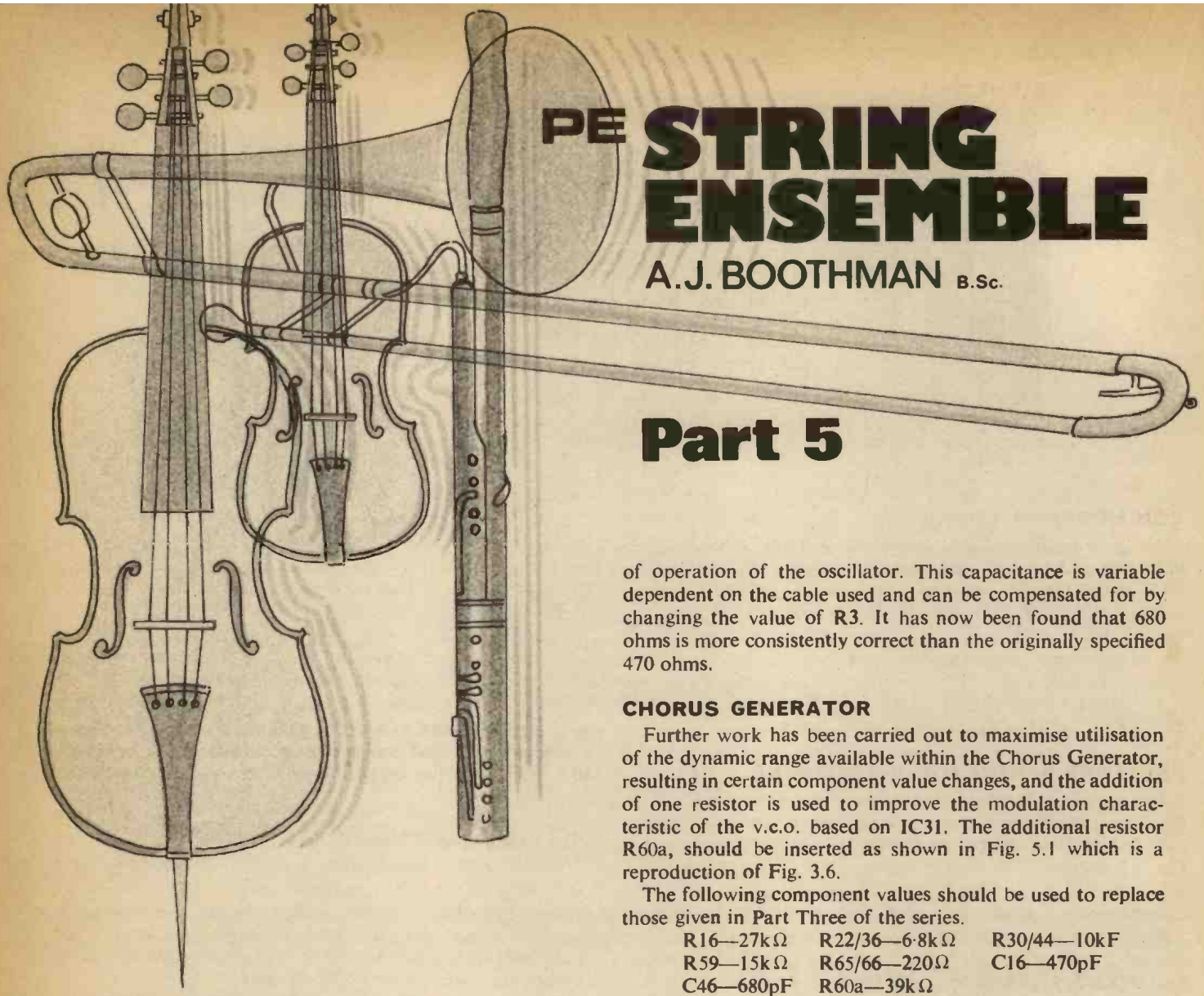


PE STRING ENSEMBLE

A.J. BOOTHMAN B.Sc.

Part 5

THE final part of the series gives details of the cabinet construction, a number of component value changes for improved optimum results, and further interwiring information and clarification.

CABINET CONSTRUCTION

The component parts for the cabinet are given in the cutting list with assembly details shown in Fig. 5.2. Some variation in dimensions may be required to suit alternative keyboards, but the construction has been kept simple for ease of adaptability. Corner joints can be made from short lengths of $\frac{5}{8} \times \frac{5}{8}$in (15·875 × 15·875mm) timber, screwing from the inside of the cabinet.

