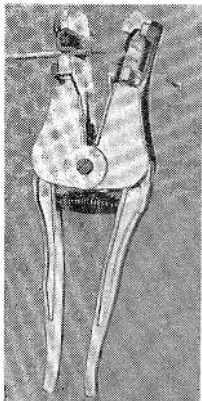
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SERVICE DATA SHEETS

- RI53: Pye TCR2000 hybrid car radio.
- TV182: Bush TV92 and TV93 television receivers.
- TV183: Ultra 81/83 series television receivers.

New Wire Strippers

Two new series of wire strippers have been added to the existing Hellermann range. The standard model, for normal commercial use, which will strip wire clean up to $\frac{3}{4}$ in. long, features an automatic device which holds the jaws open without crushing. It is claimed that practically all nicking, cutting or fraying in operation is eliminated. The new tool is especially suitable for stripping lighter gauge wires and the blades are easily changed. The complete tool weighs 14 oz. and can be obtained from the usual suppliers.



The new deluxe model is designed for use on aircraft and similar high quality precision work and is obtainable direct from the makers.

RADIO SHOW SERVICING EXHIBIT

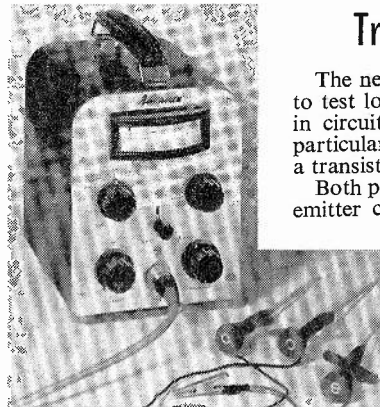
"Service Engineer" will be there

Following the success at the 1960 Radio Show, the trade technical section on the first floor will again appear at this year's show. While still making its appeal to the public, the section will be devoted particularly to the interests of the retailer and the service engineer. The servicing of equipment and test instruments will still form the core of the feature.

Two highlights of the exhibit will be a servicing section where equipment (mainly record players and tape recorders) is actually being repaired, and a fault diagnosis exhibit worked by push buttons. In addition, manufacturers of test equipment will be displaying their products in a number of booths and window displays.

An inquiry counter, staffed by RTRA representatives, will be available to answer questions on servicing as a career. Also to be seen is a new feature—a display of some hundred technical books, organised by the Technical and Scientific Section of the Publishers Association.

Lending its support to what it considers to be a very worthwhile section of the Radio Show, *Radio Retailing* will have a corner counter devoted to the *Service Engineer* supplement and service data sheets. A special offer to new subscribers will be featured. We hope that readers visiting the Show will make a point of looking over what promises to be a very interesting exhibit.



Transistors Tested in Circuit

The new Advance TT1 has been specially designed to test low and medium power transistors while still in circuit, eliminating the risk of physical damage, particularly to printed circuit boards, when removing a transistor for testing.

Both p-n-p and n-p-n types can be tested. Grounded emitter current gain may be measured in or out of circuit and leakage current (grounded emitter) with transistors out of circuit.

Current gain (beta) can be measured in two ranges (5-50 and 50-500) to an accuracy of $\pm 5\%$ with the transistor out of circuit, accuracy with transistor in circuit dependent on the base shunt circuitry. Set current normally 1-10mA, but 10mA not obtainable with transistor betas below 12 and 1mA not obtainable with transistor betas greater than 200. Shunt collector circuits of greater than 100-ohms may be balanced out.

Leakage current measurement (grounded emitter 1 μ co) 0-1mA and 0-100 μ A with transistor out of circuit. The circuit is protected so that the maximum battery drain is 110mA and the meter is protected for overloads of greater than 500%.

The probes are a feature of the tester and their design was the result of a special user research by electronic engineers. Provision is made for checking the condition of the batteries. Retractable legs are fitted to the front of the instrument for bench working.

The TT1 measures 6 \times 6 $\frac{1}{2}$ \times 7 in. and weighs just over 6 lb. Price of the instrument is £40 net.

BORDER TELEVISION

Full power test transmissions from the new channel 11 ITA station at Caldbeck are being radiated every day except Sunday from 10 a.m. to 5.30 p.m. until the first programme goes out on 1st September. At each hour, and at 15-minute intervals, slides with sound commentary will be broadcast. Standing 1,900 ft. above sea level, the mast dominates the Cumbrian Plain and S.W. Scotland.

Work has begun on the slave station at Selkirk, which will be unmanned after the initial test period, being controlled automatically from Caldbeck. Believed to be the only one of its kind in Europe, it is expected to go into operation by the end of this year.

YOUR NEXT ISSUES OF RR

- ★ AUGUST 22ND · SPECIAL RADIO SHOW NUMBER
(No "Service Engineer" or service sheets)
- ★ SEPTEMBER 11TH · SHOW REVIEW NUMBER
(with all usual supplements)

Thereafter on the 1st of each month

Service Viewpoint

AT about this time every year the publicity boys of the large radio companies feel those familiar butterflies in their tummies.

They are wondering whether the exorbitant expense of "puttin' on the style" at Earl's Court is going to be justified in the year ahead, a year that will be beset by more dithering about fine standards, colour prospects and the dread threat of the Common Market.

They are wondering what sort of accountant is going to be placated by that small-print entry in the Radio Show balance sheet—that entry that says, "Prestige".

And well may they wonder, for this year is even more marked by defections than last, and less balanced by brave new faces. Not all the absentees as enterprising as last year's Festival Hall fanfare by Pye. Nor all flying across to

Germany for the bigger and better affair.

Our own Radio Show has subtly changed its character over the recent years. It is no longer purely a "salesman's soiree", an occasion to beat the big drum. It has turned into an honest attempt by many manufacturers to meet the public and the dealers on more or less neutral ground.

A lot of the ballyhoo has been expunged. Which is why the publicity boys are suffering from the collywobbles, for ballyhoo is their business.

Is it worth it?

It was interesting to note the comments of Tony Rose, Editor of *Photo Trade World*, after the recent Photo-Cine Fair at Olympia. Analysing the costs of exhibiting to the 141,106 visitors, he assessed each maker at £7 5s. 10d. per thousand.

As a contrast, the figures for advertising in the national daily and technical (weekly and monthly) press were given. For a little over a thousand pounds outlay on advertising, a total circulation

of more than six million could be reached. A thousand readers for 3s. 4d., commented Mr. Rose.

Nevertheless, he had to concede that there was no true comparison between a stand at an exhibition and an advertisement in print. And if that is true of photography, how much more so of radio and television, where national coverage is given by the broadcast companies, as so much gratis publicity. (Who was the manufacturer at the ballot for stands who wanted to know where the "roving eye" cameras were going to be set up?)

Service engineers, who may think they have even less incentive to visit Earl's Court than retailers, should not be deterred. Do not fall for that pessimistic line, "There's never anything new". Developments have a habit of creeping up on one.

Armed with our Radio Show number and its carefully selected preview, it should be possible for even the shortest visit to prove of genuine value.

In any case, you will always be welcome at Stand 115, where there may not be an overdose of ballyhoo, but where we, at least, consider the expense of exhibiting well worth it.

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.

Appalling Audio

IT is Show-time again, and surely time somebody said something about those appalling "dem. rooms", especially in the Audio Hall.

Bad enough, when you are wandering around on a time-restricted tour of inspection, to find you have just missed the beginning of a performance and are confronted with a locked door (and a uniformed attendant, whose smile is a little strained, after the first few days). Or that you have just missed the end of a demonstration, and have nothing but the smoke-laden air and silent, stale-looking equipment to inspect.

But worse, to be trapped inside a tedious cavern while some anonymous octet saws away at Stravinsky, the visitors strive to appear appreciative, and the demonstrators are impressively reverent.

In these days of audio advances, is it not possible to construct sound-proofed, open-ended dem. rooms on the listening-booth principle, so that we can continue to wander around with no fear of being either "locked-in" or "locked-out".—Tom Hall, *Battersea*.

Testimonial

OUR department recently took over the rentals of another company. My colleagues and I were surprised—and delighted—to find that of these a number had been out for seven, eight, even nine years, and in that time only minor faults had developed.

Some customers were most apologetic when they had to call us in; perhaps the first call for more than a year!

If you print this tribute, perhaps you would allow me to state that these "old-timers" are the 15-in. models using the Plessey chassis, and the 5-channel, 14-in. Columbia. No doubt other readers will be able to add to this short list, but I must stress that we were impressed with the quantity of these models giving good service in our area, not merely the odd "good-un".—I. McGregor, *Cardiff*.

In these days of too much carping criticism it is good to see remarks of this nature. We are pleased to print a genuine tribute, and to add our congratulations. Undoubtedly, there are other trustworthy "veterans" and Radio Retailing will be glad to hear about them.—Editor.

Sales v. Quality

I WAS glad to see someone mustering the courage to argue that the most impressive sales record did not necessarily imply the best goods (B. R. Good's comment on Page 23, *Trade Topics*, June *Service Engineer*.)

Although he was talking about tape recorders, the same applies to radio, television and associated electronic equipment. Every serviceman knows that of the "popular" models there will

be one or two of reasonable quality and others that have persistent faults. Yet the prices are much the same, and the advertising would lead the public to believe there was little to choose.

It is the same through the whole commercial world, let's admit it! The old adage about "quality telling in the long run" no longer seems to apply. If it did, a couple of our makers would romp away with market records.

Now let somebody else have the courage to name them!—N. Cope, *Denton*.

Not Much Fun

I WONDER how many readers took note of the final paragraph of your condensation of the BREMA Annual Report on Page 31 of *Service Engineer* for June 1961.

Referring to interference problems, the report stated that "in many cases chassis radiation has been found to be the main mode of propagation, sometimes aggravated by screening covers being left off after servicing".

Many times I've been called to a set after another engineer and found valve screens missing from turrets, line output transformer shields vanished and heat guard plates either out of place or removed altogether.

