UHER PORTABLE TAPE MACHINES
BBC MODIFICATIONS
& SUPPLEMENTARY INFORMATION

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CONTENTS

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Introduction

This Instruction describes the modifications that have been made to a large number of the Uher 4000 Report-L and 4000 Report-IC portable tape machines used in the BBC, and includes the setting-up adjustment procedure for such machines. In addition, some supplementary information is given, particularly on the functioning of the motor control circuit and the Telephone Coupling Unit UN10/17, which is used to link a Uher portable tape machine with a Post Office line.

The modifications are primarily intended to make the machines suitable for (a) providing a low-level playback output which may be used to feed a mixer, and (b) cueing and playback over an ordinary Post Office subscriber's line. The machines are also modified so that they will only operate at 19 cm/s.

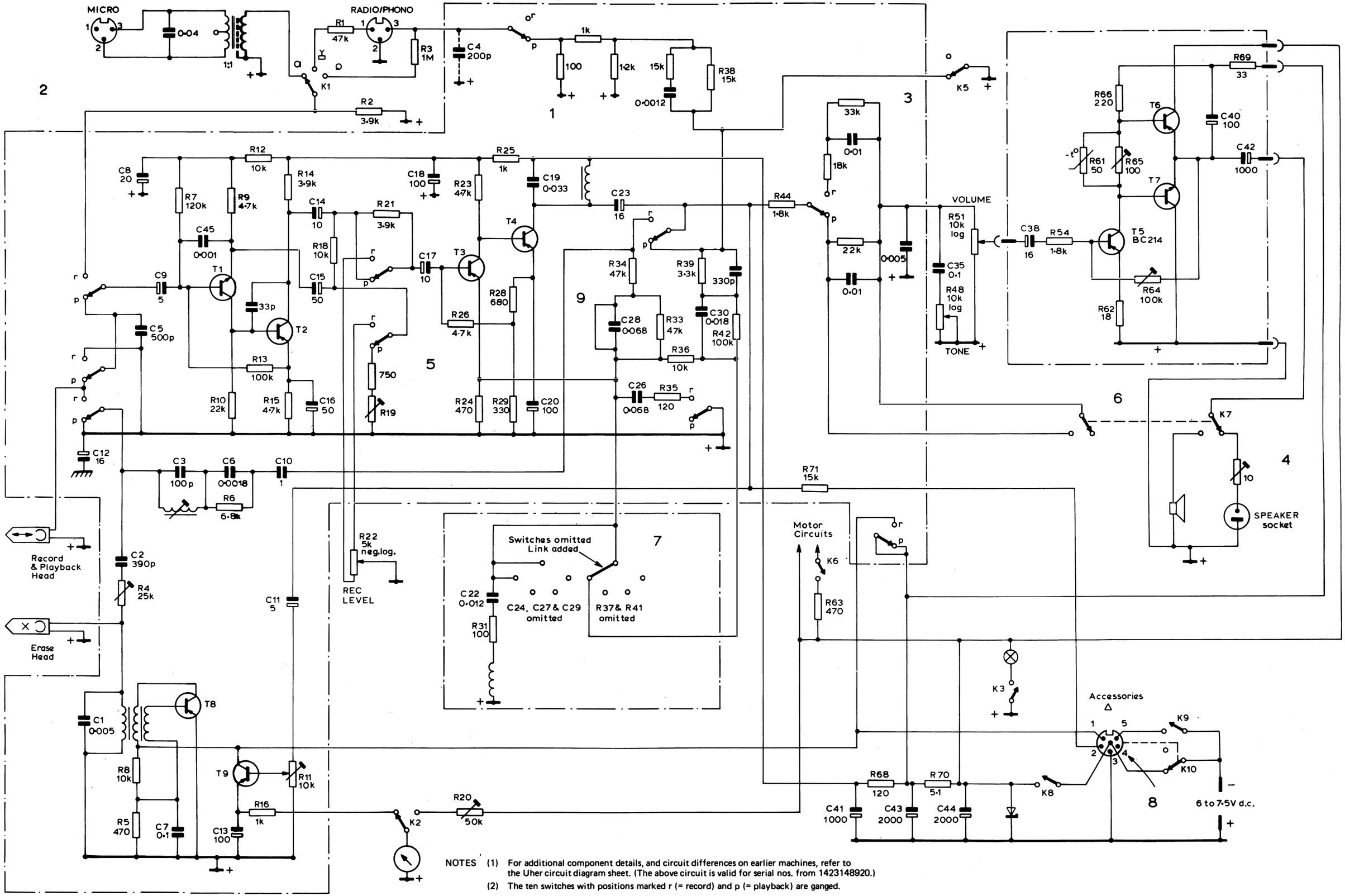
The 4000 Report-L is no longer made, and was superseded by the 4000 Report-IC, though the former is still widely used in the BBC. Originally the machines were manufacturered in Germany with alterations to BBC requirements incorporated, but more recently normal production machines have been modified in the United Kingdom. Some earlier 4000 Report-L machines were only modified to provide a low-level output suitable for a mixer: these may be identified by a red dot preceding the engraved letters **BBC**. Later 4000 Report-L machines, with all the modifications, have white dots before and after **BBC**. For a period, the modifications on the 4000 Report-IC machines were in many respects similar to those on later 4000 Report-L machines, but to satisfy revised Post Office requirements applying to the use of 4000 Report-IC machines connected to telephone lines, new modifications on these machines were introduced in 1977: the 4000 Report-IC machines with these new modifications are marked **P.O. Line II**.