IMPROVEMENTS ON PROTOTYPE

Since commencement of publication of this series the construction of further models has resulted in information from which certain component value changes are recommended to give the best results.

TONE GENERATOR/PSU

Connections from the p.c.b. to the front panel transposer switch and the tuning potentiometer are made with screened cable (see Fig 5.2), and the capacitance of the cable contributes to the capacitance C8 which determines the frequency of operation of the oscillator. This capacitance is variable dependent on the cable used and can be compensated for by changing the value of R3. It has now been found that 680 ohms is more consistently correct than the originally specified 470 ohms.

CHORUS GENERATOR

Further work has been carried out to maximise utilisation of the dynamic range available within the Chorus Generator, resulting in certain component value changes, and the addition of one resistor is used to improve the modulation characteristic of the v.c.o. based on IC31. The additional resistor R60a, should be inserted as shown in Fig. 5.1 which is a reproduction of Fig. 3.6.

The following component values should be used to replace those given in Part Three of the series.

R16—27kΩ	R22/36—6·8kΩ	R30/44—10kF
R59—15kΩ	R65/66—220Ω	C16—470pF
C46—680pF	R60a—39kΩ	

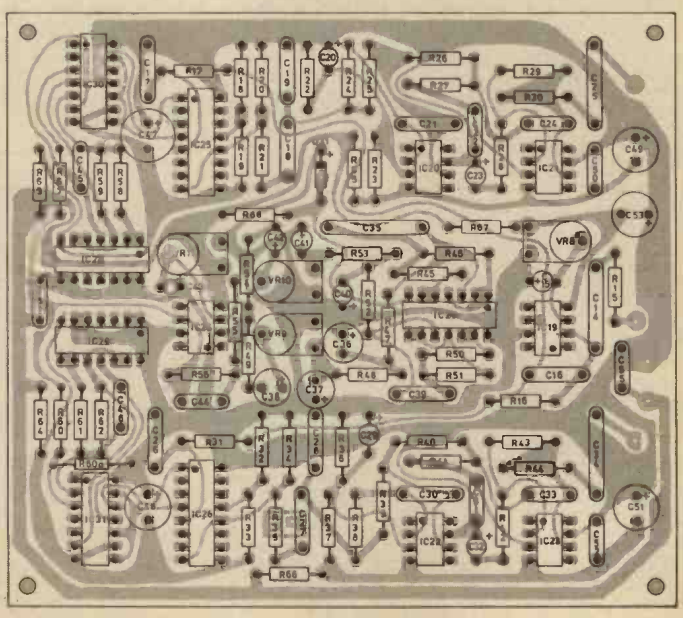


Fig. 5.1. Showing position of additional resistor on chorus p.c.b. Orientation of the I.c.s is also given

VOICE/PREAMP CIRCUITRY

Noise contribution from the Woodwind and Brass filters has been reduced to negligible proportions by replacing R107 and R116 with shorting links, removing C76 and C83 and connecting 1MΩ resistors across pins 2 and 6 of ICs 33 and 34.

The following components on this figure should also be changed as follows:

R124—150kΩ, R131—470kΩ, R135—68kΩ
C81—47nF, C88—47nF, C101—220pF

PSU/TONE GENERATOR INTERWIRING

Last month an interwiring diagram (Fig. 4.6) was given for the Chorus Generator and Voice/Preamplifier p.c.b., which included details of most of the front panel control connections. Fig. 5.2 shows the wiring for the remaining controls, which are connected to the P.S.U./Tone Generator p.c.b., and the mains input sub-panel.

The sub-panel is mounted at the rear of the cabinet, at the top left-hand end (see photo) and contains the mains switch, fuse and socket which are wired to the mains transformer as shown. Earth leads are also required both to the keyboard chassis and 0V pin on the Voice/Preamplifier p.c.b.

Low voltage a.c. connections are made in pairs between the transformer and the p.c.b. supplies +15V, 0V, and −15V are taken direct to the Voice Board, and can be routed behind the key bar to avoid entanglement with the Tone Generator output leads.

Connections to D13 on the front panel are shown, the polarity being indicated by the "flat" on the skirt of the l.e.d. The lead adjacent to the flat should be wired to the l.e.d. pin on the p.c.b. D13 is fitted adjacent to the pitch control. The 20V supply is wired to Attack and Sustain Controls as shown in the diagram and connections are made to the keyswitch rod and sustain line on the Diode Gate assembly from these controls.

