mellotron 300 Service Manual

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The

MELLOTRON 300

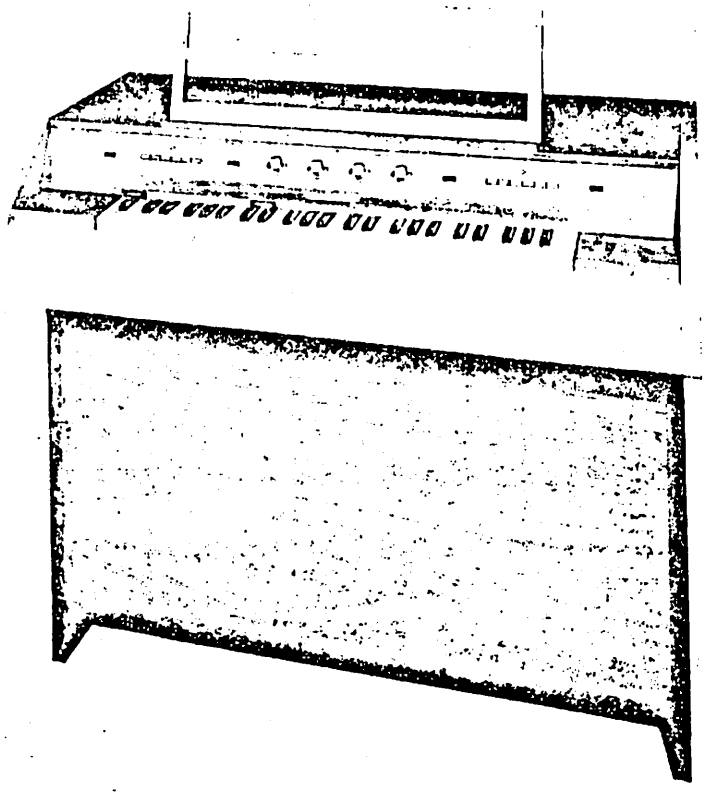
MELLOTRON Model 300: "B"-Series Tape List

Station	Track	Rhythm	Lead	Track	Station
1	A.	Viennese Waltz	Flute	A.	1
	B.	Quickstep	Trombone	B.	
2	A.	Samba	***PIANO** **	A.	2
	B.	Slow Waltz	Vibes	B.	
3	A.	6/8-Tempo	Clarinet	A.	3
	B.	Dixie	***ORGAN** **	B.	
4	A.	Pop	Spanish Guitar	A.	4
	B.	Pop	Organ	B.	
5	A.	Latin American	Organ	A.	5
	B.	Slow Foxtrot	Celeste	B.	
6	A.	***PIANO** **	Violin	A.	6
	B.	***ORGAN** **	Harpsichord	B.	

NOTE: Piano and Organ sounds marked in Italics will enable instrument to reproduce for full length of the keyboard (52-keys).

SERVICE MANUAL

ABRIDGED VERSION



THE MELLOTRON 300

THE MELLOTRON 300

INTRODUCTION

The MELLOTRON 300 is a musical instrument with its sounds derived from magnetic tape recordings of live musical instruments. These tapes are fed into a loop storage system and played by a conventional musical keyboard.

The keyboard comprises two sections:-

The Left Hand (19 keys) containing the Rhythm and Bass notes and the Right Hand (33 keys) containing the sounds of the Lead instruments.

To provide alternative selections of Rhythms and Lead instruments, the Mellotron tapes are divided into six longitudinal sections, the selection of which is controlled electronically. In addition to this, 2-track recording is used allowing a total of twelve alternative selections. The Rhythm and Lead sections are controlled independently so that any combination can be selected from the control panel.

A variable Capstan motor control drive enables the pitch and tempo of the recordings to be set by the player and separate volume controls are provided for both Rhythm and Lead sections. In addition a delay line type reverberation unit is fitted which can be made to operate on all keys.

The instrument has its own power supply and only requires the addition of the Loudspeaker/Amplifier Unit (LSA 300) to be played. For connection to external amplifiers and other equipment a 3-circuit jack output socket is supplied.

POWER SUPPLY

100 - 125V, 60 c/s

200 - 250V, 50 c/s

Consumption: peak 500 W, normal running 100W

TAPE WIDTH

2-track standard play

1/4 inch, 2-Track, standard play

TAPE VELOCITY

Normal: $7\frac{1}{2}$ in/s

Variable speed range ± 20% (± half an octave)

REPRODUCED FREQUENCY

40 c/s ± 10 Kc/s ± 3 dB

REPRODUCE HEADS

Low impedance: 3MH

SIGNAL TO NOISE RATIO

With all channels and reverberation in operation - 45 dB below OdBM

REVERBERATION

Built in delay line system. The ratio of reproduced sound and reverberation is controllable from the front panel. Operational on both Lead and Rhythm sections if required.

OUTPUTS

1) Cannon socket to feed LISA 300 cabinets

2) Isolated line output via standard G.P.O. 3 circuit jack. OdBm into 600 ohms.

PANEL CONTROLS

Reading Left to Right -

1) Mains ON/OFF switch
2) Rhythm station selector push button switch
3) Rhythm track selector switch
4) Rhythm volume control
5) Pitch control

6) Reverberation volume control

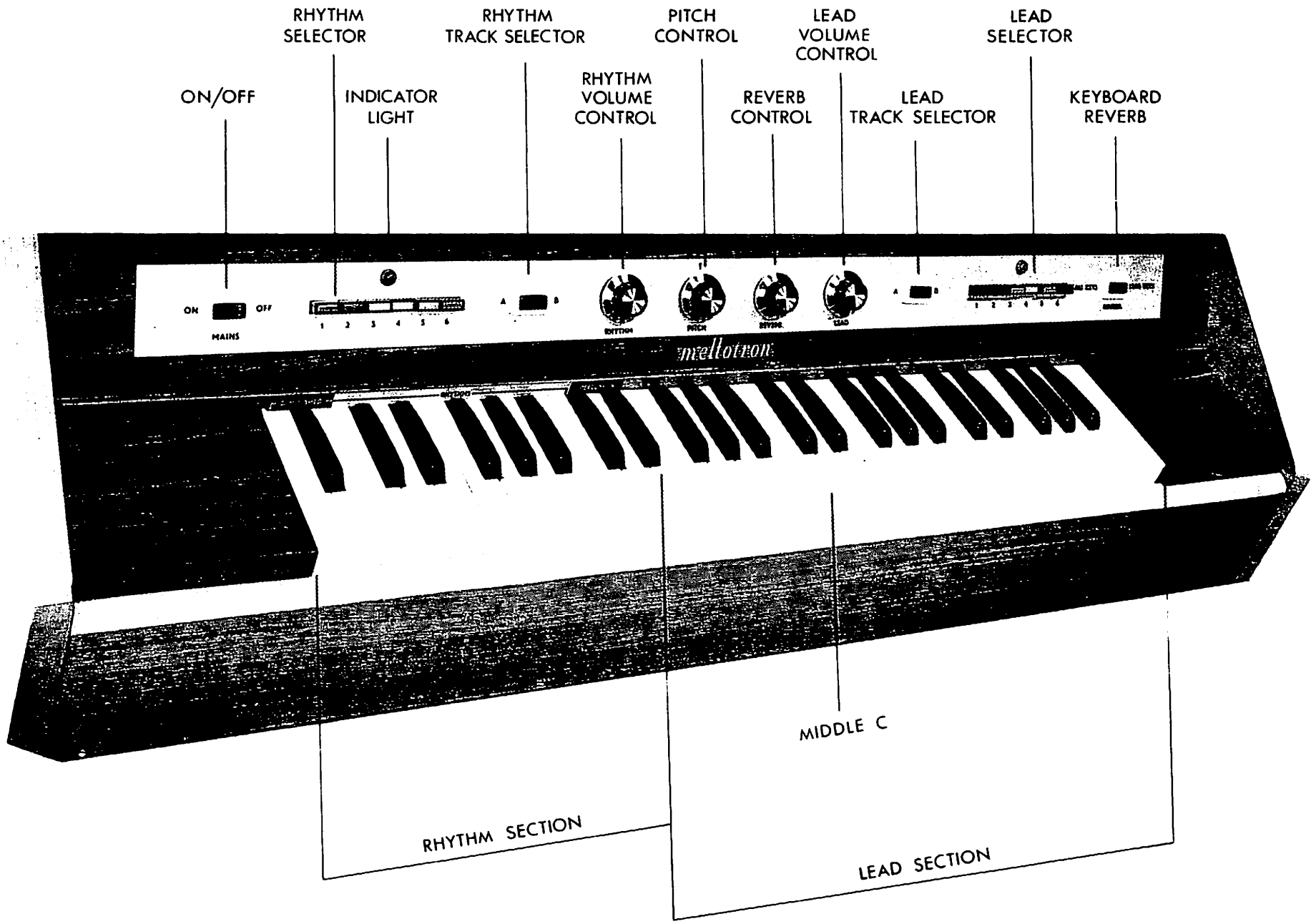
7) Lead volume control

8) Lead station selector push button switch.

9) Reverberation selector switch

MELLOTRON 300

DIMENSIONS	Length - 42¼"
	Depth - 26¼"
	Height - 36¼"
WEIGHT	250 lbs. (113.4 kg.)



DELIVERY AND INSTALLATION.

1 - 1 When the MELLOTRON 300 leaves the factory it is in perfect working order. On delivery, a very thorough check should be made on the condition of the instrument. If there appears to be any defect due to handling during transportation, it should be reported immediately.

The following checks are now carried out BEFORE SWITCHING POWER ON:

BEFORE POWER ON. Remove top lid and front and rear panels. Each removeable panel is held in position by ball clips.

Check that all plugs are firmly seated in their respective sockets. The importance of this check cannot be stressed enough.

By looking at the Vertical Tape Storage Loops either from the front or rear, ensure that all loops come to the same length within an inch or so, and that each loop comes to more than $1\frac{1}{2}$" above the bottom of the separator. If they do not, investigate the cause immediately. As an example of a possible mishap, the instrument could have been turned completely upside down in transit, allowing a tape to slip off one of the bottom rollers. This would be obvious at a glance. Section 4 will tell you how to put it back.

The Reverberation Springs are packed to avoid excessive movement and vibration during transportation. This packing should be removed.

Check the tightness of all screws in the barrier strips on the left and right hand Motor Mounting Boards, and the Sound Distribution Barrier Strip located by the Line Amplifier.

The foregoing checks will ensure that it is safe to apply power to the instrument.

1 - 2 POWER ON.

Ensure that the Mains source available is of sufficient capacity to run the instrument safely; bearing in mind that the peak load taken by the Mellotron is 500 watts.

Before switching on the Mains supply set the Mains Tapping Plug on the Power Pack correctly. Power settings of 100 - 125 volts 60 c/s or 200 - 250 volts 50 c/s are available.

The L.S.A. 300 has a power consumption of 40 watts peak and is driven from the main unit via a heavy duty cable terminated with an unbreakable lock in Cannon plug. This fits directly into the socket on the rear of the Mellotron Power Pack. This cable feeds both signal and Mains voltages to the L.S.A. 300.

a) PRELIMINARY

The ON/OFF panel switch should now be turned on whereupon the indicator lights above the Station Selector Switches should light. Check also that the indicator light at the rear of the L.S.A. 300 is alight (the unit has a seperate on/off switch).

If this is not so, investigate as per Section (4).

If a key is depressed a sound of some sort should be heard. Assuming that sound is obtained, this will show that the Capstan is turning, the key is functioning, the sound interconnections are complete and the Electronics are operative.

If sound is not obtained refer to Section (4).

b) CYCLING CHECKS.

The cycling checks are best carried out with the top and the back of the instrument removed. By inspection of the Index Tape where it lies across the Sensing Head, a number should be visible. This number should correspond with the button depressed on the panel. If it does not, switch off and depress the correct button, switching on again afterwards.

Press an adjacent button whereupon the indicator light will go out, the Keylock Flap will be heard to operate and the tapes will begin to move. They should move

rapidly for about three seconds, come to a temporary halt, and then begin to inch in a series of short jumps. As the numbered mark on the Index Tape passes over the sensing head the tapes will stop, the Keylock Flap will be heard to release, and the panel light will come on again to show that a station has been selected. The number on the index tape should agree with the number of the button pressed. If the tapes show no indication of coming to a halt after five seconds, switch off and investigate.

While cycling takes place, the bottom rollers should all stay near the bottom of the separators. This can be checked by inspecting the loops as the tape is cycled. If any loop shows a tendency to rise as cycling takes place, see Section (4). This must be checked while cycling in both directions.

Repeat the operation by cycling the tapes back to their original position, checking that the inching time is the same forward as reverse. To check this, approach a station from both directions, e.g. cycle to Station 3 from 4 and from 2 and note the actual inching time from each direction. If these are not approximately equal, see Section 3.1 (c).

The S.S.C.U. (Station Selection Control Unit) can be fooled accidentally in the following manner:

Let us say that the instrument has been cycled to Station 3 previously so that Button 3 is at the moment depressed. As we know from 2.4 (k), pressing a button gives a pulse telling the S.S.C.U. in which direction to drive the cycling motor to locate the desired station in the shortest possible time. We now press Button 6 and the S.S.C.U. will drive the tapes towards Selection 6.

However, if Button 5 is pressed immediately, before the synchronised switch has reached Selection 5 the motor will reverse because the wrong sense pulse has been given.

We can make use of this feature to check the automatic reverse function.

Great care is needed to avoid damage to the tapes should a fault exist. Cycle to Station 3, press Button 6 and immediately press 5. The tapes will now be driven towards (1). With the hand on the ON/OFF switch, watch the index tape as the stations are passed through. If the tapes do not reverse within one second of passing Station 1, switch off and investigate as per Section 4

If all is well the tapes will reverse and eventually come to rest at selection 5. The automatic reverse at the other end can now be checked by returning to 3 and then pressing 1 and 2 immediately after.

