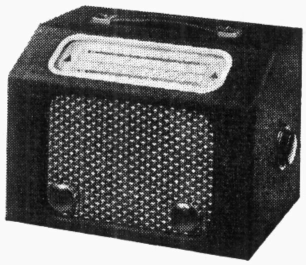
*Supplement to The Wireless & Electrical Trader, November 12, 1949*



"TRADER" SERVICE SHEET
# 932

# BUSH BP90

## *All-dry Battery Portable*



FOUR all-dry battery valves are employed in the Bush BP90, a 2-band portable superhet with self-contained frame aerial and batteries. The waveband ranges are 180-550 m and 850-2,000 m. Early models used a combined H.T. and L.T. battery, but later ones used separate H.T. and L.T. units.

*Release date and original price: November, 1946, £14 14s; reduced April, 1949, to £13 11s 4d, including batteries. Purchase tax extra.*

### CIRCUIT DESCRIPTION

Tuned frame aerial input **L1, C21** (M.W.) and **L1, L2, C21** (L.W.) precedes a heptode valve **(V1, Mullard metallized DK32)** operating as frequency changer with electron coupling.

Oscillator grid coils **L3** (M.W.) and **L4** (L.W.) are tuned by **C22.** Parallel trimming by **C23** (M.W.) and **C24** (L.W.); series tracking by **C7** (M.W.) and **C9** (L.W.). Reaction coupling by coils **L5** (M.W.) and **L6** (L.W.).

Second valve **(V2, Mullard metallized DF33)** is a variable-mu R.F. pentode operating as intermediate frequency amplifier with tuned transformer couplings **C3, L7, L8, C4** and **C11, L9, L10, C12.**

**Intermediate frequency 465 kc/s.**

Diode second detector is part of single diode triode valve **(V3, Mullard DAC32).** Audio frequency component in rectified output is developed across diode load resistor **R7** (which also acts as volume control), and passed via **C15, R9** and **R8** to grid of triode section, which operates as A.F. amplifier. I.F. filtering by **C13, C14, R6** and **C16** in diode and triode anode circuits respectively.

The D.C. potential developed across **R7** is tapped off and fed back through a decoupling circuit **R4, R1, C1** as G.B. to F.C. valve giving automatic gain control.

Resistance capacitance coupling by **R10. C17, R11** between **V3** triode and pentode output valve **(V4, Mullard DL35).** Fixed tone correction by **C18** in anode circuit.

The G.B. potential for **V4** is obtained from the voltage drop across **R12** in the H.T. negative lead to chassis.