TRANSPOSER/TUNING CONNECTIONS

A four core screened cable is used to connect the Tone Generator p.c.b. to the Transposer Switch, the screen is connected to the ground terminal on the p.c.b., but not to the switch. A single wire link should be connected between the switch and tuning potentiometer VR5, and a screened cable between the potentiometer and the p.c.b.

In this case the screen should be soldered to the p.c.b. at one end and the body of the potentiometer at the other end.

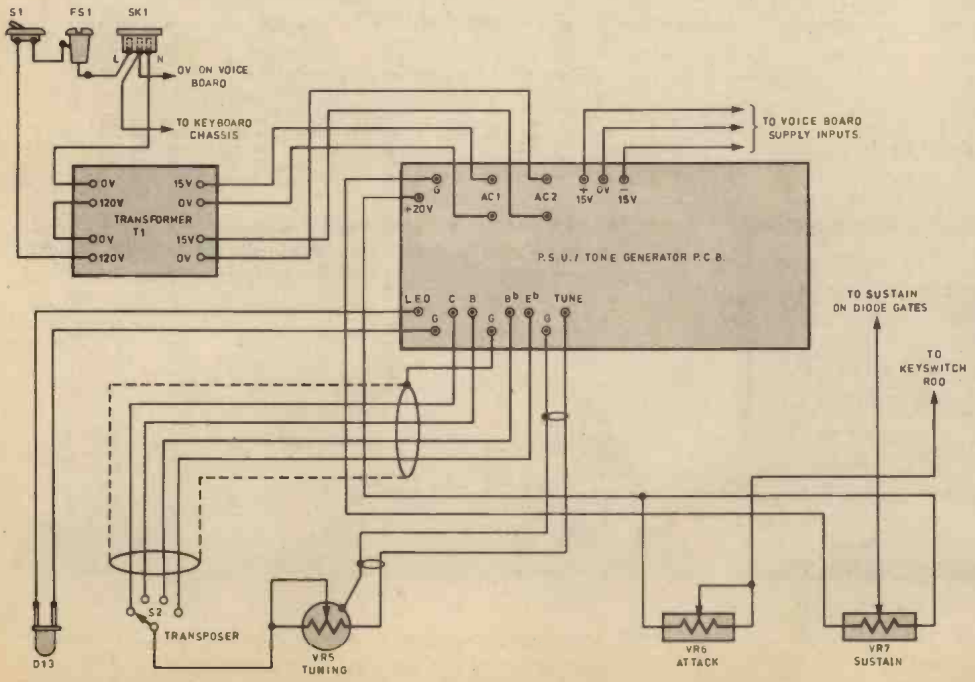


Fig. 5.2. Interwiring of P.S.U./Tone Generator to controls

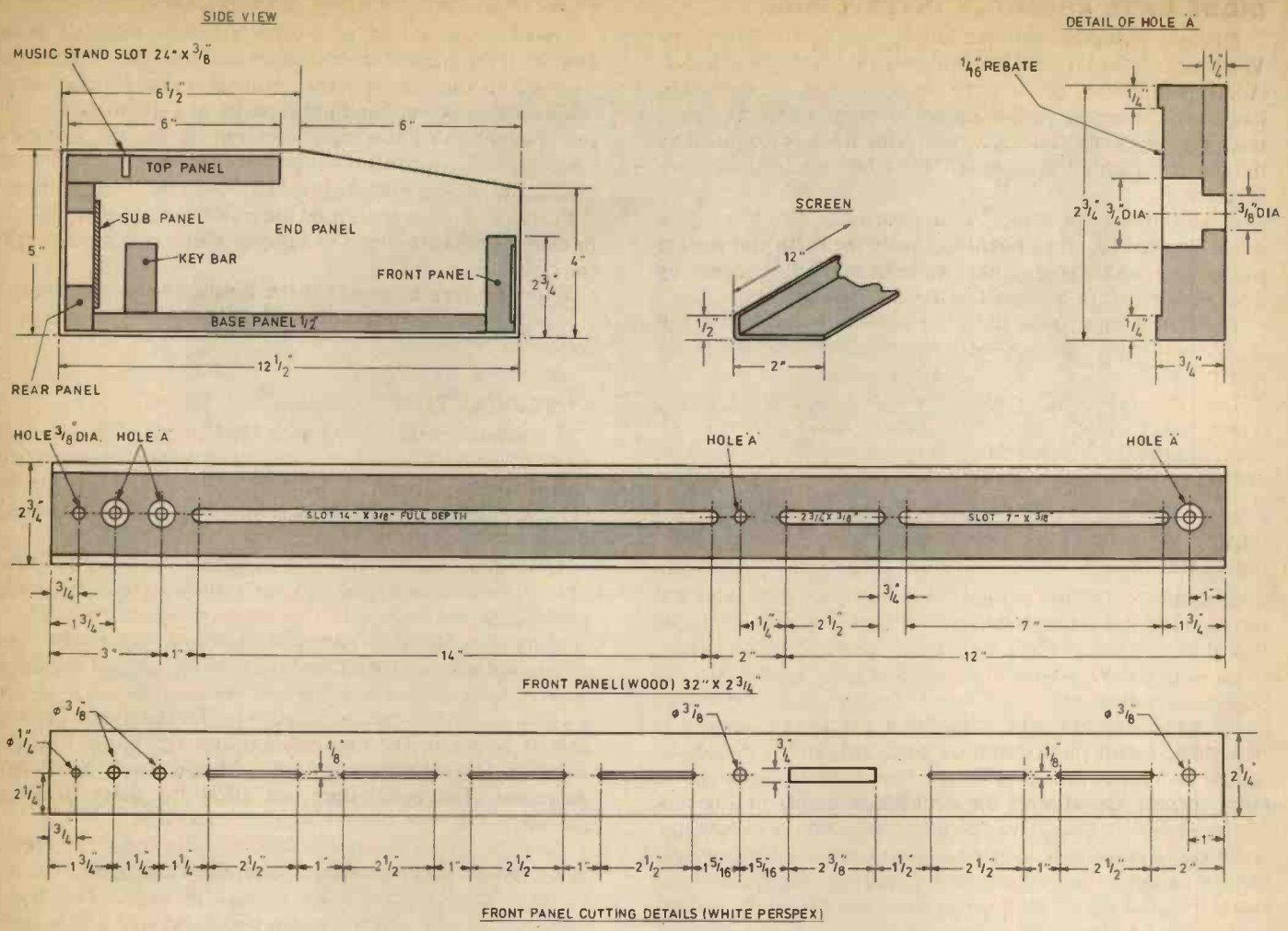
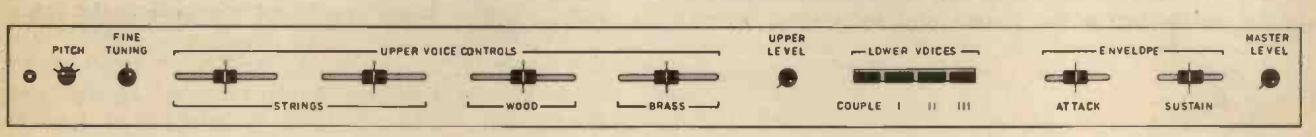


Fig. 5.3. Cutting details of casing and fascia

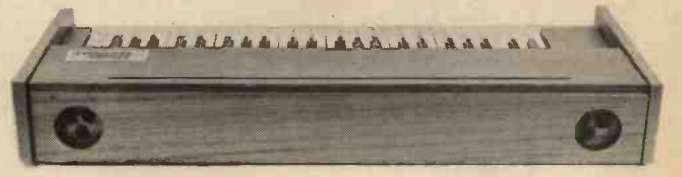


CUTTING LIST

End Panels	(2 off)	12½in × 5in × ¼in Veneered
Base Panel		32in × 10½in × ½in Chipboard
Rear Panel		32in × 3¾in × ⅛in Veneered
Front Panel		32in × 2¾in × ⅛in Veneered
Top Panel		32in × 6in × ¼in Veneered
Key Bar		22in × 1⅞in × ⅞in Timber
Sub-Panels	(2 off)	4in × 3in × ¼in Plywood
Keyboard Ends	(2 off)	To suit Keyboard
Metal Screen		12in × 2½in Bent as shown in (Fig. 5.3)

Sub-Panels are mounted against 2in holes in Rear Panel

Fig. 5.4. (Above) Showing fascia legends. (Below) Showing rear panel and attached sub-panels. Right is for mains input and left for output sockets



DIODE GATE ASSEMBLY INTERWIRING

The interwiring between the Diode Gate assembly and the Voice Board, Sustain control and earth is shown in Fig. 5.2. A lead is connected between the point at which the earth lead has been connected to the keyboard chassis and the earth track on the Diode Gate assembly. This track is identified as the one to which all capacitors C13 (4·7μF electrolytics), are soldered.

In assembling the Diode Gate boards earlier, links were made between the three boards to make the earth and sustain tracks continuous (Fig. 2.6). The sustain track is joined by a single wire to the Sustain Control VR7.

The four output track links are made between PCB2 and PCB3 only since the keyboard split occurs between PCB1 and PCB2.