Except where modifications apply, reference should still be made to the technical information provided by Uher on their circuit sheets and in their operating and service manuals for these machines.

Modifications to Type 4000 Report-L

The parts of the circuit that have been modified are marked by numbers on the circuit diagram shown in Fig. 1. Notes concerning these modifications are given below against the identifying numbers. Some older 4000 Report-L machines, marked with a red spot before the engraved letters **BBC**, have only modifications 1 and 9. Machines fitted with a 3-pole microphone socket in place of a 5-pole socket, as described in modification 2, may in other respects be unmodified machines.

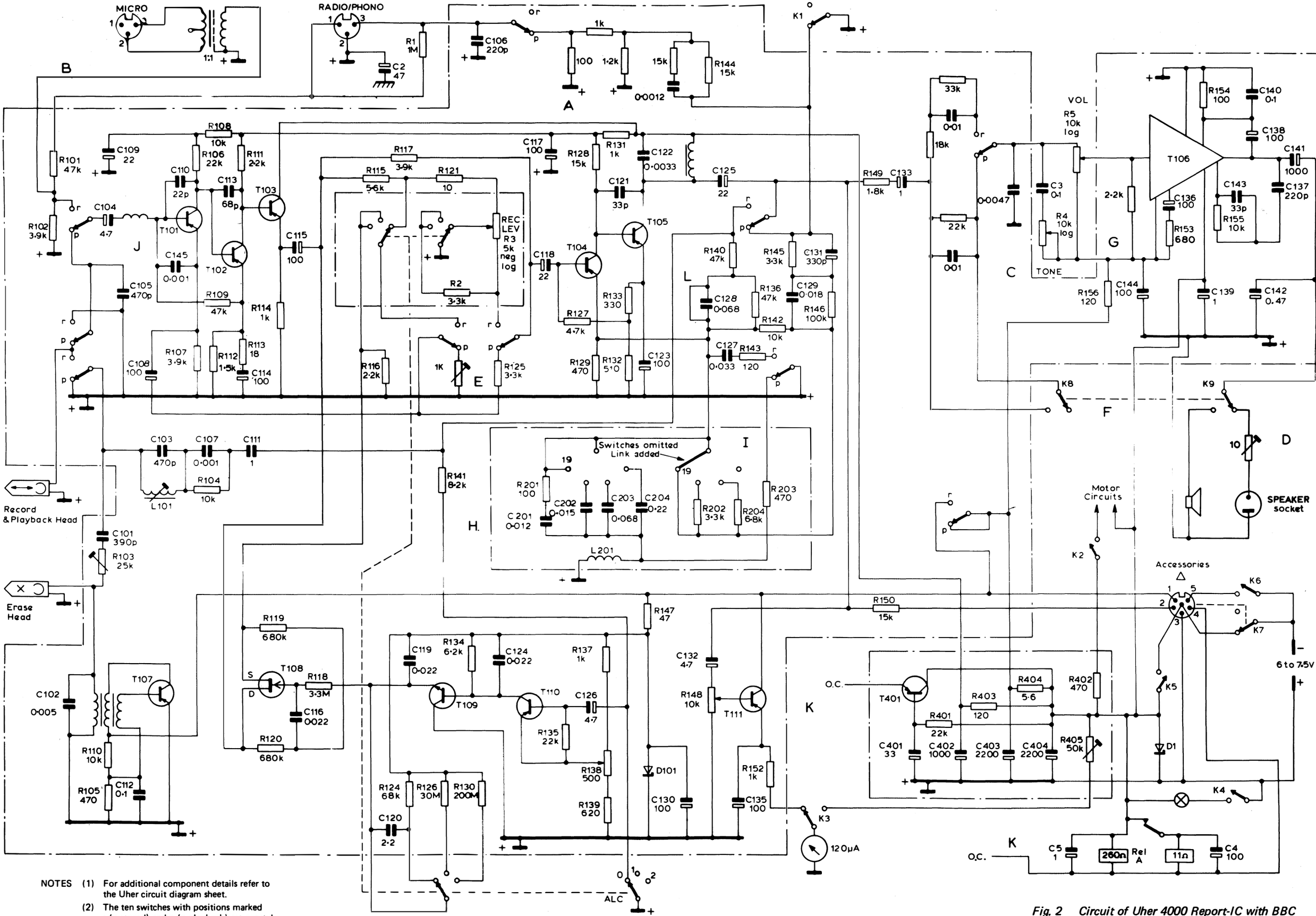
1. This modification makes the output at connector 3 of the **RADIO/PHONO** socket suitable for applying to a mixer. A resistor in series with a capacitor are added in parallel with R38 to obtain approximately C.C.I.R. equalization, and a fixed attenuator network is added in series with the feed to connector 3 to reduce the output to about –60 dB. It is assumed that the load across connectors 3 and 2 will be 600 ohms.
2. A 1:1 transformer with an electrostatic screen is added at the microphone input. As a result the input impedance is balanced, but unchanged in value. A capacitor is connected in parallel with the primary. The transformer is mounted behind the front panel, above the input selector switch and recording level control, except in earlier machines in which it is mounted on a bracket behind the microphone socket. As a rule, a 3-pole DIN socket is fitted for feeding a microphone to the transformer, in place of the 5-pole socket on a standard machine; with this change the facility for remote control via the microphone socket is omitted.
3. C32 and R46 are omitted, and capacitors and resistors are added in circuit, at the record/playback switch preceding the output stage. This is in order that, in either the record or playback mode, the output has a suitable rising frequency characteristic for transmission over a P.O. line.