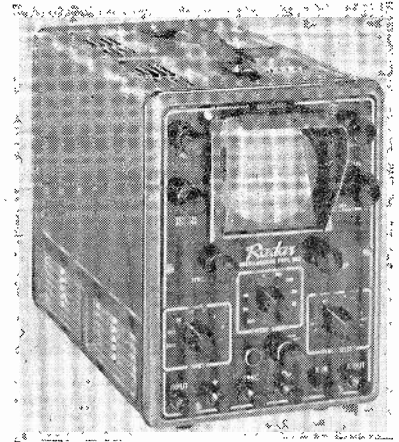
Do these engineers [*sic*] imagine that manufacturers include these items in their specifications for fun? The pity of it is that bodgers like that seldom bother to read magazines of this nature. Horror comics are more in their line, no doubt.—J. Farson, *Plymouth*.

RADAR

Model 303

Portable Oscilloscope

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



THE Radar Type 303 represents an oscilloscope that will never be without a job long enough to collect dust, whether its home be in the laboratory or radio and television service department. Simplicity of operation, coupled with remarkable versatility and portable make-up, put it in the sphere of an instrument long awaited for by the service technician in particular.

The 3 in. screen is faced by a ruled graticule, allowing measurement of pulse amplitude, etc., and in front of this can be slipped an optional polarising filter, which completely prevents light being reflected from the tube face whilst allowing the displayed trace to pass through without loss of illumination.

Such filters are now being used by some television manufacturers for the same purpose. There is also provision for a camera attachment when permanent records of waveforms are required.

SWEEP EXPANSION

The normal horizontal sweep is 6cm, but this is expandable from this figure to 60cm by means of a sweep expansion control on the front panel. This means that if a complex waveform is being viewed at 6cm sweep, up to ten times horizontal magnification is possible to permit detailed study of any particular part of the waveform.

The horizontal shift control has sufficient range to allow the expanded sweep to be shifted across the screen over its entire length, from one end to the other. Fig. 1 gives an idea of an expanded waveform of Test Card "C", as present at the cathode of a television set's picture tube.

Noteworthy is the fact that a tube of not less than 24 in. in diameter would be required to produce a sweep of equivalent length!

TIMEBASE

This recent version of the 303 features a considerably improved version of the Miller-multivibrator for the timebase. The multivibrator, built around two

triodes, is preceded by a phase splitter and trigger stage, which is followed by a paraphase output stage designed to supply symmetrical deflection voltages to the "X" plates of the c.r.t.

This combination truly provides excellent linearity of trace and solid synchronising under almost all conditions. The expand control is tied to the paraphase coupling circuit. An inbuilt integrator circuit permits synchronisation from the frame pulse of a television receiver.

The sweep range at minimum expansion is made from $1\mu\text{s}/\text{cm}$ to $500\text{ms}/\text{cm}$, and the recurrence frequency (on repetitive synchronisation) is from 0.3 c/s to 100 kc/s. A flyback suppression circuit is incorporated.

The sync can be either repetitive or triggered, and can be applied either externally or internally, via switching, at positive or negative polarity. On trigger, the sensitivity is 2 volts, and in this case the trigger signal initiates the sweep.

'Y' AMPLIFIER

The high specification of the "Y" amplifier adds greatly to the usefulness of the instrument. The response is flat within 3dB from d.c. to 6 Mc/s, and the

amplifier is able to handle signals up to 600 volts without overload. A constant-bandwidth attenuator, which avoids alteration in response, operates over eight positions.

This is calibrated in terms of volts/cm from 100 mV to 300 volts. Thus, the sensitivity of the amplifier is such that an input of 100 mV will give a "Y" deflection of 1 cm.

The input impedance is equivalent to 1 megohm across 15 pF, and by coupling the input terminal to a test voltage terminal (both on the front panel) a means of calibration is available. As the test voltage is 10V peak-to-peak, a deflection of 1 cm should be obtained with the attenuator set to the 10V/cm position, and a deflection of 3.3 cm with the attenuator set to the 3V/cm position. A pre-set adjustment allows for calibration when necessary.

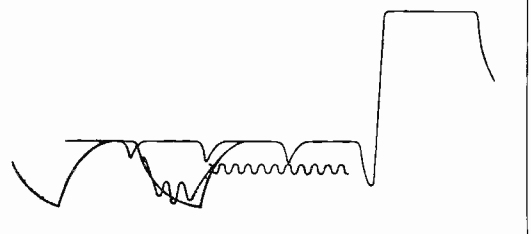
The amplifier contains four triode-pentode valves connected as two pairs of amplifiers in cascade with cathode-followers for inter-stage coupling and output. Frequency compensation is accomplished by shunt and series peaking coils.

OTHER FEATURES

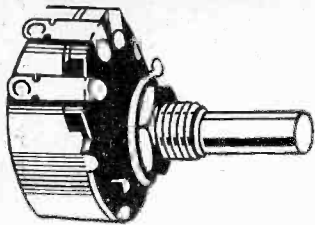
The 3 in., flat-faced tube, either type DG7-36 or 3WP1, gives a green trace and can be either long or short persistence type, as required. The e.h.t. is of the region of 1.4 kV obtained from a voltage tripler. This ensures a sharp, bright trace, which can also be adjusted

(Continued on page 59)

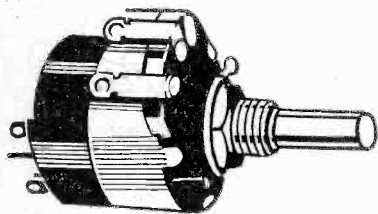
Fig. 1. A section of a line of Test Card C, as displayed on the Radar 303 with trace expansion.



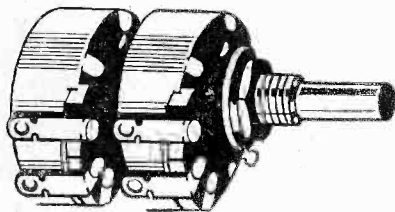
Volume Controls for Radio & TV



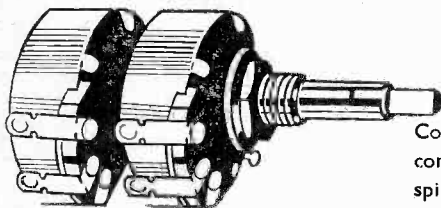
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PRESENTING DETAILS OF FAULTS ENCOUNTERED, DIAGNOSED AND CURED BY SERVICE ENGINEERS ON RADIO, TELEVISION AND AUDIO EQUIPMENT, TOGETHER WITH HINTS AND TIPS OF USE TO OTHER SERVICEMEN IN DEALING WITH DAY-TO-DAY SERVICE WORK.

Philips 1400U

Safety Circuit Trouble One of these old projection receivers was brought in with the complaint of uncontrollable brilliance.

Voltage readings were taken on the c.r.t. electrodes, showing that the cathode was about normal but the grid was 250V instead of the 120V given in the maker's manual.

Tracing back to the safety circuit it was found that the safety negative line was in fact positive. The diode which rectifies an a.c. voltage from the mains transformer to supply the negative bias was substituted, but with no improvement. The safety valve itself, suspected of having an inter-electrode short, was likewise exonerated.

Checking the circuit associated with the safety bias line, it was noticed that a 0.02 μ F capacitor (C82) connected to it had an equal positive potential on both sides. Disconnecting and measuring across it revealed that it was s/c.

It was a frame flyback suppression capacitor and was connected to the anode of the frame output valve. A replacement brought back the brilliance level to within the normal range.—V.D.C., Bristol (1014).

Pye V200

Cramp and Foldover This set had an intermittent frame fault. This would take the form of severe cramping and foldover at the top of the picture. It was one of those faults which only come on for a few minutes and then the set runs normally for hours without further trouble.

There are two linearity controls in this receiver, a normal preset which affects the overall linearity and a slider which governs the top of the scan. It was noticed that when the fault appeared, the slider control made no difference. This was checked with a meter but in spite of flexing it no fault could be found while it was being measured.

When the set was switched on again, the fault had cleared. But it was found that moving a 0.02 μ F capacitor connected from the wiper to chassis brought it back again. This was later found to be intermittently short-circuit.—V.D.C., Bristol (1015).

Decca DMC/D18

Low Timebase Voltage Complaint was no picture or raster, sound normal. There was no line whistle. Having no circuit diagram available made an easy job difficult. All the time base voltages were very low and it was decided to draw out a diagram of the timebases. Starting with the h.t. feed it was discovered that all h.t. supplies to the timebases is via a 6.8k Ω resistor in series with a 22k Ω resistor. The voltage at the hot end of the 6.8k Ω resistor was about 200V and at the earthy end of the 22k Ω resistor about 40V.

As there was something obviously wrong here, further checking around this section was made, resulting in the discovery of the trouble. A lead from the earthy end of the 22k Ω resistor goes to the channel selector switch so that when operated on f.m. radio channels the switch remains open but when operated on TV channels the switch closes and effectively shorts out the two resistors to provide full h.t. to the timebases. In this case there was a poor contact on the switch so that reduced h.t. was being fed to the time-bases both on f.m. and TV operation. Making good the contact cleared the trouble.—F.E.R., St. Ives (1030).

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 Service Engineer, 46 Chancery Lane, London, W.C.2.

H.M.V. 500T

Sound Fades Out This hybrid type car radio showed an intermittent fault on very rare occasions. The volume would cut down to a very low level and on operating the push button wavechange switch it again worked perfectly. As it was fitted to a Jaguar car whose leather upholstery would not improve with repeated fitting and removing of the receiver, the first step taken was to replace the r.f. amplifier, frequency changer and i.f. amplifier valves.

After one week's perfect operation, the fault again showed up. After very long soak tests on the bench the fault appeared and after a lot of probing and tapping was eventually traced to the encapsulated 100pF capacitor across the primaries of the first i.f. transformer. On replacing this the set worked perfectly.—N.O'R., Fermoy (1019).