Low and high output groups are each connected to the Voice Board using a four-core screen cable. with the screen connected at the Voice Board end only. The low output cable should be routed behind the key bar.

GATE ASSEMBLY—TONE GENERATOR WIRING

The interconnection pattern for the Diode Gate p.c.b.s was given in Fig. 2.8 in the second part of the series. This illustrated the three p.c.b.s, making up a single assembly, with arrows indicating the 85 points at which leads are taken from the Diode Gate assembly to the Tone Generator board. The track leads associated with the connection points can be seen in the single board photograph on page 596, and if the photograph is turned through 180° the four rows of leads can be seen to correspond with the connection points in Fig. 2.8. As described in Part Two the interconnection is carried out with easily solderable insulated copper wire; a single length acting as both the interconnecting wire on the Diode Gate assembly and the flying lead to the Tone Generator board.

In Fig. 2.8 the numbers in circles (1–8) correspond with the numbers on the outputs of IC7–18 (1–8) on the Tone Generator p.c.b. shown in Fig. 1.7 in the First Part of the series.

Each arrow represents a lead back to the Tone Generator with the note identified by checking the vertical correlation with the letters below the arrows and the circled number under the row concerned. On the left-hand end the circled number changes for the last note in a row, as also occurs in the case of C5.

SCREENING

In the design of the String Ensemble great attention has been paid to ensuring that the instrument is free from beehive (background noise from the Tone Generation circuitry). This has been achieved in respect of blocking any direct beehive through the Diode Gates into the voice circuitry. However, it is important to ensure that this is not negated by pick up into the voice circuits from the Tone Generator harness. The use of screened leads where recommended will prevent this, and care should be taken not to strip the screening back too far, leaving unscreened lengths, particularly in connections to the Woodwind slider potentiometer.

An earthed metal screen is also required to isolate the Tone Generator harness from the Voice and Chorus boards when the keyboard is lowered, and whilst the original prototype incorporated a screen fixed above the boards on stand-offs from the baseboard (see photo on page 598), it has now been found more convenient to mount the screen onto the keyboard chassis with equal success. Dimensions for the screen are given in Fig 5.3.

PLAYING THE STRING ENSEMBLE

Prototypes have now been used on a wide range of power amplification systems in both domestic and stage settings. A normal hi-fi amplifier/speaker combination has given excellent results with a power handling capacity of approximately 15W per channel using the high level output for the Ensemble into the auxiliary channel of the amplifier. With a commonly used guitar combo-amplifier rated at 100W the "Bright Input" with treble lift, has been used successfully to give either solo or chordal backing effects in a group which includes an organ for general use.

With this type of amplifier the Ensemble low level output is recommended to prevent overloading of the first stage of the combo-amplifier.

LEVEL SETTING

The Upper Voice controls plus the Upper and Master Level controls give six variable signal levels which when coupled with the Lower Voice switches and the variation in the number of notes playing at any time results in a very wise signal range driving into the chorus delay lines.

For a good signal/noise performance it is important to set the instrument such that the delay lines have a reasonable signal level, but due to the wide range of signal available it is possible to overload the delay lines under extreme conditions.

The new component values given earlier for the Chorus and Voice boards give a good optimum condition where in normal playing circumstances the Upper and Master Level Controls should be set in the mid-position and the power amplifier adjusted for maximum output with the swell pedal fully depressed. The pedal does not affect the delay lines and should be used for normal volume adjustment.

A single Upper Voice can be used with the slider control at maximum. Two voices can be used with each slider control in the mid-position. Similar compensation can be made if more voices are mixed, but since an overload safety factor has been incorporated it will probably not be necessary.

An alternative mode of operation when mixed voices are to be used regularly, organ simulation, is to turn the Upper Level control anticlockwise to, say, the one third position which will then allow all voices to be mixed additively with heavy chordal fingering without overloading the delay lines.

For solo playing on single voice the Upper Level control can be turned to maximum. The Master Level controls the entire keyboard and can be used to increase the lower keyboard level, whilst the upper keyboard level is reduced by the Upper Level control, or to further increase the upper keyboard level on single note solo playing.

OPTIMUM VOICING

The best effects are obtained with simple voice settings, that is with one voice control in use at any particular time. However, experimentation with the wide range of controls available can lead to the creation of other sounds which with subjective opinion can enhance the motives of an individual to construct the project. ★

Constructors who would like a cleaner copy of Fig. 3.5 should write in including a stamped addressed envelope.
In Fig. 4.3 and the Components List last month C81 and C82 should be 4,700pF and 47nF respectively.