4. A preset 10-ohm resistor is connected in series with the external loudspeaker socket, which is used to feed a P.O. line (via a coupling unit). This resistor is set in the output adjustment procedure so that a standard output, suitable for a P.O. line, is provided corresponding to zero level indication on the recording meter (with volume and tone controls set at maximum). The 10-ohm control is mounted inside the machine behind the external loudspeaker socket, or on one side of the **RADIO/PHONO** socket.
5. A 750-ohm resistor is connected in series with the variable resistor R19 when it is a 1-kilohm control. This facilitates adjustment of R19 to obtain a standard playback output from a recording made on the machine (after the setting of the 10-ohm control previously described). On later 4000 Report-L machines, R19 is 2.5 kilohms and the addition of the 750 ohms resistor has not been necessary.
6. A ganged pair of changeover switches is fitted so that adequate output is still available to the internal loudspeaker when it is used. The switches are operated by the shaft of the volume control. When the knob is pushed in, the added RC networks shaping the frequency characteristic for sending to line are short-circuited, and simultaneously output is fed to the internal loudspeaker instead of to the external loudspeaker socket. In the original circuit, one switch shunts the internal loudspeaker across the external loudspeaker socket.
7. The switches in the standard Uher circuit that change resistance and capacitance values in the amplifier with change of speed are omitted; a link is fitted for the fixed speed of 19 cm/s. All the resistors and capacitors required for apeeds other than 19 cm/s are omitted.
8. With the substitution of a 3-pole socket in place of a 5-pole socket for the microphone, the facility for remote control is absent. The remote control relay circuit components are omitted and there is no conductor joined to connector 4 on the accessories (△) socket.
9. C28 and R33 are short-circuited to modify the recording frequency characteristic.