K-B QVP20

Trouble with Joins One of these receivers came in for servicing with the complaint of intermittent picture. Cabinet was removed, receiver switched on and observed. Sound was normal but the video gain was low and tapping the time-base board or rocking it would bring the gain back to normal.

The video amplifier V6, its valveholder and associated circuitry was inspected and tested to no avail. Then it was noticed that the printed circuit earthing line, in several places, was soldered to the mounting frame, but two of these joints were cracked and not making electrical contact. Cleaning and resoldering earthing joints restored normal operation.—E.L., Long Eaton (1020).

Invicta 638/Pye VII0

Line Hold Critical In a case of critical line hold, a new PCF80 line oscillator V18 was fitted on several occasions. Each time it seemed to cure the fault, but later the line hold became even more critical and it was necessary to remove the set to the workshop for more detailed examination.

After switching on, the line hold

(Continued on page 55)

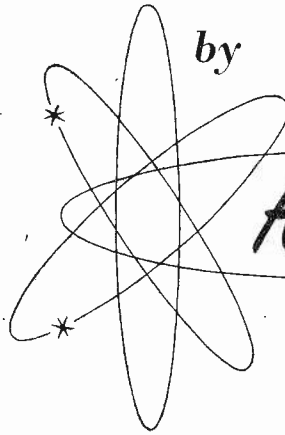
The Editor does not necessarily endorse the views expressed by contributors to this feature

SIGNAL GENERATORS

in the

AUDIO RANGE

by



Advance

- to be sure!

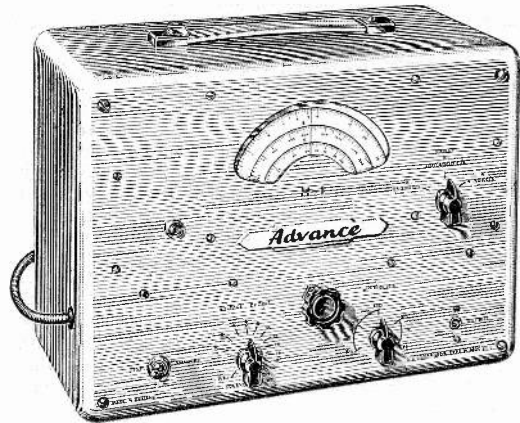
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Type H1

- Frequency range 15 c/s to 50,000 c/s.
- Sine or Square Wave output.
- Output Voltage (High Impedance).
Sine Wave, 200 μ V to 20 V, r.m.s.
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- Distortion less than 1% at 1,000 c/s.

Nett Price in U.K. **£30**

Full technical details in leaflet B41.



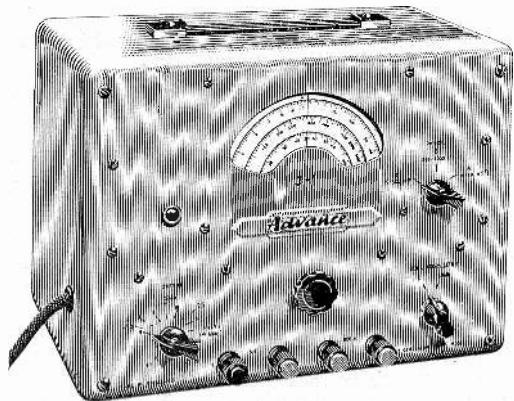
TYPE H1

Type J1

- Frequency range 15 c/s to 50,000 c/s.
- Output (Sine Wave only)
Into 600 ohms., 0.1 mW to 1 W continuously variable.
Into 5 ohms, maximum 0.5 W.
- Output Impedance.
600 ohms, unbalanced.
5 ohms. unbalanced (one side earthed).
- Distortion less than 2% at full output.

Nett Price in U.K. **£39**

Full technical details in leaflet B33.



TYPE J1

Type J2

Identical with Type J1 but with output voltage meter.

Nett Price in U.K. **£45**

Full technical details in leaflet B33.

IT/GD73

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SERVICE ENGINEER

TECHNICAL GEN

continued

control needed resetting, but then the top of the picture was pulling and the whole raster was wobbly. Channel changing, or ignition interference, would trip the line hold and it would have to be re-set again.

A check on the usual culprits failed to bring a clue to light and I was just about to check the alignment of the stabilising coil L15 when it was seen that it had no core—and the missing core could not be found anywhere in the set. A replacement core and alignment of L15 cured the fault and it only remained to wax seal the core to prevent it working loose.

On returning the set, the customer presented me with a "screw" which she had found on the television table and expressed great surprise that this little object had caused so much trouble. The set was used in alternate rooms and as it was wheeled about on its table the core must have worked out gradually, dropped onto the bottom card and thence through a slot onto the table.—S.W., Buckingham (1021).

Ultra 1760

Trouble with Frame This receiver came in with uncontrollable frame hold and very widely spaced raster lines (no interlace). The frame output and oscillator valves had been tried by the outside engineer,

with no improvement. The fault was traced to a short circuited capacitor C121. This is the sync coupler from anode of the second sync separator V7B to the grid of the frame oscillator V12B. With a short circuit on this capacitor, the anode voltage of V7B is 120V negative instead of the normal 20V positive.

Incidentally, if the maker's manual is not available, valve positions and functions are given on a card stapled inside the cabinet, a practice which could be followed by other manufacturers.—G.C., Boroughbridge (1024).

(Or refer to service sheet TV126, still available from stock!—EDITOR).

K-B QV30FM

No F.M. Sound The complaint was no f.m. radio; TV being normal. Valve and voltage checks in the sound circuits revealed no faults. A 10.7 Mc/s i.f. signal injected at the tuner produced apparently normal output and at the same time the i.f. alignment was checked, this too being normal. A new tuner was substituted—still no f.m.

Not expecting anything to happen, the contrast control was turned to maximum, as the idea of an a.g.c. fault was in my mind. Now the f.m. section was working! The negative a.g.c. voltage seemed a bit higher than one might expect on f.m., this voltage coming from the sync separator grid circuit via the usual components to the a.g.c. line. When the contrast control (an h.t. potential divider) was at maximum, the



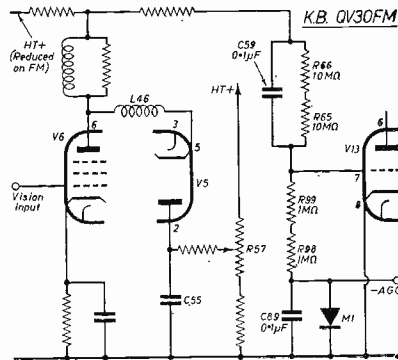
Brainless Bertie

Sets in bits upon the bench,
Tattered job sheets in the tray,
See the Service Gaffer blench,
Bertie's gone on holiday.

Feste

a.g.c. voltage was greatly reduced, thus allowing the f.m. to function.

In attempting to trace the cause of the excessive a.g.c. voltage, attention was turned to the video amplifier where disconnecting the sync separator feed restored f.m. operation. The pentode anode of the PCF80 showed 5V more



than did the other side of its load at h.t. line potential. The choke L46, from vision output anode to noise limiter, was disconnected and again the a.g.c. voltage was reduced sufficiently to allow f.m. operation.

Rotation of the noise limiter control had no effect and voltage checks revealed a few volts a.c. on the EB91 anode. This was found to be due to the valveholder (a paxolin wafer type) being faulty, the sockets of pins 2 (anode) and 3 (heater) were shorting—not a dead short but several ohms.

This upset the operation of V6 which in turn upset the sync separator input and the negative a.g.c. voltage. A new valveholder restored things to normal. One would have thought that some vision fault would have occurred, but none was seen.—G.H., Harrogate (988).

Cossor 930

Three Inches High This elderly receiver was brought into the workshop with the complaint that the picture was only about three inches in height, although linearity was quite all right. Valves had been

(Continued on page 57)

RECEIVER

SPOT

CHECKS

No. 71: KOLSTER-BRANDES QV20/1, QV30/1, QV70

Ragged Edge on Verticals: Check R92 and R93 for o/c or h.r. and, if accompanied by slightly increased brightness, check C81 for s/c or leakage.

Weak Sync: Check R96 for h.r. and R98 for o/c or h.r. if frame only affected. If line locks at different positions of control C57 may be h.r.; if line locks at one end of control C57 may be s/c.

Reduced Brightness: Check R124, R134 for s/c, R130, C61 for o/c, C96, C98 for leakage. Much reduced brightness may be caused by o/c R126 or s/c C99 with R128. Reduced brightness, varying as the resistance, may be due to R126, R131, R132 h.r., C99 or C100 leaking. Reduced brightness with smeary picture—check R94 for s/c.

No Frame or Line Sync: Check

R91, R93, R101, C55 with R63/64, C85 for s/c. If accompanied by excessive brightness check R94 for o/c or h.r. and C55 for o/c.

No Frame Sync: Check R95 for s/c or o/c, R98, R106 for s/c, R99, R100, C84 for s/c, o/c or h.r., C83, R109 for o/c, C85, C87 for o/c or leakage.

No Frame Scan: Check R106, R107, R113, R114, C92 for o/c, R115, C83, C87, C89 for s/c.

Excessive Frame Scan: If bottom extended, check C93 for s/c or leak, R123, R122 for s/c. If top extended, check R120 for h.r., R119 for h.r., R146, R147 for o/c.

