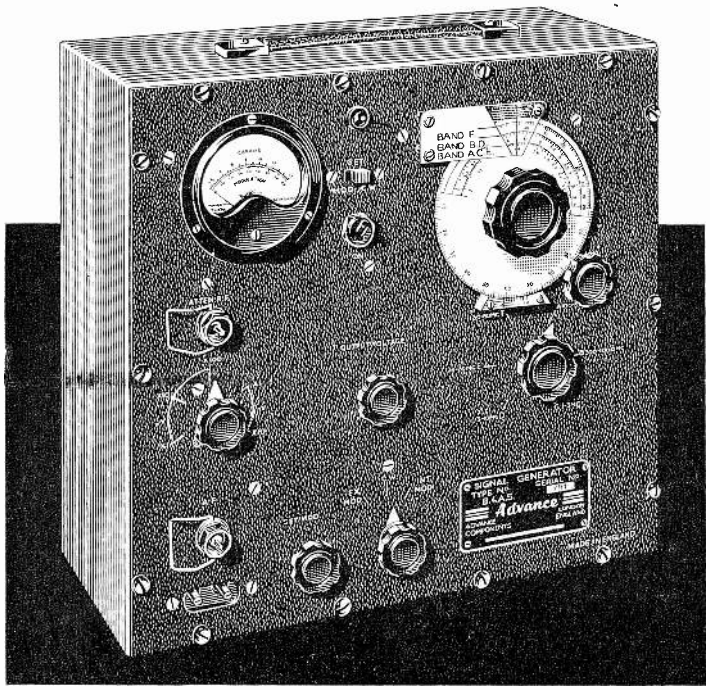
RADIO Retailing

NOVEMBER 1960

SERVICE ENGINEER

Radio, Television and Audio Servicing



The R.F. SIGNAL GENERATOR

TYPE **B4**

MODEL A: 100 kc/s to 80 Mc/s in 6 bands

MODEL B: 30 kc/s to 30 Mc/s in 6 bands

Calibration accuracy of both models is ±1%

by **Advance** *—to be sure!*

The Advance B4 Signal Generator is a well tried and proven instrument which incorporates special features consisting of a monitored R.F. output and variable modulation depth (which is also monitored). An 80 dB attenuation of special design provides exceptional accuracy of attenuator throughout the frequency range and an unusually low leakage factor is achieved by triple screening of the R.F. oscillator and by mounting the calibrated dial on the outside of the case.

NETT PRICE IN U.K.

£68

full technical details in Leaflet B38 available on request.

OUTPUT IMPEDANCE
75 ohms unterminated; termination pad supplied to provide output impedances of 37 and 10 ohms and a dummy aerial facility.

INTERNAL MODULATION:
400 c/s ±10%, modulation depth 0 to 80% ±10%.

EXTERNAL MODULATION:
Model A: 10 c/s to 30 kc/s; modulation depth 0 to 80%
Model B: 10 c/s to 10 kc/s; modulation depth 0 to 80%

AUDIO OUTPUT:
0 to 10 volts into 600 ohms at 400 c/s.

R.F. LEAKAGE: Less than 1 microvolt.

Advance COMPONENTS LIMITED
INSTRUMENTS DIVISION
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IT/GD70

SERVICE ENGINEER

Vol 3. No. 7 Nov., 1960

Edited by W. Norman Stevens

Issued as a special supplement with "Radio Retailing"

In this issue:

New Type Coaxial Plug from Boddington

We have received samples of a new type of coaxial plug now being manufactured by W. H. Boddington & Co. Ltd., 178–180 Homerton High Street, London, E.9. Basically the plug body is a nylon moulding (with a melting temperature above that of electricians' solder) which is plated with copper and silver or copper and nickel.

An important feature is the elimination of the need for machined inserts and complicated assemblies which results in a considerable saving in cost. In fact the plug, suitable for the most common forms of coaxial cable used in TV and f.m. receivers, is offered at little more than half the price of the more conventional type of plug.

So far as the user is concerned there are just two parts—the plastic cover which screws onto the plug itself. The plugs are available in packs of four dozen, at 29s. 4d. trade.

A universal type, suitable for a wider range of sizes of coaxial cable and employing the same basic principle, is in process of development.

RTEB examination results

The *RTEB* has announced the result of the TV Servicing Certificate Examination. Of the 642 candidates who sat, 298 qualified for the award of the certificate, 96 were referred in the practical test and 248 failed.

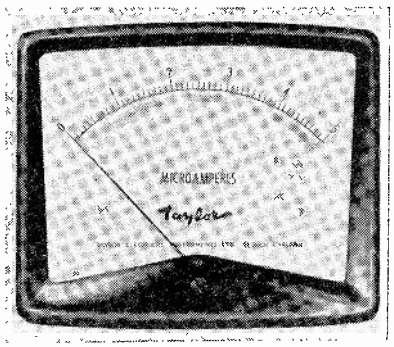
The interest in this examination is being maintained and the total number of candidates who sat for this year's examination showed an increase of 179 compared with the 1959 figure.

In the Radio Servicing Examination the results of the written paper show that of the 1,715 candidates who sat, 1,253 were successful and thus qualified to take the practical test held at various centres during October. A further 330 candidates who were referred in the practical test of 1959 took this year's practical examination, giving a total of 1,583 candidates. Results will be announced later.

TAYLOR PANEL METERS

Taylor have announced a new range of contemporary style panel meters which feature the well-known centre-pole meter movement. The *Vista* range has four basic models with nominal scale lengths from $1\frac{5}{8}$ in. to $4\frac{1}{2}$ in. The new mouldings are designed to provide open scales, with shadowless readings. Mirror scales and special scales can be supplied to customers' requirements, in addition to knife-edge or spade-type pointers. The bases of these instruments are made so that the meters can be interchanged with standard type meters of earlier design. Ranges available are as follows:

Moving Coil: d.c. volts 10mV to 1kV self contained; higher ranges with external multipliers. D.c. current 10μA (Models 30 and 40) to 5A self contained; higher ranges with external shunts. Models 45, 50 and 60 commence at 5μA. A.c. volts 5V to 1kV self contained; higher ranges with external multipliers. A.c. current 50μA to 50mA self contained, higher ranges with current transformers. Lower ranges than 50μA can be supplied.



Thermocouple: 10mA to 5A.

Moving Iron: Current—10mA to 50A. Voltage—ranges commence at 10V.

Valve Manual

Taylor also announce the release of a completely revised and up-to-date valve manual for use with their Model 45C valve tester, and earlier versions of the instrument (Models 45A, 46A, 47A and 45B). The valve chart is priced at 10s. 0d., post free, and included over 5,000 characterestics and settings.

RSGB Exhibition

NOVEMBER 23–26

This year's International Radio Hobbies Exhibition organised by the Radio Society of Great Britain, will be held at the Royal Horticultural Society's Old Hall, Westminster, from November 23–26, from 11 a.m. to 9 p.m. each day. Admission is 2s. 0d.

Apart from the Society's own exhibit, there will be commercial exhibits showing kits and components for home construction, radio receivers, transmitters and TV equipment, test instruments and accessories. Services exhibits will include the latest communications equipment. The Society's radio station GB3RS will again operate from the exhibition.

Other highlights expected to be shown, include an all-transistor communications receiver, several of the latest American receivers, and home-built amateur TV transmitter station equipment.

BELLING-LEE GUIDE TO WESTERN ITV

Dealers and engineers in Dorset, Devon, Somerset and Cornwall, preparing for full-strength test signals from the two West of England ITV stations (scheduled for February 1, 1961) will be interested in a comprehensive article appearing in the latest Belling-Lee *Bulletin*.

A map of the area shows the expected primary, secondary and fringe limits for both the Caradon Hill (Bodmin) and Stockland Hill (Axminster) transmitters. Eighty place-names are keyed on the map. The text consists of a detailed coverage of the whole area with predictions on the type signals likely to be available and notes on reception problems to be encountered in the difficult areas.

Copies of this useful edition of the *Bulletin* may be obtained free from Belling & Lee, Ltd., Great Cambridge Road, Enfield, Middlesex.

Service Viewpoint

THERE is more haphazard ham-handedness in radio servicing than in any other trade.

The craftsman's pride in his labours is almost a laughable anachronism in these mass-produced days. Yet even the humble carpenter still feels he has the ghost of Gibbons guiding his chisel. The mason has the shade of Wren peeping over his shoulder: the painter, the chimney sweep, the roadman on his rounds; even the old joke about the plumber connecting water to gas has lost its savour. He may occasionally forget his tools, but when he has them he knows how to use them.

Add a Little Method

In the opinion of some critics, the modern radio serviceman employed by the retailer is more apt to bumble his way through a job than take a true pride in his work.

To what extent is this true? Does the cap fit, lads—and if so, are we proud to wear it?

A regrettable tendency to deprecate the theory-wallah's plodding efforts exists among the younger members of the trade. Brought up in a seller's market, scornful of time-wasting "general purpose" work, the lads are content with just enough theory to get by. Those that are prepared to carry their studies a little farther usually drift away from service work and end up in electronics.

The trend is enhanced by the policy of many large firms, who are content to employ "installation mechanics" or improvers on their outside work. These chaps do no more than a simple valve change or obvious fault repair, bringing the receiver to the workshop if there is the slightest doubt about the symptoms.

Often, their time is rigorously prescribed and they cannot ferret out the fault even if they would like to try. Their equipment is limited; their function that of first-aid.

Whether this policy is a good one we leave for our readers to argue. There are pros and cons. For example, if the area covered is small enough to ensure rapid, same-day return, then a central workshop may be the answer, provided it is ultra-efficient.

Again, a customer whose set has been "lifted" is more likely to accept the bill without demur. That familiar quibble: "All that—for five minutes work?" can be obviated.

On the other hand, a reputation for fine service can be built if on-the-spot repairs are the rule. Always provided the repairs are meticulously completed, and recalls reduced to the minimum. And that needs more than a willing improver on outside service. More, he must be given time to battle with the "sticky one".

Bonus systems for quantity work kill quality work. The craftsman's pride is stultified by the knowledge that his employers value numbers more than goodwill.

The answer, whatever the system of service, is to add a little method. Treat service work professionally, as some firms do, and the reputation for ham-handedness can be left to the "chap around the corner"—who provides the service department with so much of its turnover!

Rendar Instruments

RANGE OF ACCESSORIES

An interesting range of accessories is marketed by Rendar Instruments Ltd., Burgess Hill, Sussex, including a screened jack plug with a patented cable clamp. Small metal plugs fit into the screw head of the main casing and the clamp cannot rotate when the screw-on cap is attached.

The cable remains in the original position during final assemblage and there is no danger of twisting with possible damage to the terminal. The gradual action of the interior surface of the bevelled cap in rotation brings the four clips of the clamp gently towards the cable until the required grip is obtained, at which point the cap is fully tensioned in correct position. Cables from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. diameter can be used. The jack plug is Model JPS/400 and a screened cable connector (CC/100) is also available.

There is also a miniature screened jack plug (MJPS/600) and cable connector (MCC/600). Only one soldered joint is required for assembling the jack plug. The outer braided screen of the cable makes contact with the plug cover when held by a clamping device; considerable force is needed to break this connection. Jack sockets are available for all types.

Rendar also produce a new *Safebloc* mains coupler, for connecting 2- or 3-core bare-ended flexible leads to a.c. mains. When the lid of the plastic block is closed all live items are completely inaccessible; as the lid is raised, the supply is disconnected from all exposed metallic parts. The live line is fused with 5A fuse as standard but may be fused at up to 13A if required. No soldering is required, the wires being clipped in position quickly.