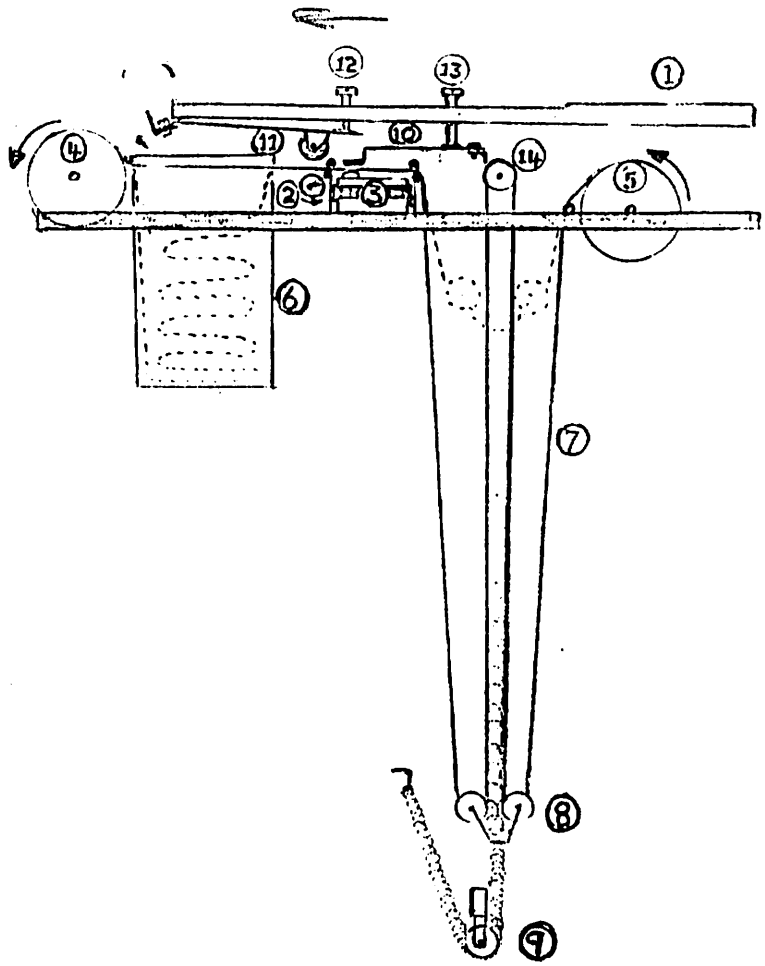
The auto reverse check ensures that the instrument is protected against the "fooling" of the S.S.C.U. inadvertently. This could occur by the operator changing his mind after first making a selection, and pressing another button before the first selection was completed.

All six stations should now be selected in turn to check that all positions can be reached. In order to obtain accurate selection, it may be found that the controls of the S.S.C.U. require adjustment. This should not be so as they are set at the factory to give smooth inching consistent with reliable selection.

SECTION 2

HOW THE MELLOTRON WORKS

FIG. D.1.



1. KEY
2. CAPSTAN
3. HEAD BLOCK
4. REAR STORAGE ROLLER
5. FRONT STORAGE ROLLER
6. TAPE STORAGE BOX
7. TAPE
8. BOTTOM ROLLER ASSEMBLEY
9. RETURN SPRING GUIDE
10. PRESSURE PAD
11. PINCHROLLER
12. PINCHROLLER ADJUSTMENT SCREW
13. PRESSURE PAD ADJUSTMENT SCREW
14. TOP ROLLER

THE MELLOTRON SYSTEM. FIG. D.1.

The diagram shows the general layout of the way in which the requirements of Section 2.1 have been met. The front and rear storage rollers are prevented from moving by being coupled together by a chain drive, which also is coupled to the drive motor and the synchronised switch. The rollers can only move when driven by the motor.

A magnetically recorded tape is slung between the two storage rollers in such a way that about 6-ft. more tape is allowed to hang than is required to stretch simply between the storage rollers. This slack is taken up in two loops passing round a system of pulleys formed by the top rollers and the front and rear bottom rollers. The bottom rollers are pulled down by the tape return spring and thus the tape is kept tight.

Mounted above the tape is a key which carries on its underside a pinch roller. When the key is pressed, the tape is squeezed or pinched between the pinch roller and the capstan. The capstan is a round bar which is made to rotate in the direction of the arrow at a constant speed. Thus the tape is made to travel towards the rear of the machine at a constant speed by the action of the capstan. Since the rear and front storage rollers are not allowed to move, the tape falls in free folds into the tape storage box, whilst at the same time the length of tape absorbed by the pulley system is reduced. This means that the bottom rollers rise as the tape is used up until finally, when the rollers reach the limit at the top of their permitted travel, a length of about 6-ft. of tape has been played into the tape storage box. The dotted line shows the tape in a position near to the end of the playing action. If at this point the key is released removing the driving force on the tape, the pull of the tape return spring acting on the lower rollers will remove the tape from the tape storage box and pull the loops downwards until the tape is tight again.

Since the rear roller has not moved throughout this action, it is clear that the part of the tape that was over the capstan when the key was first pressed, is now back exactly where it was before, ready to be played again.

Also operated by the pressing of the key is a pressure pad which forces the tape into contact with the tape reproducing head. Thus when the above action is considered, it

can be seen that the signal on the tape can be played from a selected point, this point being returned to as soon as the key is released. This fulfils the main requirements as suggested in . Since, as we have said, the slack tape taken up by the spring loaded loops is some 6-ft. in length, then this is the length of tape available for playing. At the tape playing speed of $7\frac{1}{2}$-inches per second, the time for playing is about 8 seconds which is adequate for most purposes. When 8 seconds is up the key is released, the tape returning immediately to its starting position, after which the full 8 seconds is possible again.

In order to increase the number of different sounds which are available, two things have been done. Firstly, two tracks have been recorded side by side on the tape and provision made for the head to be moved sideways to play the desired track. Secondly, the tape has been divided longtitudinally into six sections and a system arranged whereby the actual pieces of tape stored in the spring loaded loops can be selected. This process is known as CYCLING and will now be explained.

2 - 2 CYCLING.

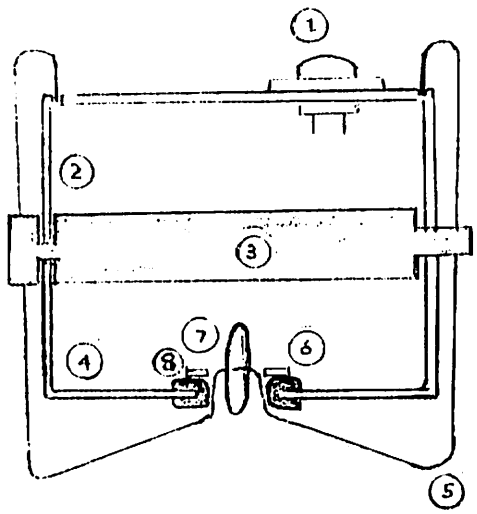
By referring to Fig. D.1. we can see that if both the front and rear storage rollers are rotated in the direction of the arrow, tape will be wound off the front roller into the loops while tape is wound out of the loops into the rear roller. If the amount by which each roller is turned is exactly the same, the position of the bottom tensioning rollers will remain constant because the actual length of tape hanging between the two storage rollers will stay the same. (Note - In the MELLOTRON this situation is not exactly met because since the diameters of the storage rollers vary as tape is transferred from one to the other, the length of tape hanging between them varies slightly and it can be observed that the length of the loops increases to a maximum when the diameters of the rollers are equal between selection 3 and 4 .)

This means that if we wish to change the six feet of tape which we have been playing, then all that is necessary to do is to rotate both the rollers in the same direction, and at the same rate until the start of a different six feet of tape is positioned in the loops

with its start over the reproducing head.

In the MELLOTRON there are six positions or STATIONS to which the tapes can be set and taken together with the two tracks on each tape, and this means that there are twelve different sounds that can be replayed from each tape.

HEAD BLOCK MOUNTING



(1) TAPE REPLAY HEAD

(2) HEAD BLOCK

(3) HEAD BLOCK ROLLER -

(4) LOWER HEAD CHANNEL

(5) M-TYPE RETAINING SPRING

(6) INSULATING GROMMET

(7) BUTTON CLIP

(8) INSULATING WASHER

2 - 3 MECHANICAL FEATURES.

a) GENERAL ARRANGEMENT.

The instrument is built in two halves on a basic metal framework. The top portion of the framework carries the major components while the vertical member holds the tape separators and tape return springs.

b) STORAGE ROLLER. FIG. D.1.

This roller is constructed of spirally wound paper and thus must be treated with a certain amount of care. At the factory it is impregnated with a shellac varnish which protects it from the effects of moisture in the air. Damage can result from the careless use of screwdrivers when fastening down the tape clamps for instance.

c) TAPE STORAGE LOOPS. FIG. D.1.

The function of the tape storage loops as described above in Section 2 is to return the tape to its original position after playing. Following the path of the tape through the loops, the tape after leaving the front storage roller passes over the front tape support and drops to the frontmost bottom toller. It then rises and passes over the top roller after which it falls again to pass round the rear bottom roller. Finally it rises and enters the tape guide passing over a support on the way. The bottom rollers are both freely mounted on a 'V' shaped link which is secured to the horizontal rail by a spring and a cotter pin.

To prevent adjacent tapes from interfering with each other, the vertical tape separators have been incorporated. These are shaped sections of plastic material tensioned between two rows of pins. One set of pins is knurled and forced into the bar which supports the top rollers while the other row is pressed through the wooden bar which spans the down frame.

d) THE TAPE HEADS. FIG. D.2. DIAGRAM

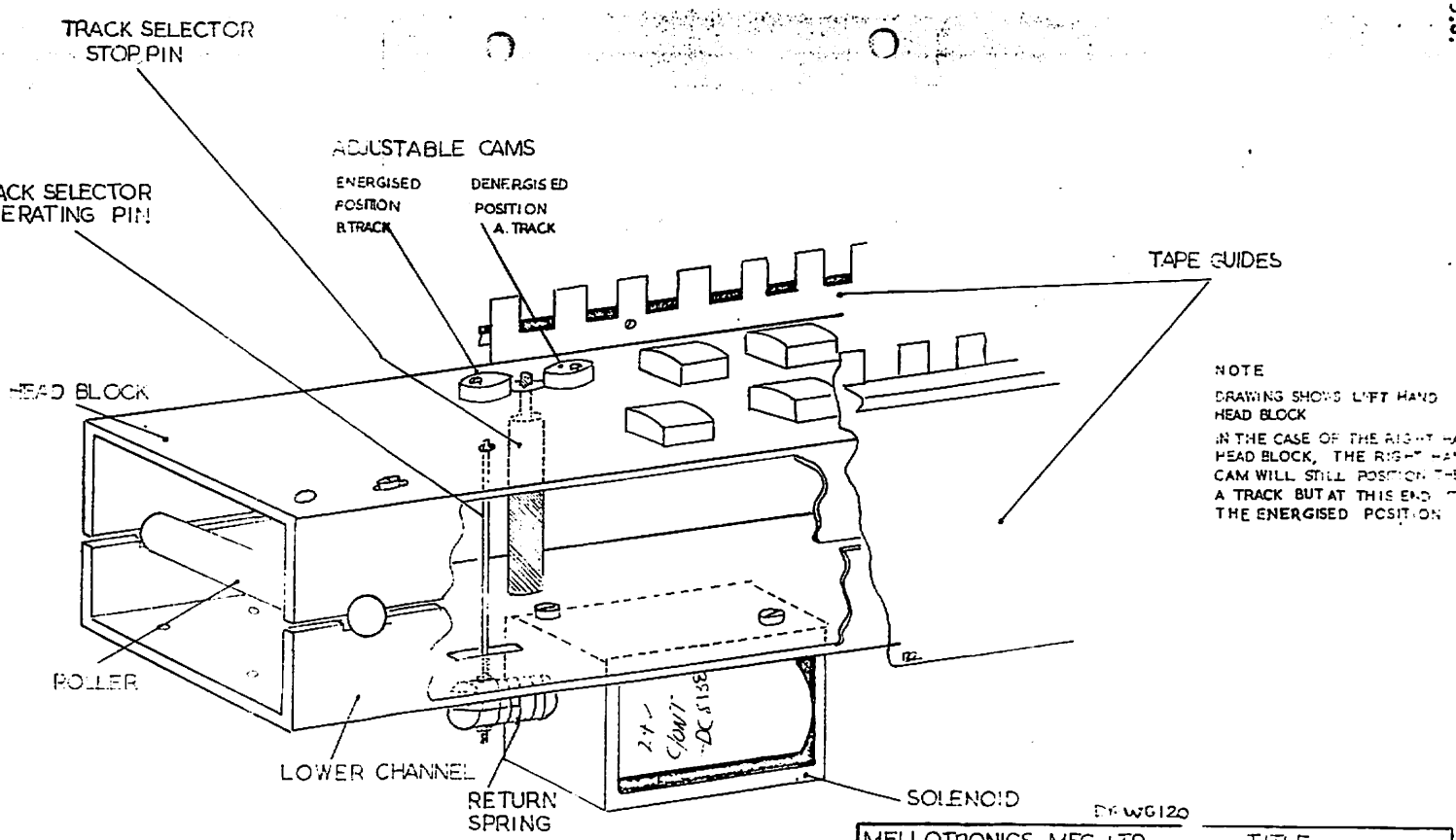
As has been said above, the tape crosses the reproducing heads immediately after leaving the storage loops. The tape is correctly positioned with respect to the heads by the front and rear tape guides. The slots in the guides are only approximately .005" wider than the tape and so care must be taken to see that no damage occurs to them when performing service operations.

The tape heads are mounted in channel section aluminium alloy called "the head block" which is supported by rollers on the lower alloy channel. To prevent excessive side movement of these support rollers, a small section of the lower channel is cut out limiting their travel. The rollers are made of an insulating material as it is essential that no electrical contact exists between the head block and the metal frame. It is for this reason that the W shaped spring which holds the head block down is insulated from the lower channel by insulating washers. The reason for the free mounting as has been explained before, is to allow the whole bank of heads to be moved sideways to reproduce the sound from any of three tracks recorded on each tape. The lateral motion of the head block is controlled by the Electrical Track Selection Switch.

To press the tape into contact with the reproducing head a pressure pad mounted above the tape is used. This consists (see Fig. D.1.) of a felt pad mounted on a shaped arm which is rivetted to a light spring. The spring is secured to the Pressure Pad Support Bar by a 4 BA screw, the hole in the spring being slotted to allow adjustment. The Damping Bars have been introduced to prevent the pad arm from vibrating vertically after being released from contact with the tape.

e) ELECTRICAL TRACK SELECTOR. DIAGRAM D.3.

This unit has been designed to provide positive location of both tracks of the tape by remote electrical control. The system is shown on figure D.3.



As can be seen, a solenoid mounted beneath the lower channel, is used to pull the head block onto Track B of the tape. On de-energising the solenoid, an expansion spring fitted to the solenoid piston will return the head block to Track A.

The solenoid movement is transferred to the head block by means of an operating pin passing through the lower channel. Adjustable cams mounted either side of a stop pin govern the precise track position.

f) THE CAPSTAN. DIAGRAM D.I.

This is in the form of a round bar running the whole length of the instrument and is the means by which the tapes are driven at constant speed over the reproducing heads. The bar is ground to very close limits on diameter and is straightened by a special process at the factory so that the speed of all tapes should be the same.