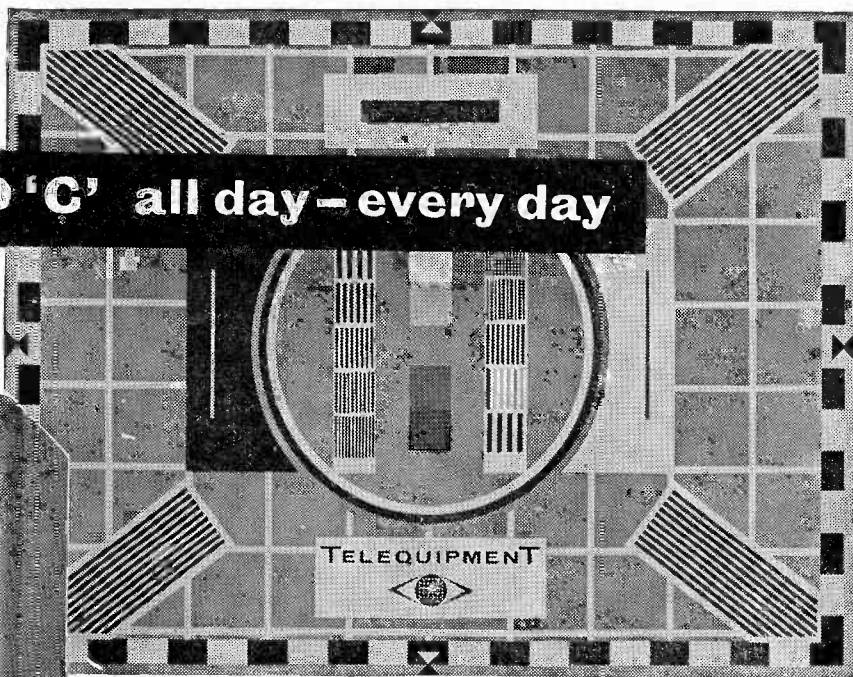
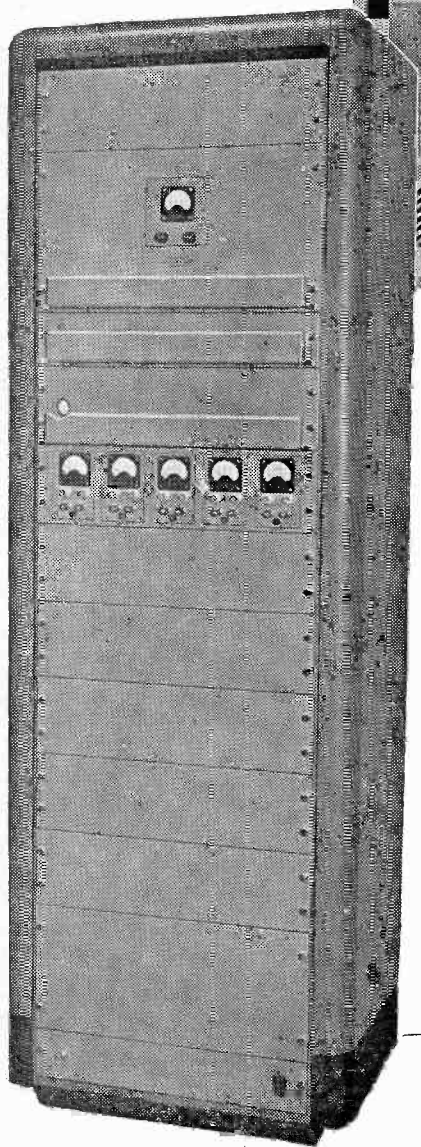
No Control of Brightness: If left side of picture goes black, check R124 for o/c. If brightness excessive, check R134 for o/c or R126 for s/c.

Weak and Smeary Picture: Check C99 for o/c.

Frame Locks One End: Check R107 for s/c and C91 for leakage. (If C91 is s/c, no frame hold, running at wrong speed).

Increased Brightness: Check R128 for o/c, R131, R132, C61 for s/c.—D.C., London (1031).

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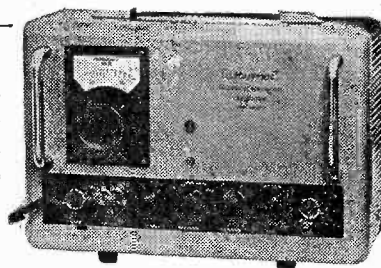
- ★ C.C.I.R. standard.
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TELEQUIPMENT



RADIO SHOW,
Earls Court,
August 23rd—September 2nd.
STAND 316

For the smaller user—
Telequipment WC44
portable waveform
generator at £62.



TECHNICAL GEN

continued

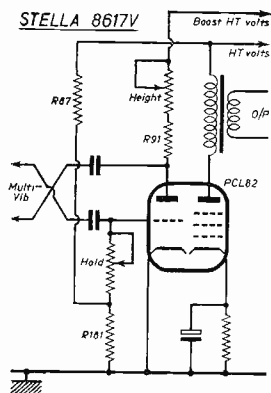
tried in the customer's home, but to no avail.

The fault was traced to R61, a 1.8M Ω resistor from the "earthy" end of the height control to V10 (ECL80) triode anode. This resistor had increased in value to approximately 6M Ω and replacement completely cured the fault.

R61 is situated on a tag panel under the time base chassis, adjacent to the main h.t. electrolytic capacitor block.—G.C., Boroughbridge (1025).

Stella 8617U

Low Frame Scan Frame was low, but perfectly linear and locking correctly. The PCL82 was first replaced with no improvement. The 100 μ F cathode bypass electrolytic C66 was bridged, still with no improvement.



Voltagages checked near the expected values, but, on the principle that high-

● odd spot

A PYE CW17 came in with badly bent verticals and line pulling. With it was a note, apparently written by another dealer explaining that the fault was "incurable... due to the experimental method of control which was found to be ineffective and has since been dropped". According to the note, also present was "astigmatism in the tube which is hardly noticeable on the picture".

The set was put into perfect working order by replacing C101 (0.01 μ F) decoupling screen of PCF80 line oscillator and C104 (0.01 μ F) coupling capacitor from line oscillator to line output valve!—F.E.R., St. Ives (1209)

ohm small-wattage resistors are always suspect, R91, the 680k Ω anode load of the PCL82 triode section of the multi-vibrator was changed and we were rewarded with a full raster.

Full, but unstable. The frame would not lock over its hold range and we had to replace two more high-ohm resistors (R87 and R181, 3.3M Ω and 2.7M Ω respectively) to secure a stable lock. Accompanying sketch shows the disposition of these components. Use half-watt replacements for future stability.—B.R.G., Bargoed (1008).

Pye V110/Invicta 638

Buzz on Sound On one of these sets, the trouble was frame buzz on sound, which seemed as though it was due to an oscillator waveform pulse. This was confirmed by quick removal of the ECC82 multivibrator V15 while set was switched on.

The cause was due to the speaker wires being unhooked from the clip on the

speaker and running close along bottom of valve base. When repositioning, ensure the leads do not touch the e.h.t. lead, otherwise line pulses will be introduced instead!

On another of these models, an early 638, the trouble was no sound, apart from a tuneable buzz. Cause was o/c of C44 (800pF), screen decoupler of the second i.f. amplifier V10. The makers recommend that this capacitor, as well as the sound i.f. screen decoupler C41, should be replaced with capacitors of 0.001 μ F and mounted on the other side of the panel, because of heat generated by the valves which affects the capacitors. This modification also improves sound tuning on Band III channels, in low signal areas, and there is also less rushing noise.

Two faults recently experienced were frame roll when switched on from cold and frame hold needs frequent resetting. This is not, as might be expected, due to the ECC82 frame multivibrator but the PCF80 sync separator and frame sync

SERVICE BRIEFS

Philips 1768U: On one of these sets, the line hold had to be continually reset until the hold finally went to one end. Speed resistor was checked and found OK. A check of capacitors on the bridge quickly found that the grid coupler C54 was leaking; replacement cured the fault. A similar leak on C54 has caused a "no line" fault on another of these sets and it does not seem able to stand up to the pulses voltages. We shall make a habit of changing it automatically.—J.H.P.-J., Bristol (956).

G.E.C. BC561: We have had three cases of this fault on almost new receivers of this model. Trouble is distorted reproduction and in each case the fault has been due to breakdown of the insulated sleeving on the output transistor leads. These leads are sometimes twisted together and the insulation chafes through.—G.C., Boroughbridge (1027).

Ecko T310/311: Weak sound on TV, while sound on f.m. remained normal has been the complaint with two or three of the above receivers. Spot checks around the a.f. stage showed normal working voltages and an audio generator applied to the top of the volume control received a hearty response, which diminished greatly when applied to the detector end of the a.m. noise limiter MR2. Replacement of MR2 restored normal operation in all cases.—N.C., Seaford (943).

K-B QV30FM/QVP30: Although this fault is straightforward it is sent in because of its frequent occurrence. The customer's usual complaint has been a gradual decrease in brightness. On checking tube voltages it is found that the control grid voltages are low and R147, a 330k Ω resistor in a potential divider network, is found to be high in value.—T.G., Seaford (947).

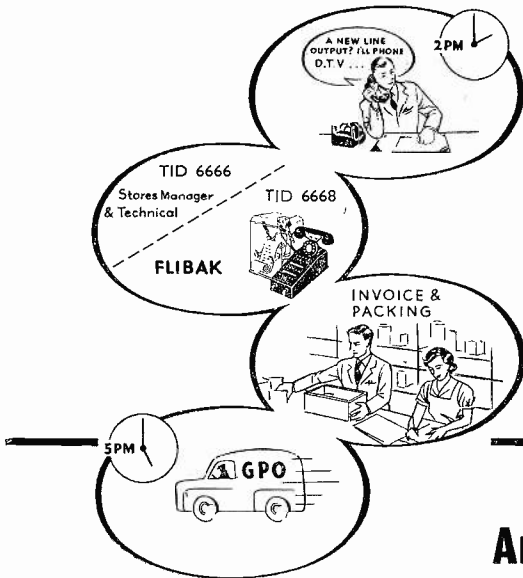
H.M.V. 1840: The trouble was a great number of black lines superimposed on the picture and considerable interference to other receivers, which took the form of vertical white lines such as those which occur from brushing. After a great deal of chasing around line components, the culprit was eventually found to be the tube itself and a replacement was necessary to clear the trouble.—N.A.B., Tadcaster (973).

Bush TR82B: This transistor portable worked normally for a short time, then cut off, although there was plenty of noise in the speaker, indicating a possible front end fault. On checking, everything seemed normal and a replacement OC44 did not improve matters. On taking resistance readings, 500-ohms was obtained from the oscillator transformer to earth. This was found to be due to the tuning capacitor being intermittently leaking to earth and a replacement was necessary.—K.R., Nelson (962).

