RADIO AND ELECTRICAL Retailing

SEPTEMBER 1961

SERVICE ENGINEER

Radio, Television and Audio Servicing

SERVICE ENGINEER

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Edited by W. Norman Stevens

Issued as a special supplement with "Radio Retailing"

In this issue:

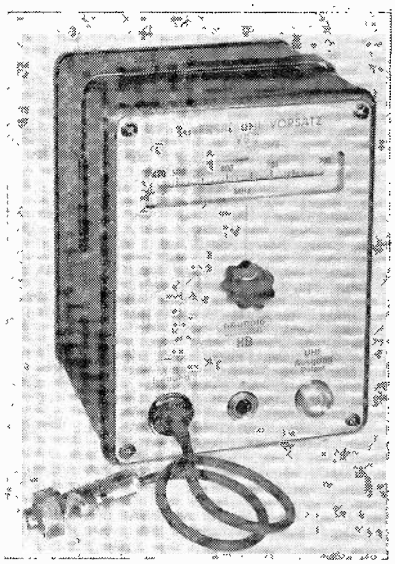
WOLSEY VS-2

A V.H.F. CONVERTER FOR WOBBULATORS

A u.h.f. converter for wobbulators is now available from Wolsey Electronics Ltd., Cray Avenue, St. Mary Cray, Orpington, Kent, who are the sole distributors for Grundig instruments in the United Kingdom.

The Grundig VS-2 incorporates a u.h.f. generator and mixer and requires an input of 55 Mc/s f.m. (deviation not more than ±30 Mc/s) at 60-ohms impedance. Output extends over the range 460–795 Mc/s. Conversion loss is approximately 13 dB.

The converter operates from 120–220V a.c. mains and has a consumption of approximately 7 watts. It is housed in a silver grey steel plate casing and sells at £30.



New Service Company
AJAX COSSOR PETO SCOTT PHILIPS STELLA

Philips Electrical Industries Ltd. announce the formation of a subsidiary company—Amalgamated Electric Services Ltd. (Waddon Factory Estate, Croydon, Surrey).

The new company will take over all the service activities at present carried on at Waddon by the central service departments of Cossor Radio & TV Ltd., Philips Electrical Ltd. and Stella Radio & TV Ltd. In addition it will be officially appointed service agents for Peto Scott Electrical Instruments Ltd., Weybridge, and Ajax Domestic Appliance Co. Ltd. (Ada Halifax).

Mobile field engineers will be maintained throughout the country primarily to service domestic appliances but also to provide full support to radio and television dealers which has been available from the Central Service Department, Waddon, for many years past.

From September all orders for spare parts, apparatus for repair, requests for technical information, etc., which have previously been addressed to the services departments of Philips, Cossor, Stella, Ada and Peto Scott should be addressed to the new company.

Brit IRE —
MORE CANDIDATES FEWER PASSES

Despite a rise in the number of candidates entering for the Graduateship Examination of the Brit. I.R.E. in May 1961, this increase was not reflected in the final number of students completing the examination requirements.

A total of 480 candidates entered for the examination which was held at 71 centres throughout the world; 210 candidates sat Section A, of which 94 were successful, and 170 candidates sat Section B, of which only 42 passed. Since all the candidates entering for Section B had previously passed Section A they are qualified for election or transfer to Graduateship or a higher grade of membership.

Candidates are required to pass all subjects of a Section at one sitting and the poor performance in many of the specialist subjects was the cause of the mediocre result in Section B. In general the cause of failure, particularly in the more advanced sections of the examination, is due to inadequate preparation, says the Institution.

EKCO—PYE SERVICE
Completion of Merger

The scheme for pooling Ekco and Pye service facilities has now been completed by the merging of the main Ekco Service Centre at Somerton Works, Westcliff-on-Sea, into Radio & Television Services Ltd.

Ekco technical advice and the supply of spares will continue to be dealt with by Somerton Works under the new administration. Managing this new RTS depot will be Mr. Ken Mays.

BREMA
SERVICE SUB-COMMITTEE

Mr. C. E. Lock (Kolster-Brandes Ltd.) has been re-elected chairman of the service managers' sub-committee of the commercial and statistical Committee of BREMA. This sub-committee was largely responsible for organising the trade technical section at this year's Radio Show.

Other members of the service managers' sub-committee are: Messrs. J. Foster (A. J. Balcombe Ltd.), M. J. H. Brady (Bush Radio Ltd.), R. W. Murphy (Ferguson Radio Corporation Ltd.), R. O. Seccombe (Murphy Radio Ltd.), R. J. W. Heath (Philips Electrical Ltd.), A. C. A. La Croix (Radio and Allied Industries Ltd.), J. S. Lawson (Ultra Radio and Television Ltd.), and L. G. Stoakes (Rediffusion Vision Service, Ltd.).

Direct TV Replacements
to distribute Ambersil

The Ambersil Division of Amber Oils Ltd. (11A Albemarle Street, London, W.1.) have appointed as distributors of Ambersil MS4 silicone grease to the radio, TV and electronics industries throughout England and Wales, Messrs. Direct TV Replacements, Ltd., 138, Lewisham Way, New Cross, London, S.E.4.

Service Viewpoint

A LETTER that appeared on Page 50 of *Service Engineer*, August issue, disturbed us. Commenting on the BREMA Annual Report, which stated that in many cases interference was caused by chassis radiation "*sometimes aggravated by screening covers being left off after servicing*", our correspondent, J. Farson, of Plymouth, stated that "many times" he had found valve screens, l.o.t. shields and heat guard plates to be missing.

Is this so, we wondered? Accordingly, we buttonholed a few of the visitors at the trade technical section during the Radio Show opening days and found that general opinion was "regretfully—yes".

Naturally, it was always the "other fellow" who was to blame. But more than a few retailers deprecated the standard of service engineers. "*What's happened to the enthusiast?*" asked one. "*I can't trust a man to do a delicate job*", said another, and a dour Scot muttered: "*Engineers—pah! All they want is the money. The job no longer counts*".

Some servicemen had ready replies. "*What do you expect, when makers encourage the 'cowboy' by fitting printed circuit modules?*" Or, "*The dealer doesn't care about service. It doesn't show enough profit*". (A nasty one that—but how true is it, we wonder?)

A disgruntled engineer informed us that the printed circuit encouraged hook-ups. "*When you want to change a component, even temporarily, you are practically forced to destroy the original*".

To this, a well-known designer replies: "Rubbish! most modern p.c.s. use the straight-through method of component lead insertion. Only a touch with a soldering iron and gentle prising is necessary. If service personnel used more logic and less horse-power, destruction would not be so rife".

Too Many Hook-Ups

Well, that is fighting talk. Horse-sense, not horse-power, in dealing with printed circuits. A view that is subscribed to in the training colleges, where present-day servicing techniques occupy a great deal of attention. An electronics lecturer commented: "*With transistorised equipment increasing, logic is going to be the technician's chief tool*".

But it is not only within the set that the Hook-Up holds sway. What about those cobwebby Public Address installations that many dealers provide for local occasions.

We became involved in one at a small holiday resort, last month. The wind was rattling a ribbon mike like a half-empty piggy-bank. A clap-happy compère had succeeded in entangling his trailing lead with the children's fancy dress competitors. Little Bo-Peep had lost her temper, and Boy Blue was blowing his top.

There came a plaintive call for a "radio man" and we found ourselves, armed with a penknife and a roll of dusty adhesive insulating tape, perpetrating one of the most infamous hook-ups we shall ever be ashamed to remember.

Now that the season is coming upon us, and the halls and chapels of our cloistered land will be resounding with Hallelujah Choruses, we may expect some more of those curtain calls: "Is there an engineer in the house?"

Let us keep our propensity for the hook-up to these semi-legitimate occasions, sublimating our destructive tendencies. Let us regain some of the reputation for technical tidiness that the service engineer once had.

New Geo-Pat Toolbox

An interesting new line from Geo-Pat Suppliers Ltd. (Lambridge Street, Larkhall, Bath) is their *Special size* combined valve, components and tool box. Overall dimensions are 14×10×4 in. and the box is built in two sections—the base and the lid compartments.

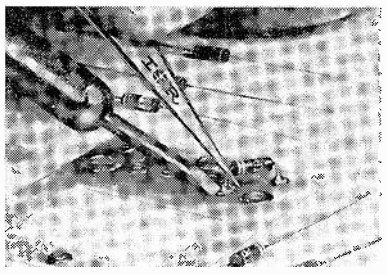
Features include a meter compartment, lined with foam rubber, a built-in components box divided into four sections with sliding top. Supplied with six tool clips and soldering iron heat guard, and available in a choice of colours, it sells at £2 5s. 0d.

It is also available complete with soldering iron, side cutters, set of screwdrivers, tweezers, neon tester, long and snub pliers. Price £4 17s. 0d.

AEI semi-conductor activities to cease

Associated Electrical Industries Ltd. advise us that the semi-conductor activities of their radio and electronic components division are being completely terminated. The activities of the semi-conductor department of the AEI electronic apparatus division at Lincoln are not affected.

Current orders and commitments will be honoured and for a limited time orders for semi-conductors will be met from stock. The company offers to advise on equivalent types.



IRC Zener Diodes

Subminiature glass zener diodes with a voltage range of 3·3–27V and rated at 250mW dissipation are now available from International Rectifier Company Ltd., Hurst Green, Oxted, Surrey.

Units are available in both 5- and 10-per cent voltage tolerance types and have a maximum zener impedance range from 5–70 ohms. The new devices are process-selected to provide sharp zener characteristics and all units feature glass-to-metal sealing. They measure 0·265×0·11 (dia.) in., excluding leads.