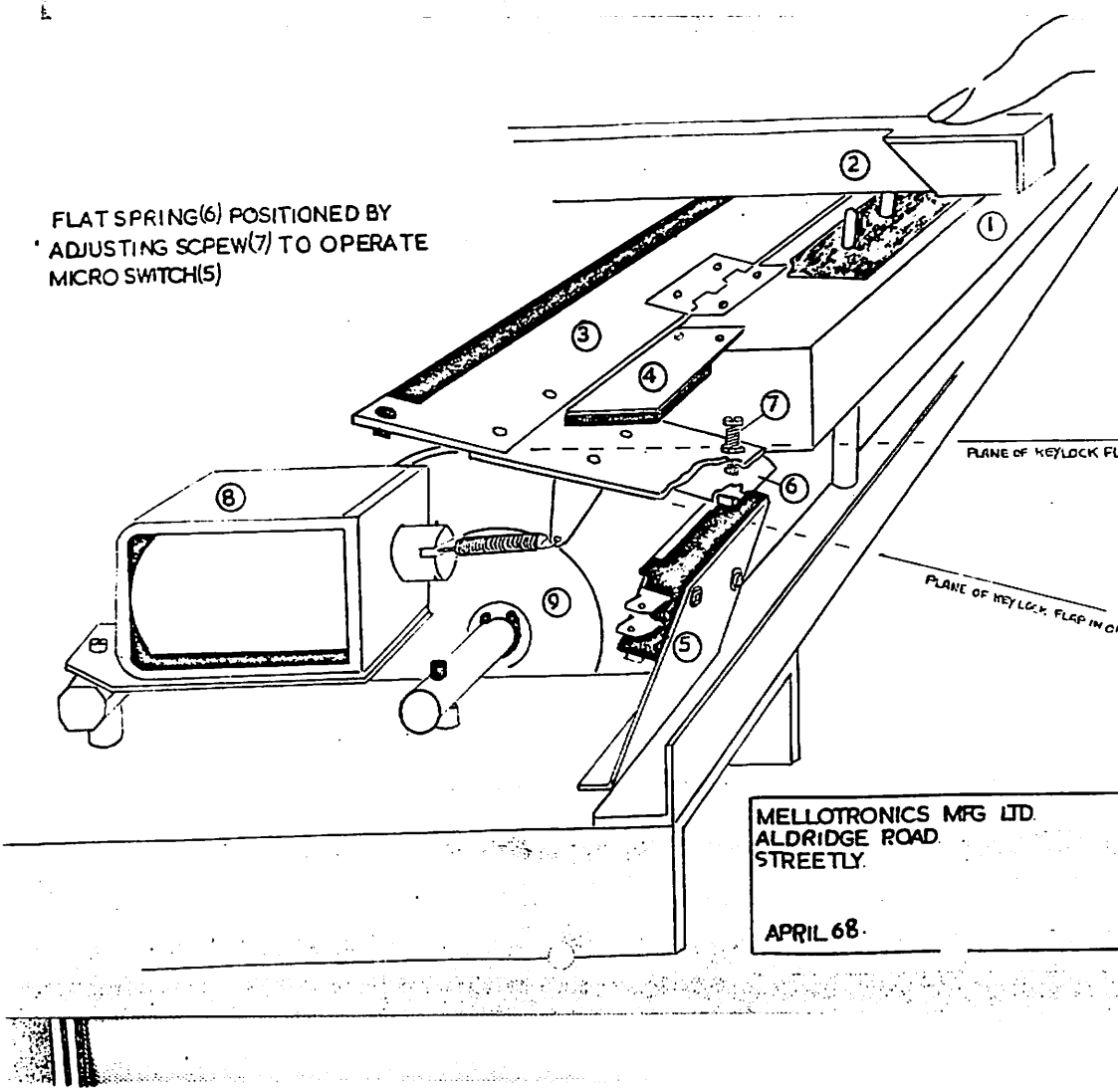
The capstan runs in ball races which are mounted to the frame in special housings, and it is driven at the left hand end by the flywheel. The flywheel is in its turn driven by a belt from the capstan motor, mounted below the frame on the motor mounting board.

g) TAPE STORAGE BOX. DIAGRAM D.I.

This is constructed of wood and is supported behind the capstan on blocks screwed to the motor mounting boards. The tape passes through the box, adjacent tapes being separated by polystyrene dividers which locate in slots in the back and front of the box. The lid prevents the tapes from rising out of the box when the tape is being played.

h) CYCLING MOTOR AND CHAIN DRIVE.

The chain drive is used because it is essential that the front and rear rollers stay in exact synchronism. That is, if the front roller pays out 10 turns of tape, then the rear roller must take up 10 turns of tape otherwise the difference would alter the amount of tape in the storage loop. The cycling motor is a shunt wound D.C. motor with a 30:1 gear box on it.



The speed of the motor when cycling the tapes is 150 r.p.m. of thereabouts. Also driven by the chain is a unit called the SYNCHRONISED SWITCH which enables the STATION SELECTION CONTROL SYSTEM to locate the correct stopping point. See

i) KEYS.

The keys are manufactured from seasoned soft woods which are chosen for their resistance to warpage. The white notes are covered with IVORETTE (Trade Name) and the black are formed by plastic mouldings glued on to the wood.

Each key is mounted on a strip of spring steel which has a hole which locates over a screw in the key mounting bar. A NYLOC nut holds down the spring and provides adjustable tension to each note individually. The front of the key is guided by an oval pin, set in the guide pin bar, which fits in a felt lined hole in the underside of the key. The guide pin can be turned to take up side play in the key which can develop as the felt beds in.

The key also carries two adjusting screws - the front one controlling the pressure pad (See D.1.) whilst the rear one adjusts the pressure on the pinch roller. For correct method of adjustment see .

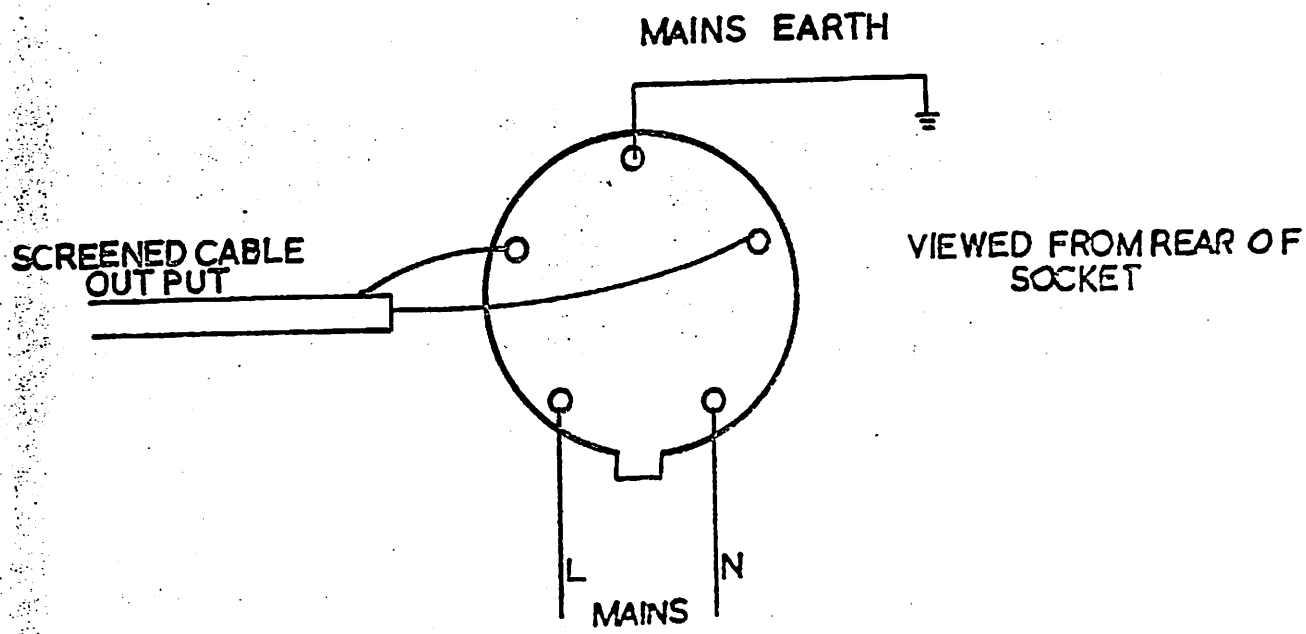
The keys are correctly set for height above the guide pin bar by the key top stop which is an alloy angle with a self adhesive cellular rubber pad underneath.

j) THE KEYLOCK.

This is a device to prevent inevitable damage to the tapes if they were played whilst the instrument was being cycled. (See D.4.). It is obvious that by playing a tape at the constant speed of $7\frac{1}{2}$-inches per second, at the same time that the cycling was carrying the tape at 36" (inches) per second, can only result in severe and almost certainly permanent damage to the tapes. The device consists of a moveable flap, which can be tilted by a linkage pulled by a solenoid. The cycling operation will only commence when

2 – 3 the player's hands are completely removed from the keyboard. This will allow the flap to close a microswitch and thus complete the selected circuit. Should a key be depressed during the cycling operation, contact with the microswitch will be broken and the tapes will come to a dead stop. On releasing the key, the keylock flap will spring back to its operational condition.

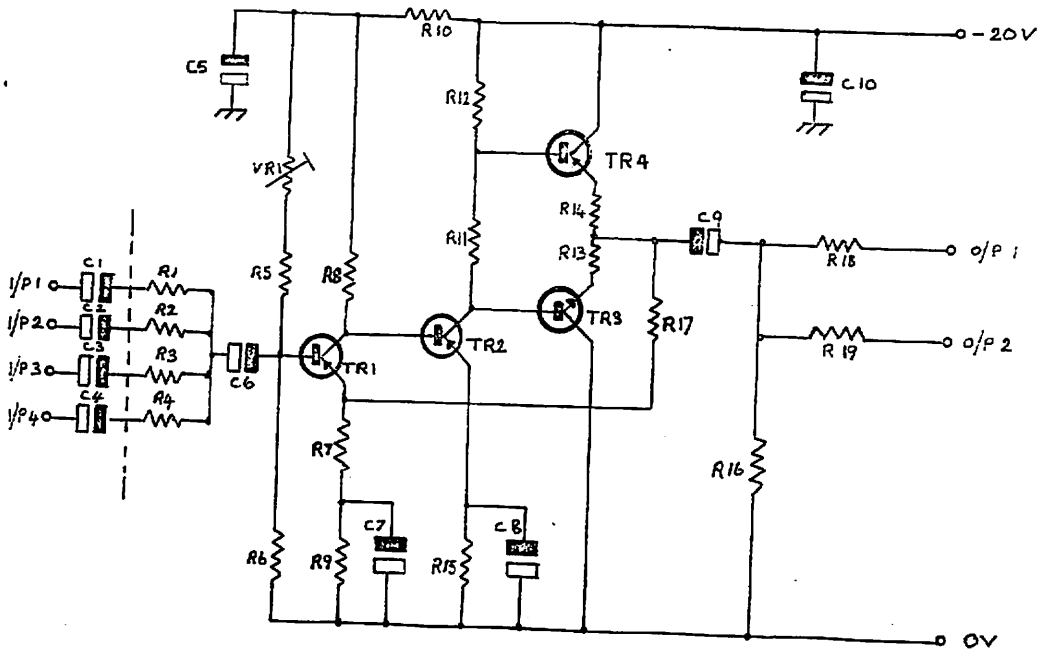
ELECTRICAL/ELECTRONIC FEATURES



D.5.

DRWG NO 102

MELLOTRONICS. MFG.LTD. ALDRIDGE ROAD STREETLY NOV 67	TITLE. MELLOTRON 300. SUB.TITLE. AMPLIFIER & SPEAKER 'CANNON' FEED PLUG



R1.R2.R3.R4. 47K
R5. 100K
R6. 10K
R7. 47
R8. 18K
R9. 180
R10. 15K
R11. 5·1
R12. 1K
R13. 5·1
R14. 5·1
R15. 120
R16. 10K
R17. 4K7 *
R18. 680
R19 680
VR1 100K SKEL P/S

* CAN BE MADE VARIABLE TO GIVE GAIN CAL FUNCTION.

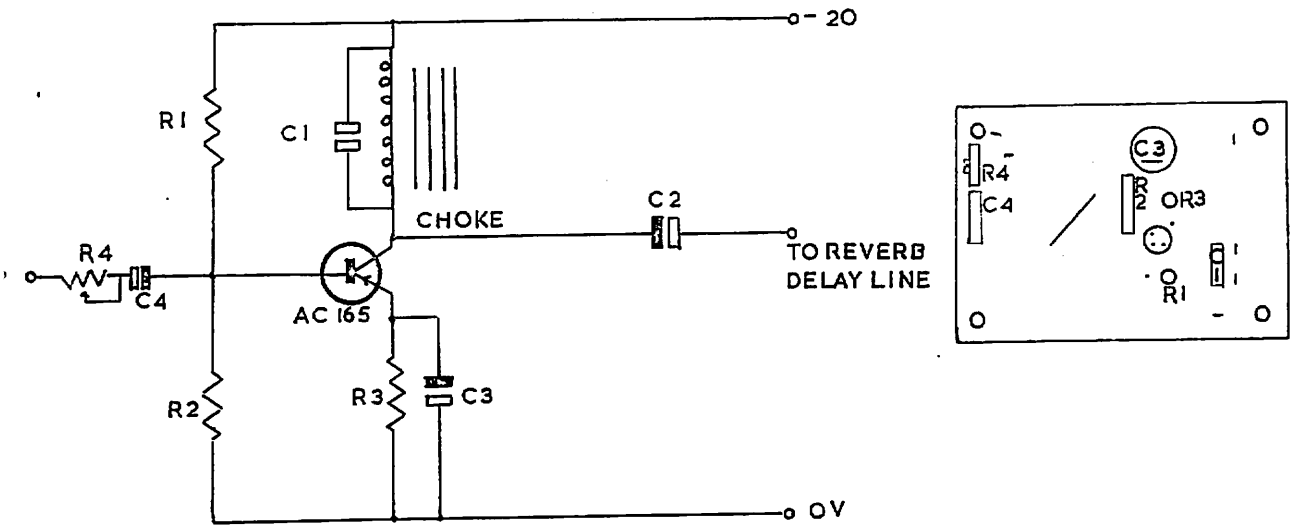
C1.C2.C3.C4. 10mFD
C5. 80mFD 25V
C6. 10 mFD 64V
C7. C8. 200mFD. 64V
C9. C10. 80mFD 25V
TR1. AC113 TR2 AC165
TR3 AC168 TR4 AC165

DRWN 115

MELLOTRONICS MFG LTD
ALDRIDGE ROAD
STREETLY

TITLE
MELLOTRON 300.
SUB TITLE

D.6.



R1 15K
R2 4K7
R3 330
R4 100K SKEL P.S.