(Continued on page 63)

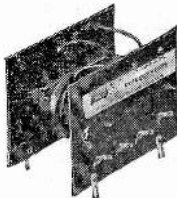
A message from F. W. FIRTH

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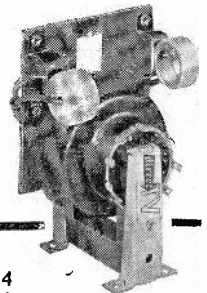


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"For fourteen years I was employed as a service manager by a busy radio and TV Dealer in South London. Consequently, I am well aware of the problems besetting the retailer, especially the problem of the "difficult-to-get" spare. In those days I mistakenly thought that if the makers could not supply a line output transformer or other special quickly I could do nothing but wait. Last week I visited my old employer and found that a certain well-known make of set, which had been waiting for a set of scan coils when I left a month ago, was still on the shelf. The following day I was able to send this component to my old employer from stock.

"Now, when I think of the number of times in the past that I kept a customer waiting when all I had to do was to contact Direct TV Replacements, I feel ashamed! The stocks of time base components held by this firm run into tens of thousands and why I did not make more use of them I just do not know!

"The organisation at Direct TV Replacements Ltd. is superb. All orders received by three o'clock are sent out on the same day, by five o'clock. Unobtainable spares are rewound in a few days.

"I was very surprised, too, to find that so many transformers that I used to obtain from the makers are, in fact, made by the Direct TV Replacement Factory. This same factory makes the well-known Skantest line output transformer tester and the equally famous D900 Transistor Tester. This Tester has the advantage of being able to test transistors whilst they are still in circuit and contains a variable power supply which can take the place of the set battery.

"Finally, I would say to the frustrated Dealer - if the makers cannot supply - see Direct TV Replacements Ltd., and if you are in a hurry, try Direct TV Replacements Ltd. FIRST!"

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RADAR 303

—continued

for astigmatism by means of a pre-set control.

The instrument contains 10 valves in addition to the c.r.t. These are of three types, viz.:—ECF80, ECF82 and EZ81 h.t. rectifier. Two front panel "X" terminals allow an external signal to provide the horizontal scan and the internal timebase signal to provide a sweep voltage for an associated wobulator for visual alignment of tuned stages, etc. A three-position switch selects "internal timebase", "external timebase" and "frame integrator".

PRESET CONTROLS

There are numerous pre-set controls to re-balance the various circuits during maintenance or after valve changes. These are: sync sensitivity, trigger sensitivity, set time, trace length, amplifier balance, set horizontal position, "Y" gain, astigmatism, h.f. linearity. These are accessible only with the cover removed.

The main front-panel controls are:—focus, vertical position, sync, input attenuator, sweep range, sync select, sweep fine, timebase selector, horizontal position, expand and brilliance. The front panel terminals are:—input, earth, sync, a.c. test voltage, "X" in and "X" out.

The instrument incorporates a detachable viewing hood which, in conjunction with the polarizing filter, allows opera-

tion in open daylight or where a high degree of ambient lighting is present.

In view of the particularly rugged construction of the instrument, it can be expected to withstand a fair amount of rough handling, and van use, without damage. The overall dimensions are:—height 9 in., width $6\frac{1}{2}$ in. and depth 13 in. The steel case, which is finished in hammer stove enamel, is complete with carrying handle and adjustable tilting stand. The weight is 20 lb.

The instrument is mains operated over the range of 200–250 volts a.c., 50 c/s, and consumes 90 watts. Other voltages are available to requirements.

ON TEST

The sample instrument was subjected to numerous tests, and used for a while in both the service department and laboratory. It was introduced to several service technicians for their observations, and was liked by all who had the opportunity of using it. There were no negative criticisms of any kind.

All the controls work perfectly smoothly in relation to the trace without backlash effects or juddering. The sync performance is such that even very small amplitude signals are locked solidly without fuss or bother. The frame integrator circuit was found extremely useful when dealing with television signal and pulse waveforms.

The wide bandwidth of the "Y" amplifier and the resulting fast rise-time ($0.06 \mu\text{s}$) almost allow the performance of a television receiver or hi-fi amplifier to be judged solely from the character of the pulses displayed on the screen.

The expansion control is of great assistance for studying a section of a waveform, especially a complex one, in detail without upsetting the synchronising, which may happen if the sweep velocity is increased to secure a similar enlargement. The $1 \mu\text{s}$ pulses comprising the 1 Mc/s frequency bars of Test Card "C" can be opened out to more than 6 cm! Here, then, is a method of determining the video performance of a TV set.

The two "X" terminals allow either the use of a wobulator which supplies its own "X" signal or of a wobulator which requires an "X" signal to provide the frequency sweep, such as the Cossor FM Alignment Generator Model 1324.

From a simple objective test of a display of some 6 line sync pulses, "X" linearity would appear to be almost perfect, there being no discernible difference in width of the series of pulses along the trace. This is, of course, the result of the revised Miller-multivibrator circuit which the instrument features.

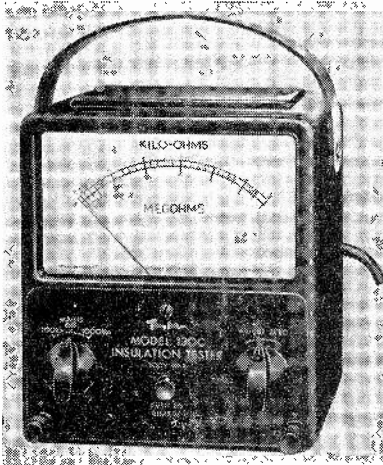
Although relatively small in size and of utmost portability, there is little doubt that the overall performance has not been sacrificed in any way to achieve such compactness, which is a requirement of most of us now that more, and more instruments are being imported to the laboratory and workshop, and now that it is current practice to bring instruments into field use.

The Radar Type 303 is manufactured by Waveforms Limited, Radar Works, Wallisdown, Bournemouth, Hants.

Price is £60.

Taylor 130C

The latest addition to the range of Taylor Electrical instruments is the Model 130C insulation tester. Total resistance measurements covered are from 20Ω to $1,000 \text{M}\Omega$ and for insula-



tion measurements a test voltage of 500V d.c. at infinity is applied to the component under test via a safety push-button switch.

Measurements are made on a clear 5-in. scale, the meter movement being of the centre-pole design with a sensitivity of $37.5 \mu\text{A}$. The movement has sprung jewels to withstand rough handling. The instrument is designed to

operate from an a.c. mains supply between 110–240V, 40–60 c/s. The primary of the mains transformer is fused and the mains adjustment panel and fuseholder are readily accessible.

The 130C has a bakelite casing and is light and portable. The price is £16 3s. trade. A high quality leather carrying case can be supplied for field engineers at £2 19s. 6d. trade.

NEW FRAME GRID VALVE — THE PC97

A new Mullard frame grid valve opens the way to simpler and less expensive r.f. amplifiers in TV tuners. The new valve, the PC97, is a triode which by virtue of its exceptionally low anode-grid capacitance of 0.5pF (achieved by the introduction of earthed shielding plates between the grid backbones and the anode) can be used in place of the conventional double-triode.

The noise factor of an r.f. stage using the PC97 is of the same order as that of a double-triode cascode amplifier. The gain will be somewhat lower, but Mullard point out that in TV tuners high gain is

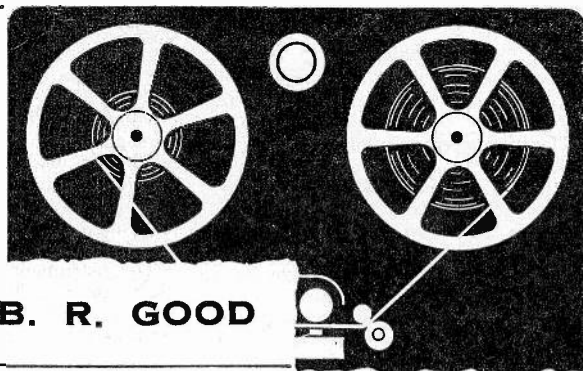
not always an advantage and it is often more satisfactory to increase the i.f. sensitivity.

Another feature of the PC97 is the special arrangement of the cathode leads and the provision of two cathode pins, which reduces the cathode lead inductance and gives good input damping.

The valve has a B7G base and measures 47.5 mm . seated height by 19 mm . diameter. The heater is rated at 4.5V, 300 mA. Mutual conductance is 13mA/V at an anode current of 11 mA. Changing the bias from -1V to -5V reduces the mutual conductance 100:1.

Servicing the MODERN TAPE RECORDER

PART FIVE OF A NEW SERIES BY **B. R. GOOD**



THIS series began with the observation that the large number of tape recorders on the market precluded a detailed survey. On the same page there appeared a diagram of the switching chart for the Grundig TK5.

This illustrates my present dilemma: for the Grundig range of models is wide and varied. There are some common factors, which will be mentioned. But it is the difference between models that matter most to the service engineer.

We shall, therefore, concentrate in this article upon the particular features of various models, as they affect servicing, after dealing briefly with a typical Grundig chassis. There must inevitably be omissions: if any readers desire further information, the Technical Editor will be pleased to pass queries on.

GRUNDIG MODELS

A typical deck to illustrate our theme is the Grundig TK25. This is a companion to the popular TK20, with the addition of a lower speed, $1\frac{1}{2}$ i/s, to the basic $3\frac{1}{2}$ i/s. There is also a TM20 in this group, which consists of a chassis only (no cabinet, loudspeaker or output stage). Apart from differences in the input panel, this is much the same as the TK20.

These are half-track machines (standard $\frac{1}{2}$ in. tape), recording upper track left to right. A single motor and very heavy flywheel with the usual self-lubricating bearings are special Grundig features, as are the friction clutch assemblies, which will be dealt with in detail later.