New BBC Satellite for Scotland

The PMG has approved in principle a BBC proposal to erect a low power TV station near Ballachulish, Argyll. This new station would act as a relay point to feed the (approved) station to be built at Kinlochleven. It will receive its programmes from the existing station at Rosemarkie, via the satellite to be built at Fort William. The new station is to be built with the other satellites in Stage 1 of the BBC scheme, due for completion by March 1962.

RADIOSPARES —NEW LINES

Several new items appear in the October-December catalogue of Radiospares. In standard ceramics the values of 120, 180, 270 and 380pF have been added, and in the slider preset controls the values of 27kΩ, 100kΩ and 680kΩ have been included. A new *Adda-Shaft* spindle of 6 mm. diameter is now obtainable and is suitable for replacements in many Continental radio receivers and tape recorders.

A new line is introduced in the *Lo-Volt* isolating transformers. Designed to comply with the insulation requirements of BS415, they are intended for use with low voltage soldering irons or bench lamps. There are two secondaries, each of 12V at 4A. Price 47s. 6d. each.

Plug-in Amplifier for EMI Oscilloscope

The versatility of the well-known E.M.I. oscilloscope, Type WM16, has been increased by two additional plug-in units—amplifiers Type 7/5 and 7/6.

The 7/5 provides for high sensitivity (5mV/cm) over 5 c/s to 25 Mc/s when a.c.-coupled, or 50mV/cm over the full bandwidth of d.c.-40 Mc/s. The 7/6 permits the display of two inputs either separately or differentially with d.c. or a.c. coupling. The common mode rejection ratio is greater than 100:1 over the pass band (d.c.-25 Mc/s) at a sensitivity of 50mV/cm.

PHILIPS INTRODUCE NEW VARIABLE TRANSFORMER

A new toroidally-wound 0·5A 120W unit, claimed to be the first of its kind in the field of variable transformers, has been developed by Philips. The B8/709/59 operates from 220 or 240V a.c. input and provides a continuously variable output voltage from zero to 250V (nominal current 500mA). Available as a manually-operated unit or in motor-driven form, it is marketed by Research and Control Instruments, Ltd., 207 Kings Cross Road, London, W.C.1.

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.

Philips N3G82VT

Car Radio Fault

This car radio has a hybrid circuit and an unusual one from the point of view of operating voltages. The transistor output stage voltages were present and an audio signal applied to the coupling transformer came through OK, but the valve section of the set was dead with no voltage on the h.t. line.

The negative h.t., direct from the car battery, for the transistor is connected to the valve stages l.t. line via a 100-ohm resistor. This resistor was found to be warm. On the l.t. negative side of it is a 100μF decoupling capacitor and this was the culprit. It was leaking.

Incidentally, there is a resistor in this set with a very unusual value of 6·8 ohms. The colour code is blue, brown, grey and not in this case 61×10^8! – W. D.G.. Prestwick (814).

Alba T724

Weak On Band III

The trouble here was that although Band I reception was quite good, Band III was very weak, fading out completely after a few minutes. It was found that even with the brightness control fully advanced, the raster was barely discernible.

It was thought that the ion trap magnet might be out of alignment, but on touching the ion trap the picture suddenly came back to normal. The fault, however, was found to be on the tube base connector on which is mounted a 0·1μF capacitor in parallel with a 47kΩ resistor. This network is in series with the tube cathode.

The 47kΩ resistor was a "dry joint" connection with the capacitor, so that the video signal to the cathode of the tube was intermittent through the capacitor alone. – G.C., Boroughbridge (818).

Ferguson 454T

Line Circuit Trouble

One of these receivers came in with the complaint of no picture, this being due to inoperative line timebase. Associated valves were tested and found satisfactory, but voltage checks revealed that there was a lack of boost voltage and only 160V on the h.t. rail instead of the normal 194V, but this was obviously caused by the excessive current drawn by the PL81 due to inoperative line oscillator.

Further investigation revealed that there was only 60V at the anode of V5B (part line oscillator) instead of the normal 108V and no potential at the cathode instead of the normal 5·3V. The trouble was then soon traced to the 0·002μF decoupling capacitor C96 which was s/c. Incidentally, a leaky C94 or C95 may cause similar trouble. – E.L., Long Eaton (827).

Pye SP17

Lack of Width

The fault here, on sets using the SP17/R chassis (which covers the Invicta 127, and 237SP) was lack of width after several months use, some of the sets suffering from the trouble when new.

Width adjustment is provided by three taps on the line output transformer. In these sets there was lack of width on the maximum tapping; mains adjustment, h.t. rectifier and associated valves, drive to PL81 and scan coils were all correct.

It was found that by replacing the cathode capacitor of the PY81 efficiency diode (68pF 5kV, or 56pF in Invicta 127) with one of 100pF, sufficient width could be obtained at the medium tapping of the width control. This capacitor is located on the line output transformer, one end connected to chassis.

Sets thus modified have been running for over a year without the trouble re-appearing.—S.W., Buckingham (847).

Regentone T21

Erratic Frame Speed

The fault on this set appeared as uncontrollable frame speed. The PCL82 frame oscillator was changed, with no results. The frame frequency varied constantly, occasionally correcting itself and the picture locking in.

Eventually, the culprit was found to be the frame hold control, the resistance of which was varying between 50kΩ and 500kΩ. The trouble appeared to be due to silver migration in the control forming on the track and effectively bridging the centre connection ring to the track.

This has been experienced on several of these controls and, as they appear in many parts of the circuitry, a fault of this nature could cause some interesting experiences.— E.B., Stoke-on-Trent (836).

Sobell T347

ECL80 Gives Trouble

The trouble was incorrect frame speed, no frame lock being obtainable. The shorting link on the 220kΩ resistor, in series with the 820kΩ resistor, in the frame oscillator grid circuit was removed but the fault persisted. The ECL80 was replaced with a new valve from stock but no difference was obtained.

Thereafter all frame blocking oscillator components were checked and/or changed, including the charging, negative feedback, coupling and sync feed components, all to no avail. Also checked were the vertical hold potentiometer and series resistor, decoupling thereto. As a last resort another new ECL80 from stock was tried, but again without effect, the best that could be achieved was frame locking with a thin white line down the middle indicating wrong speed.

The sync circuits were then checked, including the ECL80 sync separator and

(Continued on page 101)

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.

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

GOOD NEWS FOR SERVICE ENGINEERS

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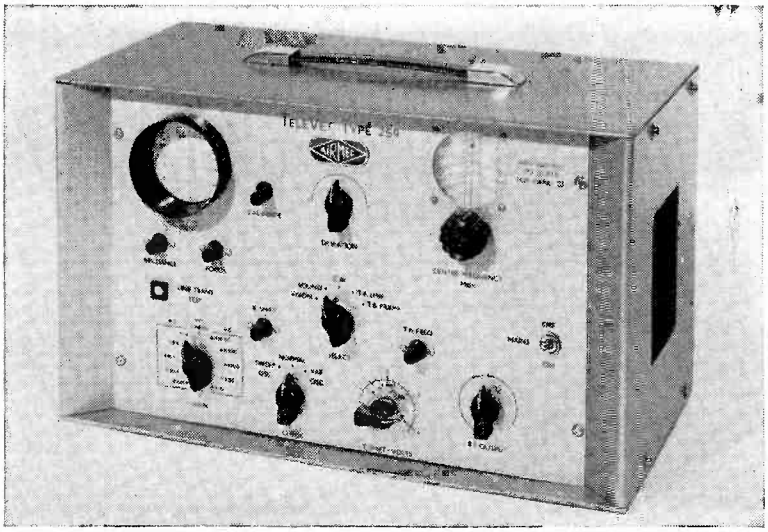

- **Improved pattern—locks on all types of set.**
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- **New spiral tuning scale over 4 ft. in length—calibrated every 100 kc/s.**
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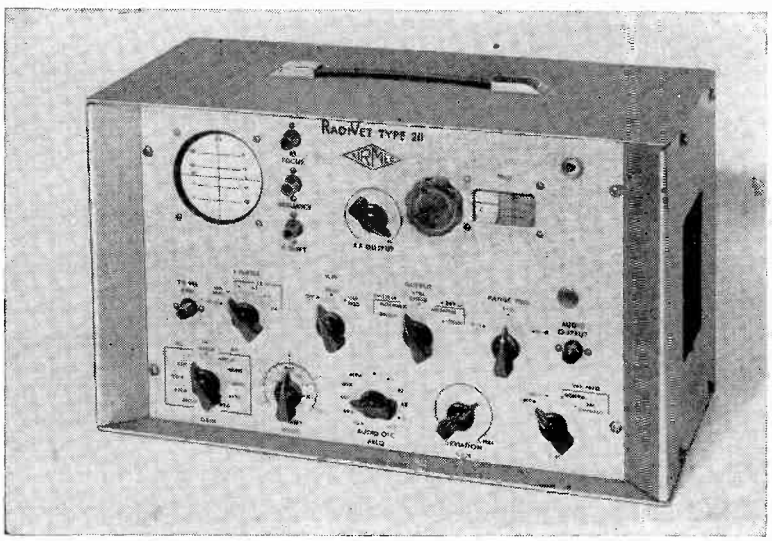

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TECHNICAL GEN *continued*

the screen decoupling capacitor. No effect. At this point I called in two other engineers to check on what I had done and to establish that I had not overlooked anything or made a mistake which would have introduced and sustained the fault. By this time we had spent hours on the job.

The next day. after dealing with two rush jobs, I again had an attempt to clear the troublesome frame fault. We went over the previous day's work but no clues were forthcoming. Then, in sheer desperation, I replaced the ECL80 with another ECL80 which had been removed from one of the sets repaired earlier to cure a sound instability fault. To our utter amazement the fault disappeared and the frame locked normally!

Another new valve was drawn from stock and tried. This, too, cleared the trouble. To summarise, two new ECL80's did not cure the trouble, and one did; one faulty ECL80 (the original) introduced the trouble and another faulty one cured the trouble! The moral seems to be never to take an ECL80 for granted.—E.P.R., Swindon (848).

Stella ST240U

S/c on F.M. This particular fault has occurred two or three times recently on this a.m.-f.m. radio receiver. The first one arrived on the bench accompanied with a note to the effect that it "smoked". On carrying out the usual preliminary cold tests in cases of suspected s/c, it was found that on switching to the f.m. position a reading of 100-ohms was obtained across the h.t. positive line to chassis.

As this virtual s/c was only present on switching to the f.m. position on the wavechange switch, we naturally suspected a fault in the f.m. compartment, a suspicion which was strengthened when, on removing the cover of the f.m. unit, it was seen that R7 had been overloaded and in fact measured only 100-ohms instead of its normal 2·2kΩ.

So far all was perfectly straightforward but when looking for the actual cause of the s/c, it was found that by rocking the UF80 (V2) slightly in its holder, the s/c could be made to come and go intermittently. Finally it was found that the 18pF capacitor C19 which is a fixed tuning capacitor in the frequency changer anode circuit was causing the trouble.