C1 .047 uF
C2 80 uF 25 V
C3 80 uF 25 V
C4 10 uF 16 V

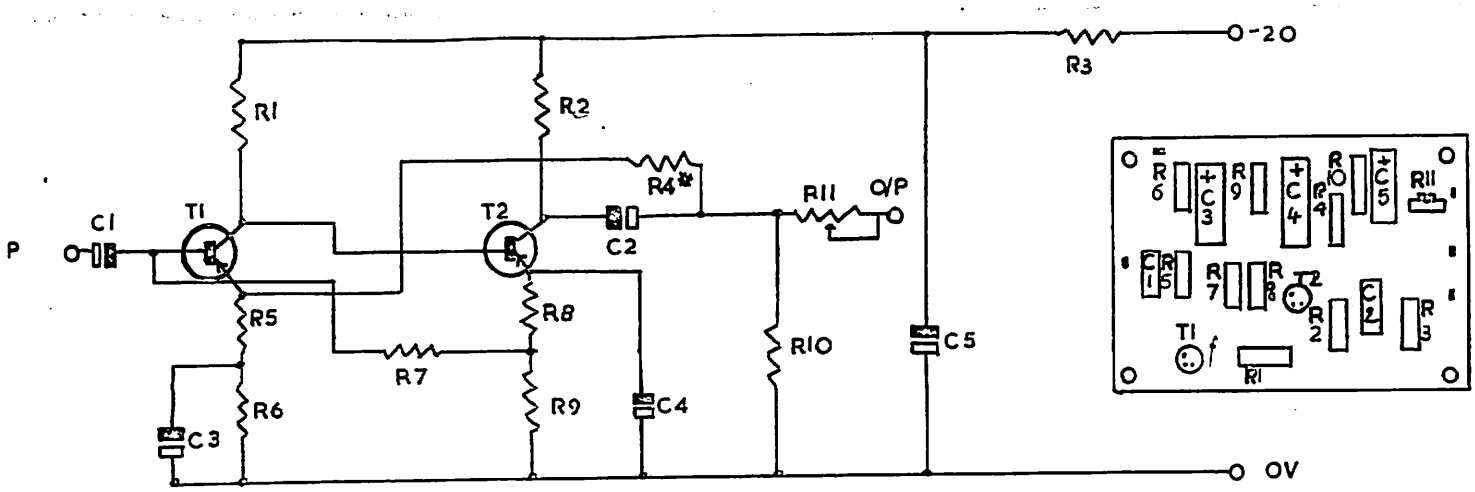
ALL RESISTORS 5% HI STAB 1/2 WATT

D.7.

DRWG NO 107

MELLOTRONICS. MFG. LTD.
ALDRIDGE ROAD.
STREETLY.

TITLE
MELLOTRON 300
SUB TITLE
REVERB DRIVER



R1	33K	C1	10uF 16 V
R2	5K6	C2	10uF 16 V
R3	8K2	C3	125uF4V
R4	220K*	C4	200uF 6-4V
R5	220	C5	80uF 25V
R6	3K3		
R7	4K7	T1	
R8	1K8	T2	2G308
R9	1K		
R10	10K		
R11	100K SKEL P S		

* VALUE TO BE CHOSEN
ALL RESISTORS 5% HI ST 3 1/2 WATT

DRWG NO 108

MELLOTRONICS. MFG. LTD. ALDRIDGE ROAD. STREETLY.	TITLE MELLOTRON 300 SUB TITLE REVERB PLAY PRE-AMP BOARD
DEC 67.	

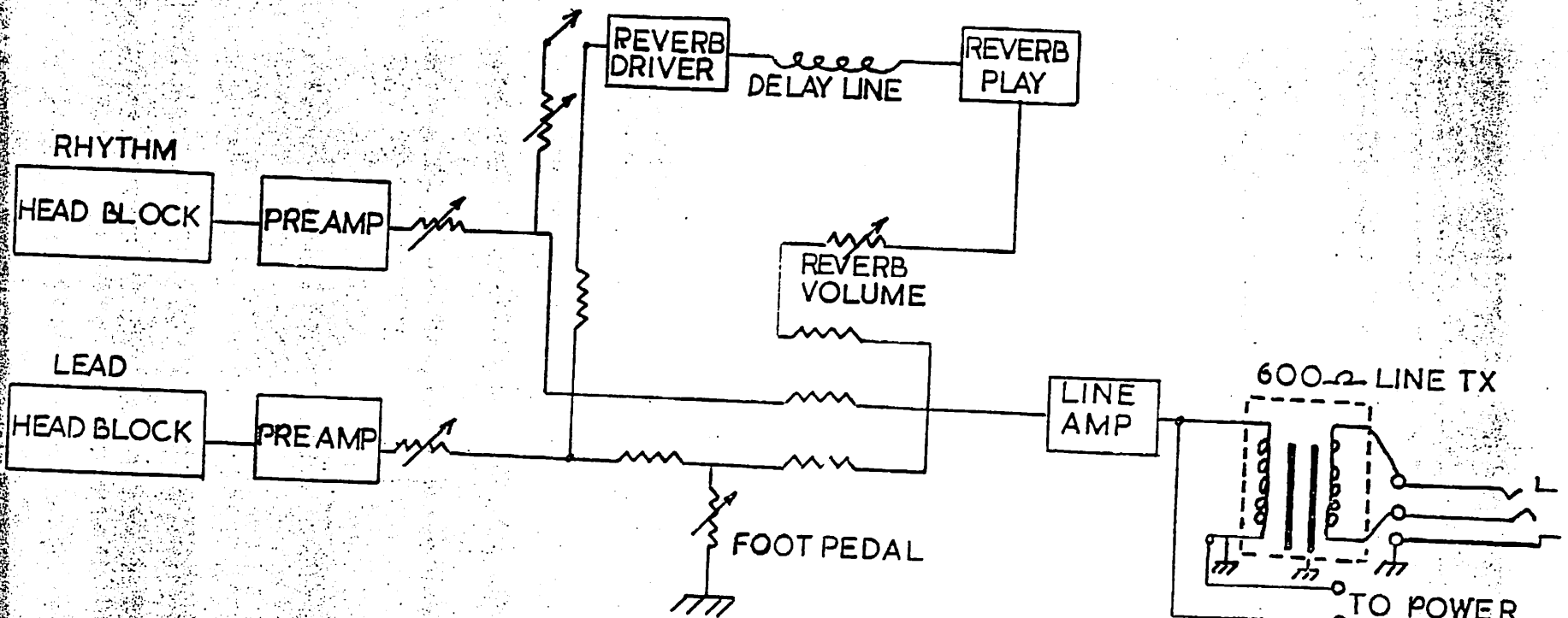
ELECTRICAL/ELECTRONIC FEATURES.

Reference to the Block Schematic Drawing No. D.10. shows the electronic and electrical lay out of the Model 300. Commencing at the lowest level point of the electronics - the output of the two headblocks. The left hand, or Rhythm Section, of the unit is fitted with 19 Magnetic Replay Heads and the right hand, or Lead Section, of the instrument is fitted with 23 Heads. These are of the low impedance type and have an inductance of 3MH. Headblocks are connected by coaxial cables to their appropriate pre-amplifiers.

* Each pre-amplifier Type PA6 (circuit of which appears in Drawing No. D.9.) provides the necessary equalisation to the NARTB characteristic (it is provided with a pre-set output level control and a small amount of equalisation adjustment to compensate for variation in magnetic heads) and raises the head output level to approximately - 18 DBM from a fully modulated tape. These outputs are taken to the independent left and right hand channel volume controls. At this point a portion of the mixer output is tapped off and fed into the reverbration, or delay line driver amplifier, which is again amplified by its play-back amplifier and fed back into the mixer via the reverbration volume control. A Selector Switch is provided on the control panel to allow either the Lead Section or the complete Keyboard to be reverbrated.

The mixed signal is then taken via mixing resistors into the line amplifier which raises the level to 0 DBM at the output jack socket which allows a peak output of approximately + 10 DBM. The external jack socket is completely isolated by a High quality 1 : 1 isolation transformer and avoids the possibility of earth loop problems when the Console is connected to external apparatus such as amplifiers, tape recorders, broadcast consoles, etc. The line amplifier output is also fed to the Cannon output socket into which the LSA 300 Amplifier Loud Speaker Unit is plugged - this socket also supplies the mains power to the 300A Amplifier, and additionally earths this unit.

* Instruments commencing Serial No. 3/026 A will be fitted with equalisation controls on the front control panel.



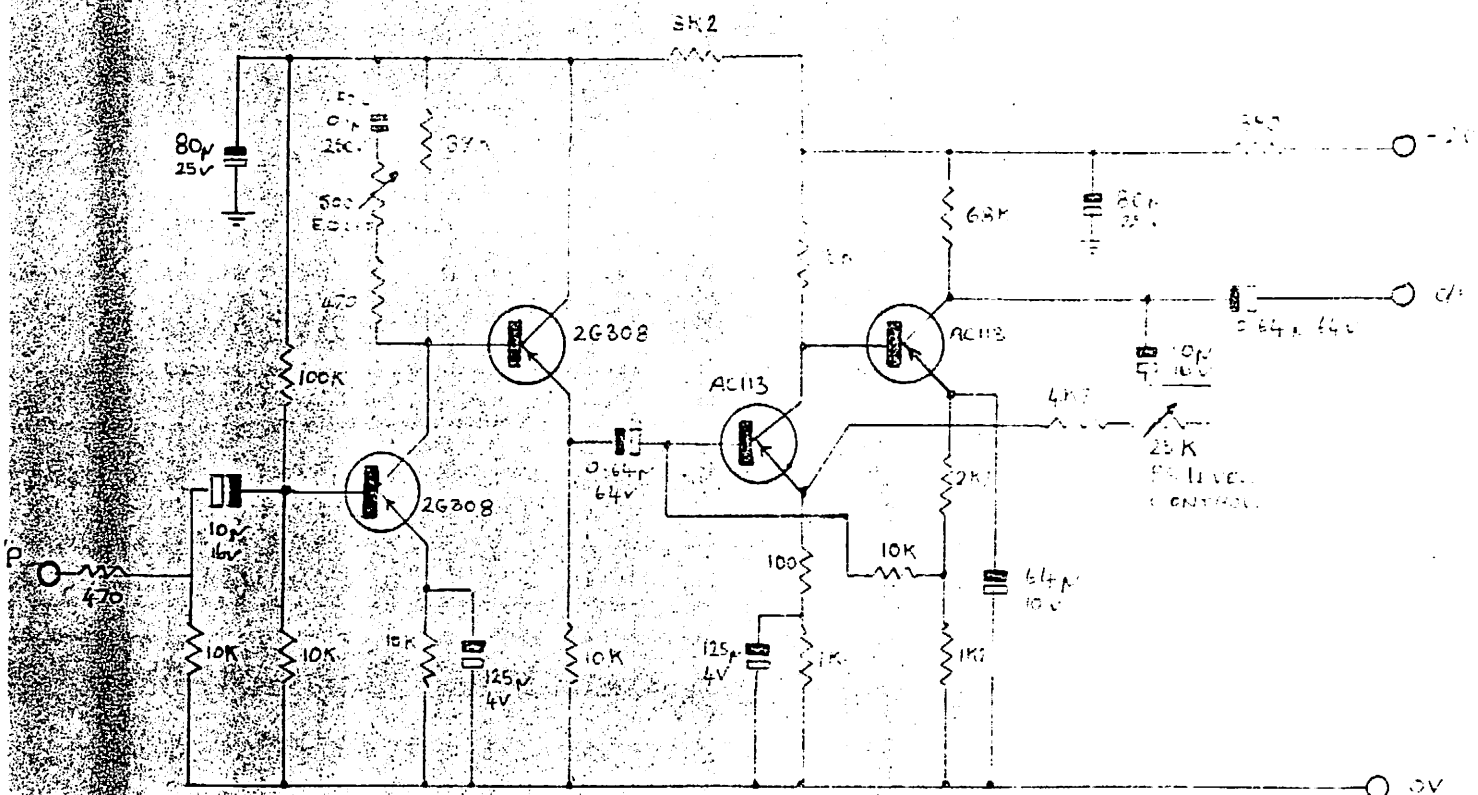
DRWN116

MELLOTRONICS. MFG LTD.
ALDRIDGE ROAD
STREETLY

JAN 68

TITLE
MELLOTRON300
SUBTITLE

BLOCK DIAGRAM



DRWG NO 122

MELLOTRONICS MFD LTD ALDRIDGE ROAD STREETLY APRIL 68	TITLE MELLOTRON 300 SUB TITLE PRE AMP P.A.6

2 – 4 POWER SUPPLY - MELLOTRON 300. CIRCUIT DIAGRAM D.11.

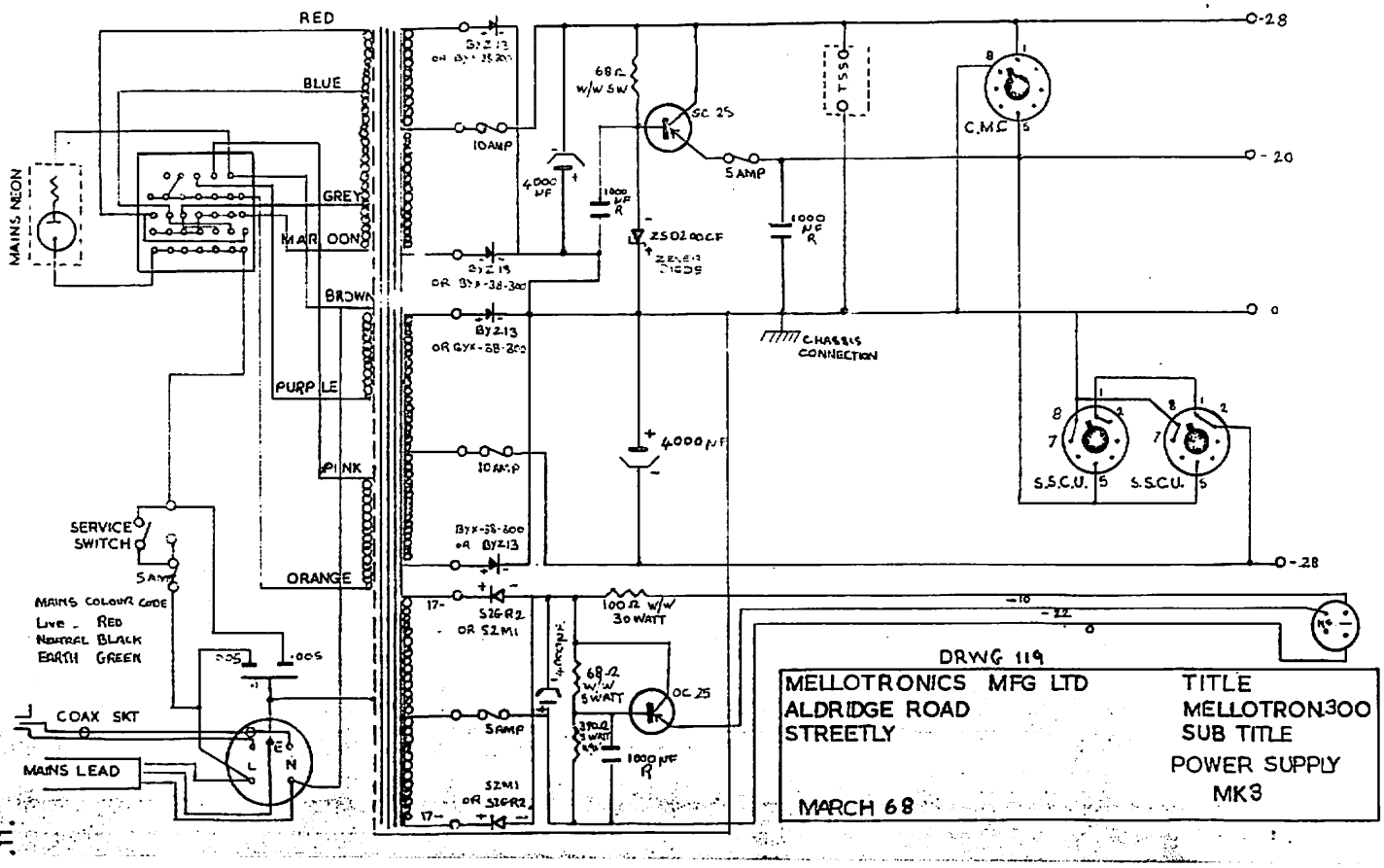
In this unit a range of Mains voltages, from 100 to 240v at 50 or 60 Hz can be used to provide the various voltages needed to operate the electronics of the MELLOTRON 300. The peak power that can be required by the Unit is 150 watts but this is only an intermittent requirement. The usual running power is of the order of 65 watts but the mains fuse is rated to cope with the surge.