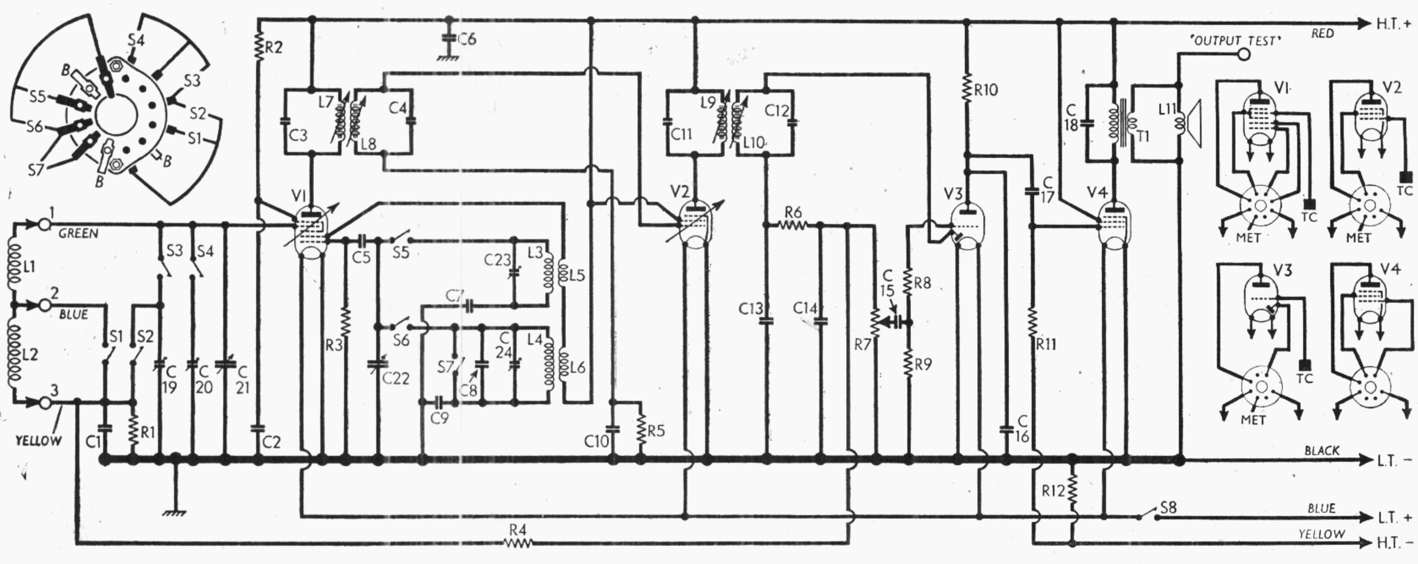
### COMPONENTS AND VALVES

| CAPACITORS | | Values (μF) | Locations |
|---|---|---|---|
| C1 | V1 C.G. decoup. ... | 0·05 | G4 |
| C2 | V1 S.G. decoup. ... | 0·05 | D4 |
| C3 | 1st I.F. trans- | 0·00006 | B2 |
| C4 | former tuning | 0·00006 | B2 |
| C5 | V1 osc. C.G. ... | 0·0005 | G4 |
| C6 | H.T. Reservoir ... | 2·0 | F3 |
| C7 | Osc. M.W. tracker | 0·000605 | H4 |
| C8 | Osc. L.W. trimmer | 0·00018 | G3 |
| C9 | Osc. L.W. tracker | 0·00039 | G4 |
| C10 | V2 C.G. decoup. ... | 0·05 | F4 |
| C11 | 2nd I.F. trans- | 0·00006 | C1 |
| C12 | former tuning | 0·00006 | C1 |
| C13 | I.F. by-pass ... | 0·0001 | E3 |
| C14 | I.F. by-pass ... | 0·0001 | E3 |
| C15 | A.F. coupling ... | 0·005 | D3 |
| C16 | I.F. by-pass ... | 0·0001 | E3 |
| C17 | A.F. coupling ... | 0·05 | D3 |
| C18 | Tone corrector ... | 0·005 | D4 |
| C19‡ | M.W. aerial trim | 0·00004 | H4 |
| C20‡ | L.W. aerial trim ... | 0·00004 | H4 |
| C21† | Aerial tuning ... | — | A1 |
| C22† | Oscillator tuning | — | A1 |
| C23‡ | Osc. M.W. trim ... | 0·00004 | G4 |
| C24‡ | Osc. L.W. trim ... | 0·00004 | G4 |

† Variable. ‡ Pre-set.

| RESISTORS | | Values (ohms) | Locations |
|---|---|---|---|
| R1 | V1 C.G. decoup. ... | 2,200,000 | G4 |
| R2 | V1 S.G., decoup. ... | 20,000 | E4 |
| R3 | V1 osc. C.G. ... | 47,000 | F4 |
| R4 | A.G.C. decoup. ... | 2,200,000 | G4 |
| R5 | V2 C.G. resistor ... | 4,700,000 | F4 |
| R6 | I.F. stopper ... | 47,000 | E3 |
| R7 | Volume control ... | 500,000 | E3 |
| R8 | V3 grid stopper ... | 100,000 | D3 |
| R9 | V3 grid resistor ... | 4,700,000 | D3 |
| R10 | V3 anode load ... | 470,000 | D4 |
| R11 | V4 grid resistor ... | 1,000,000 | D4 |
| R12 | V4 G.B. resistor ... | 820 | D4 |

| OTHER COMPONENTS | | Approx. Values (ohms) | Locations |
|---|---|---|---|
| L1 | M.W. frame aerial | 1·0 | — |
| L2 | L.W. frame aerial | 12·0 | — |
| L3 | Oscillator | 1·5 | H3 |
| L4 | tuning coils | 2·0 | H3 |
| L5 | Oscillator | | H3 |
| L6 | reaction coils, total | 6.5 | H3 |
| L7 | 1st I.F. Pri. | 7·0 | B2 |
| L8 | trans. Sec. | 7·0 | B2 |
| L9 | 2nd I.F. Pri. | 7·0 | C1 |
| L10 | trans. Sec. | 7·0 | C1 |
| L11 | Speech coil | 2·5 | — |
| T1 | Output Pri. | 500·0 | B1 |
| | trans. Sec. | 0·5 | |
| S1-S7 | W/band switches... | — | G3 |
| S8 | L.T. circ. switch ... | — | E3 |




Circuit diagram of the Bush BP90, with the waveband switch unit diagram inset at top left-hand corner. L1, L2 are the frame windings.