NOTES (1) For additional component details, and circuit differences on earlier machines, refer to the Uher circuit diagram sheet. (The above circuit is valid for serial nos. from 1423148920.)

(2) The ten switches with positions marked r (= record) and p (= playback) are ganged.

Fig. 1 Circuit of Uher 4000 Report-L with BBC modifications, (motor control not shown)



NOTES (1) For additional component details refer to the Uher circuit diagram sheet.

(2) The ten switches with positions marked r (= record) and p (= playback) are ganged.

Fig. 2 Circuit of Uher 4000 Report-IC with BBC modifications up to 1977 (motor control not shown).

Modifications to Type 4000 Report-IC in 1977

Type 4000 Report-IC machines marked **P.O. Line II** contain new modifications introduced in 1977 as well as previous modifications. The new modifications were made to satisfy a requirement that it should not be possible for outputs above allowable limits to reach a Post Office line connected, via a coupling unit, to the external loudspeaker socket.

Each of the modifications applied to the machines up to 1977, described in the preceding section, is retained, except that there is some difference in the form of modification D. Three new modifications, M, N, and O, are introduced. All the modifications are shown in Fig. 3 (derived from the Technical Services, Radio circuit drawing TSR2162.3.1A2).

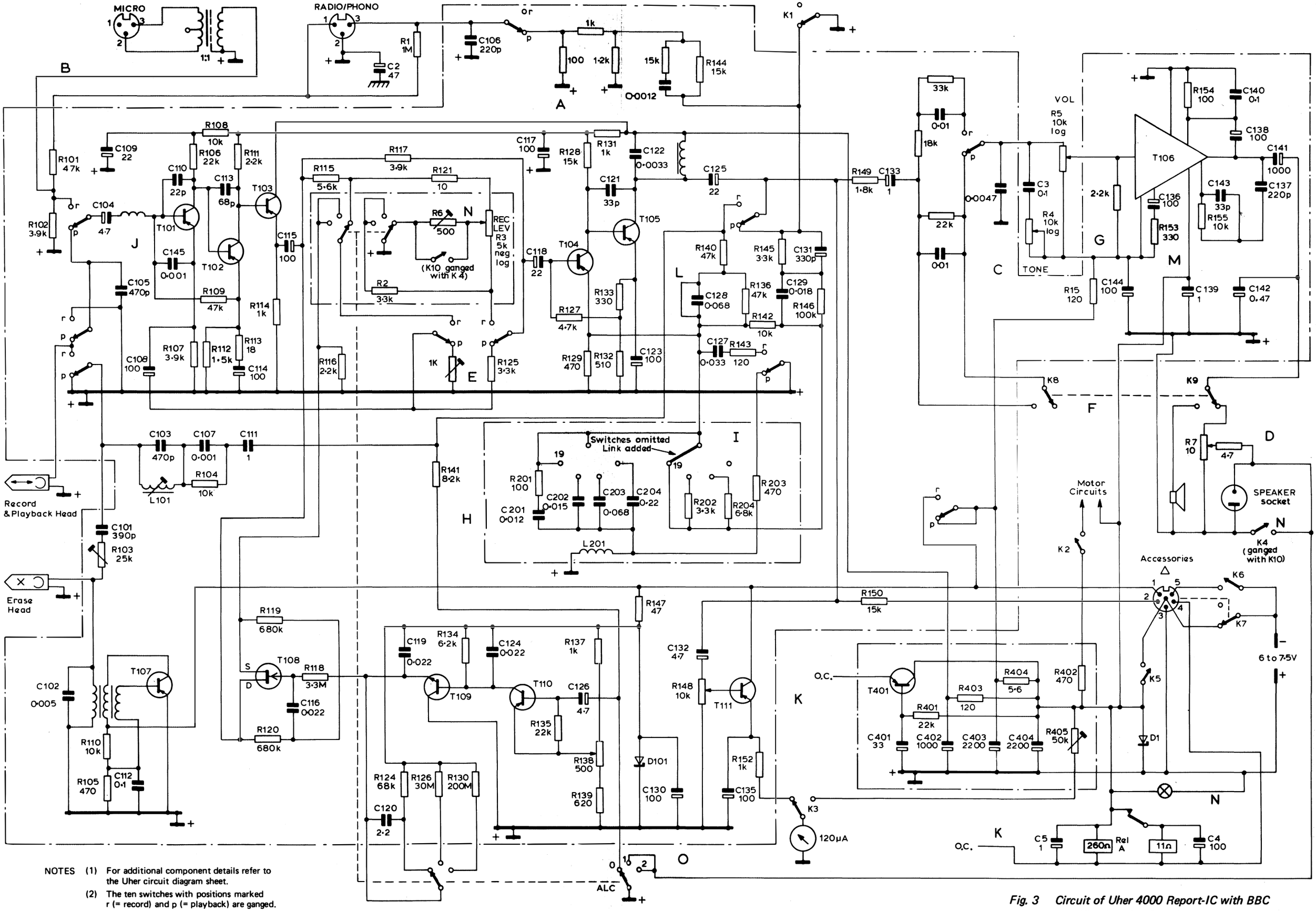
The altered modification D and the new modifications are described below against their identifying letters.