Portable S.L. Indicator

The Dawe type 1408D is claimed to be the first truly pocket sized sound level indicator, working completely with transistors and powered by a 9V battery. It covers the sound level range of 64–110 dB, employs a built-in crystal microphone, utilises the three standard weighting curves A, B and C to the IEC specification and weighs only 14 oz. with battery. Further details are available from Dawe Instruments Ltd., Harlequin Avenue, Great West Road, Brentford, Middlesex.

New Electrical Tape

Paynes Jiffytape Ltd., 1–6, Speedy Place, Cromer Street, London, W.C.1., are marketing a low cost cellulose acetate electrical tape which can withstand a working temperature of 130°C without loss of insulation properties. It is based on a pure transparent cellulose acetate.

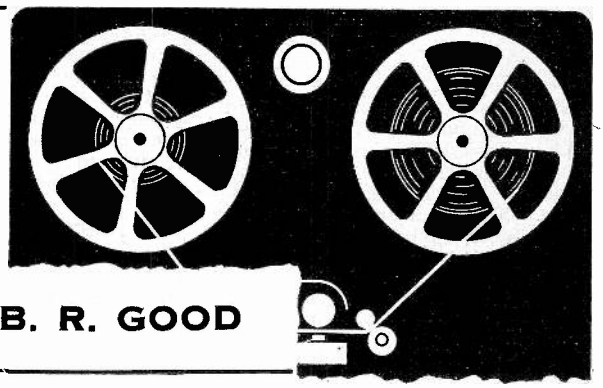
The key-coated film is coated with an electrical grade adhesive which has been processed to ensure that the tape maintains a high resistance to corrosive substances. A particular advantage is the easy unwind properties which makes dispensing and stripping a simple matter.

ITA Test Signals may cause Line Brightening

Until further notice, the waveform of ITA programmes may contain vertical interval test signals, the main purpose of which is to provide a continuous check on network performance.

On most TV sets, these signals will cause no visible effect, but in a few cases they may cause a perceptible partial brightening of lines at the extreme top and bottom of the picture.

Servicing the MODERN TAPE RECORDER



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

IN a series of this nature it is impossible not to be selective. There is a host of machines on the market, many by makers that no longer produce, others that have been superseded, some new models by makers that change their style as often as the auto designers. Nothing is constant—and space precludes our noticing them all. We are forced to spotlight particular models.

These have been chosen, in previous articles, because they are either representative of the general run of a manufacturer's line, or because they illustrate a particular feature of design.

This time we pick on a group of machines that earned the acclaim both of the "popular" critics and the more discerning enthusiasts. Machines that are a little more complicated than some previously discussed, a little closer as to tolerance, a little more exact as to specification—perhaps a little harder to service—with the compensating factor that they are less often in need of it.

BRENELL MODELS

The Brenell 3-Star and Mark 5 Tape Recorders are similar in many respects, but have some important differences. Whereas the former is a general-purpose instrument, three-speed, push-button operated, with a single motor, the latter has a top speed of 15 i/s in addition to the standard three speeds ($7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s), uses a different mechanical system, operated by individual knobs, has three motors, and incorporates the Unit Assembly system, which certainly facilitates servicing.

It should be noted that the Mark 5 deck has been incorporated in a number of other instruments, and has been the basis of several ambitious audio rigs.

The Three-Star

The rather complicated sketch shown at Fig. 1 is an attempt to outline the salient points of the deck, including only those mechanical features relevant to our service problems. In practice, the lever system of this deck is very straightforward; the diagram is intended merely to show the drive system and principal moving parts.

Both motor and flywheel are mounted on a separate, palette-shaped sub-plate, and in consequence are drawn chain-dotted. The view is from below the main deck.

A stepped pulley, A, on the motor spindle drives the take-up spool B, via a plastic belt. This pulley has a brake drum as its lower section, held by a grub screw. Faulty take-up can be caused by this grub screw working loose.

The clue is that the rev. counter, C, will still be operating, being driven by the same pulley, via a thin rubber belt.

Faulty take-up with the rev. counter also erratic may be the result of the swivel bracket, D, being loose.

This is held in tension by spring E, shown end view, and provides clutch action. Excessive tension of spring E will cause the clutch action to become too stiff when the pause control is operated.

The flywheel F is driven by idler wheel G, which is held in engagement with A and F by spring H. The idler is mounted on the speed change bracket and raised or lowered by the rotary action of cam or pulley J. A. set of cogged drive levers lie beneath this assembly (nearer the deck plate).

Rewind is obtained by engagement of idler K with the motor pulley. Note the spring k, at the outer end of the swivel arm, which transmits the movement of the main bar to the idler wheel. A belt drives the reservoir spool drum, L, from the idler wheel pulley.

(Continued overleaf)

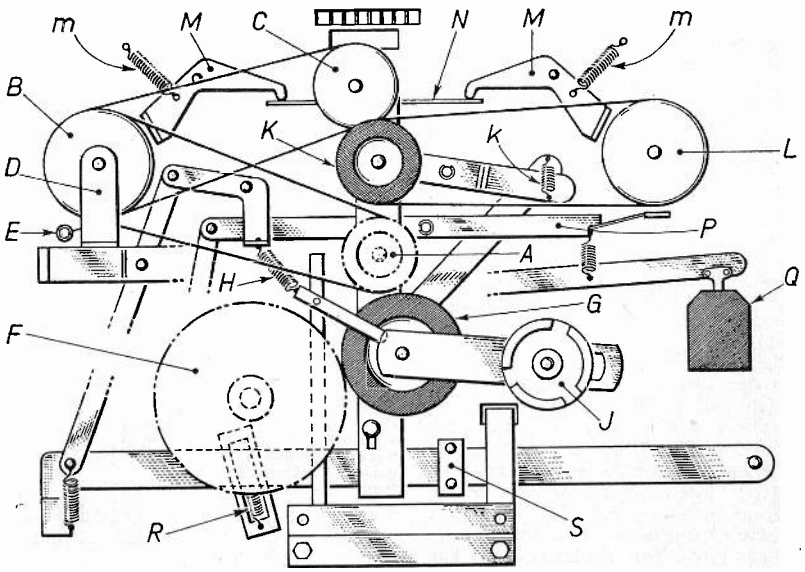


Fig. 1: An outline of the salient points of the Brenell *Three Star* tape deck.

MODERN TAPE RECORDERS
—continued

Braking

Braking operation is straightforward, and the arrangement of brake levers M-M, the assisting springs, m-m, and the operating bar N is such that they are basically self-adjusting. In the "off" position there should be a clearance of $\frac{1}{32}$-in. between the brake levers and the operating bar.

A further, auxiliary brake is operated by the pause control. The cross lever, P, of the pause brake, is sprung against the movement of the arm which operates the main motor switch, Q.

At the same time, the lower end of this pause lever assembly draws the pinch wheel assembly, R, out of engagement with the flywheel spindle, and here again there is a spring to assist the return motion.

These springs should be checked if reports of erratic action are made, as should the adjustment, S, on the main operating cross lever, which determines the pinch wheel pressure.

A point to note on this deck, especially when replacing belts, is the avoidance of grease. This can be troublesome at the cap of bracket D. The takeup belt has to be threaded between this cap and the spool drum to be replaced. It is advisable to clean the cap free of grease first, replace the belt, then grease the cap again after assembly.

The Amplifier

Electronically, the 3-Star presents few problems. The amplifier is easily removed for servicing, and if a jumper lead, 8-way, with octal plug and socket connections is made up, it is possible to remove the amplifier panel, reconnect it to the power unit panel and carry out any functional test required.

The main lever connecting the function switch with the deck assembly should be treated with care during these dismantling operations, as it tends to swing across and get hooked up, and can be bent if handled hastily.

Frequency compensation on this model is at the disposal of the operator. The electrical arrangement is conventional; a T-network of capacitors and resistors is switched between the output of the pre-amplifier EF86 and the input of the second triode of the ECC83, thus forming a feedback loop over the first triode.

The selection of network components is made by the compensator switch brought out to the lower right of the deckplate. This only operates on "Record". On "Playback" there are treble and bass controls in an alternative network, selected by two sections of the function switch wafers.

There are one or two points of interest: the heater feed from the transformer has a pair of 100 ohm resistors to chassis, on the printed circuit panel side of the connecting plug. For playback hum, check that these match.

Also, ensure that the screening can of the EL84, (Playback output, Record oscillator valve), has not accidentally become shorted to chassis. This effectively earths one side of the heater line, as the can is at heater potential for screening purposes.

The Mark V

Much more ambitious is the Mark 5 Tape Deck, which was first shown at the London Audio Fair, in April 1958, and has since proved very popular with kit-makers who required a semi-professional standard around which to build.

Although the basic operation is essentially simple, the construction is such that functional movement is difficult to analyse. *But removal of the main drive motor plate allows access to the main parts, and servicing is remarkably simple.*

From the wiring diagram of Fig. 2 it can be seen that the three-motor system takes advantage of electro-mechanical switching to achieve economy of construction. For example: the Rewind switch B is mechanically prevented from operating unless the Record/Play switch A is in the "Stop" position.

Under those conditions, full mains input is placed across either takeup or rewind motor as required. Notice that the 500 ohm series resistor of the takeup motor, selected by the speed switch (shorted out at 15 i/s), is bypassed in the wiring to the rewind switch.

On Record or Playback both capstan and takeup motors are fully energised. The suppressor units, shown dotted across switch contacts in Fig. 2, seldom give trouble, but the symptoms caused by a short-circuit in one of these should be obvious.

Unfortunately, damage to the flyleads of these "block" suppressors can be caused during dismantling; they have to be removed to facilitate the unshipping of the main drive motor plate.