As can be seen from the circuit diagram there are two switches in the live lead, so that the P.U. can be energised either by use of the Front Panel switch S1 or the service switch S2. The service switch is mounted on the power supply chassis.

A full wave rectifier with a current capacity of 3 amps provides approximately 24v, which is de-coupled and further smoothed giving an output voltage of about 20v, this supply being used to power the Preamplifiers, Line Amplifier and Reverb Driver Unit. This supply is further de-coupled to provide 10v for the foot pedal lamp.

A bridge rectifier provides the supplies for the Capstan Motor Control; these are -26v at 5 amps and -20v at 1 amp stabilised. The -20v supply is used also for the S.S.C.Us.

A further 10 amp f/w rectifier provides current for the Cycling Motors via the S.S.C.Us. The voltage here is approximately 26-28 volts. A robust socket is fitted on the Power Supply to carry mains supply voltage and audio signals to an external amplifier and speaker where used.



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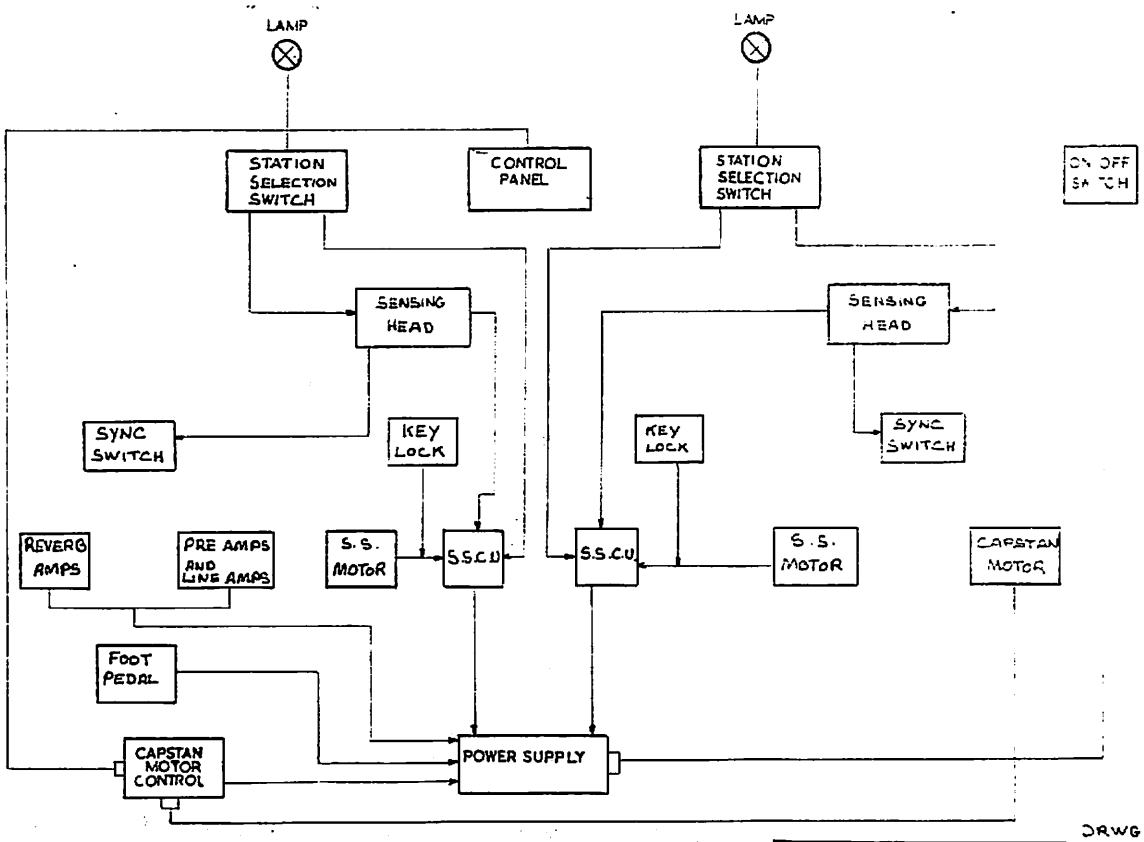


DRWG No 121

MELLOTRONICS. MFG. LTD
ALDRIDGE ROAD.
STREETLY.

TITLE
MELLOTRON300
SUB TITLE
BLOCK SCHEMATIC

APRIL 68

p.12.

POWER AND CONTROL INTERCONNECTIONS. FIG. D.12.

Shown in this diagram are the connections between the power supply and the various units which it feeds, and also the interconnections of the station selection control system. The plugs and the wiring of the sockets has been so arranged it is difficult to insert any plug into a socket not intended for it and even if this is done, no damage should result.

POWER SUPPLY. FIG. D.11.

In this unit a range of Mains voltages, from 100 to 250v. at 50 or 60 cps. can be used to provide the various voltages needed to operate the electronics of the MELLOTRON. The peak power that can be required by the Unit is 500 watts but this is only an intermittent requirement. The usual running power is of the order of 100 watts but the mains fuse is rated to cope with the surge.

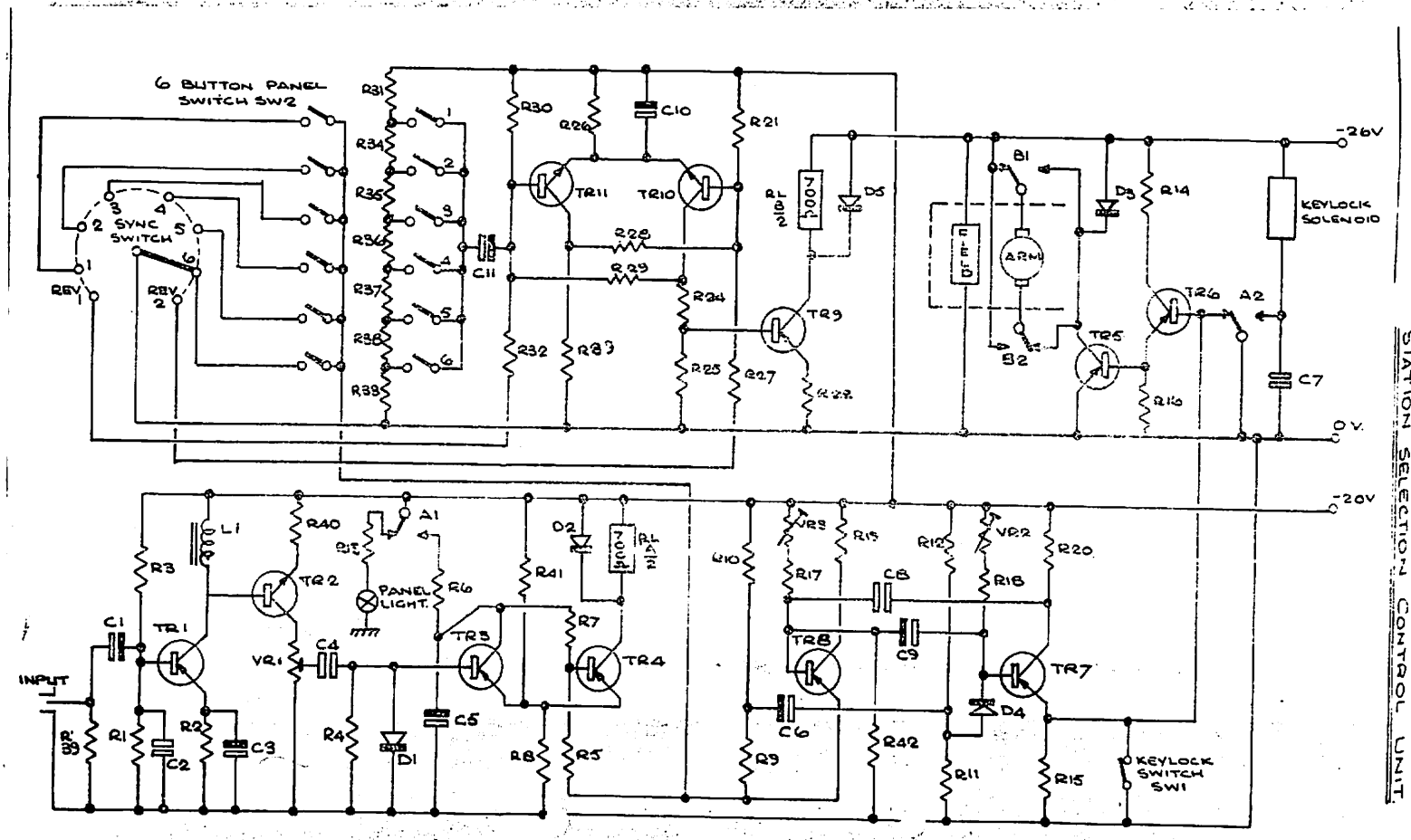
There are two switches in the live lead, so that the P.U. can be energised either by use of the ON/OFF switch on the control panel or the service switch. The service switch is mounted on the power supply chassis.

SENSING HEAD BRACKET.

Screwed to the top of the inner capstan bearing housing this unit carries the head which detects the presence of the index signal on the sensing tape. Also mounted on this bracket is the socket which enables the wiring from the S.S.C.U. to be connected to the synchronised switch.

STATION SELECTION SWITCH.

This is a six button, self cancelling, switch which enables the direction and extent of cycling to be controlled by the player. The resistors R34 to R38 in Fig. are wired between the tags of the switch.



STATION SELECTION CONTROL UNIT. CIRCUIT DIAGRAM D.13.

The function of the Station Selection Control Unit (S.S.C.U.) is to control the operation of "cycling" (See 1 - 1). The precision of the system has to be great as is explained in and the way this is achieved is as laid out below:-

The system comprises four main parts:-

The cycling motor.

The index tape.

The synchronised switch.

The electronics or S.S.C.U.

THE CYCLING MOTOR.

This is a shunt wound unit operating from 28 volts D.C. In the normal fast run condition, the field is connected permanently across the supply, the armature being supplied by the output transistor. TR5 is run in the "bottomed" condition. During the inching process, or slow run condition, TR5 is alternatively cut off or "bottomed" by the multivibrator TR7, TR8 and switching transistor TR6. The time constants C8 (R17 + VR3) and C9 (R18 + VR2) control the "On" and "Off" periods respectively.

THE INDEX TAPE.

The tape has blocks of 1 Kc/s signal at saturation level recorded on it in such a position that the centre of the block, 3/8" long, is the exact start of the signal on the sound tapes. There are thus six blocks corresponding to the six stations of tape.

THE SYNCHRONISED SWITCH.

This switch is driven from the chain which connects the cycling motor to the front and rear storage rollers. It consists of an earthed wiper, driven by a worm and pinion, and a printed circuit board into which are soldered copper contact pins. The wiper moves in a

circle and makes contact with the pins which are so positioned that the wiper is symmetrically positioned over a pin when the appropriate index signal is energising the sensing head. There are therefore six pins corresponding to the six index signals. Two extra pins provide automatic reversing, should the system overrun the end positions. It should be noted that due to the width of the wiper, this actually first makes contact with the pin when the index signal is about 12" away from the sensing head.

THE ELECTRONICS.

This comprises three main parts:-

THE MOTOR DRIVE CIRCUIT (outlined above).

THE MOTOR DIRECTION CIRCUIT.

THE INDEX SENSING CIRCUIT.

MOTOR DIRECTION CIRCUIT.

Motor direction is dictated by the condition of relay B/2 and this is arranged to be de-energised when the motor is driving the tapes from a low numbered selection to a high one. This is achieved as follows. The current thro' RLB/2 is controlled by TR9 which is switched on or off by the potential difference across R25. The state of current in R25 is controlled by the bistable trigger pair TR10 and TR11. When TR10 is conducting R25 will have a current of about 18 mA passing which will give sufficient P.D. to bottom TR11 and energise RLB/2. If TR10 conducts, then TR12 must be cut off and to do this a negative pulse must be given by the STATION SELECTOR SWITCH SW2. To see how this is done, consider that Button (6) on the switch is depressed. This will mean that the side of C11 nearest the switch will be at a potential of -4 V approximately. Button (5) is now pressed, cancelling Button (6), and the voltage at the switch side of C11 is suddenly raised to -7 V, the change in voltage being felt as a negative pulse of -3 V by TR11 which is thus switched off. By a similar argument, if a higher numbered button were depressed when a lower one was already selected, a positive pulse would be given which would cause the relay to

be de-energised.

If the situation should arise that, for some reason, such as changing one's mind, about a selection while cycling was in progress, the motor were running in the wrong direction, seeking the selected stopping point (See 1 - 2), the wiper on the synchronised switch would eventually make contact with one of the end reverse contacts which have been wired in such a way as to make the motor reverse direction whenever they are touched. In order to make the motor overrun position (I) RLB/2 must have been energised from the previous argument. To reverse it we must de-energise the relay and this is done by putting the contact called REVERSE (I) adjacent contact (I). When REVERSE (I) is connected to OV, R32 passes a current which is sufficient to 'bottom' TRII which in consequence de-energises the relay and makes the motor run away from the contact.

