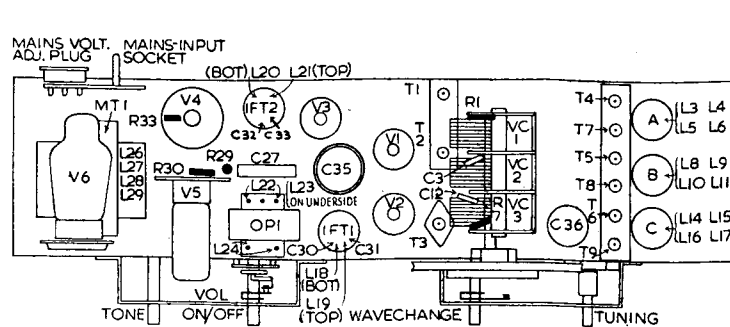
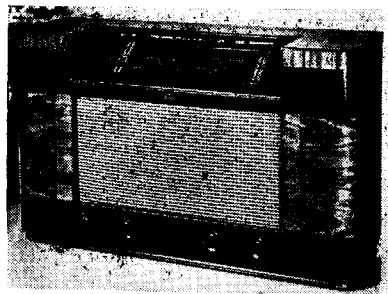
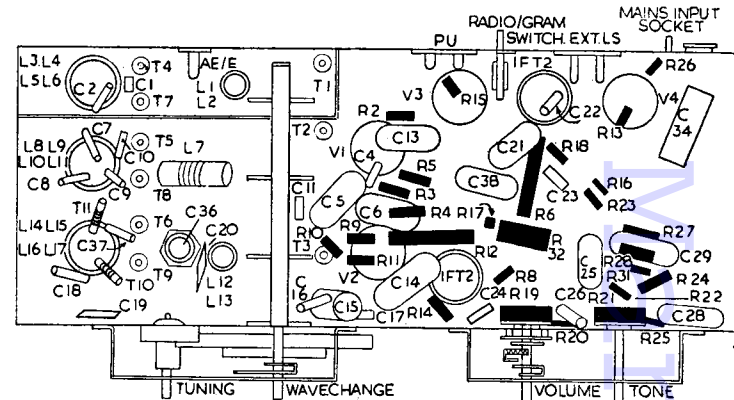
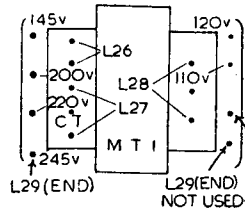


# MULLARD MAS 292



Four-valve, plus magic eye and rectifier, superhet covering three bands and for 100-250V 50-100 c/s AC mains. Sockets for external aerial, earth, magnetic type pickup and low impedance extension speaker. Walnut veneered table cabinet. Sold by Mullard Electronic Products, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Circuit description and alignment notes, see overleaf.