Brake adjustment is simple, the brakes being cork-lined, drum-bearing types, and should be carried out with switches A and B at "stop" position. The gap between the actuating levers and the 4BA stop screws should then be $\frac{1}{32}$ in. Remember to tighten the locknuts on the 4BA screws after adjustment.

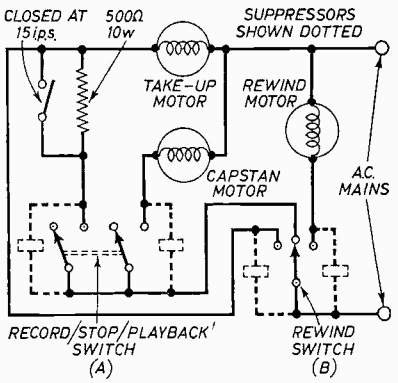


Fig. 2: Wiring diagram of the motor system used in the Brenell Mark V tape deck.

Stabiliser Brake

A stabiliser brake acts on the spindle of the reservoir drum, and should be checked if erratic running is noted. An easy check on this is to unspool a few feet of tape, make a large loop and allow the drive to feed the tape through without the influence of the stabiliser's contrary tension.

This applies in most machines with conventional capstan and pinch wheel propulsion of the tape, but not to those which use gravity clutches, etc.

Prime culprit however, is the pinch wheel itself, its collar or sleeve, or even its bearing bracket, and in machines such as this the capstan sleeve is a possible cause of speed variation.

Two capstan sleeves are in use, one of 1 in. diameter, giving 15, $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s, and the other, $\frac{1}{2}$ in., for $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ only. For quality work, the larger sleeve is desirable, and if the recorder is to be run on the "standard" speeds of $7\frac{1}{2}$ and $3\frac{3}{4}$ it is wise to use the 1 in. sleeve.

Also, if 15 i/s is not intended to be used the extra power fed to the takeup motor to prevent tape spillage is less likely to be needed and the 500 ohm resistor can be left in circuit by removing the switch lead.

Head Assembly

An attractive feature of this deck is the ease with which the head assembly can be serviced. A plate, held by six screws, supports the heads, and it will

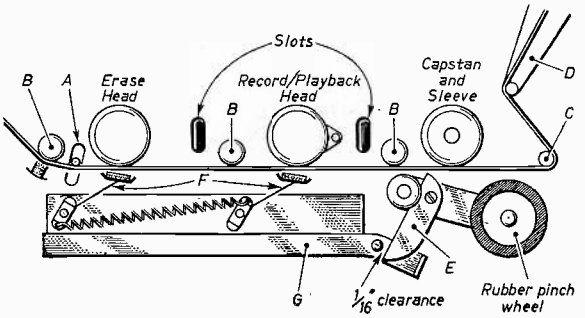


Fig. 3: Sketch showing the main features of the head assembly as used in the Brenell Mark V tape deck.

be noted that there are slots ready for the addition of duplicate heads for stereo or monitoring purposes (see Fig. 3).

Azimuth alignment is by means of a single 6BA screw, the makers recommending adjustment at 7½ i/s with a standard 8 kc/s input.

When making electrical tests it is necessary to bear in mind that the erase head is short-circuited in the "Playback" and "Stop" positions of the function switch.

Another precaution is the holding of the tape from contact with the heads during "Rewind". This is done by the pin A in its slot. The tape normally runs along the surfaces of tape guides B, takeup pin C on the pinch-wheel bracket and the pin D in the tape-tensioner bracket.

Pressure Pads

The pressure pads, F, are mounted on a bracket with a release bar G which is regulated by the adjustment of the curved lever E. Correct setting is for one-sixteenth of an inch clearance between the leading edge of the crescent lever and the stop pin, when the 1-in. sleeve is in use.

The height of the spoolholders is adjustable, by 4 BA screws to the motor spindles.

It will be noted that the makers have left adequate deck space to enable users to employ tapes of varying spools; in fact, up to 8½ in. diameter spool can be accommodated.

The deck is a self-contained assembly, and connections to it are made via two plugs (5-pin for head and 3-pin for mains connections) if the deck is used in conjunction with the Brenell Pre-amplifier and the matched Mark 5 amplifier. A point to note if the arrangement is not so simple, is that the earthing of the erase head (unscreened leads) and the screened Rec/PB twin lead is intended to be made *at the amplifier* and is not made off to the deck chassis.

Therefore, if an alternative arrangement has been made, always check earthing, to ensure that the chassis line has not been crossed. A simple fault, but one that can be very misleading!

Extending these leads for alternative construction, as when the deck is incorporated in a gramophone unit or hi-fi cabinet, may be done with coaxial cable, and the screened outer can be connected to either of the twin inners, the screening being separately earthed. But for minimum hum, it is advisable to carry the wiring through in twin screened.

For a general purpose machine, this Mark 5 has impressive performance and very few service problems. More complicated, but again very trustworthy, is the "professional" equipment, an example of which will be analysed in the final article of this series, next month.

New Books

★ *SERVICE ENGINEER REVIEWS OF THE LATEST TECHNICAL LITERATURE*

Television and Radio Repairing, **by J. Markus. Published by the McGraw-Hill Publishing Company Ltd., 95 Farringdon Street, London, E.C.4. 568 pages. Size 6×9¼ in. Price 69s. 6d.**

FROM time to time complaints have appeared in these columns that books for the radio serviceman are few and far between. Those that purport to serve the purpose too often fall between the stools of erudition and technical baby-talk.

Even more rare is the book that is aimed at the enthusiastic layman, commencing from basic data, which succeeds in putting over, without boring or bogging down the reader, the fascinating subject of radio and television repair techniques.

Which is why I am tempted to cry "Eureka!" when I read through this substantial offering from the house of McGraw-Hill.

Here is a volume that treats the subject from a strictly practical point of view. John Markus assumes that the reader wants to know *how* to mend the set on his bench, then to progress to the reasons *why* it went wrong, to investigate further associated faults and their remedies, and to go on logically to organise himself—to use his new-found knowledge profitably. Hence the advice covers not only technical aspects of radio repair, but includes much valuable information on making a service call, setting up a workshop, ordering stock, and generally expanding a business. I cannot go all the way with the blurb on the jacket: "*Before you've even gotten halfway through this book you can go out and fix half the television and radio receivers that come your way*". But, before I had gotten halfway through the 23 chapters I was well aware that the intelligent layman would have learned enough to be able to handle basic repairs. By the time the book was through I had formed the conclusion that here, at last, was the sort of plain guidance that the radio shop improver could use.

The first chapter is by way of whetting the reader's appetite. In it, Mr. Markus discusses some methods of running service departments—or setting up a one-man shop. His advice covers ordering replacements, making out charges, checking accounts, building up a data library, even the design of letterheads and business cards. The whole tone of the chapter implies that radio service is a job worth doing—and that what is worth doing is worth doing well.

After such an unusual, but salutory, opening, we get down to the bedrock of servicing. Tools are described and illustrated in the second chapter, including not only hand tools, but benches, bench wiring, cheater leads and the larger, "permanent fixture" tools. Chapter 3 is a "plain man's guide" to the theory of radio and TV reception.

Normally, this is the pitfall chapter, where the average volume devotes too much time to theoretical information and not enough to practical description. So that the unknowledgeable reader may well absorb a good deal about the way a radio set works without being able to recognise a capacitor if it came up and bit him, or to distinguish a choke from a transformer. The author has avoided this trap very nicely. He illustrates amply, and contents himself with description of purpose and function of the various parts, leaving deeper explanations to a later chapter. Significantly, his sub-headings read "*Getting acquainted with—*"

The next thirty pages deal with a subject that seldom enters even the most "practical" books on radio service: "Making a Service Call". This includes many hints on the small points of service, from removing knobs to replacing C-R tubes, and some guidance on dealing with customers.

The balance of this book is interesting. After this dissertation on customer-relations we find ourselves going back to the rudiments, studying magnetism and electricity, using multimeters, testing and replacing valves and picture tubes (three chapters that cover a lot of ground, teaching function and fault symptoms, storage systems, etc.), soldering generally and working on printed circuits.

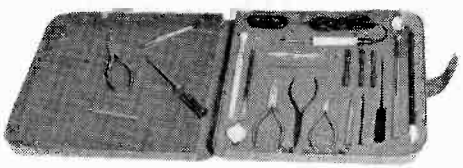
Chapter 13 is headed "Transistors and Crystal Diodes", and is perhaps the best in the book. An especial delight is the section dealing with trouble symptoms. First, a typical 6-transistor circuit is given, then a 4-page table of symptoms, causes and remedies, with particular reference to the given circuit. This should be of great benefit to learner and old-hand alike.

There are chapters on resistors, capacitors, switches, coils, transformers, tuning devices, remote controls and speakers, all in great detail and amply illustrated.

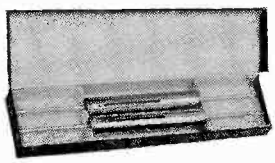
Perhaps the greatest recommendation I can give this book is that at no time did I have to perform those mental "quick-changes" that are the usual drawback of American reading. The assimilation of information is painless.