D. A preset 10-ohm variable potentiometer is connected to permit adjustment of the signal fed to the external loudspeaker socket, which is used to feed a P.O. line (via a coupling unit). In addition, a 4.7-ohm resistor is fitted in series with the socket to ensure that, if the socket is short-circuited, the output integrated circuit will be loaded by at least 4.7 ohms. The 10-ohm variable potentiometer is set, in the output adjustment procedure, so that an output suitable for a P.O. line is obtained corresponding to zero level indication on the recording meter (with volume and tone controls set at maximum).

M. The resistor R153, in series with C136 (connected to pin 8 on the output integrated circuit), is changed from 680 ohms to 330 ohms. This ensures that the correct output can be obtained in the preset adjustment procedure.

N. Two ganged switches, K4 and K10, are coupled to the tone control shaft and these close if the shaft is pushed in by means of the **TON** knob. One switch, K4, which existed originally and served to switch on a lamp illuminating the level/battery meter, is reconnected so that, when closed, it will short-circuit the external loudspeaker socket. K10 is an extra switch, connected so that it will short-circuit a preset 500-ohm variable resistor that is an added component in series with the wiper of R3, the normal recording level gain control. The 500-ohm preset resistor is adjusted so that, with the switches open, the recording gain is correct when R3 is turned to maximum. This ensures that R3, which is a front-panel control, cannot be turned to produce unnecessary gain, which might result in an excessive level reaching a P.O. line coupled to the external loudspeaker socket. If the 500-ohm preset resistor is short-circuited by K10, which is the state obtained by pressing the tone control shaft in, then the normal range of the recording level gain control is restored, but K4 then prevents any output appearing at the external loudspeaker socket. A wired connection is substituted in the original position of switch K4, where it was in circuit with the lamp illuminating the meter.

O. One section of the three-position automatic level control switch is connected so that the external loudspeaker socket is short-circuited if the a.l.c. switch is set to other than the manual level control position, **0**. This ensures that if the switch is turned to one of the automatic level control positions, **1** or **2**, an excessive level cannot reach a P.O. line coupled to the external loudspeaker socket.



NOTES (1) For additional component details refer to the Uher circuit diagram sheet.

(2) The ten switches with positions marked r (= record) and p (= playback) are ganged.

Fig. 3 Circuit of Uher 4000 Report-IC with BBC modifications in 1977, (motor control not shown).

Adjustment of Preset Controls on Machines with Modifications up to 1977

This is the procedure applied to 4000 Report-L and 4000 Report-IC machines with modifications made up to 1977. Component reference numbers for the 4000 Report-IC are given, followed in brackets by numbers for the 4000 Report-L.