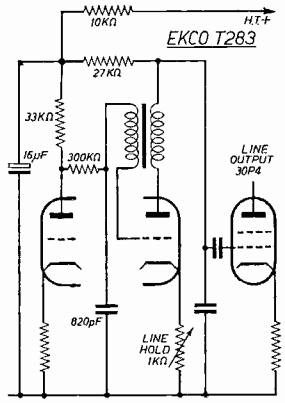
The "hot" end of it was rubbing against the side of the f.m. unit. Repositioning of this component cured the s/c. The only other thing to do was to replace R1 (h.t. smoothing) which had also been overloaded as a result of the original fault.—R.W., Birkenhead (849).

Ekco T283

Erratic Thin Picture Symptoms were thin picture when raster was obtained, although even the raster was not always obtainable. Line hold seemed to be erratic; frame hold was quite good.

It was noticed that the e.h.t. rectifier was not glowing as brightly as normal. Usual valve replacements were tried first and the e.h.t. capacitor (0·001μF, 20kV) was given a careful check as we have had failure of this component before. None of these routine checks produced results, so the output stage voltages were measured but appeared to be within a close approximation to those given in the maker's service manual.

The drive to the grid of the line amplifier, a 30P4, was 35V negative on a 20,000Ω/V meter and this was thought



to be somewhat low. Checking through the oscillator stage, the 300kΩ resistor, feeding a potential to the grid of the oscillator, read only about 70kΩ to chassis on the grid side, and this gave us the clue. Disconnecting the resistor found it to be within tolerance. This left the 820pF capacitor as suspect and it was leaking. Replacement restored normal conditions.—A.B.C., Billericay (790).

Pye PV110

No Sound, Vision This receiver arrived on the bench with no sound or vision and it was noticed at once that no heaters were alight. A straightforward o/c heater in a valve was suspected but this proved to be wrong, because on test all the valve heaters were found to be intact.

Voltage checking revealed an a.c. v. up to pin 4 of V16, the PCF80 sync separator, but no voltage on pin 5, the

(Continued on page 103)

RECEIVER SPOT CHECKS

No. 62: H.M.V. 1870 and 1874

No Sound or Vision: Check R137 (22Ω) for o/c due to 0·001μF feedthrough capacitor developing s/c.

Low Gain: Check R6 (680kΩ), part of V1B grid bias potentiometer, for o/c or h.r. Check C10, 0·001μF feedthrough capacitor, for leakage or s/c.

Line Timebase Inoperative: Check for lack of boost voltage caused by C69 (0·05μF) boost reservoir capacitor for o/c or s/c. Check line oscillator feedback capacitor C66 (30pF, 2kV) or C67 (150pF) for leakage. Check R73 (2·2kΩ 5W w.w.) V7 screen decoupler for o/c.

Line Lock One End: Check R70 (390kΩ) for h.r.

Frame Timebase Inoperative: Check C101 (0·01μF) or C103 (0·05μF) for o/c or leakage. Check C102 (0·1μF) for o/c.

Distorted Sound: Check for faulty W9 and W10. Check R91 or R94 for h.r. and C92, for leakage.

Queer Customers

NOBODY likes recalls. Least of all when they are following someone else's work. But the most disturbing recall happened to me last week.

I saw the curtains twitch as the van drew up, and as I knocked on the door it shot open. A hand grabbed me and I found myself staring into a malignant, bloodshot eye. "Now, you . . . " began the owner. I was spluttering out a protest when the flustered housewife came flapping from the kitchen beating down her belligerent spouse. "No, no, it wasn't, him," she yelled.

After some deep breathing and profuse apologies it transpired that the previous engineer had made a pass at the good lady, and hubby was lying in wait for him. Too bad he has left us and I had his recall. Incidentally, there was nothing wrong with the set: the recall was bait for his trap.—G.M., Bargoed.

TECHNICAL GEN continued

other heater pin. The valve was rechecked and found OK. It was then found that although the a.c. reading was obtained on the underside of the base, on testing pin 4 on the top side no voltage was present.

There was no continuity between the printed circuit solder joint and the valve socket pin. A dry joint was suspected, but resoldering proved in vain. On examining the socket pin it was found to be in two halves. Replacement with a new one restored continuity and thus vision and sound.—D.McL., Lochgilphead (845).

Pye V110

Sound Channel Trouble The customer complained that the sound could not be relied upon to come on at any particular time. Sometimes it was the usual half-minute from switching on, sometimes as much as ten minutes, the fault being intermittent. Sometimes the set would work normally for a few days, then the trouble would return.

The intermittent nature of the trouble made it difficult to diagnose the fault. The first time we tried to find the cause, it appeared to be somewhere in the sound i.f. amplifier that the sound was being delayed, and the second sound i.f. valve was suspected and replaced. This appeared to cure the trouble.

Three weeks later, however, the fault reappeared and this time fortunately the fault stayed on long enough to give us the answer. There was no voltage on the cathode of the second i.f. valve, due to a dry joint on the earthy end of the cathode bias resistor.—F.E.R., St. Ives (835).

Ekco T283

No Band III Picture Complaint was that Band I sound and picture were all right, as was Band III sound, but there was no Band III picture. On checking the set on the bench the Band I signal seemed to be fairly reasonable and from this it was assumed that the trouble was in the tuner unit.

After changing tune unit valves and checking the alignment of the Band III coils, all unavailing, it was decided to check the voltages of the rest of the video circuit. The voltage at R42 seemed to be low and the resistor was quite hot. This was found to be due to leakage in C23.

Replacement of these two components cured the fault. Apparently with the fault condition on, the gain was sufficient to give a pretty good Band I picture but was insufficient to give a Band III picture.—J.H., Ballymoney (837).

SERVICE BRIEFS

Ultra VP1772: In cases of frame timebase collapse, if the trouble is not due to the 30PL13 valve itself, check both C100 (0.005μF) and C40 (0.5μF) for leakage. Also check the frame height control as a blow may have pushed the slider away from the track. In cases of negative picture, if with both brightness and contrast controls retarded, the picture is of poor quality, check C37 (1μF) a.p.c. line decoupling capacitor for leakage. - V.J.G., Oxford (733).

K-B QVP20: The complaint was blurred picture on both bands, although Band I was intermittent; sound was normal, as was the raster. It was found that the video valve was drawing current but drive from the detector was absent. The grid stopper R50 was found to be o/c. This restored normal Band III reception and the intermittent Band I operation was found to be due after much searching in the not very accessible tuner to a dry joint on the oscillator section of the biscuit. - P.P., Southport (728)

G.E.C. BC402: No signals, a.m. or f.m. The W119 i.f. amplifier anode and screen volts were high, indicating low current drawn. A low voltage reading was obtained at the cathode pin, which is returned to chassis via the centre spigot. Where the wire passed through the spigot on its way to pin 3, a thin layer of resin from solder surrounded it, partially insulating it from chassis. Resoldering did the trick. - W.D.G., Prestwick (723).

Philips 1768U: Slight hum on sound and vision. This disappeared when set was turned on its side, but reappeared when restored to normal position and always at a point about 45-deg. to the horizontal. Oscilloscope showed ripple wave on h.t., even when all lines disconnected from C69/70/71 until, of course, the set reached the critical angle when it disappeared. This electrolytic proved, in fact, to be the offender.- W.D.G., Prestwick (724).

Ferranti T1024: We have experienced the fault of loss of sync on three of these sets in the first few days after installation. The complete loss of sync was in each case due to one end of C99, the line sync coupling capacitor, shorting on to pin 9 (connected to chassis) of the sync separator V13 - G.C., Boroughbridge (749).

Pam 764: Trouble was no line sync. Sync separator, line oscillator and discriminator diodes were o.k. All voltages were normal. Considerable time was wasted checking and replacing flywheel sync circuit components but fault persisted. It was then decided to modify for conventional line sync as follows: remove discriminator diodes, insert 0.001μF capacitor from sync separator anode to junction C97/C98/R124. Fault was cured, with line rock steady. There have been no further complaints. - E.L., Long Eaton (731).

Brainless Bertie

Standard pattern generators
Bertie thinks are N.B.G.
Since he tried to tune a fringe set
Which had gated a.g.c.

Feste

Regentone TR177

Frame Scan Fault The fault was an intermittent frame collapse which lasted a matter of seconds and occurred only two or three times in an evening. When the fault appeared, tapping either of the two frame valves brought the scan back to normal, but would not bring the fault back on again.

Suspecting an inter-electrode short in one of these valves, both were changed but the fault persisted when left on test. On making voltage checks it was found that the frame oscillator was inoperative. By gently probing the various components in the frame oscillator circuitry, it was found that on tapping the 0·01μF capacitor C84 (coupling V13 anode to V7 grid) the frame scan returned and collapsed alternately. Substituting this capacitor solved the problem.—D.McL., Lochgilphead (843).

Philips 1768U

No Sound, Vision No sound or vision was the fault here. A quick check revealed that the heaters were glowing and that h.t. was present. The tuner unit valves were suspected and were changed, with no result. From previous experience, the oscillator anode resistor came under suspicion, but before removing the bottom of the tuner with its small easily-dropped fixing screws, it was decided to examine the raster to see if valve noise was present.

Previously, to save time, tuner valves were changed and checked by listening to the sound rather than wait for the line circuits to become operative and produce a raster. It was soon found that there was no raster and that the e.h.t. was non-existent.

There was no h.t. voltage supply to the line output valve anode and a faulty PY81 boost diode was soon diagnosed. When a replacement was fitted, not only did the vision return but also the sound. A little puzzled by this, the circuit diagram was examined and this

(Continued on page 110)

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Cossor 943 TV (TV127, Oct., 58).
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Ferranti 14T2 and 1225 (TV45, Nov., 53).
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Ferranti T1021, 1023, 1027 (TV157, June, 60).
Ferranti T1024 series (TV165, Oct., 60).
Ferguson 204T series TV receivers (TV87, June, 56).
Ferguson 306T/308T TV receivers (TV97, Nov., 56).
G.E.C. BT1252 series TV receivers (TV96, Oct., 56).
G.E.C. BT1746 series TV (TV81, Mar., 56).
G.E.C. BT7092 and BT7094 (TV44, Oct., 53).
Grundig 500L and 700L/C *Reporter* tape recorder (S3, Dec., 53).
H.M.V. 1840 series TV receivers (TV109, Sept., 57).
Kolster-Brandes FV30, FV40 and FV50 (TV23, Feb., 52).
Kolster-Brandes HF40 series TV (TV70, Aug., 55).
Kolster-Brandes MV30 and MV50 (TV91, Aug., 56).
Kolster-Brandes NV40 series (TV115, Feb., 58).
Kolster-Brandes OV30 series (TV148, Jan., 60).
Marconiphone VC/VT59DA (TV100, Jan., 57).
Marconiphone VC60DA (TV61, Jan., 55).
Marconiphone VT68DA/VT69DA.
McMichael 55 series TV receivers (TV79, Feb., 56).
Murphy V214/V216 TV receivers (TV78, Jan., 56).
Murphy V230 portable TV (TV103, April, 57).
Murphy V240/V250 TV (TV105, June, 57).
Murphy V270/V270C TV (TV120, May, 58).
Murphy V270A TV receiver (TV140, July, 59).
Murphy V280/V300C TV (TV124, Aug., 58).
Murphy V280A series (TV134, March, 59).
Murphy V310 TV receiver (TV145, Dec., 59).
Murphy, V320 series (TV159, July, 60).
Pam 500 TV receiver (TV108, Aug., 57).
Pam 600S, 606S, 690 (TV144, Nov., 59).
Peto Scott TV 1411 series (TV65, Apr., 55).
Peto Scott 1412 and 1712 (TV54, July, 54).
Peto Scott 1418T receiver (TV106, July, 57).
Philco BT1412 and BT1551 (TV71, Sept., 55).
Philco 1000 *Slender Seventeener* (TV139, June, 59).
Philco A1960/1, A2060/1 (TV137, May, 59).
Philco A1962M/A1967M (TV142, Oct., 59).
Philips 1458U series (TV129, Nov., 58).
Philips 1756U series TV (TV111, Oct., 57).
Philips 1768U/2168U (TV117, March, 58).
Philips 1796U/2196U (TV152, Mar., 60).
Pilot PT450 series (TV161, Aug., 60).
Pilot TV84/87 television series (TV59, Nov., 54).
Pye PTV portable TV (TV113, Dec., 57).
Pye CW17 series TV (TV122, June, 58).
Pye CTL58VS series (TV150, Feb., 60).
Pye CTM17S series (TV131, Feb., 59).
Pye V200/V400 series (TV163, Sept., 60).
Regentone "Big 15/5," T and C (TV48, Feb., 54).
R.G.D. 1455 and 1456 TV receivers (TV99 Dec.,56).
Ultra VA72, YA72/73 series (TV38, March, 58).
Ultra V84 and Y84 TV receivers (TV47, Jan., 54).
Ultra 81 series TV receivers (TV74, Nov., 55).
Ultra 915 and 917 TV receivers (TV93, Sept., 56).
Ultra 50 series TV (TV123, July, 58).
Ultra 52 series TV (TV135, April, 59).
Ultra 60 series TV (TV126, Sept., 58).
Ultra 62 series TV receivers (TV141, Sept., 59).
Ultra V1770 series (TV161, Aug., 60).
Vidor CN4217/8 TV receivers (TV57, Oct. 54).