The Motor

The motor is an outer rotating cage split phase induction type, driving the flywheel A from a stepped pulley B, via a plastic belt C. A smaller pulley D, on the flywheel, connects drive belt E to the right-hand, take-up clutch F. This ensures the correct pressure for Record and Playback, the back tension of the

left-hand spoolclutch G being provided by friction.

Direct drive to the right-hand spool is applied via the idler wheel I on Fast Forward, between the motor pulley and the upper section of the divided clutch. This makes for very smooth operation.

Similarly, Rewind drive to the left-hand spool is direct, the swivel lever H, pivoted at P, engaging the clutch rim with the motor pulley. The position indicator, of the conventional "speedometer" type, is driven via another belt J, from the upper portion of the left-hand clutch.

The clutches are similar but not identical, and care should be taken when dismantling for cleaning, etc., not to mix up the parts. A small point which can cause a lot of worry!

The method employed is of friction drive proportional to the weight of the spools and tape, and thus a regulation of tension.

Uneven Spooling

In practice, this gives rise to judder and uneven spooling if the felts are allowed to harden, or if dirt is allowed to intrude between the clutch plates. Fortunately, dismantling is simple, and

cleaning with methylated spirits, plus a slight "roughening" of the felts should restore correct operation.

After removing the top spring ring, the clutch spindle assembly lifts off, revealing a circlip. Removal of this circlip allows the upper half of each clutch to be withdrawn.

Take care of the washer beneath the circlip—its presence is important on reassembly. If it does become necessary to remove the lower clutch assembly, remember that the second washer on the bottom of the right-hand clutch is thicker.

On models such as the TK5, TK55, and TK830, where a slightly different clutch assembly is used, there will be found both a steel and a plastic washer in these locations. Remember, on reassembly, that the plastic washer is fitted adjacent to the rotating surface.

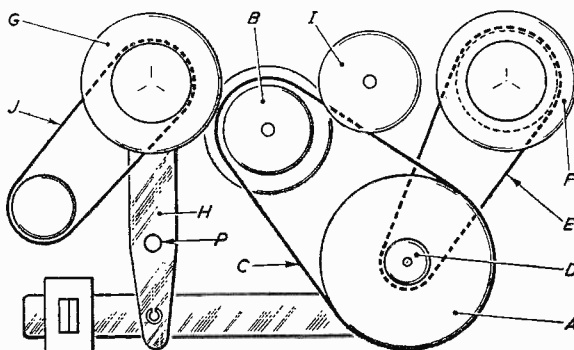
Drive Belts

The drive belts mentioned above, and those on earlier models, are of a thermoplastic material. For this reason, they may be affected by temperature, and can harden through disuse.

This occasionally gives rise to peculiar symptoms, such as incomplete rewinding, gradual slowing down and irregular speed. The fault can be cured by the application of gentle heat to the drive belt—not, please, as I once saw used, the shaft of a soldering iron!

If there is time to spare, other jobs

★
Fig. 1. Diagram showing the motor and drive system as used in the Grundig models TK20 and TK25. The belt sections are circular. See text for explanation of reference letters.
★



to do while you wait, it is advisable to switch the tape recorder to Fast Rewind and let it run for an hour. Do this with tape and spools in place to allow the friction drive to take full effect.

Braking

Braking is straightforward. Felt pads on angle arms engage the outer diameters of the clutch rims when the selector is turned to Stop, or, where applicable, to "Temporary Stop". In Playback and Record positions, these pads should be quite free. Adjustment is best done with the machine switched to Rewind. *On Fast Forward, the left-hand brake felt should be just clear of the clutch rim, and on Rewind, the right-hand brake can be similarly adjusted.*

The Temporary Stop position has a further refinement of a locking spring catch on some machines, notably the later runs of the TK5. If this has been left engaged and the recorder switched from Temporary Stop to Rewind or Fast Forward, the erase pressure pad may have been left under tension. Apart from increased wear to erase head and tape, this can result in dislodged pressure pads, with the complaint of "noisy background".

Speed Changing

Speed changing varies between different models, but perhaps the most popular method is as used on many of the three-speed versions, such as the TK55, TK35, and the two-speed models such as the TK30 and TK60.

To change from $7\frac{1}{2}$ i/s to $3\frac{3}{4}$ i/s, a lever pushes the plastic belt to a smaller diameter step on the motor pulley. This is a straightforward action. But to obtain the still lower speed of $1\frac{7}{8}$ i/s, the motor is operated on a reduced voltage from a tapping on the mains transformer (from 165 volts to 117 volts).

Other adjustments on the mechanical portion of these machines are the pressure and spacing controls on the tape drive and head assembly, shown in Fig. 2.

Pressure Roller

The pressure roller assembly and pressure pad bracket are mounted on a

swivel lever, pivoted at point P to the head plate. A spring S holds the tension toward engagement, movement of the left side of the lever being effected by the selector to disengage.

The felt pressure pad F is on a bracket held in torsion by a spring around the mounting pillar G. The pinch wheel is on an angle piece attached to the main bracket and an adjustment at the outer end of the angle piece, screw J, allows variation of pressure, while an eccentric screw, K, provides a rocking adjustment to make sure the pinch wheel is vertical, parallel to the drive spindle.

Stabilising System

The pinch wheel makes contact with the capstan spindle L, which protrudes through the plastic bearing M. This last has occasionally led to complaints: the aperture is not circular but has small protrusions and some play can be felt if the spindle is held and moved. *This is quite correct.*

The plastic bearing is part of a stabilising system, the long spindle running in a special bearing beneath the flywheel, with a self-centring device acting upon its lower end. There should be sufficient play between spindle and disc to allow this self alignment to take effect.

Other features of the top-plate are conventional and should give little trouble. The Record/Play head R has a central fulcrum and two screws for azimuth alignment, one being spring-loaded.

The erase head E is on a separate assembly and the main tape guides T are of the usual style, with the left-hand one split and insulated for short-circuiting by the metal end of the tape and auto-stop relay operation.

Relay Operation

Relay operation of the main functions, and electro-mechanical control generally, is a prime feature of the Grundig range. A close inspection of the contact leaf arrangement is usually sufficient to give the service engineer some idea of the mechanical function, but the electrical

arrangement, with one relay being dependent upon another for action, may need study. *Do not attempt to adjust relay settings unless you are absolutely certain they have been disturbed.*

For example, a fairly frequent complaint on the TK20, and others of similar design, has been weak or non-existent playback. A quick inspection will soon show whether the Record/Play relay, mounted just behind the head assembly, is pulling in when the selector (or key) is switched to Playback.

If this does not function, the trouble often lies with the high-wattage 11kΩ series resistor, between relay and h.t. rail, via contacts on the input buttons.

On other models, such as the TK25, a further relay, the two-contact head relay, is in series with this circuit and a contact on the erase cut-out (superimposition) control. This is also in series with a contact on the Record button. So it can be seen that there are five separate links in this chain.

Note Sequence

Care must be taken when testing to ensure that functions are in the necessary sequence – especially when servicing an unfamiliar model. *Such complicated sequences as the auto-stop, braking, record and record/playback relay on the TK55, stereo playback machine, need careful study to unravel.*

On this machine, braking is electrically initiated, with a pressure solenoid, capacitor discharge circuits, holding contacts on relays and a reverse-action auto-stop to complicate matters.

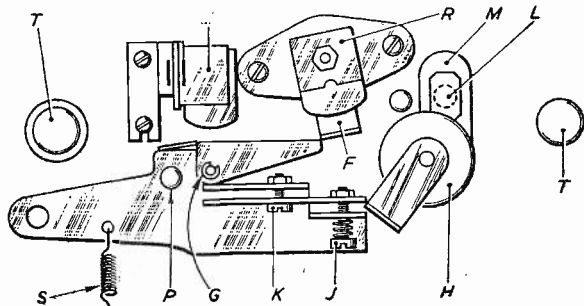
Stereo Switching

Even more fearsome is the switching circuit of the fully stereo models, such as the TK830/3D. This range employs a total of five relays, Motor, Centrifugal, Track, Braking and Muting, with a pressure solenoid and two clutch solenoids. Contacts on these, in conjunction with the increased switching of separate tracks, all act in conjunction and exact sequence. *It requires a two-page chart to set out the action. From the service viewpoint – it always pays to check the centrifugal switch on this model when erratic action is reported.*

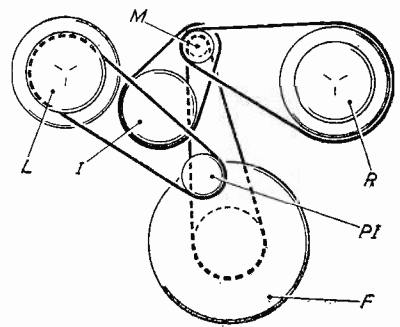
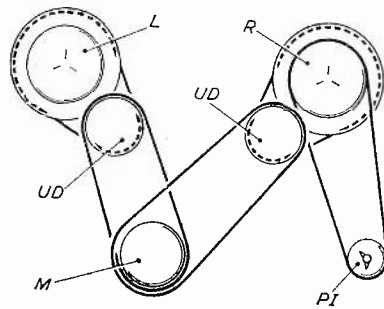
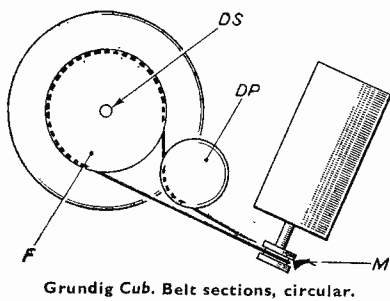
At the other end of the scale is the transistorised battery portable, typical of this style of machine, the Grundig Cub. Readers who have met this stylish little machine will need no reminding that it combines elegance with efficiency. It has several features of interest to the engineer.