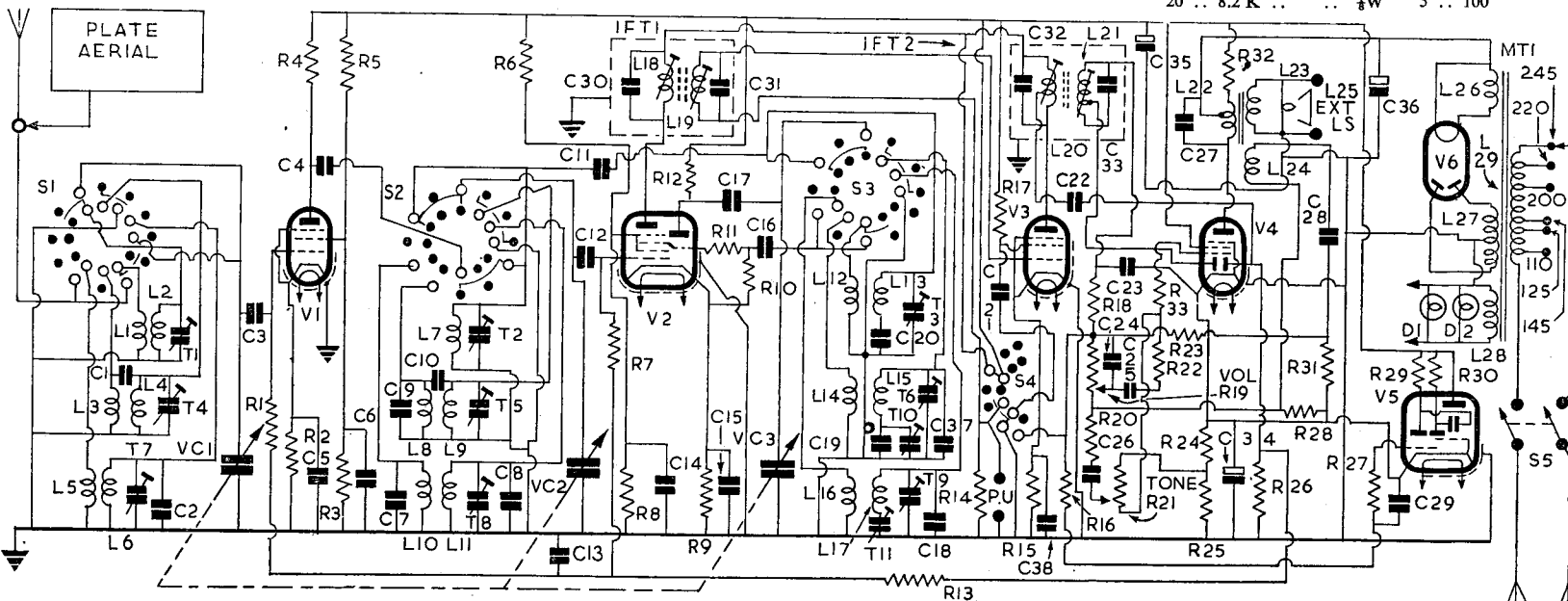
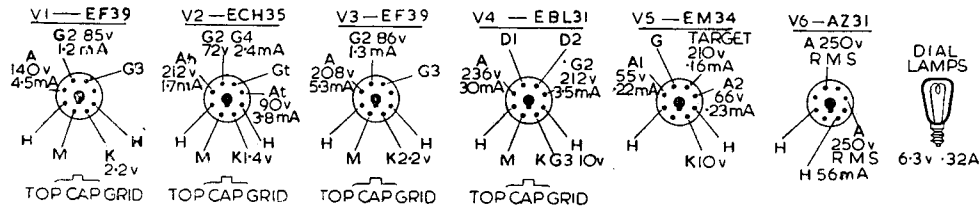
| RESISTORS |       | R Ohms |       | Watts |       | L Ohms     |                      |
|-----------|-------|--------|-------|-------|-------|------------|----------------------|
| 1         | 1 M   | 21     | 1 M   | 1     | Potr. | 6          | 48                   |
| 2         | 390   | 22     | 100 K | 2     | 1W    | 7          | Very low             |
| 3         | 56 K  | 23     | 2.2 M | 3     | 1W    | 8          | 290                  |
| 4         | 18 K  | 24     | 120   | 4     | 1W    | 9          | 4.5                  |
| 5         | 47 K  | 25     | 180   | 5     | 1W    | 10         | 500                  |
| 6         | 39 K  | 26     | 820 K | 6     | 1W    | 11         | 48                   |
| 7         | 1 M   | 27     | 1 M   | 7     | 1W    | 12         | .75                  |
| 8         | 47 K  | 28     | 1.8 K | 8     | 1W    | 13, 26, 28 | Very low             |
| 9         | 150   | 29     | 8206K | 9     | 1W    | 14         | 2.6                  |
| 10        | 39K   | 30     | 820 K | 10    | 1W    | 15         | 7.5                  |
| 11        | 220   | 31     | 8.2 K | 11    | 1W    | 16         | 5.5                  |
| 12        | 22 K  | 32     | 1.5 K | 12    | 3W    | 17         | 20                   |
| 13        | 1 M   | 33     | 1 K   | 13    | 1W    | 18, 19, 20 | 7.5                  |
| 14        | 1.5 M |        |       | 14    | 1W    | 21         | 5 (only part of L21) |
| 15        | 330   |        |       | 15    | 1W    | 22         | 600 (tap at 16)      |
| 16        | 3.3 M |        |       | 16    | 1W    | 23         | 1.8                  |
| 17        | 82 K  |        |       | 17    | 1W    | 24         | 220                  |
| 18        | 47 K  |        |       | 18    | 1W    | 25         | 4                    |
| 19        | 600 K |        |       | 19    | Potr. | 26         | 220 Total            |
| 20        | 8.2 K |        |       | 20    | 1W    | 27         | 38 Total             |

## INDUCTORS

| L | Ohms     |
|---|----------|
| 1 | 2.3      |
| 2 | Very low |
| 3 | 25       |
| 4 | 4        |
| 5 | 100      |