This book, the eighth of Mr. Markus, volumes that McGraw-Hill have published, amply demonstrates he has not grown stale. Recommended to all practical men, learners and laymen. —*H.W.H.*

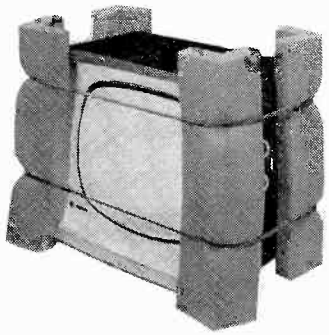
PHILIPS



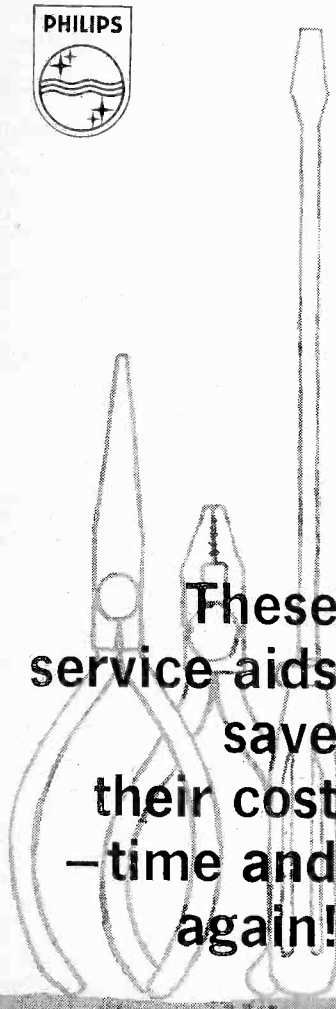
Philips Mini-Circuit Tool Kit is specially designed for servicing sets that incorporate printed panels and miniaturised circuits.

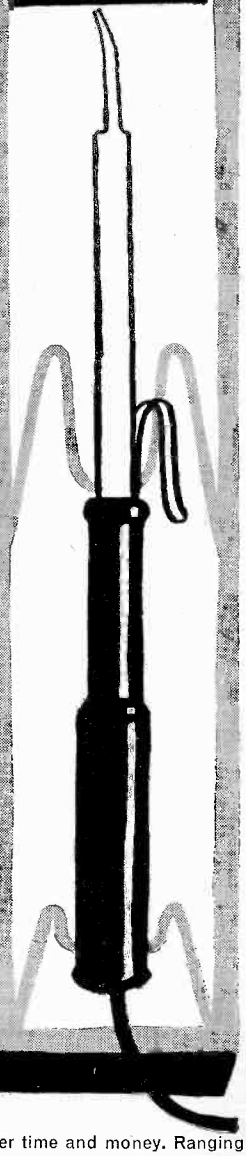


Philips Tension/ Pressure Gauge is indispensable to the engineer for the servicing of tape recorders and record changer units.



Made of high quality foam plastic, Philips Cabinet Buffer Set ensures that expensive radio and TV cabinets are not damaged during transit.





These service-aids save their cost —time and again!

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TECHNICAL GEN for SERVICING MEN

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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.

Pye Luxury 17

Tuner Gives Chirp

A "chirp" was the customer's complaint here. When the fine tuner was rotated to a particular position, sure enough an instability burble could be produced. The sound i.f.'s were checked and the fault eventually localised to the second i.f. stage.

The screen decoupling capacitor, a frequent offender, was tried, but this time unsuccessfully. The cathode capacitor was tried by bridging and the fault cleared. A replacement was fitted but the fault still persisted. Bridging the replacement also, cleared the fault.

It was then realised that when bridging, the test capacitor was not connected directly across the one in the set, but across to a more accessible earthing point. The replacement capacitor was therefore refitted using this new earthing point. The fault had now cleared. R.f. chassis currents must have been responsible for the original trouble. —V.D.C., Bristol (1040).

Invicta 738/0

Half as Wide

This set was in for repair due to the picture having failed. There was a breakdown in the scan coils, which were badly burnt, and they were replaced under guarantee. The set then suffered from insufficient width, this being only about half as wide as it should have been, although the linearity was quite good.

A new line output transformer was fitted as I thought the original might have been damaged by the overload it had suffered, but this did nothing to improve matters. Using the oscilloscope and the waveforms and voltages given in the service manual, I had satisfied myself that the line signal on the grid of the line output valve was correct, proving that the fault was in the output circuit.

Fortunately there are not many associated components involved and it didn't take long to check every one—but nothing was found. At this point, I sat down and studied the circuit.

It was found that the h.t. supply to the boost diode anode was fed through an l.f. choke and then through a winding on the line output transformer, the choke preventing the h.t. line decoupling from damping out the line oscillation. It was covered in pitch and measured 40Ω but the manual gave no d.c. resistance. It was considered that if this choke was inefficient due to shorted turns it could well cause the width trouble.

Since it worked in the high audio frequency range (10 kc/s) I tried the primary of an ordinary sound output transformer as a substitute and this did the trick. A correct L16 choke was obtained later.—R.H.M., Luton (1044).

Pye VT4

Frame Slip Trouble

One of these early Pye sets came in with vertical slip. The valves and circuitry were checked and found to be satisfactory. It was found by chance that when the white spotter control was advanced, the frame timebase locked.

This at first amazed us, as this control appeared to be so remote from the frame circuitry. However, on examining a VT4 circuit, it will be seen that one end of the white spotter control is fed through a 22kΩ resistor to the top end of the frame hold control.

The 25kΩ suppressor control was checked and found to be o/c between the top side and the grid of the valve. Replacement restored the frame circuit to its correct limits.—D.McL., Lochgilphead (1053).

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.

Bush 76R

Told You So!

The set was brought in with the complaint of insufficient height. The usual valve check was made and the new apprentice's remark that it might be the tube was answered in the appropriate manner. The pictured was quite bright and contrasty, locked in well with sufficient width. Focus, also, was quite good.

Voltage checks on the frame output valve revealed nothing amiss but the voltage on the frame oscillator anode seemed a bit low and as this was supplied from the boost rail it was checked and found to be only 200V. The c.r.t. first anode voltage was also low.

It was then noticed that the focus control varied the picture height. The boost rail was checked for leakage and this disappeared when the connection to the focus anode was removed. The tube tester revealed a leak between focus anode and grid. We managed to remove the leak on the tube but not the grin from the face of the new apprentice!—F.C., Crewe (1063).

English Electric C45

Bounce and Jitter

This receiver was brought in with the complaint of frame bounce and jitter. The frame blocking oscillator and the output stage were carefully checked and valves substituted without any improvement. The 'scope was then used to check waveforms and this showed that the oscillator was generating an erratic saw-tooth. No fault could be found in this circuit and the sync waveform was next examined. It was found that the frame sync pulse was severely distorted.

The sync separator and coupling components were investigated with no success and the video output stage likewise. It had been noticed that when the receiver was switched on for the first time, instability occurred for a few seconds then cleared. As I wasn't getting very far with the frame fault I decided to clear this. A routine check revealed that one of the i.f. decoupling screen capacitors had gone o/c.

This was replaced and it was then found that not only was the set stable.

(Continued from page 73)

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

SERVICE DATA SHEETS

THE DATA SHEETS LISTED BELOW ARE STILL AVAILABLE FROM STOCK TO SUBSCRIBERS, POST FREE, AT THE PRICES QUOTED. A COMPLETE INDEX TO ALL DATA SHEETS PUBLISHED UP TO DECEMBER 1960 IS AVAILABLE AT 9d.

Price 1s. each

Ace "Astra" Mk. II Model 553 (TV52, May, 54).
Alba T655 TV (TV130, Dec., 58).
B.S.R. UA8 autochanger (S7, March, 57).
Bush T36 series TV receivers (TV83, Apr., 56).
Bush TV22 series TV receivers (TV67, Jun., 55).
Bush TV53 series TV receivers (TV101, Feb., 57).
Cossor 930 series TV receivers (TV62, Feb., 55).
Cossor 937, 938 and 939 (TV90, July, 56).
Cossor 943 TV (TV127, Oct., 58).
Cossor 945 (TV112, Nov., 57).
Cossor 946 TV (TV104, May, 57).
Cossor 947 TV receiver (TV114, Jan., 58).
Decca DM35/45/55 (TV155, May, 60).
Ekco T330/331 series (TV154, April, 60).
Ekco T342/344/348 (TV157, June, 60).
Ekco T345 series (TV165, Oct., 60).
Ekco T368/T371 series (TV176, April, 61).
Ferranti T1002 series (TV154), April, 60).
Ferranti T1021, 1023. 1027 (TV157, June, 60).
Ferranti T1024 series (TV165, Oct., 60).
Ferranti T1046/T1049 series (TV176, April, 61).
Ferguson 204T series TV receivers (TV87, June, 56).
Ferguson 306T/308T TV receivers (TV97, Nov., 56).
Ferguson 506T, 508T, 546T (TV171, Jan., 61)
Ferguson 516T series (TV173, Feb., 61).
G.E.C. BT1252 series TV receivers (TV96, Oct., 56).
G.E.C. BT1746 series TV (TV81. Mar., 56).
Grundig 500L and 700L/C (S3, Dec., 53).
H.M.V. 1840 series TV receivers (TV109, Sept., 57).
H.M.V. 1890 and 1893 (TV171, Jan., 61).
H.M.V. 1892, 1896 (TV173, Feb., 61).
Invicta 538 series (TV168, Dec., 60).
Invicta 940, 941. (TV181, July, 61).
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. (TV84,May,56).
Marconiphone VT163 (TV173, Feb., 61).
Marconiphone VT164 (TV171, Jan., 61).
McMichael 55 series TV receivers (TV79, Feb., 56).
Murphy V214/V216 TV receivers (TV78, Jan., 56).
Murphy V230 portable TV (TV103, April, 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).
Murphy V330 series (TV167, Nov., 60).
Murphy V350 series (TV175, March, 61).
Pam 500 TV receiver (TV108, Aug., 57).
Pam 600S, 606S, 690 (TV144, Nov., 59).
Pam 800 series (TV168, Dec., 60).
Pam 119A, 120A, 123A, 1000A (TV181, July, 61).
Peto Scott TV 1411 series (TV65, Apr., 55).
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).
Phillips 100U/200U series (TV179, June, 61).
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).
Pye V210 series (TV168, Dec., 60).
Pye V700A, V830A (TV181, July, 60).
Regentone "Big 15/5," T and C (TV48, Feb., 54).
R.G.D. 1455 and 1456 TV receivers (TV99 Dec.,56).
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).
Ultra 1780/82 series (TV177, May, 61).
Ultra 1781/83 series. (TV183, August, 61).
Vidor CN4217/8 TV receivers (TV57, Oct. 54).

