

are the same as for UNIT "A" operational amplifiers. S11, VR25, VR26, and all sockets may be mounted after the front panel has been marked and drilled.

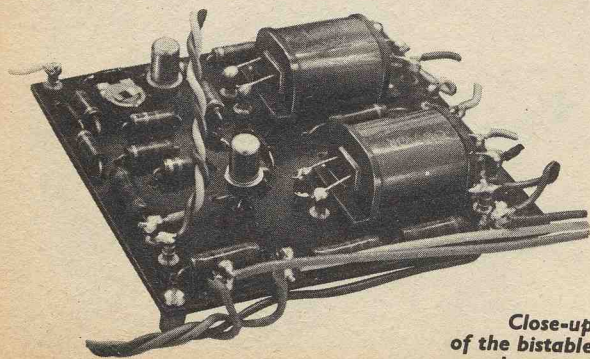
#### INTERNAL LAYOUT OF THE MULTIPLIER

The internal layout and interconnecting wiring of the multiplier are shown in Fig. 9.5. Operational amplifier, bistable relay driver, and product amplifier circuit panels are bolted with stand-off spacers to a 12in x 4in s.r.b.p. or plastics laminate baseboard, which rests on the wooden bearers at the base of the UNIT "D" box.

Component placement positions for the bistable relay circuit panel, and the product amplifier panel, also appear in Fig. 9.5, together with a rear view of the front panel assembly. The operational amplifier (OA4) is made up in accordance with instructions given in the May issue of PRACTICAL ELECTRONICS (pages 209-210).

#### BISTABLE RELAY CIRCUIT CONSTRUCTION

Drill the bistable relay circuit panel according to Fig. 9.6, and insert turret tags. Then mount all components and complete underside wiring, leaving the reed switches RLA1, RLA2, RLB1, and RLB2 until



last. A triple reed coil is specified for the Fig. 9.2 circuit, to allow the addition of an extra pair of reed switches if the multiplier is to be enlarged to cater for three input voltages; this modification will, of course, also involve the construction of another product amplifier.

#### PRODUCT AMPLIFIER CIRCUIT CONSTRUCTION

Drilling details and underside wiring of the product amplifier panel appear in Fig. 9.7. Accurate matching of input transistors TR1 and TR2 may not be necessary with this low gain circuit. A 2N2926 transistor should not be employed in the TR4 position, in place of the 2N3904, as its maximum  $V_{ce}$  will be exceeded.

After inserting turret tags, mount resistors and transistors first, then follow with L1, and capacitors C2-C5. C1 is soldered into position last of all, across the amplifier input turret tags, as shown in Fig. 9.5.

#### FINAL ASSEMBLY AND SETTING UP OF UNIT "D"

Mount the three circuit panels on the baseboard and complete all interconnecting wiring between the circuit panels and the front panel, including S12 which can be left floating for the time being. The resulting assembly can be set-up and tested out of its box.

Connect red, green, and blue flexible wires from the bistable relay panel to the UNIT "A" power supply solder tags, or alternatively to TL1, TL2, and TL3 with stackable plugs.

Place S11 in the "off" position and zero-set the operational amplifier (OA4) following instructions given earlier for UNIT "A" amplifiers, after allowing the usual warm-up period. When adjusting the VR26 balance control connect M/SK2 to any earth socket with a patching lead. Next, attach a sensitive d.c. voltmeter (0-1V) to M/SK3 and zero-set the multiplier output by adjustment of VR1 on the product amplifier circuit panel.