1. Switch the machine to the recording mode. On a 4000 Report-IC, set the **ALC** selector switch to **0**. On a 4000 Report-L, set the input selector to its central, radio source, position.
2. Apply a 1-kHz signal at a level of −40 dB to connectors 1 and 2 (earthy) on the **RADIO/PHONO** socket.
3. Adjust the recording level control to obtain an output of −1 dB between connectors 2 and 3 (earthy) on the accessories socket (△) when measured with an EP14/1 (or ATM/1) set to high input impedance (i.e. about 50 kilohms).
4. Adjust the meter sensitivity control R148 (R11), inside the machine, so that the recording level meter reads zero level.
5. Pull out the volume control knob. Turn the volume and tone controls fully clockwise.
6. Connect a 3.9-ohm load to the external loudspeaker socket and adjust the 10-ohm internal preset control in series with this socket to obtain −11 dB across the load.
7. Turn the preset control R103(R4) to feed maximum bias to the recording head (i.e. set the control to minimum resistance).
8. Record a 1-kHz input for about 10 seconds under the conditions set up in steps 1 to 4, i.e. with the recording level meter reading zero level.
9. Play back the recording with the controls set as in step 5 and adjust the 1-kilohm preset control fitted in place of R122 (or adjust R19 in a 4000 Report-L) so that −11 dB is obtained again across a 3.9-ohm load at the external loudspeaker socket.

Adjustment of Preset Controls on 4000 Report-IC Machines with 1977 Modifications

1. Switch the machine to the recording mode, set the **ALC** selector switch to **0** (manual), and press in the tone control knob.
2. Apply a 1-kHz signal at a level of −40 dB to connectors 1 and 2 (earthy) on the **RADIO/ PHONO** socket.
3. Adjust the recording level control on the front panel to obtain an output of −1 dB between connectors 2 and 3 (earthy) on the accessories socket (△) when measured with an EP14/1 (or ATM/1) set to high input impedance (i.e. about 50 kilohms). Note: As a rule, this should result in the recording level control being adjusted to about half its range of rotation.
4. Set the meter sensitivity control R148, inside the machine, so that the recording level meter reads zero level.
5. Pull out the tone control and volume control knobs. Turn both these controls fully clockwise.
6. In steps, increase the recording level control on the front panel, and readjust the 500-ohm preset control connected within the machine to the recording level control to maintain −1 dB at the accessories socket (corresponding to zero on the recording level meter), until the recording level control is fully clockwise. This is done in steps to avoid damaging the meter.
7. Connect a 4-ohm load (a 3.9-ohm resistor may be used) to the external loudspeaker socket and connect an EP14/1 across this load. Adjust the 10-ohm internal preset control associated with the loudspeaker socket to obtain −13 dB across the load.
   Alternatively, plug a UN10/17 coupling unit into the external loudspeaker socket and adjust the 10-ohm preset control to obtain +2 dB across a 600-ohm load at the output of the coupling unit.
8. Turn the preset control R103 to minimum resistance so that it feeds maximum bias to the recording head.
9. Using the same 1-kHz signal as before (i.e. giving −1 dB on an EP14/1 at 2 on the accessories socket), make a recording on tape on the machine for about 10 seconds.
10. Play back the recording with the tone and volume control knobs pulled out and turned fully clockwise. Adjust the 1-kilohm preset control fitted in place of R122 so that −13 dB is obtained across a 4-ohm load at the external loudspeaker socket (or +2 dB across a 600-ohm load at the output of a UN10/17 plugged into the external loudspeaker socket).

After the above adjustment procedure using 1 kHz tone, connect to the machine the microphone that will normally be employed with it and readjust the 500-ohm preset control (previously set in step 6) as follows:

1. Check that the **ALC** selector switch is set at **0** and that the front-panel recording level control is fully clockwise. Ensure that the tone and volume control knobs are pulled out.
2. Operate the machine in the recording mode and, holding the microphone at a normal distance (say, 450 mm), readjust the 500-ohm preset control so that typical spoken passages cause the recording level meter to just indicate zero level at peaks of deflection.