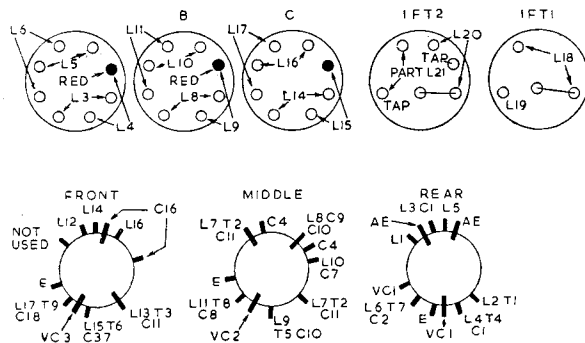
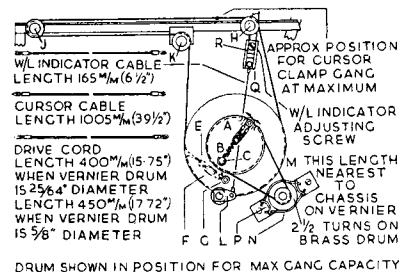
## CAPACITORS

| C  | Capacity     | Type              |
|----|--------------|-------------------|
| 1  | 1.5 pF       | Stone             |
| 2  | 12 pF        | Ceramic           |
| 3  | 100 pF       | Ceramic           |
| 4  | 220 pF       | Ceramic           |
| 5  | .047 Tubular | 100V              |
| 6  | .047 Tubular | 400V              |
| 7  | .330 pF      | Ceramic           |
| 8  | 15 pF        | Ceramic           |
| 9  | 82 pF        | Ceramic           |
| 10 | 1.5 pF       | Stone             |
| 11 | .4 pF        | Special           |
| 12 | 100 pF       | Ceramic           |
| 13 | .047 Tubular | 100 V             |
| 14 | .047 Tubular | 400V              |
| 15 | .047 Tubular | 100V              |
| 16 | 56 pF        | Ceramic           |
| 17 | 100 pF       | Ceramic           |
| 18 | 33 pF        | Ceramic           |
| 19 | 330 pF       | Mica              |
| 20 | .0045        | Mica              |
| 21 | .047 Tubular | 400V              |
| 22 | 6.8 pF       | Ceramic           |
| 23 | 82 pF        | Ceramic           |
| 24 | 120 pF       | Ceramic           |
| 25 | .047 Tubular | 100V              |
| 26 | .001 Tubular | 400V              |
| 27 | .001 Tubular | 600V              |
| 28 | .1 Tubular   | 100V              |
| 29 | .047 Tubular | 100V              |
| 30 | 103 pF       | Mounted           |
| 31 | 97 pF        | inside IFT 1      |
| 32 | 103 pF       | Mounted           |
| 33 | 103 pF       | inside IFT 2      |
| 34 | 25           | Electrolytic 25V  |
| 35 | 32           | Electrolytic 320V |
| 36 | 32           | Electrolytic 320V |
| 37 | 5.6 pF       | Ceramic           |
| 38 | .047 Tubular | 100V              |



# MULLARD MAS 292

—Continued



**Aerial.** A plate aerial, formed by a 6in. square of foil inside the back panel, is provided. The signal from this, or from an external aerial, is fed through S1 to aerial coupling coils L1 (SW), L3 (MW) and L5 (LW). L2, L4, and L6 are the respective grid tuned coils connected by S1 to tuning capacitor VC1 and through C3 to grid of RF amplifier V1. T1, T4 and T7, C2 are trimmers and C1 provides capacitive coupling on MW band, in addition to the normal inductive coupling.

AVC is applied to V1 grid through R1, C13. V1 is RC coupled to following stage, R4 being anode load.

**Mixer.** C4 feeds, via S2, SW tuned circuit L7 and MW and LW inter-valve coupling coils L8, L10 respectively. C10 is additional coupling on MW band. C9, C7 are shunted across MW and LW coupling coils. The grid tuned coils L7 (SW), L9 (MW) and L11 (LW) are connected by S2 to tuning capacitor VC2 and through C12 to grid of hexode section of V2. T2, T5, T8 and C8 are trimmers.

AVC is applied through R7 to hexode grid and is decoupled by C13.

**Oscillator** is connected in a tuned-anode parallel-fed circuit. L13 (SW), L15 (MW), and L17 (LW) are the tuned coils connected by S3 to VC3 and through coupling capacitor C17 to oscillator anode of V2. T3 (SW), T6, C37 (MW) and T9, C18 (LW) are trimmers, and C20, C19, T10 and T11 are padders. C11 provides extra coupling between the oscillator circuit and the input grid of V2 on SW band.