Price 9d. each

Alba T717 and T721 (TV143, Nov., 59).
Alba T744FM TV series (TV121, June, 58).
Alba T766 TV receiver (TV166, Nov., 60).
Ambassador-Baird TV 19-20 (TV119, May, 58).
Argosy Model T2 TV receiver (TV53, June, 54).
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).
Bush TV92 and TV93. (TV182, August, 61).
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).
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).
Ekco TC369, T370, T372. (TV180, July, 61).
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)
Ever Ready, *Sky Personal, Sky Leader* and *Sky Baron* (T150, April, 61).
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).
Ferranti 005, 105 and 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).
Ferranti TC1047, T1048, T1050. (TV180, July, 61).
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 T/C10A radio (R41, June, 53).
Marconiphone VT64/65DA (TV76, Dec., 55).
Masteradio D154 "Ripon" series (R84, Feb., 56).
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).
McMichael MP20 (TV 174, March, 61).
McMichael MP27 series (TV178, June, 61).
Murphy A146CM baffle radio (R75, June, 55).
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).
Peto Scott 732 series (TV172, Feb., 61).
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 TV94 series TV receivers (TV107, Aug., 57).
Pilot VS9 console TV receiver (TV34, Nov., 52).
Pilot PT451, PT651 (TV170, Jan., 61).
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 ARG81 series (R127. March, 59).
Regentone RT50 tape recorder (S14, Sept., 59).
R.G.D. T14 transportable VT (TV138. June, 59).
Sobell TS17 and T346 TV (TV94. Sept., 56).
Sobell 626 Series a.m.-f.m. radios (R102. June, 57).
Sobell TPS710, T192, T293 (TV174, March, 61).
Sobell TPS781 series (TV178, June, 61).
Sound A20 tape recorder (S9, Feb., 58).
Stella ST151A radio (R66, Jan., 55).
Stella ST8314U TV receiver (TV55, Aug., 54).
StradModel 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).
Ultra 1771 series.(TV170, Jan.. 61).
Vidor CN4228/9 TV receivers (TV136, May, 59).
Vidor CN4230/1 TV receivers (TV125. Sept., 58).
Waveforms *Radar* 405D (T.I.7, Apr., 56).

Price 6d. each

Alba 69 series radiograms (R120, Sept., 58).
Alba 3211 series (R126, Feb., 59).
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).
Cossor CR1500A stereo radiogram (R147, Nov.,60)
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).
Ekco RT366 tape recorder (S17, June, 61).
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)
Ever Ready *Sky Baronet, Sky Countess* (R152, July, 61).
Ferguson 348BT portable (R151, April, 61).
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 transistor portable (R143, July,60)
Ferranti PT1030 transistor portable (R145, Sept.,60).
Ferranti TR1044 tape recorder (S17, June, 61).
G.E.C. BC501/BC502 portables (R146, Oct., 60).
G.E.C. BT306, BT308 (TV169, Jan., 61).
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).
H.M.V. 1417 transistor portable (R151, April, 61).
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)
K-B RT20 tape recorder (S16, May, 61).
Marconiphone P17B portable (R49, Jan., 54).
Marconiphone T24DAB (R77, Aug., 55).
Marconiphone T82B portable (R151, April, 61).
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).
McMichael MT102 portable (R149, Feb., 61).
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).
Peto Scott MR60 *Fanfare* tape recorder (S15, March, 61).
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).
Philips 301T and 395T (R148, Dec., 60)
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).
Pye TCR2000 car radio. (R153. August, 61).
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).
Sobell ST301 portable (R149, Feb., 61).
Taylor 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).

TECHNICAL GEN continued

from cold, but that the frame fault had disappeared. A check with the 'scope, revealed a normal sync pulse. Distortion must have been taking place due to unstable i.f.'s but which had no other effect on the picture when first switched on.—V.D.C., Bristol (1041).

Cossor 951

Touchy Frame Hold

After exonerating the frame oscillator and output valves (ECC82 and PL84), the prime suspect for this fault was C66, a 220pF coupling capacitor from the anode of the pulse-shaping half of the ECC82 to the grid of the other half, the frame oscillator.

However, this was in order, as was C29 and C31, ·002μF and 470pF in the grid of the pulse shaper. The resistors feeding this circuit were within tolerance, so attention was turned to the sync separator (pentode section of ECL80).

Here, there was a lower voltage on the anode than was expected. Further investigation showed that the screen grid decoupler had developed a leak—reading approximately 18kΩ on the bridge when removed and tested. This is a 0·1μF, decoupling a 470kΩ resistor.

The disconcerting fact was that line was unaffected. Replacement brought the anode voltage up to the recommended 82 volts and a firm frame lock. —M.A.Q., Bargoed (1033).

RECEIVER SPOT CHECKS

No. 72: PHILCO 1000

Weak or No Sound: Check R39, 4·7MΩ or high resistance or open circuit.

Weak Sound with Distortion: Check C62 sound cathode decoupling capacitor for o/c.

No Brightness, E.H.T. Normal: If boost voltage is not present at pin 10 of the c.r.t., check C84 boost smoothing capacitor for short circuit. If faulty, replace with one of higher working voltage.

No Brightness: If this is accompanied by the line output valve glowing red, check the 0.001uF line coupling capacitor C78 for o/c.

Frame Lock One End: Change R58. This may be 1MΩ or in some sets 1·5MΩ.

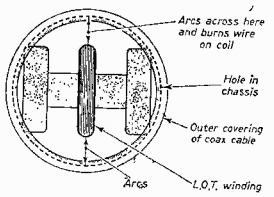
Poor Frame Sync: Check the 0·02uF frame sync coupling capacitor C65 for o/c.

Insufficient Height: If accompanied by poor linearity, check the 500uF frame output cathode decoupling capacitor C73 and the 1,000uF frame shift capacitor C75 for o/c.—W.J.P., Colchester, (1036).

Ekco T330

Cure for Arcing

A lot of trouble has been experienced with e.h.t. arcing on this particular model. The cause has been due to leakage from the coil of the line output transformer to chassis, as shown in the underchassis sketch shown below.



Cure for arcing

I have found a permanent cure for this trouble by obtaining 8½ in. of coaxial cable and stripping off the outer polythene covering. Then with a razor blade carefully cutting down the centre. This is then fitted in the same way as a rubber grommet round the circle of the chassis hole, forming a perfect insulation. —J.P.R., Scarborough (1057).

Philips 100/U

Lack of Height

This fault came on intermittently, but not, as is usual, only when the set warmed up. On occasions it was present as soon as the receiver was switched on; at other times the whole evening's viewing was normal.

After several false shots, replacement of the PCL82 frame output plus half multivibrator oscillator, and the ECL80 whose triode forms the other half, and of the 100 mfd. electrolytic decoupling the cathode of the frame output pentode, the set was brought to the workshop.

A meter was left in circuit to measure voltage at the height control, which is fed from the boost line. A reading of 400 to 450 volts was obtained on the top range of an Avo 8. When the fault condition appeared, this voltage fell to less than 300, and continued to drop.

The obvious current drain was difficult to pinpoint as any disturbance of the circuit restored correct conditions. After much patient elimination, however, it was discovered that the focus control, a 2 megohm potentiometer had a faulty track and was intermittently *reducing* to a low value.

Although the immediate effect was upon the height, the line circuits, and the picture brightness did not appear to suffer.—H.W.H., Gilfach (1032).

Brainless Bertie

Bertie knows that 'leakage'
Isn't just stuff from taps,
Now that electrolytics
Look like the old 'paper caps.'

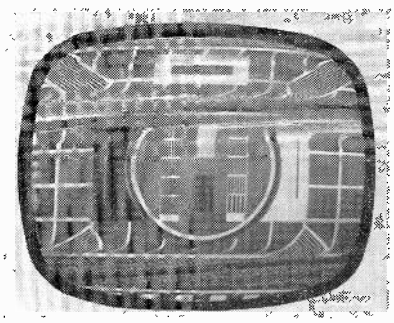
Feste

H.M.V. 1840

Line Lock Trouble

This set was brought in and it was found impossible to lock the line in over the entire picture area. A valve check and a good look around the line sync coupling revealed nothing. The sync separator and its components also checked OK.

Attention was then turned to the video amplifier stage and the screen voltage measured very low. The screen is fed by a 4·7kΩ and a 15kΩ resistor between



H.M.V. 1840—photograph of fault

h.t. line and cathode. The 15kΩ resistor was found to have gone down to 1kΩ. Replacement of this component restored 100 per cent line locking.—F.C., Crewe (1065).