Checking Frequency Response

1. Demagnetize the heads.
2. Play a BBC 19-cm/s standard frequency-response tape on the machine and measure the response at all frequencies into a 600-ohm load between connectors 3 and 2 (earthy) on the **RADIO/PHONO** socket.
3. Using a reel of new tape, make a recording on the machine at the same frequencies as on the BBC frequency-response tape. Feed the recording input, from an audio generator, to connectors 1 and 2 (earthy) on the **RADIO/PHONO** socket at a level of about −40 dB. Set the recording level control to obtain a reading of −12 on the meter of the machine with a 1 kHz input, then note the audio generator output and maintain this output at all the other test frequencies.
4. Replay the recording made in step 3 and measure the response as in step 2. Compare the results at all frequencies with those obtained when the BBC frequency-response tape was played.

A relatively poor output at low frequencies and an excess (up to several dB) of output at the higher frequencies is typical and is acceptable for the purposes to which the machine is put.

As a rule, with the type of tape currently in use, the bias preset control (R103 in a 4000 Report-IC or R4 in a 4000 Report-L) must be set for maximum bias (i.e. minimum resistance) to prevent the response at top frequencies being too great.

Checking Erase Voltage

To measure the voltage across the erase head, use a meter that is suitable for reading up to 50 volts at 60 kilohertz. A reading of about 35 to 40 volts should be obtained on a 4000 Report-L and a similar voltage, or slightly higher, on a 4000 Report-IC.

Motor Electronic Control Circuit

The following description of the action of the electronic control circuit for the motor is provided as an aid to fault diagnosis. It applies to the Uher 4000 Report-IC and the 4000 Report-L: the component reference numbers for both are given, with those for the 4000 Report-L shown in brackets. A diagram of the control circuit is given in Fig. 4 for reference.