TAPE SENSING CIRCUIT.

The function of this is to de-energise the RUN relay (RL A/2) when the correct station signal on the index tape passes over the sensing head. The signal sensing circuit is formed by transistors TRI to TR4. TRI is a tuned amplifier with maximum gain at about 1000 cps. TR2 is an amplifier feeding the gain control VRI. TR3 acts as a pulse integrator, while TR4 is the relay driver. The continuous burst of signal is obtained when the index recording passes over the sensing head.

To give an understanding of the operation of the control unit, a description of an operation cycle follows. Let us consider that the synchronised switch is in the position as shown in Fig. D.13.. To get to this position the Button (6) must have been depressed and so CII will be connected to the junction of R38 R33. Under these conditions, the emitter of TR8, R5 and R9 will be connected to OV. The effects of this condition will become clear later.

If we now press Button (5) the connection of CII will be suddenly changed to the junction of R37, R38, which will give the required negative pulse to the trigger circuit to energise RLB/2. See above for the argument concerning motor direction. At the same time, the

connection to OV of the emitter of TR8 etc. via the Synchronised Switch is interrupted. TR8 is unable to pass any current and multivibrator action between TR7 and TR8 is not possible. TR7 will thus be continuously 'bottomed' because of the heavy base current supplied by R18 + VR2 and will draw a heavy emitter current of the order of 20 mA. It will be noticed that at this time R15 is shorted out both by A2 relay contact and SW1, the keylock microswitch. Thus TR6 will draw no current at this time and similarly TR5. The motor is therefore not running. The voltage at the emitter of TR8 will rise towards about -18V and thus also supply TR4 with sufficient base current to 'bottom' it. RLA/2 is energised and Contact A changes over, extinguishing the pencil light and supplying an alternative path for the base current to TR4 base. At the same time contact A2 changes over, energising the keylock solenoid and removing one of the short circuits across R15.

Then the keylock is fully in position that is, it is safe for the tapes to cycle, the microswitch SW1 is operated and the other short circuit across R15 is removed. This enables the P.D. across R15 to rise to such a value that TR6 is 'bottomed' and the entire emitter current, about 250 mA is used to supply the base current of TR5. This is more than enough to 'saturate' TR5 and the motor will now run. This will cycle the tapes and will at the same time turn the wiper of the synchronised switch in the direction of contact (5).

As we have said above, during this period the voltage at the emitter of TR8 will rise toward -18V as capacitor C6 charges. This will typically take about 2 seconds and when fully charged, C6 will have a P.D. of -15V across it. This is because the junction of R24 and R23 is about -3V, D4 having no effect since it has a reverse bias of -2V across it. This state of affairs lasts until the wiper on the synchronous switch first makes contact with pin 5. At this instant the emitter of TR8, R5 and R9 are earthed to OV, and the anode of D4 is immediately driven to +7V because C6 cannot change its state of charge instantaneously. D4 thus conducts and drives the base of TR7 to +7V thus cutting it off and removing the drive from the motor. TR7 is cut off until C6 has discharged sufficiently to stop D4 conducting, the time to do this lasting about $1\frac{1}{2}$ seconds, during which time the inertia of the moving tapes is lost.

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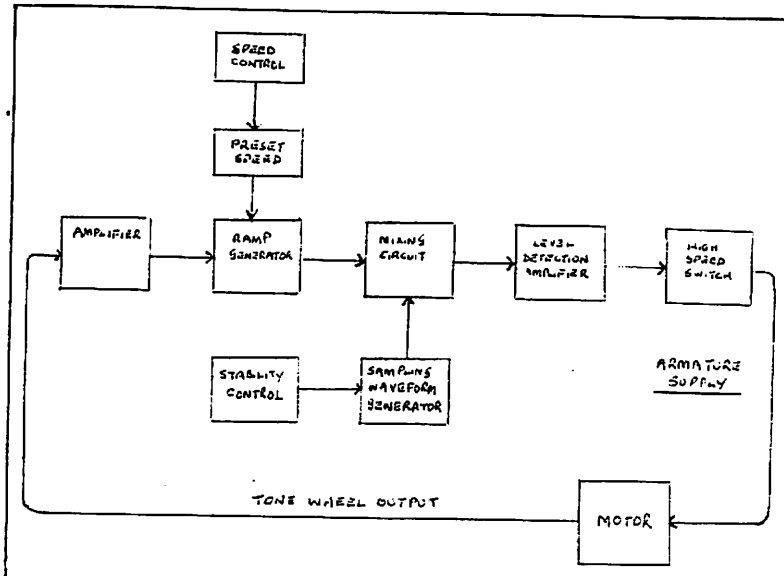
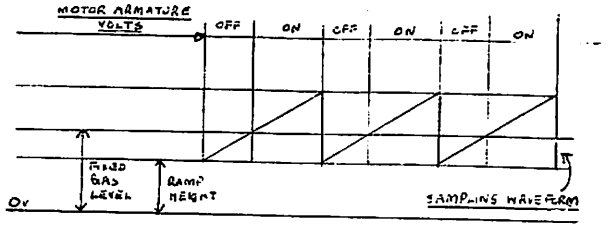
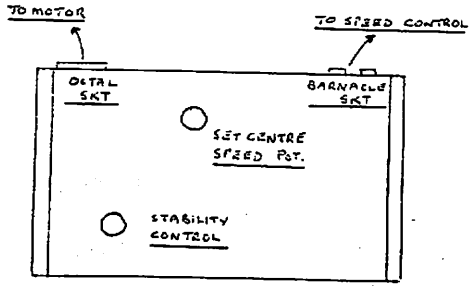
CAPSTAN MOTOR CONTROL





NOTE - AVERAGE ARMATURE VOLTS DEPENDS ON RATIO BETWEEN ON AND OFF TIMES



EXTERNAL VIEW OF UNIT

Normal multivibrator action then follows and pulses of voltage are developed across RI5, a typical pulse being 20 mS duration spaced from the next by 80 mS. This will give an equivalent tape speed of about 1½ inches per second. The tapes are thus 'inched' along in a series of short jumps until the block of index signal passes over the sensing head.

The index signal is amplified by TRI and TR2 and converted to negative going pulses by C4, R4 and DI. These pulses are used to cause TR3 to discharge C5 and reduce the voltage at the base of TR4 to such a level that the RLA/2 de-energises. Contact A, changes back, removing the alternative current path to the base of TR4 (the other has already been removed when the end of R5 was connected to OV by the synchronised switch). The panel light is illuminated again and at the same time A2 changes back, short circuiting RI5 once more and stopping the cycling motor. The keylock is released and the instrument is ready for use.

I) CAPSTAN MOTOR CONTROL. DIAGRAM D.14.

The Speed Control system used with the Mellotron 'FX' Console uses the Pulse Width Modulation system to vary the average armature voltage. The system is arrange so that a reduction in motor speed, due to extra load, will cause an increase in average armature voltage.

The tone generator mounted on the motor shaft is used as the control input. The output of the input amplifier is used to re-set the ramp generator, the height of the ramp depending on the speed control setting and the frequency of the input. The slower the motor runs, the greater will be the ramp height. The sample waveform generator supplies a sawtooth waveform which is D.C. restored to the peak amplitude of the ramp. This composite waveform is used to drive a Level Detection Amplifier which gives an output when the input exceeds a certain fixed voltage level. This output is used to operate a high speed switch in such a way as to switch the motor on when the input to the level detection amplifier is in excess of the fixed voltage. As explained above, when the

motor speed reduces, the ramp height increases, thus switching the motor on for a larger proportion of each cycle of sample waveform. The loop gain of the system depends on the amplitude of the sample sawtooth and too small an amplitude will cause 'hunting' (violent over correction). It is, therefore, necessary to obtain a compromise between satisfactory sensitivity and excessive gain.

ALTERNATIVE CAPSTAN DRIVE SYSTEM.

As an alternative to the normal variable Capstan Speed Control the unit can be fitted with a synchronous external rotor motor of the hysteresis type which would operate via its coupling capacitor 13.5 mfd 275v rms working (A.C.) from a 110v A.C. supply derived from a tap on the mains transformer fitted into the Power Pack. With this unit installed the capstan and, therefore, tape speed will be held constant by the mains frequency which can be 50 or 60 cps. The motor would be fed via best quality 3 core cable as used for connecting the Mellotron to its main supply. The green wire being connected to properly earth the synchronous motor and its mounting bracket the earth connection on the Power Pack.

This will apply to instruments commencing Serial No. 3/026 A.

MELLOTRON AMPLIFIER/ LOUDSPEAKER CABINET TYPE 'LSA 300'

This unit is a carefully designed loudspeaker enclosure fitted with a two-way speaker system with a large elliptical loudspeaker for the bass and middle frequencies and a small foam-suspended high frequency unit.

Mounted below these, in its own compartment, is a stabilized fully Transistorised 12 watt amplifier complete with its own power supply. The LSA 300 unit is connected to the Mellotron 300 unit by plugging in its multipin self locking plug into the socket provided on the console. Each LSA 300 unit is also fitted with an identical follow on socket so that any number of units can be plugged into each other to provide audio power, in units of 12 watts to any desired power.

3 – 1 THE 300A AMPLIFIER

The Amplifier unit is a push/pull solid state unit with an undistorted output of 12 watts and a peak output of 16 watts equipped with its own power supply. It has a frequency response of 30 c/s - 15 k/cs of ± 1 dB. Its signal to noise ratio is - 85 dBM below full output. A pre-set input level control is fitted to enable LSA 300 units to be matched for similar outputs.

The mains transformer is properly double wound and insulated and sectionalised, to allow operation on various voltages. Both mains and internal supplies are independently placed.

SPECIFICATION

SUPPLY VOLTAGE

100 - 125V, 60 c/s

200 - 250V, 50 c/s

Consumption: 40W peak

CIRCUITRY

Solid State

AUDIO OUTPUT

15 watts

Continuous sine wave output with a total harmonic distortion of .2%

LOUDSPEAKER SYSTEM

2 way high quality loudspeaker system comprising a heavy duty 12" x 7" elliptical low frequency speaker and a 3" foam suspension high frequency unit rated at 20 watts.

A simple passive cross-over coupling is used.

The speaker units are acoustically matched to a vented enclosure, and the amplifier unit is mounted in a separate compartment at the base of the cabinet.

CONNECTORS

The LSA 300 is complete and couples to the Mellotron 300 via a 3-yard P.V.C. sheathed heavy duty multicore cable terminated with an unbreakable lock-in Cannon plug. This fits directly into the socket on the rear of the 300 Console and feeds both speech and mains

voltages to the amplifier.

Each LSA 300 unit is equipped with a duplicate socket so that any number of speaker/amplifier units can be plugged in with a follow-on arrangement.

DIMENSIONS

HEIGHT - 29½"

WIDTH - 19 3/8"

DEPTH - 11 3/4"

WEIGHT

62 lbs. (28.1 kg)