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Alba T717 and T721 (TV143, Nov., 59).
Alba T744FM TV series (TV121, June, 58).
Ambassador-Baird TV 19–20 series (TV119, May, 58).
Ambassador TV4 and TV5 (TV32, Sept., 52).
Argosy 1412L/1412B (TV19, Aug., 51).
Argosy Model T2 TV receiver (TV53, June, 54).
Baird TV receivers, P/T 167 (TV35, Dec., 52).
Beethoven B94, 95, 98 and 99 (TV92, Aug., 56).
Bush BE15 battery radio (R51, Mar., 54).
Bush RC94 AC radiogram (R34, Nov., 52).
Bush VHF54/VHF55 receivers (R94, Jan., 57).
Bush VHF61 a.m.-f.m. radio (R134, Oct., 59).
Bush VHF64/RG66 radios (R116, July, 58).
Collaro RC54 record changer (S6, Oct., 55).
Cossor 500 series radios (R95, Feb., 57).
Cossor 522/523 a.m.-f.m. radio (R72, May, 55).
Cossor 524 *Melody Maker* (R85, Mar., 56).
Cossor TV Model 926 (TV37, Feb., 53).
Decca SG177/SG188 Stereograms (S12, Oct., 58).
Decca *Double Decca* Model 51 (R65 Dec., 54).
Deccalian radiograms 91 and 92 (R23, Dec., 51).
Deccalian Model 90, radiogram (R21, Nov., 51).
Dynatron TV38 series (TV151, Mar., 60).
Etronic ECS2231 projection TV (TV46, Dec., 53).
Etronic ETA632 radio receiver (R43, Aug., 53).
Ever Ready *Sky Monarch* (R104, July, 57).
Ever Ready *Sky King, Queen, Prince* (R106, Sept., 57).
Ferguson TV tuner units (TV85, May,56).
Ferguson 300RG autogram (R78, Aug., 55).
Ferguson 382U series (R124, Jan., 59).
Ferguson 341BU portable radio (R67, Jan., 55).
Ferguson 968T series TV (TV60, Dec., 54).
Ferranti radio receiver Models 005 and 105 radiogram Model 405 (R36, Jan., 53).
Ferranti 147 series radio receivers (R81, Nov., 55).
Ferranti 255, 355, 455, radios (R107, Oct., 57).
Ferranti 1325/1825 TV receivers (TV95, Oct., 56).
G.E.C. BT302-5 (TV160, Aug., 60).
G.C.E. BT1449/BT2448 (TV102, March, 57).
G.C.E. BT2155/8149 (TV156, June, 60).
Kolster-Brandes HG30 radiogram (R53, April, 54).
Kolster-Brandes QV20/1 series (TV162, Sept., 60).
Marconiphone T24A series (R98, April, 57).
Marconiphone T/C10A radio (R41, June, 53).
Marconiphone VT64/65DA (TV76, Dec., 55).
Masteradio D154 "Ripon" series (R84, Feb., 56).
Masteradio Model T853 (TV36, Jan., 53).
Masteradio TD4T and TD7T/C (TV58, Nov., 54).
Masteradio TE series (TV128, Nov., 58).
McMichael *Clubman* Model 535 (R62, Oct., 54).
McMichael FM55 a.m.-f.m. radio (R82, Dec., 55).
Murphy A146CM baffle radio (R75, June, 55).
Murphy V114C/V118C TV (TV98, Nov., 56).
Murphy V200 TV receiver (TV72, Sept., 55).
Pam 701, 702, 714, radios (R100, May, 57).
Peto Scott 16 series TV receivers (TV86, June, 56).
Peto Scott 19 series TV (TV116, March, 58).
Peto Scott 1722/1723 (TV149, Feb., 60).
Peto Scott 1730 and 2128 (TV158, July, 60).
Peto Scott 1731/2131 (TV164, Oct., 60).
Philips 141U portable radio (R56, June, 54).
Philips 643 series a.m.-f.m. radio (R87, July, 56).
Philips G62A series (R131, July, 59).
Pilot TM/CM54 TV receiver (TV41, June, 53).
Pilot TV94 series TV receivers (TV107, Aug., 57).
Pilot VS9 console TV receiver (TV34, Nov., 52).
Pye P23CR and P24CR (R48, Jan., 54).
Pye P29UBQ (R37, Feb., 53).
Pye *Fen Man* I and IRG (R109, Nov., 57).
Pye *Fen Man* II and IIRG (R112, Jan., 58).
Raymond F46 radio receiver (R69, Feb., 55).
Regentone TR177 series (TV132, Feb., 59).
Regentone ARG81 series (R127, March, 59).
Regentone RT50 tape recorder (S14, Sept., 59).
R.G.D. T14 transportable VT (TV138, June, 59).
Sobell 516AC/U radio (R57, July 54).
Sobell TS17 and T346 TV (TV94, Sept., 56).
Sobell 626 Series a.m.-f.m. radios (R102, June, 57).
Sound A20 tape recorder (S9, Feb., 58).
Stella ST151A radio (R66, Jan., 55).
Stella TV receiver ST1480U (TV25, Apr., 52).
Stella ST8314U TV receiver (TV55, Aug., 54).
Strad Model 510 table receiver (R35, Dec., 52).
Taylor testmeter Type 171A (T16, Aug., 54).
Ultra ARG891 "Ultragram" (R83, Jan., 56).
Ultra "Troubadour" U696 (R44, Aug., 53).
Ultra "Twin" portable radio (R55, June, 54).
Ultra U930/U940 *Minstrels* (R119, Aug., 58).
Ultra V1763 TV receiver (TV 147, Jan., 60).
Ultra VP14/1753 series (TV153, April, 60).
Vidor CN4213 and CN4215 TV (TV28, June, 52).
Vidor CN4228/9 TV receivers (TV136, May, 59).
Vidor CN4230/1 TV receivers (TV125, Sept., 58).
Waveforms *Radar* 405D (T.I.7, Apr., 56).

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Alba 69 series radiograms (R120, Sept., 58).
Alba 3211 series (R126, Feb., 59).
Baird baffle radio receiver (R61, Oct., 54).
Bush TC184 television tuner (TV75, Nov., 55).
Cossor Model 466 car radio (R71, Apr., 55).
Cossor radio Model 494U (R38, Mar., 53).
Cossor *Melody Portable* 543 (R92, Dec., 56).
Cossor 546 transistor portable (R115, May, 58).
Cossor 551/552 portables (R117, July, 58).
Cossor 575/579 (R142, June, 60).
Cossor 580 stereo player (S13, April, 59).
Cossor 581 and 569 portables (R137, Nov., 59).
Decca *Deccalian* 88 player (S10, March, 58).
Decca RG200 radiogram (R125, Jan., 59).
Deccalian Model 81 (R29, Apr., 52).
Defiant MSH953 AC radio (R40, May, 53).
Defiant RSGH89AC radio (R70, Mar., 55).
Dynatron TP11/TP12 (R141, May, 60).
Ekco BPT333 transistor portable (R143, July, 60).
Ekco BPT351 transistor portable (R145, Sept., 60)
English Electric *Rotamatic* TV tuner (TV82, Mar.,56).
Etronic EPZ4213 portable radio (R52, Mar., 54).
Etronic radio Model ETU5329 (R39, Apr., 53).
Ever Ready Model "C" radio (R50, Feb., 54).
Ever Ready *Sky Baby, Sky Princess* (R99, May, 57).
Ferranti 13-channel TV tuner (TV73, Oct., 55).
Ferranti 525 radio receiver (R58, Aug., 54).
Ferranti Model 546 radio (R45, Sept., 53).
Ferranti U1003/RP1008 (R123, Dec., 58).
Ferranti PT1010 transister portable (R143, July,60)..
Ferranti PT1030 transistor portable (R145, Sept.,60)
G.E.C. BC501/BC502 transistor portables (R146' Oct., 60).
H.M.V. radio Model 1122 (R54, May, 54).
H.M.V. radio Model 1356 (R42, July, 53).
H.M.V. 1252 f.m. adaptor (R111, Jan., 58).
Invicta 26 "Vicki" portable (R93, Jan., 57).
Invicta 33 series radio receivers (R89, Sept., 56).
Invicta Models 37 and 59RG (R86, May, 56).
Invicta Model 55 portable (R46, Oct., 53).
Kolster-Brandes TV converter (TV77, Jan., 56).
Kolster-Brandes FB10 portable (R32, Sept., 52).
Kolster-Brandes MP151/2, PP251 (R135 Oct., 59).
Kolster-Brandes NG20/NR30 (R113, Feb., 58).
Kolster-Brandes OP21 (R122, Nov., 58).
Kolster-Brandes PP11, PP21, PP31 (R130, June, 59).
Marconiphone P17B portable (R49, Jan., 54).
Marconiphone T2211 converter (TV30, Feb., 56).
Marconiphone T24DAB (R77, Aug., 55).
McMichael 153 table radio (R75, July, 55).
McMichael 493 portable radio (R47, Nov., 53).
McMichael 554 radiogram (R96, Feb., 57).
McMichael 855 table radio (R91, Nov., 56).
Masteradio D155 series (R108, Nov., 57).
Murphy V310 modifications (TV146, Jan., 60).
Pam 111 transistor portable (R140, April, 60).
Pam 706 *Pixie* portable (R97, March, 57).
Pam 710 portable (R90, Oct., 56).
Pam 955 series radios (R103, July, 57).
Pam TB59 (R138, Feb., 60).
Portogram "Junior 8" reproducer (S5, July, 54).
Portogram "Preil 20" amplifier (S4, May, 54).
Philco A 536 W/M radio receivers (R68, Feb., 55)
Philips television tuners (TV88, June, 56).
Philips G77B, G81U, G83B (R137, Dec., 59).
Pilot television tuners (TV89, July, 56).
Pilot PR251 transistor portable (R144, Aug., 60).
Pye HF25/25A hi-fi amplifiers (S11, June, 58).
Pye P131MBQ portable (R121, Oct., 58).
Pye P43 radio receiver (R63, Nov., 54).
Pye 13-channel tuner unit (TV66, May, 55).
Pye *Pipers* P115U/P116U (R110, Dec., 57).
Pye *Black Box* record reproducers (S8, Sept., 57).
Pye 841130 series TV tuners (TV110, Oct., 57).
Raymond F55 table radio (R74, June, 55).
Regentone PRG1 and Five-18 (R139, Mar., 60).
R.G.D. B56 portable radio (R132, July, 59).
Roberts CR portable radio (R80, Oct., 55).
Roberts "Junior" portable (R26, Reb., 52).
Roberts P5A portable radio (R73, May, 55).
Roberts R66 portable radio (R88, Aug., 56-.
Roberts R77 portable (R105, Aug., 57).
Roberts RT1 transistor portable (R118, Aug., 58).
Sobell FMG57/FMG708 radios (R114, April, 58)
Taylor Electrical "Windsor" circuit analyser Model 20B (T.I.5, Sept., 52).
Ultra 101 transistor portable (R144, Aug., 60).
Ultra FM950 f.m. radio (R129, May, 59).
Ultra TR100 portable (R128, March, 59).
Ultra U960 portable radio (R133, Sept., 59).
Vidor Model CN414 portable (R28, Apr., 52).
Vidor CN420A portable radio (R64, Dec., 54)
Vidor CN421 portable radio (R79, Sept , 55)