Batteries

Batteries are in two sections: for the 6-volt d.c. motor, 4-leak-proof *Mono-cells* are used, and provision is made for an external 6-volt source, such as a car



★
Fig. 2. Diagram showing the head assembly of the Grundig models TK20 and TK25 with the mechanisms of the pressure and spacing controls. For references, see text.
★



KEY

- L—Left-hand spool.
- R—Right-hand spool.
- M—Motor spindle.
- I—Idler pulley.
- DP—Drive pulley.
- DS—Drive spindle.
- FW—Fast Wind pulley.
- PI—Position indicator.
- UD—Unidirectional pulley.
- X—Belt sections.

Above: Models TK819, TK820 and TK830.
Below: Models TK9 and TK12.

Above: Models TK30, TK35, TK55, TK60 and TM60. Below: Models TK5 and TK8.

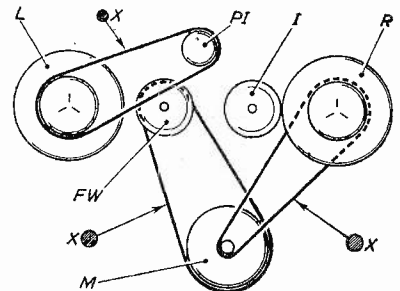
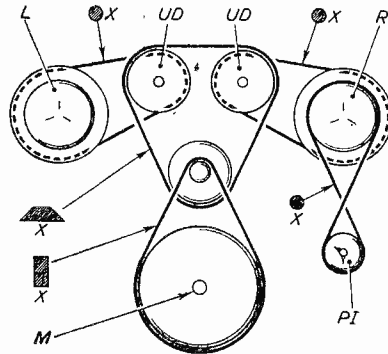


Fig. 3. Diagrams of the various drive systems used in Grundig tape recorders from the simple Cub to the complex TK9 and TK12.

battery. But the amplifier is fed by a 3-volt No. 8 battery, and with a current drain of approximately 10 mA on Record and Playback it is not expected that much more than 10-15 hours' use will be gained.

Thus, if a Cub (or similar machine) is brought in with an apparent amplifier fault after being used on external supply, always check that the 3-volt supply is correct.

Substitute the battery with a good one, if in doubt, for a meter reading may occasionally be misleading, especially if the battery has developed a high internal resistance.

Transistors used are two OC71s, a matched pair of OC72s and an OC602 which is used across the motor as a stabilising device in conjunction with a centrifugal switch.

For complaints of rough running that have no obvious mechanical cause, check that the 22Ω resistor between emitter and collector of this transistor is in order, and that the .005μF capacitors across the motor and from collector to deck of the OC602 are correct.

Selector Switch

The selector switch has three distinct switch operators; at the upper level is a chain wheel and chain which swivels the head mounting bracket to provide engagement of the permanent magnet erase head.

Adjustment of this item should be

checked on "Record", when there should be a 10-20 degree rake between the axis of the erase head and the centre line between the tape guides.

Second function of the selector switch is the wafer on a lower level, which contains the motor and battery switching. All other switching is carried out by a slider on the printed circuit panel, the lug of which is impelled by a plastic cam at the base of the selector switch.

A further selector lever on the switch spindle, just above chassis level, is connected to two lever arms on which the spool carriers are mounted. The functions are selected by lateral movement being transmitted to the spools so that they engage with the drive spindle.

No Capstan

On this machine there is no capstan driving the tape, which is pulled around by the take-up spool. No fast forward rewind is allowed for and the reverse rewind is fairly slow (taking over five minutes to re-spool the 3-in. reel of tape).

In the rewind position, the spool carriers are moved to the right (looking down on deck) and the left-hand carrier engages the idler wheel which is sprung so that the drive spindle transmits movement.

Possible causes of fault are distorted idler wheel or slack lever springs (beneath chassis), and drive belt slip at the "change of direction" point near the pulley.

Because of this lack of capstan, it is not always possible to obtain good results when playing back tapes recorded on the Cub through the medium of other types of machine. "Cub" tapes should be re-recorded. This is because the speed, a nominal 3 3/4 i/s, is proportional to the amount of tape on the spool. Actual speed varies between 3 and 4 1/2 i.p.s. It is worth remembering this point in case customers complain!

Part Six will appear in the September issue.

See us at the Radio Show

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We look forward to meeting you at our main stand and at our counter display in the Servicing Feature. See you at the Show!

New Books

★ SERVICE ENGINEER REVIEWS OF THE
LATEST TECHNICAL LITERATURE

Transistors, compiled by the staff of Gernsback Library Inc., published by Gernsback Library Inc., 154 West 14th Street, New York. (U.K. Agents: Modern Book Company, 19 Praed Street, London, W.2). Size 8½ × 5½ in.; 96 pages. Price 16s. 0d.

EXPERIENCE is the best teacher. The engineer learns more about the theory of electronics from the equipment he is handling than from books alone. Similarly, the student gains from practice in building experimental hook-ups.

This is a book that should benefit both, for as well as describing methods and devices for testing transistors, it gives a number of bench-tested circuits and constructional details for building transistorised test equipment. A reader who takes the trouble to work his way through the book will reach the final page much wiser about transistors than when he started.

The book falls into two parts. The first deals with the testing of transistors, and describes equipment built for this purpose. The second section gives nine circuits of varying degree of complexity, each using transistors. Complete parts lists are given, and though these contain items not obtainable here, the British reader should have little difficulty finding suitable substitutes. The transistors are all internationally listed.

To be accurate, the title of this book should properly have been *Transistorised Test Equipment*. Apart from a useful explanation of semi-conductor parameters in Chapter Two, the whole work is devoted to constructional practice. This may mislead intending purchasers, and could deter the genuine enthusiast who, while finding this volume quite useful, might shy away from yet another "popularised transistor theory", which this seems to be, at a casual glance.

The thirteen chapters are reprints of articles that originally appeared in *Radio-Electronics*. They have been slightly edited, the publisher's information tells us, although the three I checked, which were first published in 1959, had nothing altered. All that was added was a preamble of a couple of sentences, linking the chapter to the body of the book.

This makes for uneven texture, as the writers were both staff technical journalists and freelance contributors. Much might have been gained by having the guiding hand of an experienced editor to weld the book into a more readable entity, and an introductory chapter on transistor theory should have been provided—if only as a matter of courtesy.

But talking of what might have been does not detract from the merit of what is. This collection of chapters will prove useful to both technician and student. Essentially practical, it should attract the sort of chap who would like to knock up a Mini-tracer, a TV Bar Generator, a Lab-type Transistor or a Scope Calibrator in his spare time, to mention only a third of the interesting circuits shown.—M.A.Q.

TV Trouble Analysis, by Harry Mileaf. Published by Gernsback Library, Inc., 154 West 14th Street, New York 11, N.Y. (U.K. Agents: Modern Book Company, 19 Praed Street, London, W.2). Size 8½ × 5½ in. 220 pages plus 4-page index. Price 26s. 0d.

HERE, at last, is a book on TV trouble-shooting that is refreshingly different. Taking an essentially practical view, the author has developed his "theory of trouble", and given us a positive approach which enables a better understanding of fault conditions.

Growth of the radio trade has been

there was e.h.t., but no screen illumination. On attempting to adjust the brightness control it was found to have seized up.

The combined brightness/volume control was replaced but when set was switched on a cloud of smoke issued forth from the top of the brightness control. This was found to have seized up also. The cause was s/c of C27 (0.1µF), connected from centre of brightness slider to chassis. Replacement of C27 with one of 1kV rating cured the trouble.

When sets come in with crackling on sound due to volume control, or o/c mains switch, I now always replace C27 with a 1kV capacitor to guard against this trouble occurring.—S.W., Buckingham (1022).

too rapid for the technician to survive on his memory alone. Time wasted on an unfamiliar set can not be afforded. The solution is to understand how a set works when trouble is present.

To illustrate his theme, Mr. Mileaf spends 36 pages in a first chapter on waveform analysis. He explains the characteristics of the various stages of the TV receiver, briefly running through signal theory. As the quoted figures refer to American standards, this chapter need not occupy the British reader. However, the principles that follow are of absorbing interest.

Chapters 2 to 5 analyse all the component parts of the receiver, valves, capacitors, resistors, transformers, coils, loudspeakers and tuners. Describing their construction, the author shows how defects can occur and goes on to show the effect of such failure on the circuit operation.

This novel approach is seldom seen outside the pages of those magazines devoted to the amateur (and in such articles as the *Apprentice* series of *Radio Retailing*). The book is well worth a place on our shelf for these chapters, alone.

In the succeeding chapters the "Trouble Theory" is further developed, this time taking the various circuits of modern receivers and discussing what happens when they break down—always remembering that the breakdown is almost inevitably the result of valve or component failure. Plenty of waveform illustrations are used, as is the general American practice. In addition, there are numerous diagrams to pinpoint the arguments of the text, and these are well up to the usual Gernsback standard.

Although, as in the first chapter, allowance has to be made for a difference of transatlantic standards, there are so many common factors that this excellent volume cannot fail to be of service to the technical man. The style is concise and logical, the text practical at a service engineer's level, the illustrations impeccable. Well worth studying.—H.W.H.

Blue Spot and Uher Service Departments

Now that structural alterations at 205 Great Portland Street (London, W.1) have been completed, Bosch Ltd. announce that the service and spares departments of *Blue Spot* receivers have been transferred back there from Hendon, under the supervision of Mr. H. G. Dettmar.

The service department and spares division of *Uher* tape recorders, for which Bosch have now been appointed official U.K. agents, will also be located at 205 Great Portland Street, under the supervision of Mr. W. Wahl.

Sales information, advertising material and technical advice will also be available at the same address.

TECHNICAL GEN

continued

pulse shaper V16. A replacement will sometimes cure both faults. Line coil remains unaffected by this valve.—S.W., Buckingham (1023).

Invicta 638/Pye V110

Set Goes Dead The symptoms were "set dead". On replacing fuse, heaters glowed but there was no sound, no raster, no h.t. The rectifier surge limiting resistor R35 (10-ohms) was o/c and was replaced. Then, sound was OK and

Take-over Bid

LAST December I got into the doldrums because of the icy economic wind. And that metaphor is as mixed as my feelings now that enough time has gone by to prove my very un-Christmassy predictions.