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## VALVE ANALYSIS

Valve voltages and currents given in the table below are those measured in our receiver when it was operating from a set of new batteries. The receiver was tuned to the lowest wavelength on the M.W. band, and the volume control was at maximum, but there was no signal input.

Voltages were measured on the 100 V range of a model 7 Avometer, chassis being the negative connection. The voltage measured across **R12** was 8.5 V.

| VALVES | Anode V | Anode m/A | Screen V | Screen M/A |
|---|---|---|---|---|
| V1 DK32 ... | 81·5 / Oscillator / 81·5 | 0·5 / Oscillator / 2·3 | 42.0 | 1·75 |
| V2 DF33 ... | 81·5 | 0·5 | 81.5 | ·15 |
| V3 DAC32 ... | 9·0 | 0·04 | — | — |
| V4 DL35 ... | 77·0 | 4·2 | 81·5 | 1·0 |

## GENERAL NOTES

**Switches.—S1-S7** are the waveband switches, ganged in a single rotary unit beneath the chassis. The diagram inset in the top left-hand corner of the circuit diagram shows the unit in detail, as seen from the rear of an inverted chassis. All the odd-numbered switches **S1, S3, S5, S7** close on M.W. (knob anti-clockwise); on L.W. all the even-numbered switches close.

**S8** is the Q.M.B. L.T. circuit switch, ganged with the volume control **R7.**

**External Speaker.**—No provision is made for an external speaker, but a convenient point for the connection of one of low impedance (about 3-4 Ω) is provided by the "output test" tags at the rear of the chassis.

**Coils—L1, L2** are the frame aerial windings, for which the connections are indicated in our plan view. The oscillator coils **L3-L6** are in a single unscreened unit beneath the chassis. The connections to the tags on its base are identified in the diagram above.

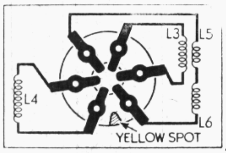
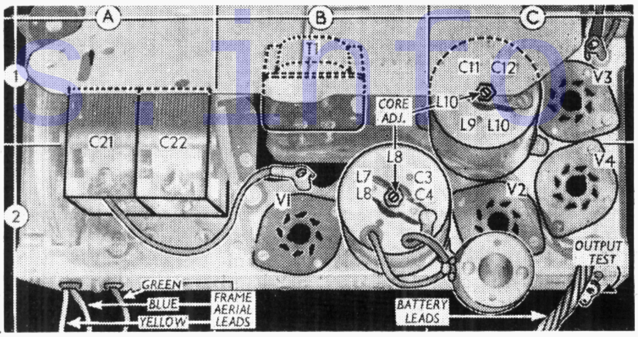



Diagram identifying the connecting tags of the oscillator coil unit.

**Batteries.**—In our version, which was a recent model, separate all-dry H.T. and L.T. batteries were employed. The H.T. unit was an Ever Ready type H.T.90, rated at 90 V, with wander-plug sockets; the L.T. unit was an Ever Ready Alldry 1, rated at 1.5 V, with a two-pin socket. In earlier versions, up to serial No. 13/15000, a combined 90 V H.T. and 1.5 V L.T. unit was used, with a 4-pin connecting socket. The type was Ever Ready Batrymax B103 or Drydex 503.

Plan view of the chassis, in which some of the detail is drawn in broken line to indicate that it is shown "through" the scale backing plate.




**Chassis Divergencies.**—In the earlier versions referred to under "Batteries," with serial numbers below 13/15001, the I.F. transformers were of a different pattern, and **C16** and the "output test" tags were omitted. The frame aerial was also of a different shape, having been altered in the later version to accommodate the bulkier batteries.

**Tuning Drive Wire Replacement.**—The tuning drive is quite simple, and its course is shown in the sketch (Col. 3) which is drawn in three-quarter perspective as viewed from the same end as the gang drum, with the gang at maximum. It is helpful if the strut supporting the upper edge of the scale backing plate is removed during the process.

Take 3ft of drive wire, which can be obtained from the makers, and clamp and solder the ends into the anchor plate, forming a closed loop 30⅝ in in circumference. Run the wire as shown in our sketch, then fit the cursor in line with the extreme right-hand indentation at the top of the scale backing-plate (about 1½ in from right-hand edge of backing-plate). Finally adjust pointer as described under "Circuit Alignment."

## CIRCUIT ALIGNMENT

If only the aerial and oscillator circuits require alignment, the chassis need not be removed from the cabinet. Access to the oscillator trimmers is obtained through a hole in the bottom of the cabinet, normally covered by the left-hand runner (viewed from rear); this is removed by withdrawing three woodscrews. The "output test" test tags at the rear of the chassis provide a convenient connection for the output meter.