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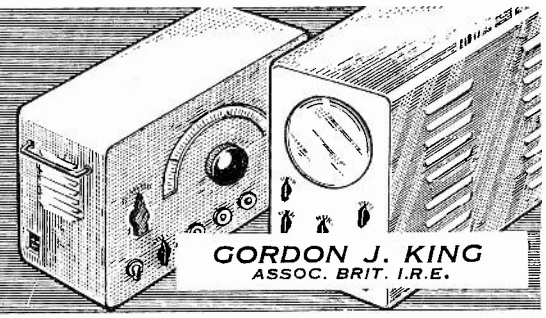
Modern Test Instruments

FOR THE SERVICE DEPARTMENT



GORDON J. KING
ASSOC. BRIT. I.R.E.

OWING to the large range of oscilloscopes now available to the service engineer, it has been necessary to continue last month's description of well-known instruments and to take a look at more models, including types suitable for almost all activities.

We start off with the very comprehensive selection of oscilloscopes marketed by Cossor Instruments which range in price from £33 to £385.

PART SIX
Oscilloscopes—2

Cossor 1035 Mk III

This model is a double beam instrument which is designed for general purpose use. It is less expensive than the 1059, but has the same type tube with post-deflection anode. The timebase can be either triggered or repetitive and a variable timebase delay is provided.

The free-running timebase is continuously variable over 3·3 to 1 on each of the nine ranges giving from 100 mS to 10μS. Sweep expansion is also continuously variable to more than five times, and at maximum is equal to a spot velocity of 4 cm/μS.

The Y1 amplifier has a maximum gain of 3,000 over the range of 5 c/s to 5 Mc/s (30 per cent down) on all sensitivity ranges except on the 50mV range which has a frequency limit of 1·5 Mc/s. There are seven sensitivity ranges giving from 10V/cm to 10mV/cm.

The Y2 amplifier has a maximum gain of 30 over 5 c/s to 250 kc/s (30 per cent down), and is directly calibrated in terms of voltage over five ranges, giving from 5V to 500V.

Cossor 1039M Mk.II

This is one of the smallest oscilloscopes available. It is truly portable in nature, and the $2\frac{3}{4}$ in. tube is well balanced in a case measuring only $5\frac{1}{2} \times 4\frac{1}{2} \times 13\frac{1}{2}$ in. depth. The weight is only $10\frac{1}{4}$ lb., and the leather carrying handle at the top of the case, which folds flat when not in use, enables the instrument to be easily carried from job to job with considerably less trouble than a small bag of groceries.

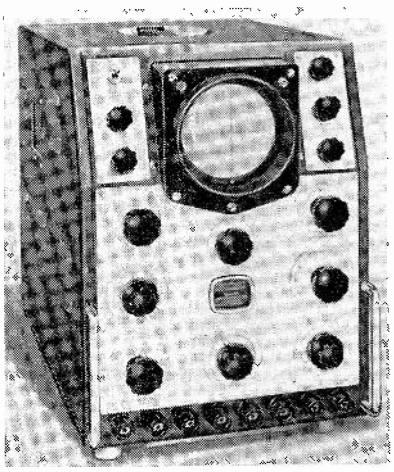
The instrument can be used for all servicing tasks, including the visual alignment of tuned circuits, and in this connection ties in extremely well with the Cossor alignment generators, such as Models 1322 and 1324 (see Part 4).

It also makes an ideal monitor for TV waveforms on relay systems.

Such a monitor is often necessary for checking and setting the sync/picture ratio, as well as for other jobs, such as pulse testing, etc.

The c.r.t. is a single-beam job, Type 24D, giving a green trace, and is operated with 860V on the anode. The trace is adequately bright enough for all normal tests, even in the face of high ambient light. A repetitive timebase is featured, and is synchronised on positive-going signals. The sync signal is applied externally, via a socket on the front terminal panel.

The timebase operates over five switched ranges, giving from 10 c/s to 50 kc/s in conjunction with the normal "velocity" control. There is also a switch position which cuts the time-base off so that an external "X" signal can be applied to the appropriate front panel socket. At this same terminal, when the timebase is running, a timebase signal is available for sweeping an external wobbulator for visual alignment and response curve examination. The amplitude of scan at maximum velocity is not less than 5 cm, and a flyback suppression circuit is incorporated.



The Cossor Model 1035 Mk.III general purpose double-beam instrument.

The "Y" amplifier is single-stage and has two gain positions. The first, giving a maximum gain of 75, provides a bandwidth of 25 c/s to 120 kc/s (30 per cent down), and the second, giving a maximum gain of 20, improves the bandwidth from 25 c/s to 1·5 Mc/s (30 per cent down.) The sensitivity on the high gain position is better than 0·015V/mm with full screen deflection, while the low gain sensitivity is of the order of 0·056V/mm with full screen deflection. A continuously variable gain control is also fitted.

The instrument is for a.c. operation, 220V to 240V, 50–100 c/s, and the consumption is 30 watts.

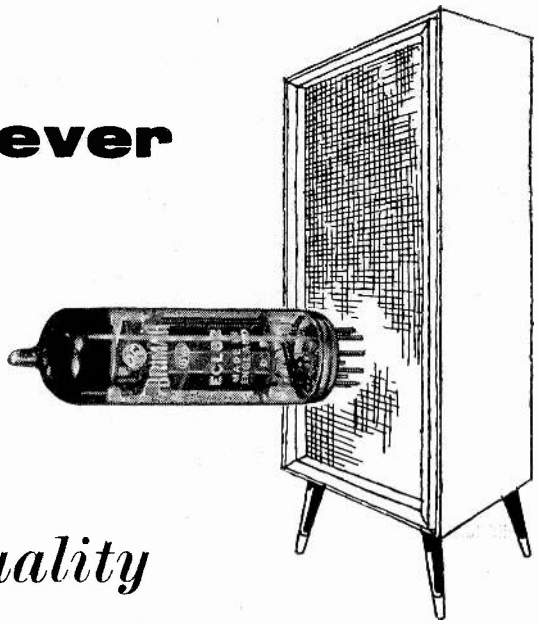
Cossor 1045

This is a single-beam kit instrument, but is also available factory assembled at a slighter higher cost. It features a 4 in. c.r.t., giving a green trace at 1·3 kV and is built into a case measuring $14\frac{3}{4} \times 9 \times 18\frac{1}{4}$ in. depth. Weight 18 lb.

The timebase is repetitive from 10 c/s to 500 kc/s over five ranges and these cover sweep velocities from 10 mS/cm to 0·2μS/cm, the flyback being suppressed on all ranges. The timebase can be synchronised from positive or negative pulses derived externally or from the Y amplifier.

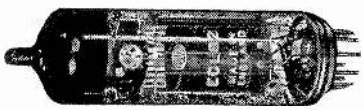
The X amplifier has a gain of 28 variable down to zero, which gives a continuously variable X amplitude expansion, with a maximum sensitivity of 0·75V/cm. The frequency response is from 2 c/s to 275 kc/s (30 per cent down), and the rise-time 1·4μS. The X amplifier can be used for applying external signals, and in this connection there is a 50 c/s sinusoidal input havin continuous control of phase from 0 135 deg.

whenever



quality

counts



better make it

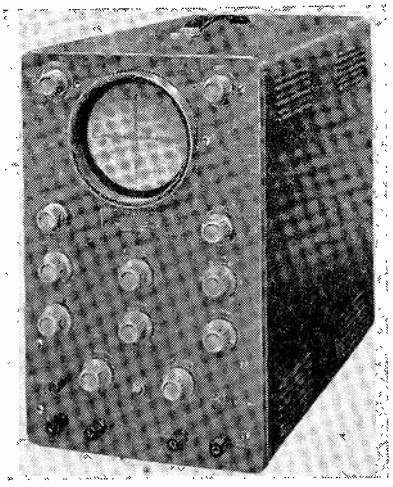
... quality of sound reproduction or quality of television picture, Brimar valves have a vital part to play. Distortion-free amplification largely depends on having the right valve ... and Brimar valves have proved conclusively to be the *right* valves for today's exacting needs. When it comes to TV, Brimar Teletubes are equally 'in the picture'. No wonder Brimar valves are specified both by set manufacturers and for dealers' replacement purposes.

BRIMAR

Brimar Limited

FOOTSCRAY · SIDCUP · KENT · FOOTSCRAY 3333

The Y amplifier is variable in gain from zero to a maximum sensitivity of 50mV/cm, over the band 5 c/s to 3 Mc/s (30 per cent down). The amplifier response falls so that if at 3 Mc/s the deflection is 8 cm, at 7 Mc/s it would be 3 cm, but there is a useful response to



This is the Cossor 1045, a single beam oscilloscope available in kit or assembled form.

10 Mc/s. The rise/time is 0·12μS and the overshoot less than 10 per cent. Facilities are available for intensity modulation through 20 mS time/constant to c.r.t. grid.

Cossor 1091

Here is a more elaborate instrument with two beams. The tube is a Type 93D, giving a green trace, and works with an accelerating potential of 1·6kV. A Type 93L, long persistence tube, can be fitted if required. These tubes have a flat 4 in. screen.

The timebase can be set to either "triggered" or "repetitive", and synchronised from positive or negative going signals either derived from the Y1 amplifier or externally. There are 21 calibrated sweep speeds from 1 μS/cm to 5 S/cm. All these ranges can be expanded by 5 times, giving a maximum calibrated sweep speed of 0·2 μS/cm. Continuously variable sweeps are also available with repetition rates from $\frac{1}{4}$ c/s to 200 kc/s. The accuracy of time measurement over the centre 6 cm is ±10 per cent, and ±15 per cent over the 1 μS range.