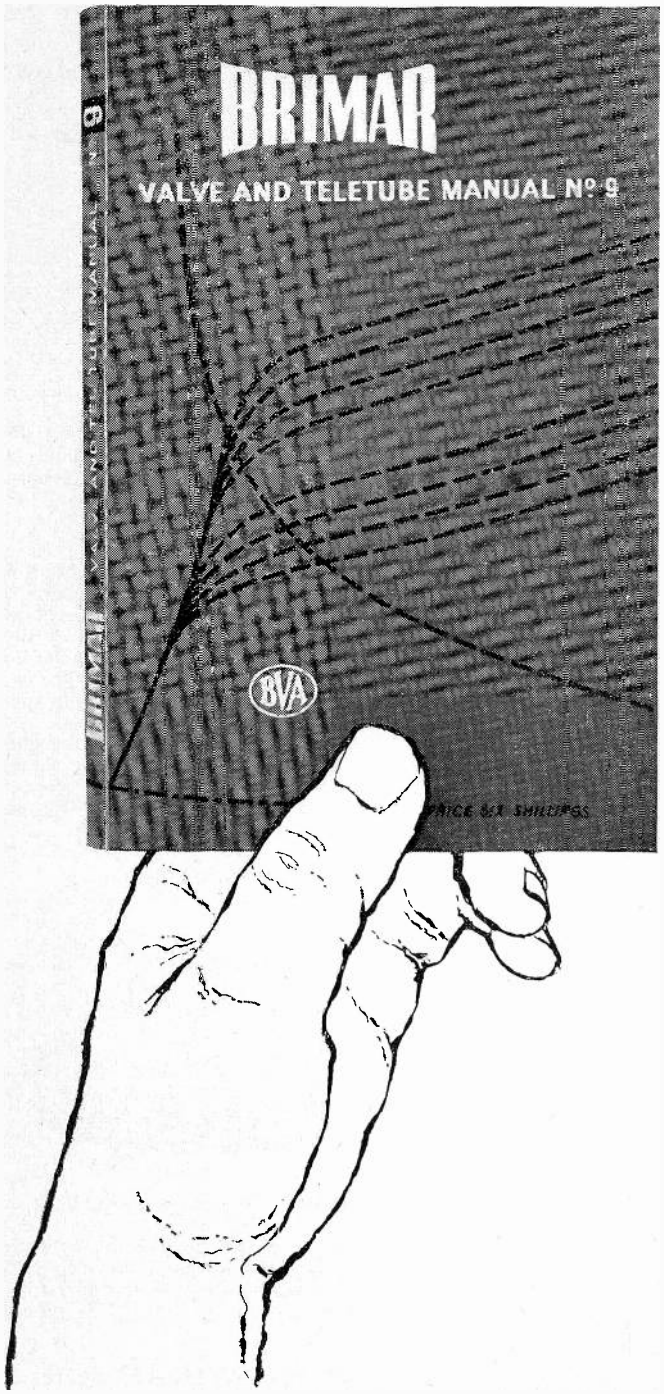
Spencer West 180 Series

Jump and Flash

Trouble was frame jumping, the frame linearity control flashing over. When the coupling capacitor to the linearity control was disconnected, the base of the frame output valve started to flash over.

The first suspects were o/c scan coils or o/c frame output transformer second-

(Continued from page 75)



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ary, but both were cleared. Voltage checks were then made in the frame timebase and it was found that voltages on the height control and anode of the frame oscillator were high. The height control was checked and found to be o/c at the earthy end.

The control is fed from the boost line via a 150kΩ resistor, so that there was about 700V on the control. The potentiometer was replaced but the voltage was still 550V. The 150kΩ series resistor was then found to have decreased to only 25kΩ.—B.W., Middlewich (1047).

Philips 1796U

Some Recent Faults

On this set, a recent fault was line drift, the picture slipping horizontally after the receiver had been running a short while. It could be locked again by adjustment of the line hold control. This would be repeated after a few minutes.

Sometimes the adjustment of the control would have to be in a clockwise direction and at other times in an anti-clockwise direction. The fault was eventually traced to the anti-hunt capacitor C55 which was leaking.

Another fault on one of these sets was intermittent frame cramping which, after checking valves and other frame timebase components, was found to be due to faulty scan coils. On this model, bent verticals can be due to either a faulty reactance/line-oscillator valve or sync separator/phase discriminator valve.—R.R., Mansfield (1060).

● odd spot

WE were called recently to a set that had been properly "haywired". Apparently the customer had found that tapping the back of the set caused the picture to come and go. He removed the back and the covers of the line output stages and went on tapping, eventually blowing the fuses.

He then wrapped coils of wire around the fuseholders, resumed operations, succeeded in off-setting the ion trap, burning out the mains choke and ripping loose a couple of capacitors that "looked greasy".

After putting all this right we found the aerial coaxial intermittently shorting at the plug. On questioning the customer he admitted: "Oh yes, the plug fell out when my wife moved the set to dust. Funny thing, it was just after I put it back that all the trouble happened". — H.W.H., Gilfach (1034).

SERVICE BRIEFS

Pye V710A: The unusual fault was excessive frame scan with height control at minimum. The frame oscillator-amplifier PCL82 and its voltages were checked and found correct. The circuit and the fault making it difficult to know what to try first, the second component checked by substitution was found faulty. This was the 470pF capacitor between the PCL82 triode grid and chassis, which was leaking.—G.H., Harrogate (989).

Philips 1746U: The complaint was continuous line frequency drift. Line oscillator and amplifier valves were checked and found normal. Capacitors and resistors in the oscillator section were all found OK. However, on checking the blocking oscillator transformer it was found that the primary winding was completely open circuit. In fact, a megger test gave a reading of infinity. A replacement transformer cleared the trouble but the puzzling thing is how did the oscillator function at all with one transformer winding open circuit?—K.C., Enfield (961).

Bush TV98C: This was an intermittent fault, black lines being superimposed on the picture. After a good deal of testing in the line and vision i.f. stages the trouble was eventually traced to a faulty preset focus control, replacement of which effected a cure.—N.A.B., Tadcaster (975).

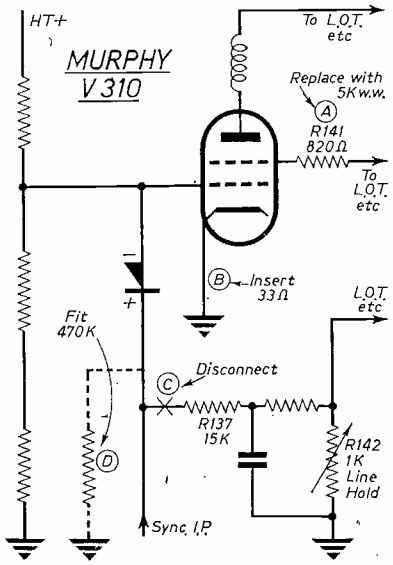
Ferranti T1046: The frame was cramped at the bottom and this was found to be due to the 0.1uF capacitor C87. When a slight amount of heat was applied to the capacitor on a 200V d.c. supply, it leaked up to 20mA. I have had similar trouble with the same make and type of capacitor in the frame timebase of a Decca DM4. The picture would start rolling after the set had been on for about an hour.—J.J.McK., London (950).

Pilot TV84: Definition was good and sound normal, but the Test Card C picture was cogging. Voltage and component checks around the sync separator revealed no clues. The cause was traced to the 330-ohm resistor in the cathode circuit of the EF91 vision output valve. It was twice its coded value. Replacement gave a normal picture.—G.H., Harrogate (987).

Murphy V310

Line Drift Mod.

Line drift can be a very troublesome fault on these sets and is curable by a makers' modification, which is all right if the customer doesn't mind the delay and a largish bill. Also, of course, one may not be a Murphy agent and able to obtain the makers' kit.



My method, which gives positive lock from one end of the line control to the other, with *no* drift, is as follows:

Disconnect the diode on the line output valve grid from R137 (15kΩ) and insert a 470kΩ resistor between the positive end of the crystal diode and chassis. Insert a 33Ω ½W resistor in the line output valve cathode. Finally, replace the screen dropper R141 with a 5kΩ wirewound resistor.

Incidentally, in these models, for weak frame hold, try replacing R78 in the V7 cathode with a resistor of 15kΩ or 22kΩ—F.R., Southport (1043).

Pilot TV94

Bunching of Frame

The trouble with this set was that as brightness was increased, frame bunching appeared. The amount of bunching depended on the picture content; i.e., none on a plain raster but on test card transmission bunched in about eight positions. The frame flyback coupling capacitor was checked and found OK.

The only cause of the fault seemed to be that video was getting into the frame output stage. The only coupling was between the c.r.t. grid, via the frame flyback suppression capacitor.

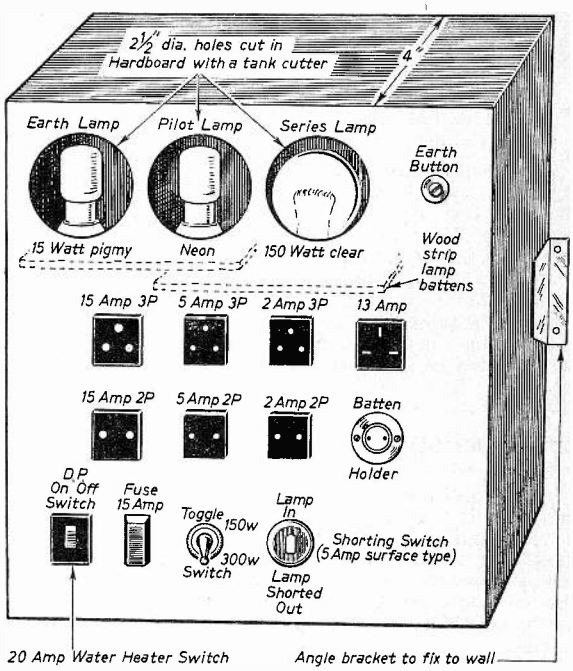
The 'scope was applied to the grid of the c.r.t. (which was a regunned one)

(Continued on page 99)

The SERIES BOARD

by **IVAN CHAPMAN**

Describing the design and construction of a useful workshop accessory and methods of using the series board to do preliminary service checks on electrical appliances.



TO me the series board is the most indispensable piece of apparatus in the workshop—an engineer's right hand. You *can* work without a series board but I suggest that you would work much better and more effectively with one.