L12, L14 and L16 are the grid reaction coils connected by S3, through C16 and stopper resistor R11, to oscillator grid.

**IF amplifier.** L19, C31, the secondary of IFT1, feeds 470 kc/s signal to grid of IF amplifier V3. R14 is inserted so that the PU may be connected to the grid. When S4 is in the radio position, R14 is short circuited.

**Pickup.**—The input circuit is designed for an electro-magnetic type of pickup. When PU is connected and switch S4 in "gram" position, then HT is disconnected from hexode anode of V2 and anode of V3. At the same time, the earth side of screen decoupling capacitor C21 is disconnected from chassis and connected to top of volume control R19. This, in effect, converts V3 to a triode, with the screen and screen resistor becoming anode and load resistor with C21 as coupling.

**Signal rectifier.** L21, C33, the secondary of IFT2, feeds signal to one diode of V4. R19, the

volume control, is the load and R18, C23 form a filter.

**Tuning indicator.** R16 feeds DC component of rectified signal appearing at top of volume control R19 to grid of "eye," V5.

**Automatic volume control.** C22 feeds signal from primary of IFT2 to second diode of V4. R26 is diode load and R13, C13 line decoupling components.

**Output stage.** C25 feeds signal from volume control R19 through C25, R22, R33, to grid of output pentode section of V4. R21, the tone control potentiometer, is the grid resistor and R33 a grid stopper. R22 also acts as a stopper but its primary function is to prevent C26 and R20 loading the volume control circuit and thus affecting the volume level when the tone control slider is moved towards the grid end.

L23, OP1 secondary, feeds an 8in. PMJ speaker L25. Sockets across L23 provide for a low impedance (5-7 ohms) extension speaker.

Continued on BSR PA20B Chart, page iv

### ALIGNMENT INSTRUCTIONS—

| Apply Signal as Below  | Tune Receiver to                                     | Trim in Order stated for Max. Output                           |
|--|--|--|
| (1) 470 kc/s, via .032 capacitor to G1 of V2   | 192 metres   | Damp L20. Trim L21<br>Damp L19. Trim L20<br>Damp L18. Trim L19 |
| (2) When gang is at max. capacity the pointer should coincide with the upper end of the "M." | per end of scale metre sections, to the right of the |  |
| (3) 17 mc/s to AE socket via dummy aerial  | 17.65 metres   | T3, T2, T1   |
| (4) 1.450 m/cs as above  | 207 metres   | T6, T5, T4   |
| (5) 650 k/cs as above  | 461.5 metres   | T10 and repeat (4) and (5)                                     |
| (6) 360 k/cs as above  | 833 metres   | T9, T8, T7   |
| (7) 160 k/cs as above  | 1875 metres  | T11 and repeat (6) and (7)                                     |

Damp circuits by connecting 80 pf capacitor across coils. Wire trimmers capacity is reduced by removing turns of wire. Remove turns until output meter shows falling off from maximum. Then replace some turns. Cut off surplus and seal with wax.

## At your Service..

to eliminate all those horrible noises in Radio Sets caused by bad Contacts. All you have to do is to put a few drops of SERVISOL on all Switches, Valve Pins, Holders, etc.—there are dozens of them—without any dismantling. M.F. Resistance drops instantly, reception improves, volume increases and crackles disappear.

There is no substitute for **SERVISOL**.  
At all Wholesalers.  
5/- ½ pint tin with a spout.  
Nett Trade.

Head Office  
**14 North John Street  
LIVERPOOL 2**

## Servisol Ltd.

## For all Electrical Tests

# PIFCO

## ALL-IN-ONE RADIOMETER

with internal battery and multi scale the PIFCO All-in-One Radiometer tests everything electrical, Radio and P.A. Equipments, Household appliances of all kinds. Car Lighting Systems, Bell and Teleprinter Circuits. May be used on AC or DC mains.

- **CIRCUIT TEST**  
Tests for open or faulty circuits in all radio and electrical apparatus and domestic appliances. Equally for testing car lighting and starting circuits.
- **L.T. TEST**  
0-6 volts AC or DC
- **MILLIAMPERE TEST**  
0-30 m.a. scale for testing total discharge from battery or testing single cell.
- **H.T. TEST**  
0-240 volts. May be used direct on any mains, AC or DC.
- **VALVE TEST**  
Made by inserting valve in socket on front of meter.