Expansion is provided by an X amplifier and is switch selected at x1 and x5 pre-adjustable for calibration through the front panel. When the timebase is switched to the continuously variable position, the X amplifier is also continuously variable from about 3 cm sweep to greater than 50 cm sweep. The X amplifier can be used to amplify external signals for sweep application, and when so used the maximum sensitivity X-wise is 0·2V/cm, 0·5 c/s to 100 kc/s (30 per cent down). The minimum sensitivity is 2·5V/cm, 0·5 c/s to 350 kc/s (30 per cent down).

For Y deflection two identical amplifiers are used. These operate from d.c. to 3 Mc/s (30 per cent down), and at 3 Mc/s provide a deflection of 4 cm minimum, and at 7 Mc/s 2 cm minimum.

Compensated attenuators provide sensitivities of 50V/cm, 15V/cm, 5V/cm, 1·5V/cm, 0·5V/cm, while on the Y1 channel a pre-amplifier is automatically switched in circuit and increases the sensitivity on that channel over three additional ranges, viz: 150 mV/cm, 50 mV/cm and 5 mV/cm. The pre-amplifier's response is 5 c/s to 350 kc/s on the 5 mV/cm range and 5 c/s to 500 kc/s on the other two ranges.

Facilities are available on the instrument for intensity modulation of the beam. Coupling to the modulator grid on the tube is via a 20 msec time-constant, and the voltage required for this application is of the order of 25V peak-to-peak.

The instrument is contained in a substantial metal case of dimensions 15×9⅞×19 in. depth, and weighs 29 lb. It is operated from a.c. mains 200–255V, 50–100 c/s, and the consumption is 80 watts.

Cossor 1058

This is a single beam instrument fitted with a 4 in. diameter p.d.a. tube and provides a display of 6 cm amplitude from zero frequency to 6 Mc/s. The direct-coupled Y amplifier gives a sensitivitiy of 0·25V/cm and accurate calibration facilities. A symmetrical X amplifier is also incorporated which provides a sweep expansion of up to 5 times.

Triggered or free/running timebase is available with a wide range of scanning velocity from 30 cm/sec to approximately 1·5 cm/μS. A ten-position "trigger selector" switch gives facilities for operation from positive or negative signals from external test circuits or Y amplifier and also triggered operation from TV line or frame pulse on a 1-volt double-amplitude pulse TV signal (positive-going).

Cossor 1059

This is an expensive precision double-beam instrument providing comprehensive measurement facilities over a wide band of frequencies. A 4 in. diameter tube is incorporated with post-deflection anode, which provides a high degree of display definition with freedom from flare.

Two identical amplifiers are employed for Y deflection, and the sensitivity is continuously variable and calibrated between 0·1V/cm and 10V/cm over a bandwidth of 10 c/s to 10 Mc/s (30 per cent down). Two additional pre-amplifiers are provided enabling the sensitivities of the Y1 and Y2 or Y1 and X amplifiers to be increased ten times. Signal delay facilities are available on both channels.

The X amplifier allows continuously variable sweep expansion up to 5 times, and provision is made for operating the c.r.t. at 6kV accelerating potential when maximum speed is required.

The timebase is triggered and has a range of 0·03μS/cm to 15 mS/cm in eleven steps. It can be triggered from positive or negative signals derived externally or from the Y1 amplifier.

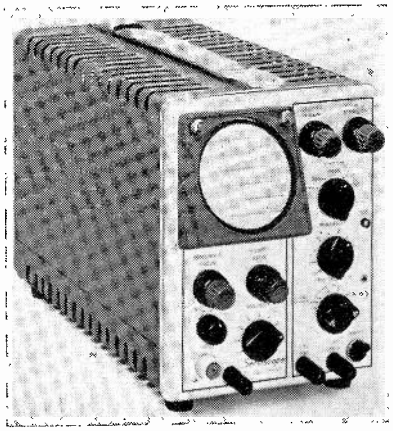
Telequipment S31

Housed in a metal case of dimensions 6½×8½×14 in. overall and weighing only 16 lb., this transportable oscilloscope features a 3 in. flat tube operating at 1·4kV. The screen face is tilted at a convenient viewing angle, and a removeable green filter is fitted to improve contrast at high ambient illumination.

The timebase provides 18 pre-set calibrated sweep speeds from 500 mS/cm to 1 μS/cm, and slower speeds are available by internal adjustment, if required. The time measurement accuracy is of the order of ±10 per cent.

The timebase signal is fed via an X amplifier which gives continuously variable X-expansion in excess of 10 screen diameters (e.g., 50 cm). Facilities are available for direct access to the X amplifier.

Two modes of triggering are provided: one, automatic synchronisation which automatically locks the timebase to any frequency between a few cycles and 1 Mc/s at any input level; and two, selective triggering which enables the time-base



This is the Telequipment *Serviscope* S31, also available in rack mounting construction and with double-gun c.r.t.'s.

to be triggered from any selected point on the input waveform. This arrangement gives extremely solid synchronisation from even the most complex of waveforms. The trigger signal can be positive, negative or TV line or frame (+ve or −ve) either internal or external.

The Y amplifier has a maximum sensitivity of 100 mV/cm and a frequency response from d.c. to 6 Mc/s (approximately −3dB) adjusted for maximum pulse response. The rise-time is 0·06μS with less than 2 per cent overshoot. The input attenuator has nine positions calibrated direct in V/cm from 100mV to 50V/cm, and the voltage measuring accuracy is ±5 per cent. A voltage calibrator 1V peak-to-peak squarewave is incorporated.

The instrument is mains operated 200–250V, 50–100 c/s, or 95–115V. Other voltages available to special order.

Telequipment D31R, S31R and D31

All these models have the same technical specifications as the S31, but the D31 and the D31R are provided with a double gun c.r. and two identical Y amplifiers. The timebase is common to both traces.

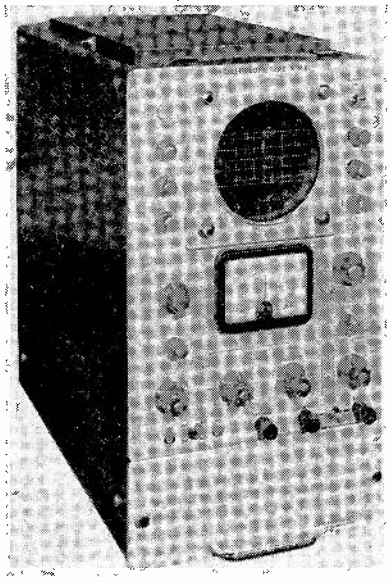
Both the D31R and the S31R are designed for rack mounting featuring 19 in. panels, the former 7 in. high and 13¾ in. deep and the latter 5¼ in. high and 13¾ in. deep.

The double-beam models incorporate a 3½ in. flat-faced two-gun tube operating at 1·6kV e.h.t.

E.M.I. WM8

This is more of a laboratory instrument in the upper price group. It features a 5 in. tube, Type SE5A1, operated at 6kV, and has facilities for intensity modulation at the tube grid.

The timebase provides sweep speeds from 50 mμS/cm to 15 mS/cm continuously variable. The maximum repetition rate with the timebase free-running or triggered is 300 kc/s. Sweep expansion is continuously variable up to 3 times. The maximum sensitivity of the X amplifier is 700mV/cm, while the non-linearity positional error is not greater than 2 per cent of the full scan of 10 cm unexpanded.



A laboratory-standard instrument in the high-price bracket—the E.M.I. WM8.

The timebase can be either repetitive or triggered, and synchronised internally or externally on positive or negative signals. An interesting feature is a "level control" which enables the sweep to be triggered at a selected amplitude on the triggering waveform, in the range of plus 20V to minus 20V.

The Y amplifier has a sensitivity of 1V/cm to 25V/cm over the band from d.c. to 15 Mc/s (−3dB), and by the use of a plug-in pre-amplifier, Type 8, the sensitivity can be increased to 50mV/cm over five ranges. The rise-time of the amplifier is 25 mμS and ring is less than 1 per cent. The amplifier has differential inputs with a common attenuator switch, and the fine gain control permits any signal to be displayed at a convenient size of the screen.

A built-in lumped constant signal delay line enables the usual separate trigger feed to an oscilloscope to be dispensed with in most cases, and provides a jitter-free display. The instrument also gives an 18V peak negative-going sawtooth output for wobbulator sweep application, and 32V peak as a sweep "bright-up" pulse.

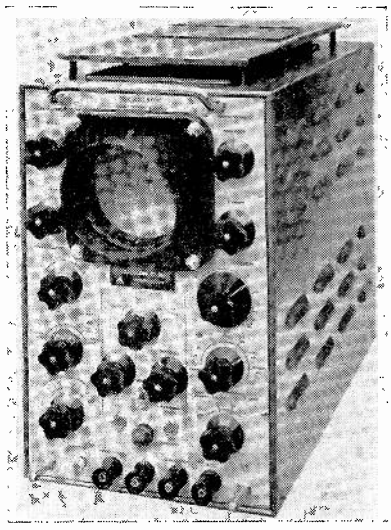
The dimensions are 20¾ × 11 × 21¼ in. and the weight 30 lb. Power requirements are 90–130V or 200–240V, 50–60 c/s, at 225VA.

Solartron CD523S

This is another general purpose instrument which uses a 10 cm flat-screen tube, Type 4EP7, with post deflection acceleration. The screen gives a blue trace and has a long persistence, suitable for photographs at timebase speeds up to 0·5S/cm. It is built into a case measuring 16¼ × 10 × 23 in. long, less viewing hood, and weighs 70 lb. It is mains operated from 110V to 220V, 40–60 c/s, 230VA.

The timebase is of an improved Miller form which has an increasing tendency to synchronise as the sweep progresses. This unique feature permits examination of a wide range of frequencies without the need to re-synchronise. The timebase gives velocities from 10 cm/μS to 1 cm/S in seven steps, each continuously variable over a 10 to 1 range, on a calibrated control. It can be operated under either triggered or repetitive conditions on both positive and negative going signals, internal or external, or on frame TV input. The time scale range is from 0·1 μS/cm to 1 S/cm.

An X amplifier serves to amplify the timebase signals. This is designed for optimum pulse response, and has four sensitivity ranges from 10V/cm to 1V/cm with bandwidths between d.c. to 5·5 Mc/s and d.c. to 2 Mc/s. An expansion control gives four steps x0·5, x1, x2 and x5. The amplifier may be used independently from the timebase, if desired, for investigations where time is not a variable.



Another high-price general purpose oscilloscope, the Solartron CD523S.

The Y amplifier comprises two sections. A d.c. amplifier with no overshoot for pulse work. A capacitor-coupled pre-amplifier, providing high gain with feedback and adjusted for optimum pulse response. Each amplifier has three ranges of sensitivity giving an overall sensitivity range from 10V/cm (d.c. to 10 Mc/s) to 1mV/cm (10 c/s to 100 kc/s).

A five/position attenuator operates on all ranges to reduce the size of the picture in approximately 30 per cent steps. A power socket is included to supply an external pre-amplifier probe. There are numerous additional facilities which are available for this instrument.

Marconi TF1153

This is a general purpose oscilloscope with full facilities for precise evaluation of both time and voltage. The instrument can be powered from 200–250V (or 100–125V with special transformer), 40–100 c/s. Its dimensions are 3¾ in. height, 19 in. width and 20 in. depth. It weighs 46 lb. A 3½ in. diameter tube provides a green trace.

The timebase velocity is switchable from 1μS/cm to 0·01 S/cm, and may be triggered for the single sweep condition, or synchronised for the free-running condition, from a positive or negative going signal either internally from the test signal or externally. On free-running, a continuously variable control allows adjustment of the repetition frequency between the steps of the range switch, but this control does not affect the trace velocity.