Ever had a TV set that blows its fuses occasionally without any obvious cause? A series board would help you. Ever had an intermittent break in the lead to an appliance? The series board would enable you to find its exact location. Ever had a slow or faulty motor in a vacuum cleaner, drill, mixer, etc.? The series board will tell you whether the fault is due to brushes, commutator or coils. And, in addition, the board is your ever-present safeguard when connecting up to the mains.

Connecting Up

It is surprising now many different ways are adopted by service engineers in initially connecting equipment for repair to the mains. When we receive a piece of equipment, be it a TV, radio, iron, drill or cleaner, we must first of all ascertain how far it is faulty, and to do so it is almost always necessary ultimately to connect it to a supply to find its true workability.

Plug in and hope for the best seems to be the motto of some. This can be very painful, apart from having to replace blown fuses. Painful because if the lead wires are shorting in the plug top, you will no doubt (as I did once) get a burnt hand before the fuses blow.

To prevent thus type of thing happening many engineers follow the text book method and while this has much in its favour it is slow and timewasting. To obtain an ohmmeter, connect it across the leads to check continuity and then measure the appliances ohmic resistance (even if this resistance is known and it often is not) will only tell us that it is safe to connect without disaster. *The appliance may still be faulty, and when full mains volts are applied instead of the low voltage of the ohmmeter anything can happen.*

It is far safer to make a series board and use it for every appliance, large and small, and soon you will have saved hours of time and wasted effort.

The series board is a device on which is mounted every type of mains outlet socket used in your area, with a lamp (or lamps) in series with the mains feed to them, plus controlling switches. The basic idea is outlined in Fig. 1, the circuit being shown feeding one outlet socket for simplicity. Eight sockets of various sizes are suggested, usually being enough for most requirements. More can be added if this is thought necessary.

Wiring

The sockets are wired in parallel with an additional metal button connected to the earth pin wiring, for checking articles fitted with two-pin plugs or lamp-holder plugs.

As can be seen from Fig. 1, when an article is plugged into the socket, it can have 150 watts placed in series with it if the toggle switch is in the "off" position, 300 watts in series with it if the switch is in the "on"

(Continued overleaf)

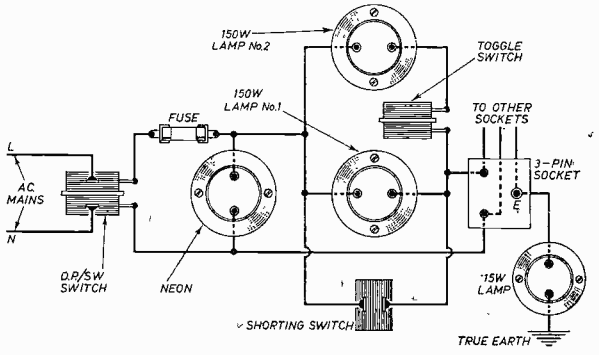


Fig. 1: Sketch showing the basic idea of the series board, the circuit being shown feeding one outlet socket only. Eight sockets of various sizes are suggested as suitable for most requirements, the sockets being wired in parallel.

SERIES BOARD

—continued

position or full mains by closing the shorting switch.

Additionally any fault between the appliance and its earth lead will light the 15W lamp by a variable amount, depending on the leakage present. If the article has only a two-pin plug, a similar test is carried out by connecting a jumper lead between its metal case and the earth button. The full circuit for eight sockets is shown in Fig. 2 and the method of earthing can be seen more clearly.

Construction

After much thought it was found desirable to construct the actual board in the form of a shallow box, using hardboard as the front and 4 in. match board or planking for the four sides and the two short shelves inside, on which are mounted batten holders to hold the lamps.

The whole unit is then fixed to the wall at the rear of the workbench. This enables the indicator lamps to be hidden at the back with only the sockets being on the front surface, the lamps being observed through holes cut out of the hardboard.

This does two things, it saves the lamps being broken when sets are manoeuvred on the bench and also prevents one series lamp not being seen. The hiding of one lamp is a decided advantage, for provided you take note of the position of the toggle switch (i.e., whether 150W or 300W is in circuit) you can concentrate on the glow of one lamp only. For this reason the visible lamp must be a clear glass type, but the hidden one can be pearl white or even coloured.

The point is that after only a very short time one comes to expect a particular brilliance for the appliance in question and this is one vital factor in using a series board. The appearance of the finished article is shown on page 77.

General Principles

Before describing how the series lamps will give information about individual appliances let us look at the general principles. By plugging in any appliance an immediate indication will be obtained of continuity or otherwise, and whether the article is taking a load current that will not blow the fuses when full power is applied.

Full brilliance of the lamp will, of course, indicate a dead short. If in doubt put a dead short across a two-pin socket whilst the article is connected. No change of brilliance indicates that the article is short circuited.

With a little practice the glow of the lamp will tell you the approximate wattage taken by the appliance. It will also indicate (in the case of three-core cable) any leakage between the article and earth and whether the leakage is slight or severe.

It will not show if the earth lead is complete between the appliance and its plug but it will do so if you deliberately short the live side to the case or chassis at the appliance end.

It will already be seen that quite a lot of tests can be made by simply plugging in and using an insulated screwdriver or similar to put on an earth fault.

Now to describe tests made to individual appliances.

TESTING APPLIANCES WITH THE SERIES BOARD

Flexible leads. Plug in on the 150 watt position and if there is no illumination, flex the cord lightly from one end to the other. The lamp will light when you get to the break. A real time saver this, and moreover it is a positive indication, not just a flick of a meter needle.

★

Radiators. Plug in on the 300W position. If there is no glow, switch on the second bar. If still no glow short each end of each bar with jumper wire. If this fails to produce illumination, in most cases the trouble is an open circuit in the flex.

If the lamp lights on plugging in, depress the switch to check the second bar. It is surprising but quite a noticeable increase of brilliance is observed if the second bar is OK even though the load of the fire is 2kW.

If the switch does not increase brilliance, short each bar in turn to find the faulty one. There is no need to apply full mains and wait until it gets hot to find out which one is open circuit, with the attendant difficulty of working on a now hot bar.

★

Vacuum Cleaners and other motor driven articles (drills, mixers, etc.). A very revealing test can be made on these appliances. Use the 150W position for small motors, 300W position for larger cleaners and upright models. A good motor will cause the lamp to light brightly, lowering the brilliance gradually as the motor picks up speed.

The lamp should then provide stutter-free illumination at this reduced level. If the light is stuttery the brush gear is likely to be at fault, but if the lamp has a definite wink effect, suspect an open circuit commutator or armature. *Shorted turns in the field coils will cause the lamp to light brightly and not fall to the lower level as the motor starts up.*

★

Television Sets: Use the 150 watt position. Plug in and switch on. If the set has a metal h.t. rectifier the effect will be as follows. An immediate dull glow will appear, then die away. In a few seconds the glow will increase as the heaters warm up. If there is glow only, you know that the mains input circuit, on/off switch and fuses are OK so the heater chain will be open circuit. If the set has no metal rectifier, the initial switch-on surge is absent. No glow at all on all types of a.c.-d.c. set indicates open circuit heater.

To check the location of the open circuit, short each side of the fuse to

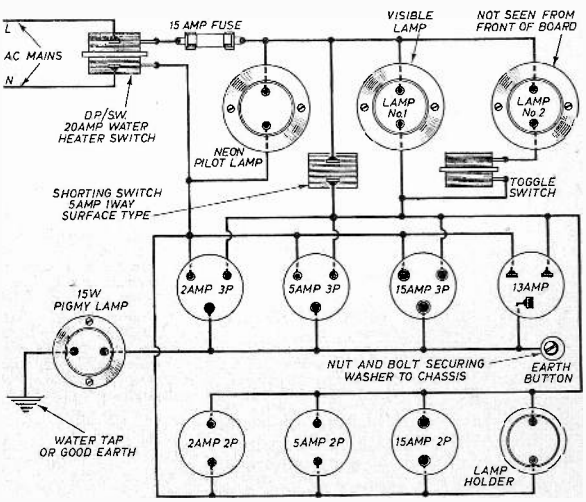


Fig. 2: An extension of the diagram of Fig. 1, showing the full circuit arrangement for eight sockets. The sketch in the main heading of the article shows the final appearance of the series board shown here diagrammatically. The "hidden" lamp is mounted underneath the 150W series lamp on the underside of of the fixing batten.

chassis and if the lamp glows carry on shorting down to chassis, mains dropper, thermistor, etc. If OK down to the thermistor, valve or heater wiring is suspect.

It is worth putting a short across the c.r.t. heater at this stage. If after five seconds the lamp starts to glow this indicates an open circuit tube heater. If not, remove the valve near to the centre of the heater chain and short each side of heater pins of this valve holder to chassis. If lamp lights, valve chain is open circuit between this point and chassis; if lamp does not light the o/c is between this point and dropper.

Intermittents

At least by this method you have reduced the number of valves to check by half. In many circuits the sound output valve is placed near the middle of heater chain.

A TV set that is in good working order when connected in series with 150 watts will produce sound and when in series with 300 watts will produce sound and picture (though of reduced size). The 300 watt position can, therefore, be used for tracing intermittent h.t. shorts which would normally blow the fuses before any testing could be done (intermittent arcing in h.t. rectifier, for instance).

Moreover, the sudden increase of lamp brilliance indicates when the short occurs and as h.t. is available to all points of the set, though of reduced voltage, it is easy to trace points that should be at h.t. potential, which have gone down to chassis, etc.

The faulty section of the receiver can thus be pinpointed without a lot of snipping of h.t. feed wires which would be necessary if test meter technique was being applied.

Further, by use of the on-off switch on the board, the receiver can be completely disconnected from the mains while components are replaced and then reconnected safely, a glance at the rear indicating power is again applied.