You may remember, I described how a service department felt the axe, was disrupted and segregated, because the financial wizards could not juggle the company accounts to show a profit. I foresaw that engineers would be used as errand-boys, at the beck and call of shop managers, exactly as if each branch of a chain was a tottering one-man business.

This device of administering the engineers by sales staff is known by the euphemism: "Cutting Down the Overheads". When that phrase is used, the city gents stand to attention and raise their bowlers. Perhaps it is the resultant rush of blood to the feet that prevents them from seeing that the outcome, for the reasons I gave last December, will be service that is not only much less efficient but ultimately more costly.

The next move, sub-contracting, proves even more of a fiasco. Branch managers, just beginning to get accustomed to the pleasures of slave-ownership, are reluctant to see service snatched from their grasp. They sub-contract, grudgingly, the longer-distance calls and the tedious complaints. Like those of Mrs. Grumble, who will not be placated until she has obtained a second opinion.

Result - super service, with expenses to match. So the audit boys get the wind up again (that same old economic breeze?) and decide that service had better be organised. But still without overheads. A spare pensioner from the sales staff can look after the engineers. He can route calls, make out orders, and tot up the costs.

The only trouble is that he wastes a

precious workman's time asking plaintively for advice. What is this note that Joe has appended to a job sheet: *L.O.T.u/s*? Should he order some manner of oriental flower? And how is it that Sammy has booked out an FC13C when the only contact rectifiers on the stockbook are 14-R-A-something-or-other? He needs someone, too, to point out his folly in ordering another two dozen 30C1 valves when there are already four dozen PCF80s on the shelf.

And as for returns under guarantee... beneath the desk is a box full of unlabelled transformers and printed-circuit mod-



He needs someone to point out his folly.

ules on which no allowance has been claimed - instead, new replacements have been ordered.

It is evident, even to our surviving apprentice, that such a state of affairs can not remain. Somehow, service has to be organised; a department will have to grow up.

Yet, in the event, the solution is breathtaking for those of us old-timers whose arteries had hardened too much for us to march off to a better 'ole. We find ourselves the stars in a modern morality - the takeover bid.

Until the thing happened, we had only a vague idea of what went on. In each daily newspaper came stories of company X swallowing up Y. Tycoons made millions between breakfast and lunch, and before tea another factory would be closed, its labour discarded. But all those things happened to other people. Like being struck by lightning or winning a Premium Bond prize.

This time, it happened to us. And the implications would be laughable if indeed they *had* happened to somebody else. You see, in the assets that our parent firm organised there was a ready-made



We get labelled as Fixtures and Fittings.

service department. Not a thriving concern, 'tis true. Not even a tightly run little entity, such as ours used to be. But nevertheless a department of sorts, complete with manager (technical), a couple of bench bods, and too many engineers.

So they, having been "taken over", are running us! We veterans, who, if we stop for a smoke get labelled as "Fixtures and Fittings", are now working for the same firm, under the same name, and more or less the conditions as they were before the cataclysm last winter.

Provided there is not another upheaval in the near future, I presume this department will settle into the sort of smooth running that any technical group should be able to manage. There will be slight administrative changes, no doubt. We may find ourselves knocking on different doors as our working areas change. We may have to forgo a few privileges and work out ways of procuring alternatives.

Stores procedure, stock booking, vehicle maintenance, the odd job for mother-in-law, these will no doubt be revised. Yet the outcome will be that the firm, as a whole, will have a technically organised service department, albeit under new bosses.

So will somebody tell me what has been gained? When we financial ignoramus pointed out that any other method of service was wasteful we were met with as near a smile as the bleak visages of the business heads could muster. What do we do now - tell the directors: "I told you so?"

I concluded my December article with a metaphorical shrug of resignation. There were always streets to sweep. This time, it seems, the prospects of my getting a correctly organised department are brighter.

The only trouble is that by the time the powers-that-be get through reading this they may be inclined to subscribe to even greater efficiency by cutting back some of the deadwood, the idlers, the layabouts, those who comment too freely.

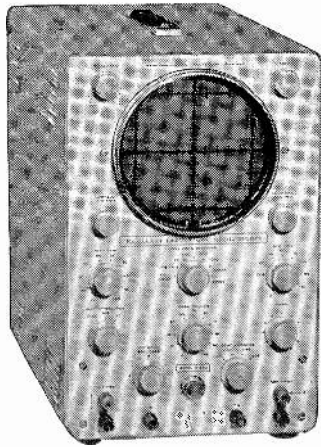
I have a kind of Damoclean shiver running down my back, Joe. Hand me my brush!



Engineers would be used as errand boys.



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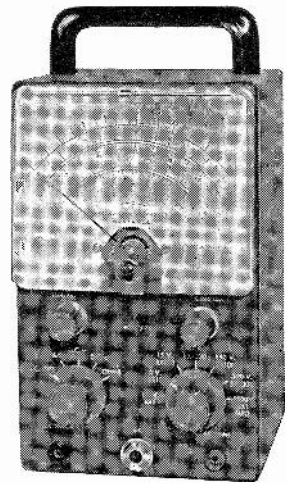
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This multi-function VVM measures A.C. Volts (RMS and pk. to pk.), D.C. Volts and Resistance. The 7, A.C. (RMS) and D.C. ranges are 1.5, 5, 15, 50, 150, 500 and 1500. The 7, A.C. pk. to pk. Voltage ranges are 4, 14, 40, 140, 400, 1400 and 4000. D.C. input impedance is 11M Ω . Seven Ohm-meter ranges have multiplying factors of X1, X10, X100, X1000, X10K, X100K and X1M Ω . Centre-scale resistance readings are 10, 100, 1000, 10K Ohms, 1M Ω and 10M Ω . A centre-zero dB scale is provided also for measuring audio amplifier performance. Test leads, prods and battery are included in the kit. **£13. 0. 0.**

PROBES: R.F. **£1. 9. 6.**, H.V. (30kV d.c.) **£2. 15. 6.**



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- GRIP DIP METER. Model GD-1U.** A Grip Dip Meter giving continuous coverage between 1.8 and 250 Mc/s. Self contained, including mains power supply for 200-250 volts A.C. operation. Box of 5 plug-in coils supplied. The instrument can be used to measure resonant frequency, inductance, capacitance and Q factor together with locating the source of parasitic oscillation, etc. **£10. 9. 6.**

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VOL. 2

Radio Receivers
and Radiograms

Volume One has 142 pages of information on TV receivers, of immediate practical value to the television service engineer, both in the workshop and in the field. Details are given of valve complement, c.r.t., i.f.'s, controls, electrolytics, metal rectifiers and diodes, thermistors, surge limiters and mains droppers, mains input, fuses, e.h.t., aerial inputs, together with servicing notes or special remarks. A special section deals in detail with Band III converters and conversion.

Valves: 1 6CH35; 1 6EF39; 1 6B14; 1 6D7.

Inter. Freq.: 460kc/s.

Pilot Bulb: 6.5V 0.3A M.E.S.

SPECIAL REMARKS: The radio section has its own power pack, but uses the a.f. amplifier of the TV sound channel.

T141 (12in. table model), TC138 (12in. console model), TRC139 (12in. console with pre-set radio)

Valves: 5 6F1; 2 6D2; 4 SP61; 1 6P28; 1 U24; 1 PY31; 1 6P25; 1 6K25; 1 PZ30.

C.R.T.: Mazda CRM121B.

Inter. Freq.: Sound 19.7 Mc/s; Vision 16.2 Mc/s.

Channels: All in Band I—lower sideband.

Band III Tuner: Type TT234.

Controls: Contrast 5k w/w; Brightness 100k DP switch; Volume 20k w/w.

Electrolytics: 100+50µF 350V kwg. common negative.

Aerial: 70-80 ohms unbalanced.

Mains: 200-250V a.c. only live chassis.

Fuses: Two 1.5 amp.

E.H.T.: 7kV (line flyback).

SPECIAL REMARKS: For fringe areas a single-valve pre-amplifier is available, and a slot is provided to hold it on the back of the cabinet. The amplifier is powered from a socket on the back of the chassis. SP418 may be found in place of the SP61s; and one SP418 may be replaced by a 6C9.

—osc. high.

Channels: All five

Band III Tuner

TT234.

Controls: Bright

Volume 25k

w/w.

Electrolytics: 12

common negat

Aerial: 70-80 oh

Mains: AC only

d.c.).

Fuses: Two 1.5

E.H.T.: 8kV (lin

SPECIAL REMARKS

a sound i.f. of 19

16 Mc/s.

SERVICING NOTE

adjustment occur

check the 2.7-meg

between the cent

blocking oscillat

in valve.

T217 (17in. table

also later ver.

and T200

Valves: 5 10F1

2 10F13; 1 2C

1 6E82; 1 U

(spot-wobble)

C.R.T.: Mazda

Inter. Freq.: Sot

16 Mc/s.

Channels: All five

Band III Tuner:

Controls: Voltur

Volume Two has 190 pages of information on radio receivers and radiograms of equal value to the field engineer and the man at the bench. Details are given of valve complement, mains input, i.f.'s, electrolytics, pilot lamps, controls, mains droppers, waveband coverage, speaker, fuses, and in the case of radiograms or record player unit, pick-up.

Notes on aerial inputs, and provision of extension speaker and pick-up sockets are also given.

There are also sections on tuners and notes on transistors and printed circuits.

Extract from Vol. I showing typical entry.

Volume 1 covers the basic circuit specifications of the vast majority of post-war TV receivers and includes a section on Band III converters. Volume 2 deals similarly with radio receivers and radiograms and includes a section on tuners. Both volumes are packed with data, invaluable in the service workshop, essential to the outside engineer.

Vol. 1—(Television Receivers)

10/6 post paid

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13/6 post paid

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