An X amplifier is used between the timebase and tube X plates, and this has a sensitivity of approximately 4V/cm within 3dB from d.c. to at least 900 kc/s. Alternatively, the timebase signal may

be derived from an external source connected via front panel terminals either to the X amplifier or direct to the tube X plates. In this case, intensity modulation can be injected to the tube grid via another front panel terminal.

The Y amplifier has a sensitivity on d.c. from 30V/cm to 1V/cm over four ranges, and on a.c. from 1V/cm to 0·01V/cm over five ranges. The frequency response on d.c. is from d.c. to 4 Mc/s and on a.c. from 0·2 c/s to 4 Mc/s, decreasing to 1 c/s to 600 kc/s on the 0·01V/cm range, within 3dB in all cases. Overshoot does not exceed 3 per cent and the drop does not exceed 4 per cent at 50 c/s repetition frequency. There is a delay line of 0·5 μS in the signal path.

Time is measured with a directly calibrated X shift control, and voltage by means of a Y shift control and centre-zero meter.

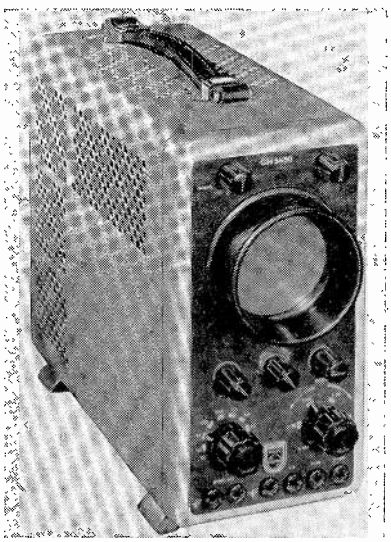
Philips GM5650

Again, this is a general purpose instrument and uses a Type DG7–32 c.r.t. with symmetrical deflection, operated with 400V on the acceleration anode. Incident light is kept off the tube screen by a light shield mounted in front of it. It encloses the whole circumference of the tube, and an easily removable measuring lattice, shaped like a beaker, can be slid into it.

The timebase can be operated free-running as well as triggered. Use is made of a special circuit in order to prevent variations in brilliance during triggering when irregular suppression pulses occur. The sweep can be adjusted in 8 overlapping ranges between 20 mS/cm and 0·5 μS/cm. An output socket is provided for connecting the timebase signal to a wobbulator.

Triggering and synchronisation can be either internal or external with positive going signals in the former case and negative going signals in the latter case. The deflection sensitivity horizontally is 5V r.m.s./cm over 20 c/s to 10 kc/s.

The Y amplifier has a bandwidth from d.c. to 4 Mc/s (−3dB ±½dB). This provides a Y sensitivity from 300mV/cm to 300V/cm, peak-to-peak. The amplifier can, however, be switched to "narrow band" from d.c. to 700 kc/s (−3dB ±½dB) when the sensitivity is increased from 45mV/cm to 135mV/cm, peak-to-peak. Frequency independent attenuators, suitable for block and pulse-shaped voltages are used with the Y amplifier.

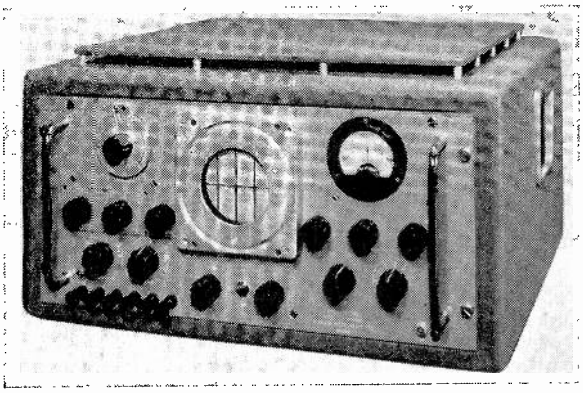


The Philips GM5650 is a general purpose transportable oscilloscope.

★

The Marconi Instruments Model TF1153 is a high-quality general purpose instrument with full facilities for precise evaluation of both time and voltage.

★



Rohde and Schwarz OMF

This oscilloscope provides for all kinds of measurements in the range from d.c. to 20 Mc/s and is particularly useful in TV engineering. The calibrated sweep is adjustable between 0·02 μS/cm and 100 mS/cm. Sweep expansion is possible in steps of X1, X5, X10 and continuously between 0·2 and 1. This facility and a line selector enable, e.g., a small portion of a TV picture to be viewed.

Sweep synchronised time markers (10, 50, 100, 200, 1,000 mμS) and a calibrated voltage which can be accurately adjusted and displayed during the measurement permit accurate time and voltage calibration of the oscillogram.

Y sensitivity is 250mm/V, peak-to-peak. A clamping circuit permits the display of the back porch of a TV signal. A built-in high-pass filter enables the measurement of non-linearities by the intermodulation method. A probe reducing the sensitivity to 1/10 increases the input impedance of the Y amplifier from 1 megohm shunted by 35pF to 10 megohms shunted by 7pF.

Make Model	Tube	Y Amplifier (Max. Bandwidth)	Timebase	List Price
Cossor 1039M Mk. II	2½"	25 c/s—1·5Mc/s	10c/s—50kc/s	£33 0 0
Cossor 1091 (1) (3)	4"	d.c.—3Mc/s	1μS/cm—5S/cm	£83 10 0
Cossor 1058 (3)	4"	d.c.—6Mc/s	30cm/S—1·5cm/S	£78 0 0
Cossor 1059 (1) (3)	4"	10c/s—10Mc/s	0·3μS/cm—15mS	£385 0 0
Cossor 1035 Mk. III(1)(3)	4"	5c/s—5Mc/s	100mS/cm—10μS	£170 0 0
Cossor 1045 (3)	4"	5c/s—3Mc/s	10c/s—500kc/s	£46 0 0(2)
Telequipment S31 (4)	3"	DC to 6Mc/s	500mS—1μS/cm	£75 0 0
Telequipment D31 (1)	3½"	DC to 6Mc/s	500mS—1μS/cm	£95 0 0
Telequipment S31R (4)	3"	DC to 6Mc/s	500mS—1μS/cm	£78 0 0
Telequipment D31R (1)	3½"	DC to 6Mc/s	500mS—1μS/cm	£98 0 0
EMI WM8 (3)	5"	d.c.—15Mc/s	50mμS/cm—15mS	£300 0 0
Marconi TF1153 (3)	3½"	d.c.—4Mc/s	1μS/cm—0·01S	£275 0 0
Philips GM5650	3"	d.c.—4Mc/s	20mS/cm—0·5μS	£65 0 0
Rohde&SchwarzOMF(3)	13 cm.	d.c.—20Mc/s	0·02μS/cm—100mS	£843 0 0
Solatron CD523S (3)	10 cm.	d.c.—5·5Mc/s	10cm/μS—1cm/S	£275 ex-works

(1) Double Beam
(2) In Kit form £34 0 0
(3) With X expansion
(4) Rock-mounting

SUMMARY TABLE OF OSCILLOSCOPES DESCRIBED IN THIS ARTICLE

Next month, in Part Seven of this series, miscellaneous pieces of test equipment, not covered under previous headings, will be described.

revealed that the ECL80 triode a.f. amplifier is fed from the boost line. The old saying "more haste, less speed" would seem to apply here. – V.D.C., Bristol (901).

Cossor 937/8/9

Line Output Fault

One of these sets came in for servicing with the complaint of no picture. Sound was normal and the line timebase was operative, but there was a lack of potential at the anode of the 21A6 and cathode of the 17Z3.

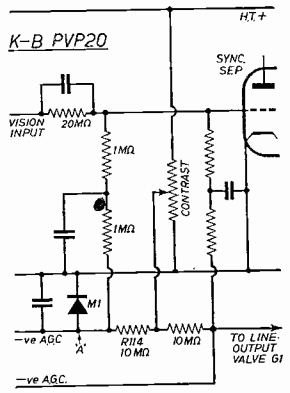
Removal of chassis and subsequent investigation revealed an o/c 17Z3 winding between tag N and tag P of the line output transformer. Unfortunately, the open circuit was not at the tag ends but somewhere inside the winding and beyond repair. As a replacement transformer was not to hand it was decided to connect the 17Z3 anode to tag P.

This was successful, there being ample brightness and normal e.h.t., although there was slight cramping on the right of the picture and insufficient width. We failed to clear the cramping, which was at the edge of the picture and not really objectionable, but we succeeded in extending the width by replacing C78 with a 0·5μF capacitor.—E.L., Long Eaton (828).

K-B PVP20

An A.G.C. Fault

The fault on this receiver was insufficient contrast even with the contrast control at maximum. Loss of aerial input was ruled out as no "noise" was visible with the weakly contrasted picture, so the set was brought into the service department for examination.



Reasoning that negative a.g.c. bias volts could be the cause, the a.g.c. networks were checked with a testmeter and at point A (see diagram) were 1·5V *positive*. The a.g.c. delay diode M1 was cleared as OK by substitution. A negative voltage reading was obtained on the contrast control slider junction and the other a.g.c. line.

As R114 (10MΩ) is a "link" between the two a.g.c. lines, this was checked and was found to be open circuit. Replacement of R114 brought back normal contrast.—G.H., Harrogate (838).

Philips 2155

Lack of Sync

The fault on this receiver was non-existent line or frame hold on Band III, which, at the location of the set, was the weaker of the two signals. On Band I, line would hold but the frame was just out of locking range. Contrast control seemed to have little effect, although in this model it has never as wide a control as in other sets since the a.p.c. is of the sync-cancelled variety.

However, a fault which affected sync and frame speed indicated something common to both. Inspection of the circuit diagram gave the clue. Sync separator and half-frame oscillator are a single ECL80 valve and this type has a common cathode. The contrast control is the separator section cathode bias resistor and it was, of course, open circuit. – W.D.G., Prestwick (817).

New Books

***Fundamentals of Semi-Conductors* by M. G. Scroggie, B.S.E.E. Published by Gernsback Library, Inc., 154 West 14th Street, New York 11*. Size 8½ x 5½ in. 160 pages. Price 2.95 dollars.**

HERE at last is a book on the vexed subject of semi-conductors that combines the virtue of being eminently readable with that of imparting the maximum of information.

More's the pity that, although by one of our leading British technical writers, it has to come to us via the Atlantic.

Since the great transistor revolution a number of books have appeared purporting to explain principles and practice. Those that are understandable by the average technician are inevitably incomplete: those more comprehensive are less comprehensible. Mr. Scroggie's book is sufficiently theoretical to satisfy the purist, yet as easily read as an article in a practical magazine.

Not surprisingly, for the author has more than 700 published articles to his credit, and his "Second Thoughts on Radio Theory" is by now a classic of lucid technical exposition.

Fundamentals of Semi-Conductors does not concern itself primarily with transistors, and for this reason alone is commendable to the student. The special properties of semi-conductors and their various applications are dealt with in detail. Amply supported by a large number of simple diagrams, the chapters progress from original theory to specific uses—including the throwing off of some ideas that are still on the drawing board.

The first three chapters will repay careful reading by the student before going on to more practical description of the typical semi-conductor in the fourth. Chapter 5 deals with Junctions, chapter 6 with diodes and rectifiers, chapter 7 with transistors of various sorts, including tunnel diodes, and their applications and characteristics. The next chapter covers photocells in a more comprehensive way than is usual in the "popular" publication. The last chapter then takes us through other semi-conductor devices, including some that may be new to the radio retailer and his service staff.