Write for full details and Export terms. Overseas Agency enquiries invited.

**PIFCO LTD., PIFCO HOUSE, WATLING STREET, MANCHESTER, 4**  
and at PIFCO HOUSE, GT. EASTERN STREET, LONDON, E.C.2

## BSR MODEL PA 20B—Contd.

special winding L5 on the output transformer in series with the cathode of V3.

R15 is anode load, C6 feeds signal to grid of V5, one of the push-pull beam tetrode output valves, and also to potential divider formed by R16, R17, and thence to grid of phase inverter V4. R14 is anode load of V4.

HT for V3 and V4 is obtained from R20, decoupled by C10. C7 applies signal at anode of V4 to grid of second push-pull beam tetrode output valve V6. R16, R17 form the grid resistor of V5 and R19 that of V6.

**Output stage.** Cathodes of V5 and V6 are strapped together and obtain bias by R18, C8. Grid signals are obtained from V3 and V4, through C6 and C7 respectively. Screen voltages are obtained direct from HT line with C11 for decoupling.

HT for anodes of V5 and V6 is fed to centre-tap of primary L3 of the output transformer. R21 and R22 are anode stoppers. Secondary L4 of the output matching transformer OP1 is tapped for output impedances 500, 15 and 7.5 ohms. A special tapping is provided for the output indicator lamp. C12 is shunted across the whole secondary.

## PHILIPS MAS 292—Continued

**Negative feedback.** The feedback circuit is in the form of a bridge network with feedback voltages, applied from L24, via C28 across the two parallel circuits R28, R31 and R19, R23. V4 cathode is joined to the junction of R28, R31: the grid is connected in effect, to the junction of R19, R23. Relative to the cathode, the voltages from L24 via C28 are in phase with the grid signals, while the voltages from the other end of L24 are out of phase with the grid.

Component values are adjusted so that, with the volume control near to its maximum, the in-phase feedback voltage is equal to, and therefore neutralises, the out-of-phase voltage. Thus, there is no negative feedback when the volume control is full up for maximum sensitivity. As the volume control is moved away from maximum, the out-of-phase voltage exceeds the in-phase voltage and increasing negative feedback is obtained.

**Tone control** operates by varying the amount of out-of-phase voltage from L24 applied to the grid of V4. Frequency discrimination in favour of the upper register is determined by R20, C26. Thus, with the slider of R21 at the grid end of the track, maximum negative feedback is applied to the higher audio frequencies.

**High tension** is provided by directly heated full-wave rectifier V6. L27, the HT secondary of MT1, the mains input transformer, supplies its anode voltages and L26 its filament current. Smoothing is provided by C35, C36, R32 and part of L22, which is incorporated to give hum cancellation by virtue of currents of opposite phase in the two sections of the winding.

Heaters V1 to V5 and dial lights obtain filament current from L28.

Primary L29 of mains input transformer MT1 is tapped for 100-155 and 190-255V, 50-100 c/s AC. S5, ganged to the volume control spindle, is the ON-OFF switch.

**Chassis removal.** Take off four control knobs. Unsolder lead to tag on base foil. Remove four

**High tension.** Where AC mains are available the HT is provided by an indirectly heated rectifier V7. L9, the HT secondary of MT1, the mains input transformer, supplies its anode voltages, and L8 its heater current. HT is fed from the rectifier to a changeover switch S2.

When AC mains are not available, HT can be provided by a 12V battery-operated vibrator unit, type LT20, the output from which is plugged into the special socket fitted on front panel of amplifier. HT from this unit is also fed to S2.

Whichever HT supply is used, it is fed by S2 to choke-capacity smoothing circuit L6, L7, C11, C13.

Heaters of V1 to V6, mains indicator lamp and heaters of valves in radio unit obtain their current, on AC supplies, from secondary, L10 of MT1. On battery operation they obtain their current from the vibrator supply of 12V through a dropper resistor R23. S1 and S3, ganged to S2, disconnect the heaters of V1 to V6 from across secondary L10 and connect them to 12V DC.

Primary L11 of MT1 is tapped for input voltages of 200 to 250V 50-100 c/s. S4 is the mains ON-OFF switch only.

**Chassis removal.** Remove the four bolts (one at each corner) and lift out chassis.

screws holding scale assembly to cabinet, then two vertical screws (one at each end of chassis) which hold the chassis to the large side brackets. These brackets remain attached to the cabinet. Chassis is free to be withdrawn and can be stood on end using the transformer projecting lugs as feet. The speaker leads are long enough to permit this.