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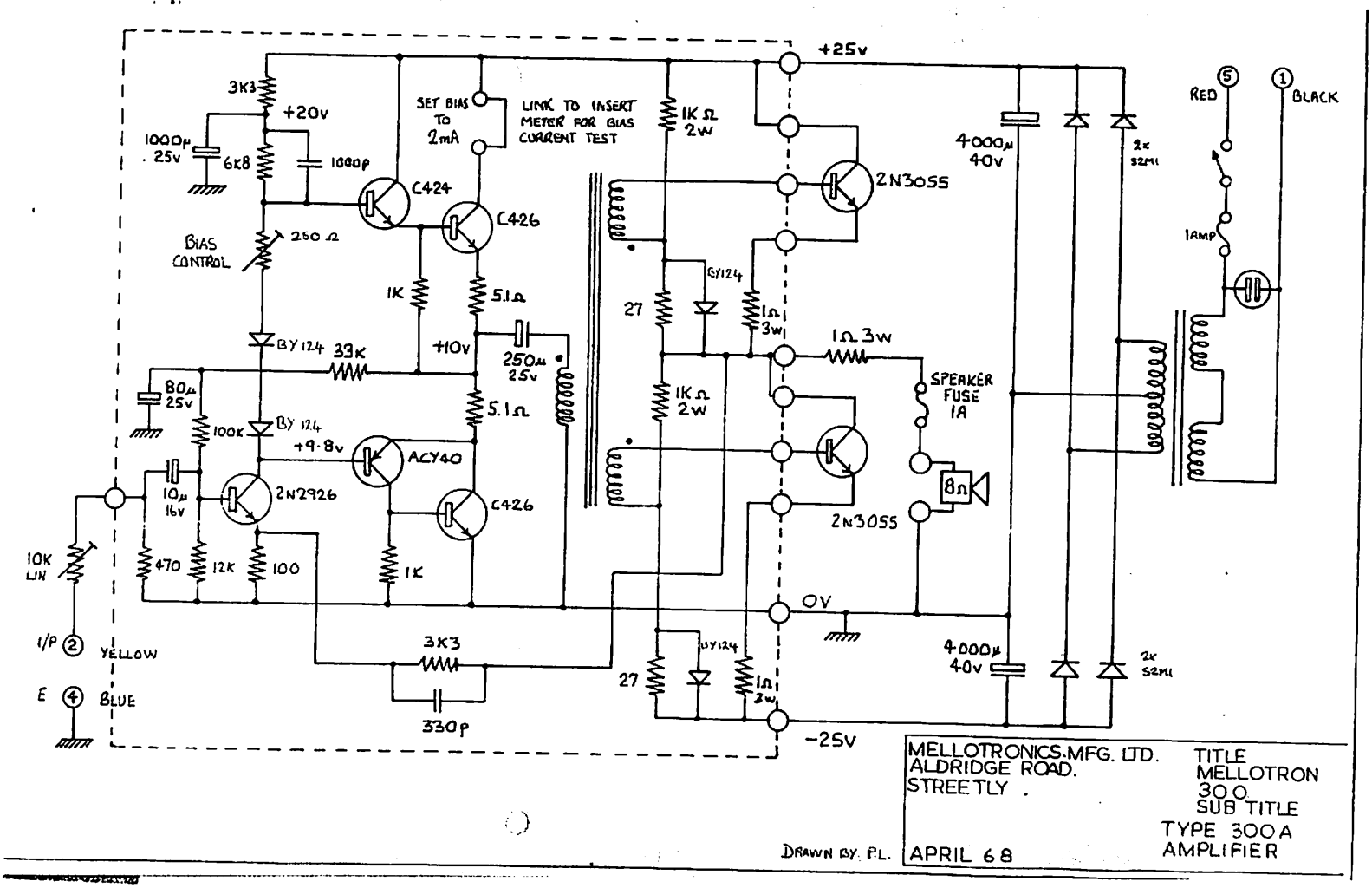
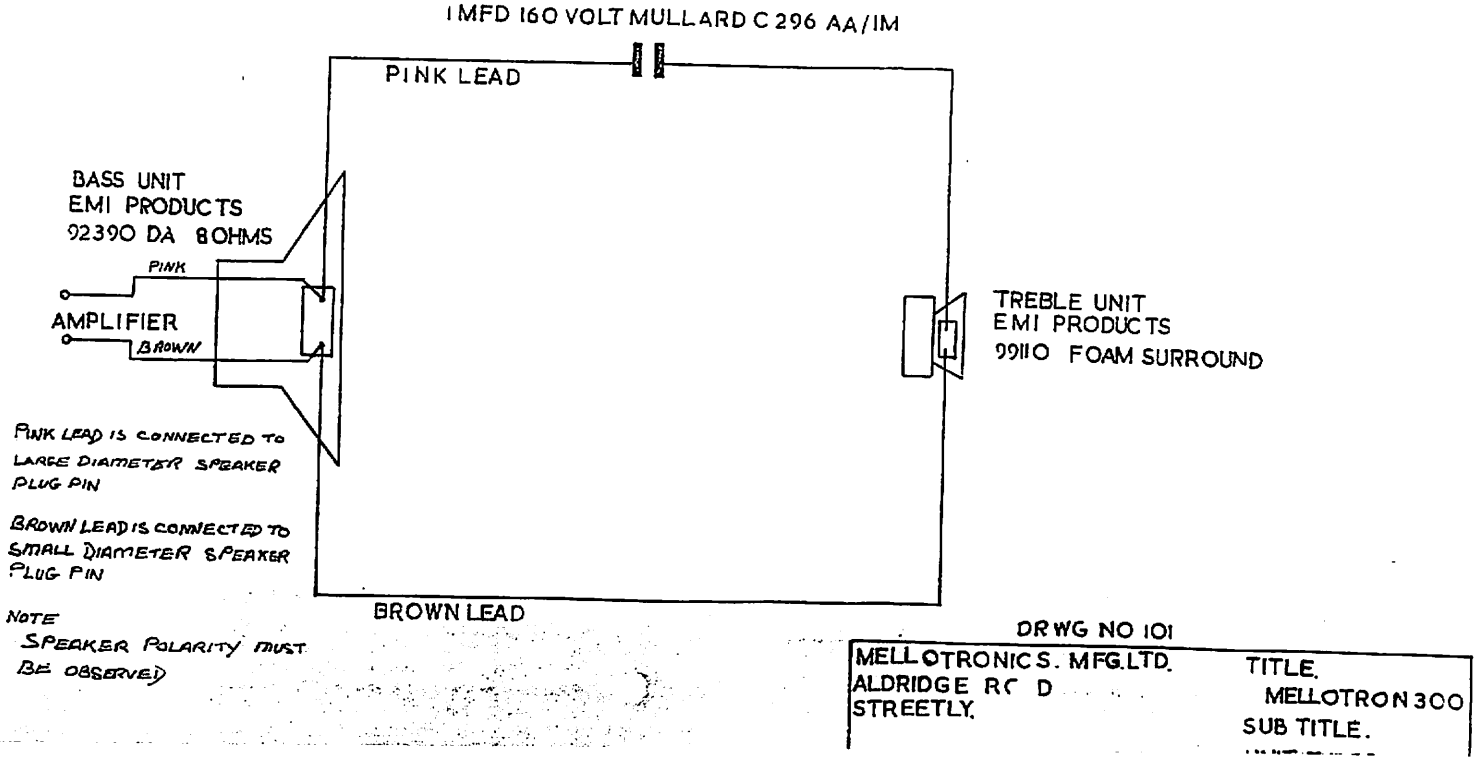
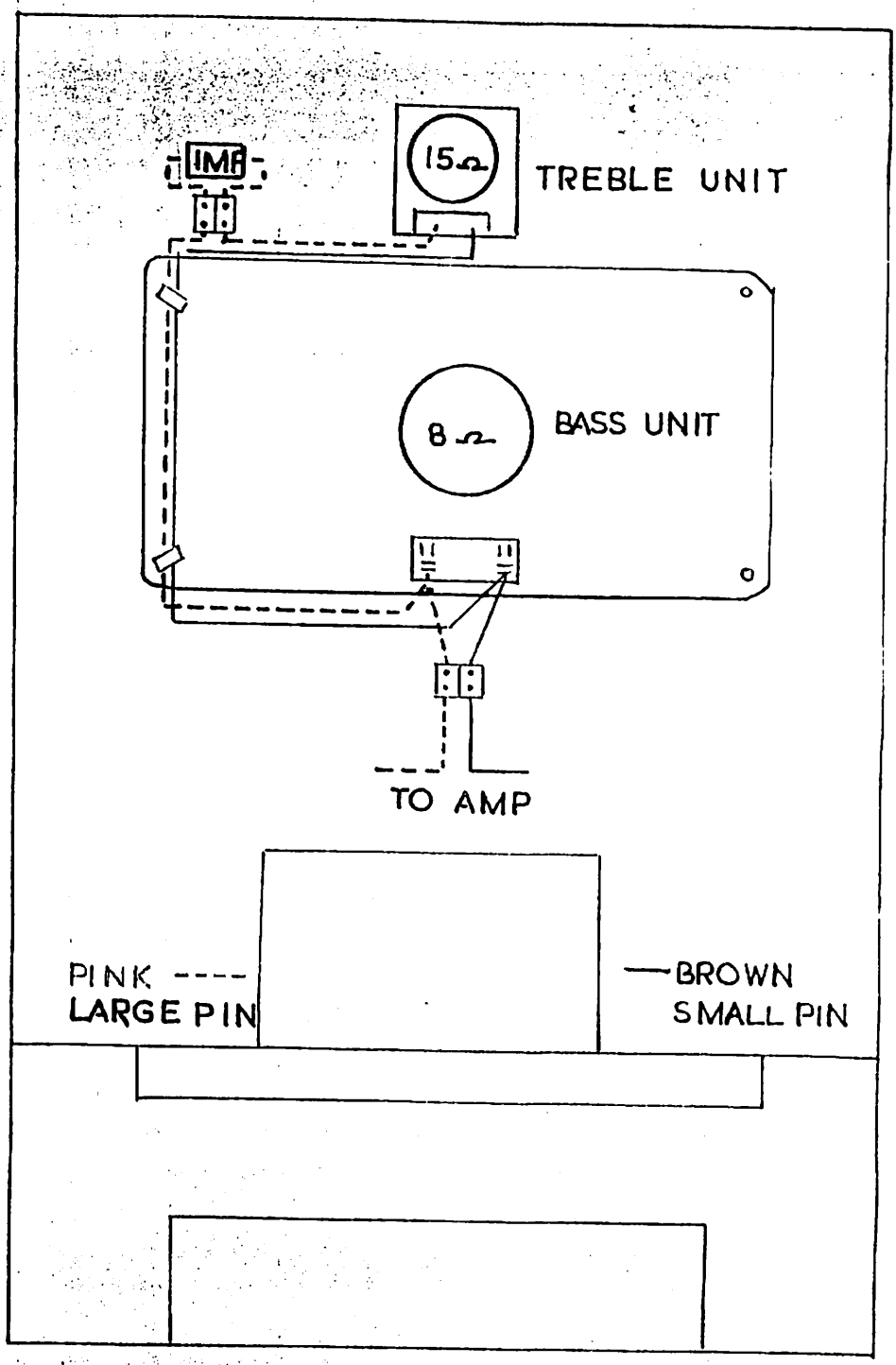






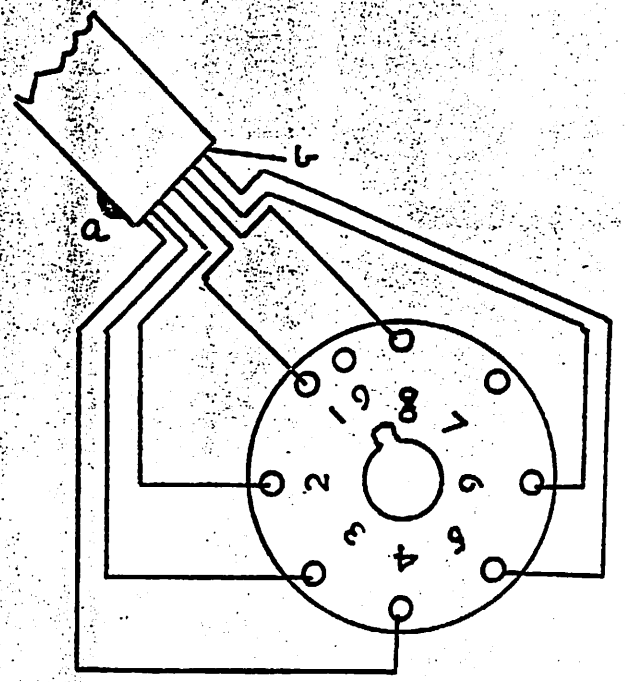
MELLOTRONICS MFG LTD
ALDRIDGE ROAD
STREETLY

JAN 68

TITLE
MELLOTRON 300
SUB TITLE
LOUD SPEAKER
LAY OUT &
WIRING

DRWG NO 114

NOTE
SPEAKER POLARITY MUST BE STRICTLY OBSERVED.
PINK LEAD IS CONNECTED TO LARGE DIAMETER SPEAKER PLUG PIN.
BROWN LEAD IS CONNECTED TO SMALL DIAMETER SPEAKER PLUG PIN



R.H. PLUG

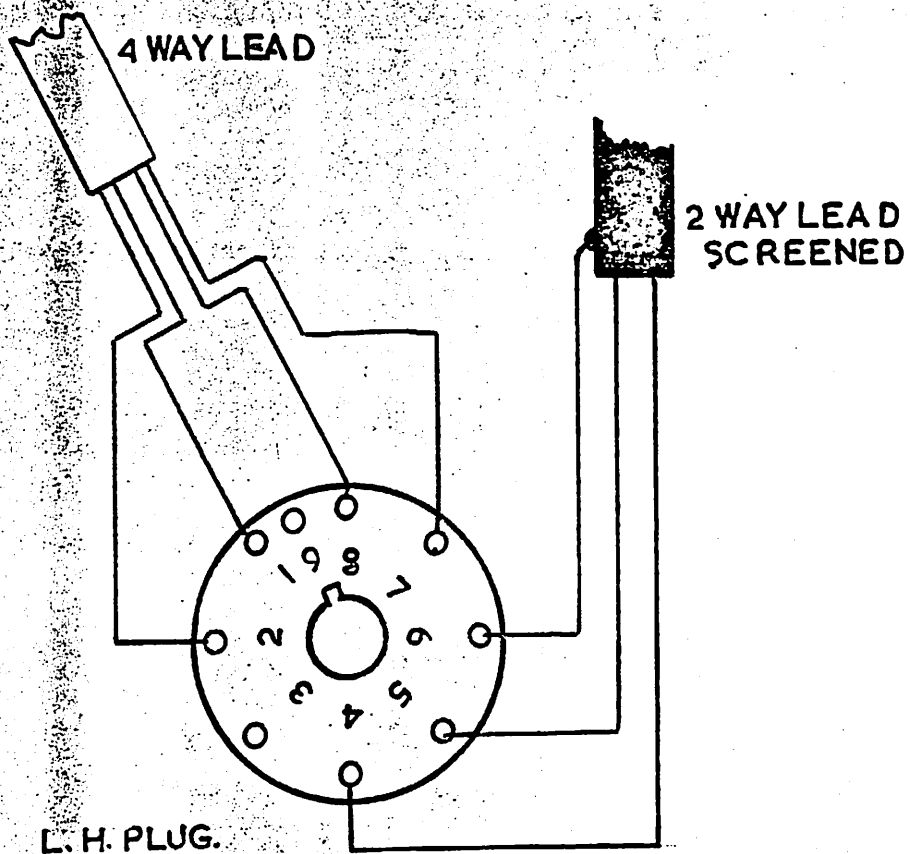
PIN	COLOUR	
a	BRAID	NOT CONNECTED TO TOP OF FRAME
b	RED LEAD	NO CONNECTION
1	WHITE "	
2	BROWN "	
3	YELLOW "	
4	GREEN "	
5	ORANGE "	
6	PURPLE "	
7		NO CONNECTION
8	BLACK "	
9	NO CONNECTION	

DRWG NO 103

MELLOTRONICS MFG. LTD.
ALDRIDGE ROAD
STREETLY

DEC. 67

TITLE.
MELLOTRON 300
SUB TITLE
CONNECTION DATA FOR
OCTAL PLUGS 8 WAY LEAD



L. H. PLUG.

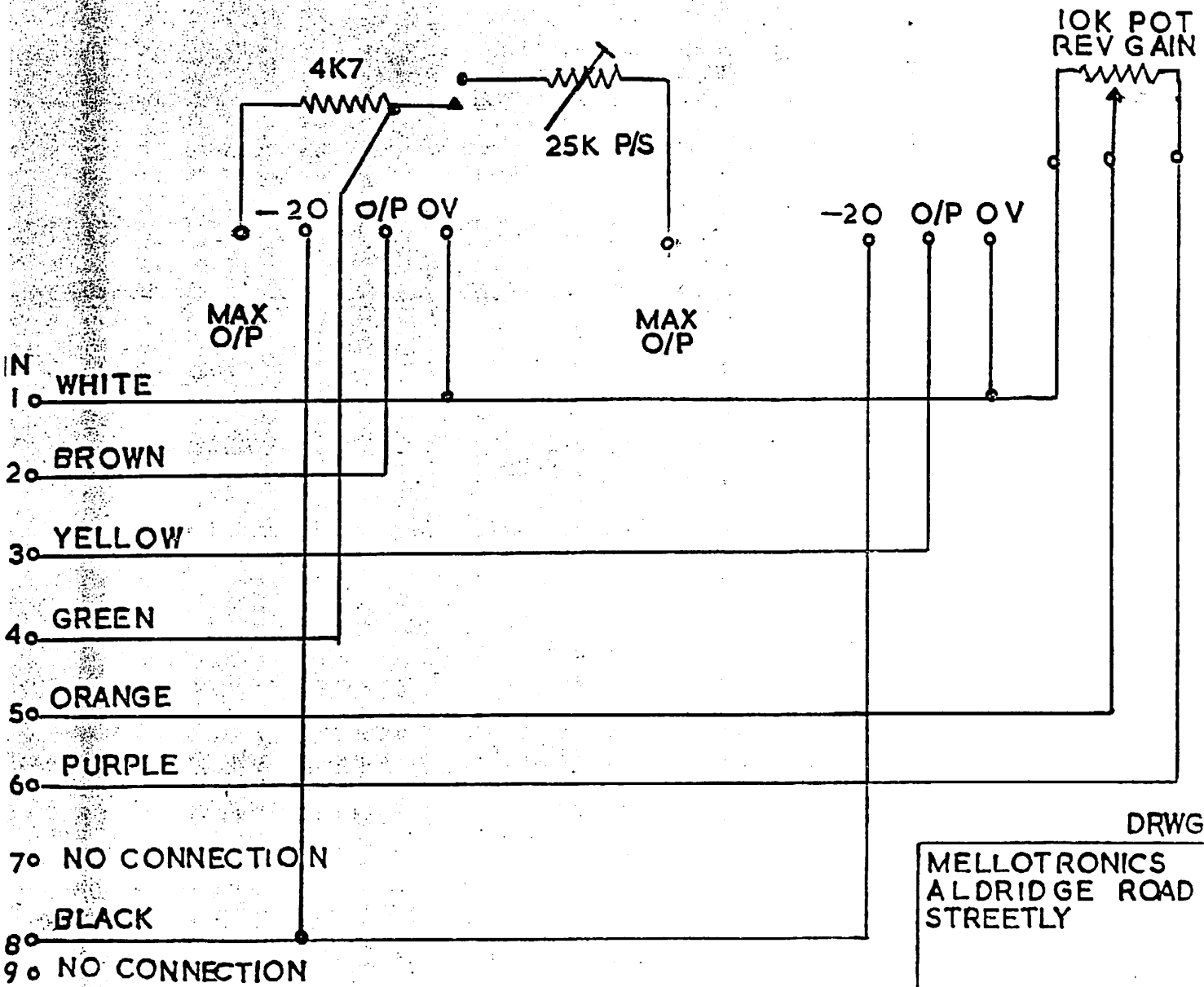
PIN	COLOUR	FUNCTION
1	GREEN	MAINS
2	BLACK	
3	NO CONNECTION	
4	RED	SPEED CONTROL
5	BLACK	
6	BRAID	
7	RED OV	TRACK SELECTOR
8	BROWN-28	
9	NO CONNECTION	