O.C. Heaters

With regard to the tests for o/c heaters, I am aware that some readers will raise an objection to this test. The fact is that with the heater chain o/c, a 200V potential difference is present between cathode and heaters of the valves above the break and many will wish to omit this test for this reason.

But it is worth remembering that the customer will probably have switched the set on and off several times before calling for service, thus doing the same thing, and a valve should stand that for the short time required to complete the testing.

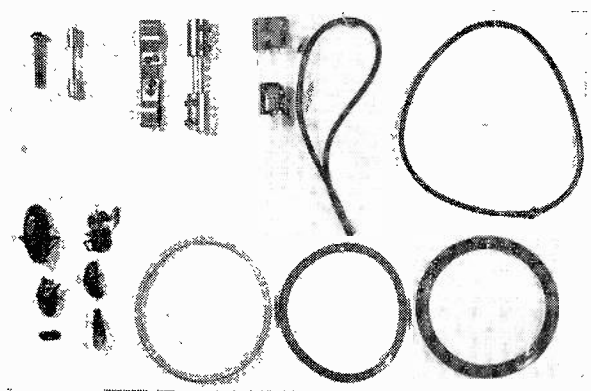
These are but a few of the large number of uses of which a series board can be put. There are dozens of further tests and these will no doubt occur if the board is in regular use.

Final Point

As one final point, the board should always be used after fitting new reservoir or smoothing capacitors to a set, first in the 150 watt, then the 300 watt position. The lamp will act as a surge limiter and enable the capacitor to re-form after perhaps a long shelf life and thus avoid these very annoying repeat calls.

In all, the board saves a good deal of time and much valuable information is to hand instantly by merely plugging in an appliance. Often it is not even necessary to reach for test gear, let alone take the trouble to connect it up.

Museum Pieces from Service Depot



You never really know what you'll find on opening the back of a set. Engineers in the Grundig service department have their fair share of intrusive foreign bodies, both accidental and by design. And the picture shows a kind of rogues gallery of objects extracted from Grundig tape recorders returned to service.

No. 1 is a screw fitted in place of a fuse with predictable results. No. 2 is a replacement fuse; better than a screw, but rated 100 times too high!

No. 3 and 4 are a pair of gadgets designed to connect knobs to the spindle. And No. 5 is a record and erase head so badly worn that it had gone right through to the plastic behind. The machine still worked – after a fashion.

No. 6 and 7 are two broken drive belts which were 'repaired' by joining together with thread.

A charming family group is depicted in item No. 8. These are the charred remains of an adventurous, but reckless, tribe of cockroaches.

Nos. 8, 9 and 10 are eaxmples of improvised drive belts. The first is of unknown lineage, but the other two are easier, one being a bottle closure and the other a belt from a vacuum cleaner.

We would be interested to hear from readers of any comparable 'finds' which could take their place beside these splendid Grundig museum pieces.

TECHNICAL GEN continued

and when the brightness control was increased the video signal appeared on the grid. There was a 0·01μF capacitor decoupling the grid, but this tested OK.

A new tube was tried and this cured the fault. However, on refitting the old tube and increasing the grid decoupling capacitor to 0·1μF, this also proved satisfactory and saved the customer a lot of expense.—B.W., Middlewich (1045).

Ekco T345

Open Circuit Winding

The set came in with no picture; the e.h.t. rectifier was dead. A replacement U26, though good, did not light up. Line whistle was in evidence and there was plenty of r.f. at the U26 anode. On checking the heater winding it was found to be open circuit. On removal this was found to have burnt through to the rear of the transformer.

The unusual feat·re of this fault is that there was no sign of flashover to the e.h.t. winding proper, to the core, and it was hard to see how a comparatively heavy PVC wire should break in this way while only supplying low current to the U26 heater even though being at high potential, however, replacement of tee two-turn winding was a simple job and saved the cost of a new transformer —G.M., Smethick (1067).

SERVICE WITH A GRIN

by H. W. HELLYER

Don't Touch the Exhibitors

I SEE that *Service Viewpoint* has been worrying whether the Radio Show is worth it. Well, of course, that depends which side of the fence you stand. From Joe Public's point of view it is just another Earl's Court. Motor Show, Boat Show, Ideal Homes, what does it matter?

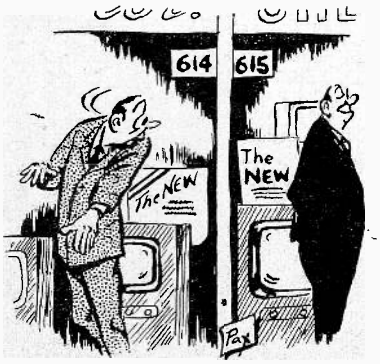
Just somewhere to take the kids when it rains; or the missus when it doesn't. A place of noise and garish colour, where the only free samples are the inevitable brochures which Joe Minor will hoard and secrete until next spring-cleaning. Then the whole family can pore over them, marvelling at the wonders already out of date.

The prime attractions are undoubtedly the entertainment stages and the "upstairs" demonstrations. At the former, Miss P. can enthuse about her latest idol: at the latter, Granpa P. will idle over old enthusiasms. "*Never had nothing like that when I were a lad*".

And when this writer was a lad (not *quite* 87 years ago), exhibitions were not quite so blatantly publicity-conscious. There was more urge to instruct; less to extol.

★ ★ ★

Today, from the point of view of the advertising boys, the press officers, the public relations wallahs, the Radio Show is another opportunity to show off their prowess at drum-beating. Like those leopard-skinned tenor-drummers twirling their sticks they bustle around with an air of new-born jollity, each rattling out a different rhythm. They love the Radio Show, the soft soap and hard liquor, and never fear to have their drumsticks bounce back and hit them on the nose when the next Show comes along.



. . . be sure a neighbouring rival has blazoned out a better.

But as for the exhibitors, those blokes whose goods the P.R.O.'s are doing their best to project, to them the Radio Show is often much of a worry.

They have to pay through the nose for the privilege of keeping up with the Joneses, plan for a twelvemonth in

Designers have been peeking into each other's backyards.

fretful secret to make their showtime début worthwhile, yet gear their production to the vagaries of Joe Public's unpredictable demand. If they plump for one technical gimmick be sure a neighbouring rival has blazoned out a better—they always know a good thing the moment someone else sees it.

★ ★ ★

Which probably explains why, at every Radio Show, the advances are basically the same. Despite the frenzied drum-beating, the visitor gets a distinct impression that designers have been peeking into each others backyards and building the same sort of pagoda.

Not that a tour of Earl's Court is likely to bring on an attack of the *longeurs*, though it may accelerate one's gout. The kernel may be the same, but each nut has a different shell. There is, at least, an appearance of variety.

It is little use asking the advice of the gentlemen who decorate the stands.

The service engineer—or, as Mr. Clements would say, "technician"—occasionally gets a little peeved at this annual desire to be different. So often it means that accessibility has been sacrificed for style, or a good circuit corrupted for the sake of a gimmick.

★ ★ ★

It is only human to think that when you've got a thing just as you want it the best place to leave it is right there. But, as the P.R.O.'s would remind us, that way lies no progress, to stand still is to go backwards, and each such modern dicta. So the service engineer sighs in acquiescence and trudges around the exhibits to try to anticipate a few of next season's worries.

However, it is little use his asking the advice of the gentlemen who decorate the stands. From bitter experience I can assure him they are chosen from the zombied ranks of those that believe the man who keeps his big trap shut never bites off more than he can chew.

★ ★ ★

You may notice that I have deliberately left until last the impressions of the retailer. Not because they are insignificant, but because I am hoping my space will run out before I work up a spiel of indignation about short-sighted dealers who can't be bothered to patronise the Show—*their* Show—who ignore it in their advertising, shun any tie-up in their window displays, hardly care to acknowledge its existence to their customers.

That sort of chap is too common. He is short-sighted. At Earl's Court he would find opportunity to make fresh contacts with maker and distributor, learn a bit more about the models he does not stock, gauge the opinions of Joe Public, and generally gen himself up in his business by soaking in an atmosphere of radio retailing.

But why should I waste valuable space on him? That sort of chap has probably gone to Germany, anyway, for the "biggest Radio Show on Earth". I presume *that* one is worth it!

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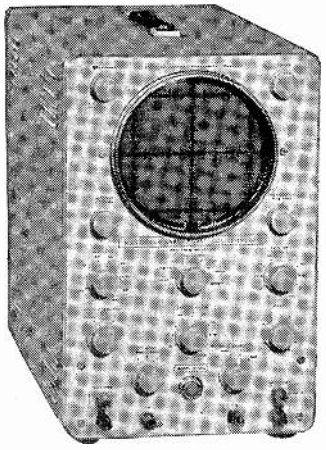

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The OS-1 uses a 2¾" cathode ray tube and is a compact portable oscilloscope ideal for servicing and general laboratory work. Y amplifier sensitivity 10mV/cm; response ±3dB 10 c/s-2·5 Mc/s. Time base 15 c/s-150 Kc/s. Features include int. Ext. and 50 c/s sync; Sine sweep; time base output for wobbulator; X amplifier socket 1, 10 and 50 volt calibrator. Uses printed circuit board for consistency and ease of assembly. Case 7⅜"×4 11/16"×12½" long. Weight only 10½ lbs. ..... **£19. 10. 0.**

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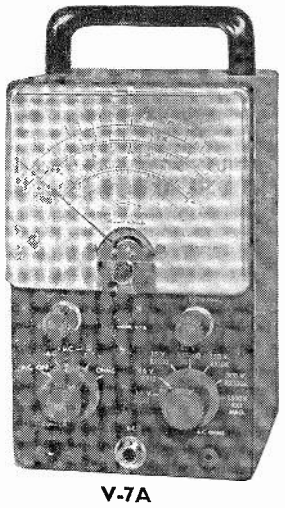

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