Taken at the level at which its author intended—"to make it possible to understand more advanced literature"—this book, No. 92 of the Gernsback Library, is exactly the kind of reading the retailer's serviceman requires if he intends to cope with future business and the growth of semi-conductor techniques. Thoroughly recommended.—*M.A.Q.*

(* *Gernsback Library publications are obtainable in the U.K. from Atlas Publishing & Distributing Co., 18 Bride Lane, Fleet Street, London, E.C.4.*)

***Television Explained.* Seventh Edition, by W. E. Miller, M.A. (Cantab). M.Brit.I.R.E.; revised by E. A. W. Spreadbury, M.Brit.I.R.E. Published by Iliffe and Sons Ltd., Dorset House, Stamford St., London, S.E.1. Size 8½ x 5½ in. 202 pages, including 10 pages of art plates, 89 diagrams. Price 12/6d.**

THERE is little that can be said about this publication that has not been said before. The book in its original form was first published in 1947, and received general acclaim.

It was then sole work of Mr. Miller, Managing Editor of *The Wireless Trader*. After five editions had appeared, Mr. Spreadbury took over the donkey work of revising the book. It says much for his credit that the extensive revising made necessary by rapid developments in the TV field has still not detracted from the style set by the original author.

Discerning technical readers, who are aware of Mr. Spreadbury's capabilities, will also appreciate the control with which he writes. There must have been many temptations to break into mathematics, quote formulae, digress into theory. He has resisted them and retained the easily assimilated manner that will recommend this book—once again—to the amateur, the improver, and the student with rudimentary knowledge of radio.

Commencing with a series of photographic plates of picture faults, the book progresses through 15 chapters, describing the conventional television receiver stage by stage.

A later chapter takes the reader to the newer development of the TV/f.m. receiver, the main difference in this edition. There are so many varying circuits that a generalised description of the principle must have been difficult to work out. The chapter, though lacking in the circuits which would have made description more explicit, is a brave effort to instruct.

Finally, there is a chapter on installation and operation and a page explaining simple attenuators, another listing abbreviations and a comprehensive index. Impeccably produced, a credit to any bookshelf, *Television Explained* in its Seventh Edition should enjoy continued success.—*D.C.*

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.

Service Small and Good

YOUR editorial "Sales and Service" raises some provocative points. The most important seems to be that the large department is disembodied. It has not the personal touch that a small dealer enjoys with his customers.

But it goes deeper than this. Take a typical case. The customer calls to the shop and complains. The dealer telephones the service agents who may not be able to send straight away—indeed, seldom can, except in the larger cities where organisation can be tighter. By the time the engineer arrives, the customer is getting disgruntled. If he cannot cure the fault on the spot, there is even more dismay.

Also, the large service department often expects engineers to bring to central depot all but the simplest faults. They must, or the quantity of work will drop. So the customer is now without a set. And it is the dealer who gets the blame—and ultimately loses business.

No, Sir, the small dealer, repairing his own sets, gives far better service to his customers. **H. H. Owens,** *Manchester.*

Apprentice Prospects

YOU say (*Service Viewpoint, October*) that future service engineers can only be recruited from experienced apprentice ranks. No doubt this is true, but I think that an even more important problem is not merely recruiting apprentices but in keeping them!

In the first place, what prospects can the average establishment offer for years of study and training? Little, compared with the attractions of research laboratories and set makers departments. And if lads are looking for more immediate rewards, other industries can offer them.

But when the apprentice has reached a reasonable level of proficiency, who is to blame him if he deserts radio and TV servicing for the more glamorous (and lucrative) field of electronics? Since we seem to be losing many of the more ambitious and intelligent lads to the counter attractions of electronics we are in danger of being left with not-so-bright youngsters and old timers too set in their ways to seek improvement.

The answer seems to lie not entirely with employers, nor is it simply a matter of cash rewards, but rather with the service set-up generally.—**J. Smith,** *Twickenham.*

Too Much Theory?

I COULDN'T help wondering whether reader N. R. Stride is really the "Bernie" described in *Service with a Grin* (October issue). He sets out a logical and unanswerable case that E.L. didn't orter 'ave done it. Yet E.L. comes smartly back to say, in effect, that while his critic may be right, the fact remains that the disaster predicted has not occurred. Perhaps, like Bernie, we are sometimes too much the slave to theory? —**W. Booth,** *Gidea Park.*

by H. W. HELLYER

The Metric Way

OLD hands of the radio trade will not be shaken by the announcement that British Chemists should be fully converted to the metric system by 1963. Stumbling on in the wake of the world, we in Britain have been measuring out our aspirin by the Apothecaries Table.

We are reluctant to admit that decimal points are quite cricket. But now, the Pharmacopoeia Commission are to ask the President of the Board of Trade to include the provisions for conversion in the weights and measures legislation.

Apart from the disturbing feature that the rounding off will lead to variations of some eight per cent, which makes hay of some of the directions on those Poison bottles, we in the radio trade, as I said, will treat the news with a shrug.

After all, we have been taking the metric mixture for years, quite painlessly.

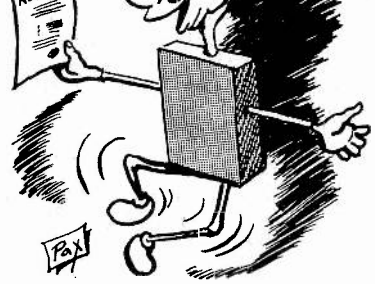
We put away old-fashioned units when we finished playing with Leyden Jars and stowed our home constructor's Wheatstone Bridge Outfit in the cupboard.

Conscious of our insularity we have accepted those charming foreigners, Mega, Milli, Kilo and Micro. Even little Pico has had his adoption papers through and the veriest apprentice uses the familiar diminutive "puff" as if he'd known the wee chap all his life.

But time goes on, and soon a fresh batch of names will enter our work-life. Beyond the bronze doors, behind the marble walls, great minds deliberate.

Solid-state devices are surrounding us, like the troops of a hostile army. Our armoury is getting out of date, our nomenclature is rusting. Soon, like the chemists, we shall have to wake up to progress.

It is only about thirty years since we were decrying the superhet. "*Ridiculous notion, asking for instability, Egad.*" We have only just learned to tolerate flywheel timebases, and an upside-down h.t. rail is an object of suspicion. So it is hardly any wonder that the necessary extension of limits brought about by the new materials, the modern techniques, fills us with anticipatory dread.



Little Pico has his adoption papers.

In America, the National Bureau of Standards agreed earlier this year to adapt a batch of new prefixes. These are already in common use on the Continent, but we plodding fellows will probably resist their intrusion until the Americans serve them up with the breakfast food.

Taking a bagful of noughts and giving them names doesn't make our job much easier, you might think. Are we happier calling 10^{12}, 10^{9}, and 10^{-9} Tera, Giga and Nano, respectively? As far as Joe is concerned, it is simply a conspiracy to give him more to remember, who has not mastered the difference between power and voltage decibels yet.

Nano, smiling at her wayward daughter Giga.

Readers who share my interest in semantics will be impressed by the beautifully international names. If a British Commission had been called upon to label those multiplying zeros they would probably have come up with, Pludge, Grobbet, and Clack.

But Tera, Nano, Giga, Pico—what a lovely family of names. Can't you just see them? Tera, the rough and ready father-figure, like a Lawrence senior with a heart of gold. And Nano, motherly, smiling at her wayward daughter Giga, the perpetual teenager, while little Pico, like Tiny Tim without the crutches, plays in the corner with his cycles. Giga has just had a square-wave. With her coiffure full of paper 'caps she may seem unmodulated to the biased view, but the lass has plenty of potential. Her suitors will offer negative resistance.

If I appear to grow romantic, forgive me. Blame it on the weather, seasonal shell-shock, the bonfire smoke, anything. But don't admit that I am scared of those relentless tyrants, figures and formulae.

Hit on the head by a book of four-figure tables.

Ever since I was hit over the head by a book of four-figure tables, this fear has inhibited me. I never know how many noughts to cancel, whether it is three times ten-to-the-eighth when in kilocycles, whether Mu is R-plus-Ra or the other way round.

And if you are honest, dear reader, you will admit that theory is sometimes a bit scarifying. Those of us long enough in the tooth to feel for the characters in the TV adverts, (*Not mooch foon, is it?*) will have developed our own short-cut formulae.

I recall a contemporary at a Service Radio School who could sometimes be caught muttering the rune to himself as he marched out of step: "*One over two-pi-root-LC*". It didn't save him, though. He was soon promoted and sent overseas.

So the prospect for stickers-in-the-mud like me looks bleak. We shall never re-learn our secret talismans in terms of the newer symbols. I put the problem to colleague *Feste*. He answered in typical fashion.

With a hey-nano-nano and a tera-diddle-doo . . .
The Watt's too small,
The Amp's too big, a
Volt or two suits me and you,
And Ohms are easy, rise or fall,
But soon they'll drive me up the wall
With Nano, Pico, Tera, Giga.
Noughts too many, noughts too few,
Fractions infinitely small,
Decimals are growing bigger . . .
Soon we'll have no "ones" at all,
How are blokes like me to figure?

And then there is the problem of pronunciation. Never very certain in the English language, imported words get distorted, as heard through a low-fi hook-up.

Do we, for example, say *Gigga*, *Geega*, *Guyga*, or any of the above with a second "Gee"? Shall we soon invent derivatives to fix them in our minds, such *aides memoire* as "puff"?

And, if we do manage to remember them, are we going to remember also when and where to apply them? I fear I shall find myself resorting to the age-old expedient of the unfortunate blot when I'm doubtful about a decimel place, Nano or no.

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100	18	1	17/32	CE434BAE	6	1/8	12	1/7
25	25	1	13/32	CE432CE	6	1/4	12	1/3
50	25	1	17/32	CE434CE	6	1/6	12	1/5
100	25	1¼	21/32	CE135CE	6	1/10	12	1/9
25	50	1	17/32	CE434DE	6	1/6	12	1/5
50	50	1¾	21/32	CE139DE	6	1/10	12	1/9
8	150	1	17/32	CE434FC	6	1/6	12	1/5
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4	450	1¼	21/32	CE135PE	6	1/6	12	1/5
8	450	1¾	29/32	CE96PE	12	1/8	24	1/7
16	450	1½	1 1/32	CE140PC	1	2/6	6	2/4½
32	450	2	1 1/32	CE97PC	1	3/6	3	3/4
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8-16	450	2	1 1/32	CE97PC	1	3/6	6	3/4
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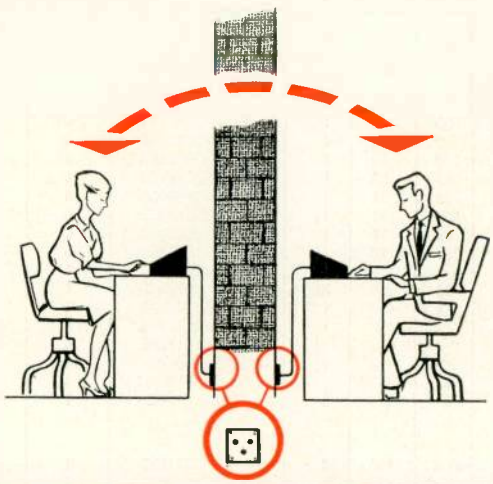

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