DRWG NO 104

MELLOTRONICS MFG LTD
ALDRIDGE ROAD
STREETLY

DEC 67

TITLE
MELLOTRON 300
SUB TITLE
CONNECTION DATA FOR
OCTAL PLUGS 4&2 WAY LEADS

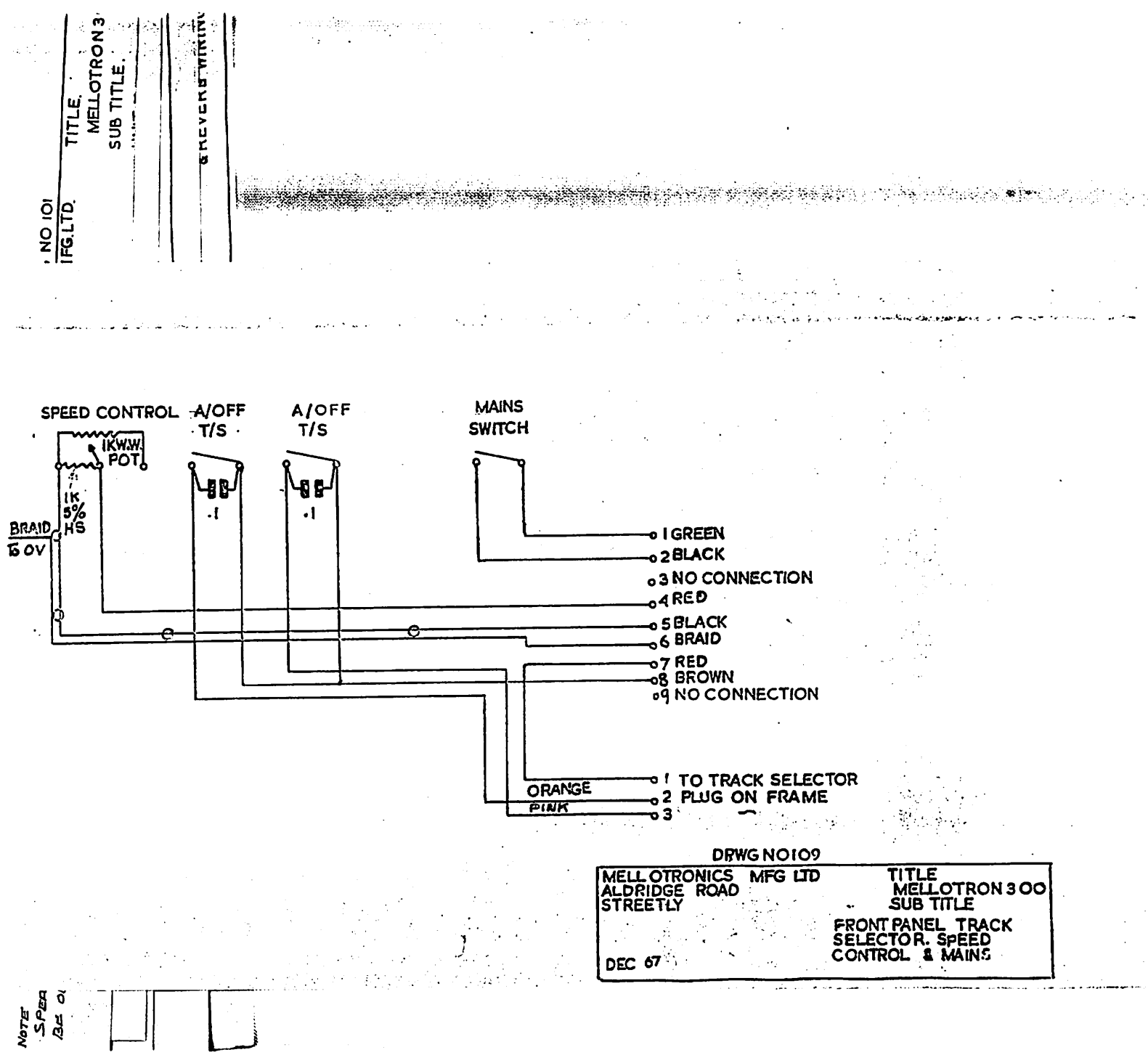


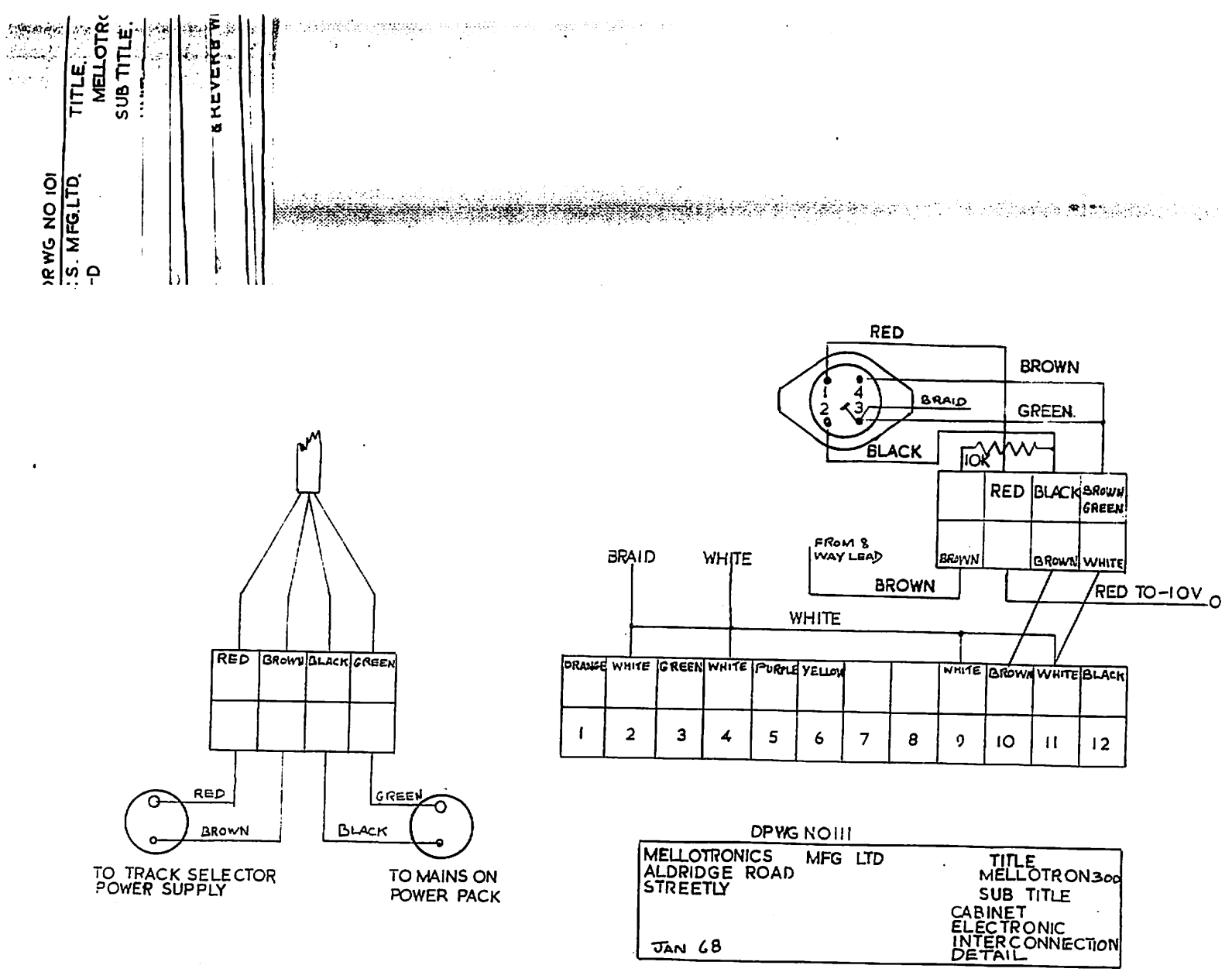
DRWG NO 106

MELLOTRONICS MFG LTD
ALDRIDGE ROAD
STREETLY

DEC 67

TITLE
MELLOTRON
300
SUB TITLE.
FRONT PANEL PRE AMP
& REVERB WIRING





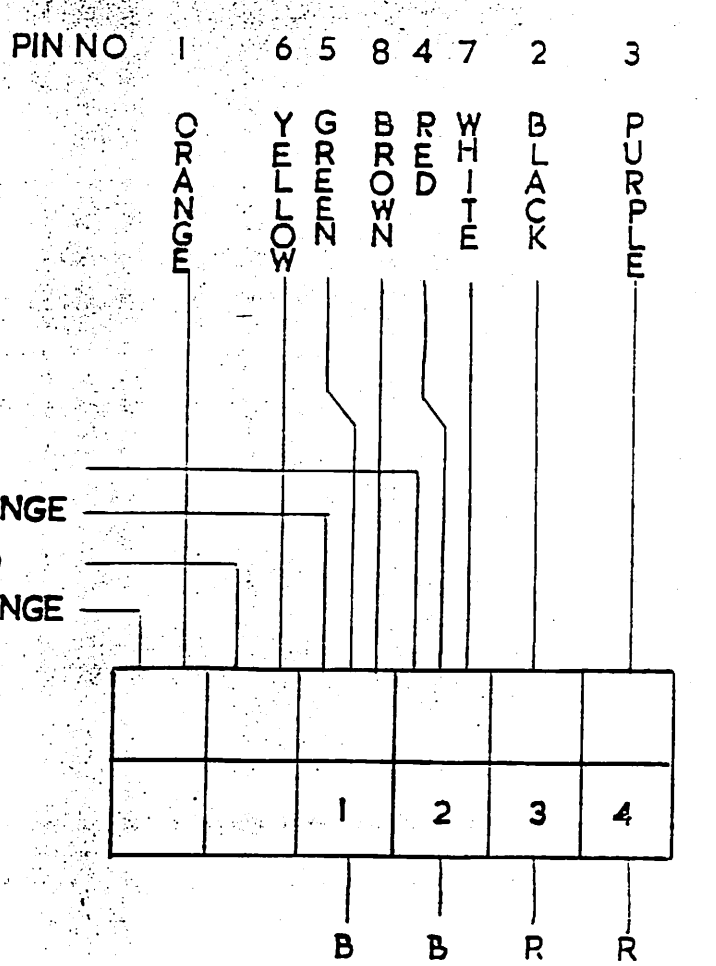
DPWG NO 111

MELLOTRONICS MFG LTD
ALDRIDGE ROAD
STREETLY

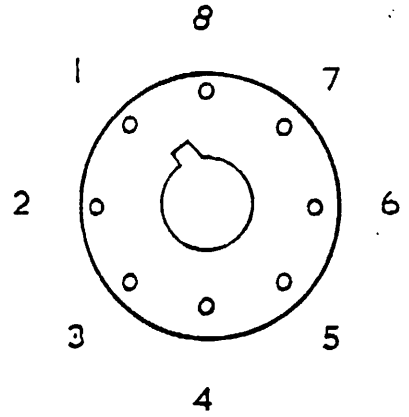
JAN 68

TITLE
MELLOTRON 300
SUB TITLE
CABINET
ELECTRONIC
INTERCONNECTION
DETAIL

A



CYCLING MOTOR LEADS



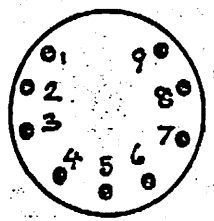
A TERMINATION S S C U

B " " MICRO/ SWITCH & KEY LOCK SOLENOID

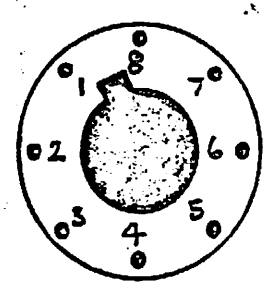
DPWG NO 112

MELLOTRONICS MFG. LTD. ALDRIDGE ROAD STREETLY	TITLE MELLOTRON 300 SUB TITLE CONNECTION DATA FOR

8 AY LEAD		
PIN	B9A	OCTAL
1	BROWN	BROWN
2	WHITE	WHITE
3	ORANGE	ORANGE
4	YELLOW	YELLOW
5	~	PURPLE
6	PURPLE	BLACK
7	BLACK	RED
8	RED	GREEN
9	GREEN	~



B9A PLUG
S.S.C.U END



OCTAL SOCKET
(SENSING HEAD BRACKET)
FROM S.S.C.U.

DRWG NO 113

MELLOTRONICS MFG LTD
ALDRIDGE ROAD
STREETLY

JAN 68

TITLE
MELLOTRON300
SUB TITLE
WIRING DATA
(8 WAY LEAD S.S.C.U
, SENSING HEAD BRACKET)