When replacing chassis, ensure that the two rubber-bushed holes in the front of chassis engage with the large projecting pins on cabinet support brackets. Leave the replacement of the scale assembly screws until last. Insertion of these screws is facilitated by sticking each screw to the driver by means of a small amount of wax or alternatively by magnetising the screwdriver.

**Cord drive replacement.** Make up the cord assembly as shown, p.vi. Fit as follows: Face the front of chassis and turn gang to maximum. Slip roller A into one loop of cord and one end of spring B through the hole in the roller. The other spring end fits over lug C on the drum. Pass the cord clockwise round pin D down to the righthand side of the vernier brass drum. Wind 2.5 turns clockwise and return to the left side of the smaller groove on the gang drum. Feed clockwise round the groove and pin D back to the roller A. Loop the free end of the cord on to the roller. The latter operation is facilitated by temporarily detaching the spring from the lug C. The cord should be under tension exerted by the spring.

**Pointer cable replacement.** Make up the cable as shown. Turn gang to minimum. Slip the small roller E into one loop of the cable and one end of the spring F through the hole in the roller. The free end of the spring loops on to the drum lug G. Pass the cable via the opening in the edge of the drum, into the outside groove, then up to and round the pulleys H, J and K back to the left side of the drum. Continue in the outside groove back to the roller E via the drum edge opening. Finally, loop the free end of the cable on to the roller. This last operation is more easily carried out if the spring is temporarily detached from the lug G. The cable should be under tension exerted by the spring. The pointer can now be secured to the cable.

no other

## Valve Tester

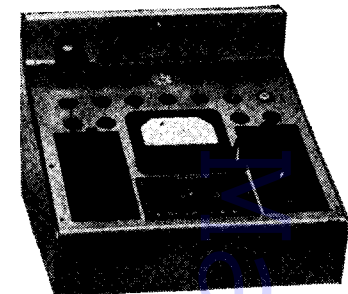
has all these features

1. Tests all types of valve in general use—easily adaptable for future patterns.
2. Variable D.C. supplies for anode, screen and control grid for WORKING CONDITION tests.
3. Emission and slope measurements; comprehensive inter-electrode insulation tests.
4. Hot cathode/heater insulation and filament continuity tests.
5. Tests Thyatron valves for emission and control ratio.
6. Multi-range general purpose meter can be incorporated.

## SERVICE VALVE TESTER

It's an Everett Edgcumbe Radiolab product.

Full details gladly sent on request. Ask for catalogue sheet 718 F.



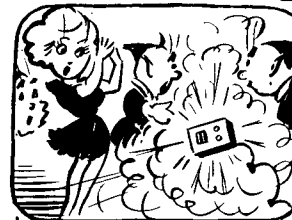
EVERETT EDGCUMBE

Makers of electrical instruments for indicating, recording and controlling, photometric apparatus and process controls.



COLINDALE WORKS, LONDON, N.W.9  
Tel.: COLindale 6045

DHB



"I told you that set was too small to cope with the Royal Albert Hall

Now look! It's gone mad  
You'll need FLUXITE, m'lud

For it's needing a slight overhaul."

For all SOLDERING work you need FLUXITE—the pasteflux—with which even dirty metals are soldered and "tinned." For the jointing of lead—without solder and the "running" of white metal bearings—without "tinning" the bearing. It is suitable for ALL METALS—excepting Aluminium—and can be used with safety on Electrical and other sensitive apparatus. With FLUXITE, joints can be "wiped" successfully that are impossible by any other method.

OF ALL IRONMONGERS, in tins—10d., 1/6 & 3/-. Used for over 40 years in Government works and by leading Engineers and Manufacturers.

The "FLUXITE GUN" puts Fluxite where you want it by simple pressure. Price 1/6 or filled 2/6.

# FLUXITE

SIMPLIFIES ALL SOLDERING

Write for Leaflets on Case-Hardening Steel and Tempering Tools with FLUXITE, also on "wiped" joints. Price 1d. each. FLUXITE LTD., (Dept. T.E.), Bermondsey St., London, S.E.1

# STURDY FOR REWINDS

Send your rewinds to Sturdy. All makes Radio Mains Transformers, Field Coils, etc. First-class work with quick delivery and fully guaranteed.

STURDY ELECTRIC CO., LTD.  
DIPTON Tel.: DIPTON 221 NEWCASTLE-ON-TYNE