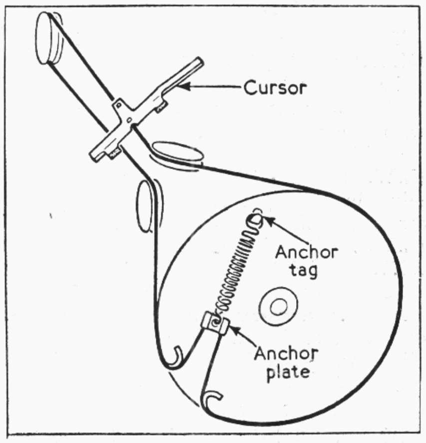
With the gang at maximum the pointer should coincide with the calibration marks on the right-hand side of the scale. It may be adjusted in position by slackening the two drive drum screws and rotating the drum on its spindle.

**I.F. Stages.**—A damping unit consisting of a 30,000 Ω non-inductive resistor in series with a 0.05 μF capacitor should be made up, to be connected across the primary winding of a transformer when the secondary is being adjusted, and vice versa. Switch set to M.W., turn gang and volume control to maximum, connect signal generator leads to control grid (top cap) of **V2** and chassis, feed in a **465 kc/s** (645.16 m) signal and adjust **L10** (C1) and **L9** (E3) for maximum output. Transfer "live" lead to top cap of **V1** and adjust **L8** (B2) and **L7** (F4) for maximum output. Repeat these operations until no improvement results.

**R.F. and Oscillator Stages.**—The signal generator should be coupled to the receiver via a single loop of wire about the same size as the frame aerial, and placed 6 to 12 inches away from it. The chassis should be in the cabinet.

**M.W.**—With the set still switched to M.W., tune to 300 m on scale, feed in a 300 m (1,000 kc/s) signal and adjust **C23** (G4) and **C19** (H4) for maximum output. Check calibration at 200 m (1,500 kc/s) and 500 m (600 kc/s).

**L.W.**—Switch set to L.W., tune to 1,000 m on scale, feed in a 1,000 m (300 kc/s) signal and adjust **C24** (G4) and **C20** (H4) for maximum output. Check calibration at 1,500 m (200 kc/s) and 2,000 m (150 kc/s).




Sketch of the tuning drive system, viewed from the drive drum end with the gang at maximum.

## DISMANTLING THE SET

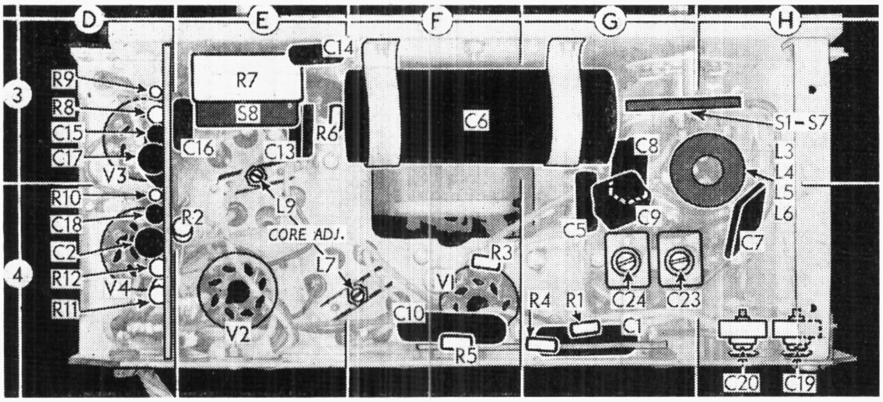
**Removing Chassis.**—Remove the two front control knobs (recessed screws), the back cover and batteries. The third knob (tuning) may now be removed by loosening the fixing screw inside the receiver;

remove the two woodscrews (with a paxolin spacing collar each), which form locating pegs at the top of the frame aerial, withdraw the two 1⅜in 4BA bolts and nuts (with washers) from the bottom of the frame aerial, free the three spade connectors on side of frame. and lift the aerial out;

remove the two 4BA bolts holding the chassis to the two wooden battens in the cabinet;

remove two 4BA nuts (one spring and one plain washer each) securing chassis brackets to front of cabinet, and withdraw chassis from cabinet.

*When replacing,* the green frame aerial lead should be connected to the rear tag on the frame; the blue lead to the centre tag; and the yellow lead to the front tag.




Under-chassis view. A diagram of the **S1-S7** switch unit, indicated here by an arrow, is inset in the circuit diagram overleaf, viewed in the direction of the arrow in this illustration.

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