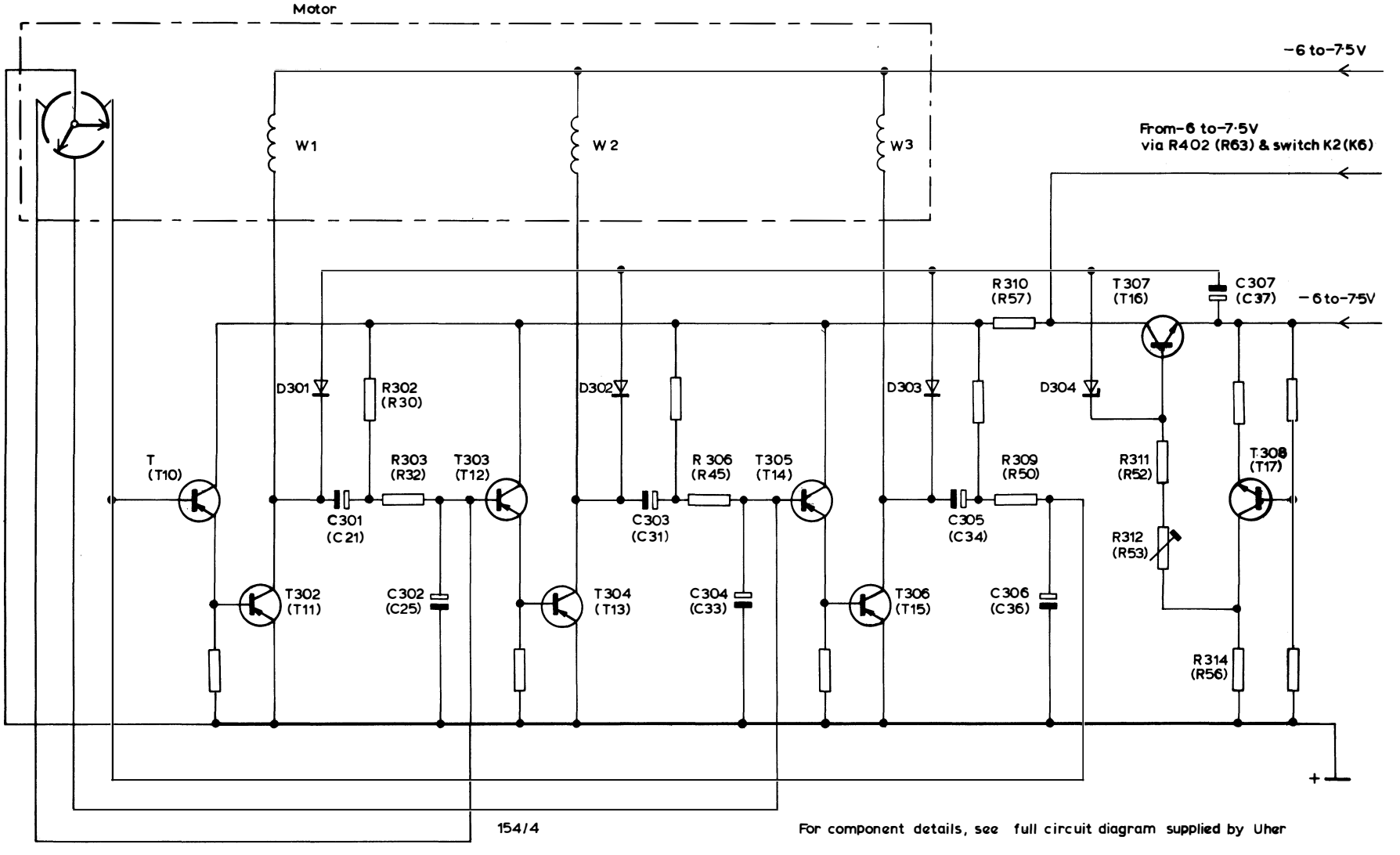
When the machine is switched on for recording or playback, the supply is fed to motor windings W1, W2 and W3, and also to the emitter of T307(T16). The base of T307(T16) is positively biased through R311(R52), R312(R53) and R314(R56), so that T307(T16) is switched on and passes the supply to T301(T10), T303(T12) and T305(T14) collectors. The bases of T301(T10), T303(T12) and T305(T14) are each connected to one of the contacts of a mechanical distributor, which is coupled to the shaft of the motor. Two of the bases are always earthed through the distributor, while the third is not earthed. In the circuit diagram, the base of T303(T12) is not earthed and is consequently biased on via R302(R30) and R303(R32). As a result, T303(T12) switches on T304(T13), allowing current to flow through motor winding W2 and causing the rotor to turn. The rotor, in turning, moves the contacts of the distributor, removing the earth from T305(T14) base and earthing the bases of T301(T10) and T303(T12). T305(T14) is now biased on, thus switching on T306(T15), and current flows through motor winding W3, causing the rotor to continue to turn. The earth is now removed from the base of T301(T10), current flows through W1, and the rotor continues to turn with increasing speed. The mechanical distributor disengages at 1,250 rev/min and its function is taken over by RC networks C301(C21), C302(C25) and R303(R52); C303(C31), C304(C33) and R306(R45); C305(C34), C306(C36) and R309(R50).

The switching of the motor drive transistors T302(T11), T304(T13) and T306(T15) produces pulses of voltage at their collectors, and these pulses are rectified by diodes and charge up C307(C37) until it reaches the conduction voltage of the zener diode connected to the base of T307(T16). When the zener diode conducts, the postive bias on the base of T307(T16) is lowered, reducing the voltage supplied to T301(T10), T303(T12) and T305(T14) and so also reducing the current flow through the motor windings, so that the acceleration of the motor decreases. As a result, the motor is governed to a nominal speed of 3,000 rev/min. The governed speed is adjustable within ±8 per cent by R312(R53).

A reduction in the supply voltage decreases the collector current of T308(T17), thus increasing the positive bias to T307(T16) base and tending to stabilize the supply voltage fed to T301(T10), T303(T12) and T305(T14). As T308(T17) and T307(T16) function in opposition to one another, a degree of temperature compensation is also achieved.

When the machine is operated in the fast forward or rewind condition, switch K2(K6) feeds the supply directly to R310(R57), bypassing the speed controlling transistor T307(T16).

In the event of serious difficulty with the motor control circuit, a complete board carrying the circuit can be supplied by Uher.



For component details, see full circuit diagram supplied by Uher

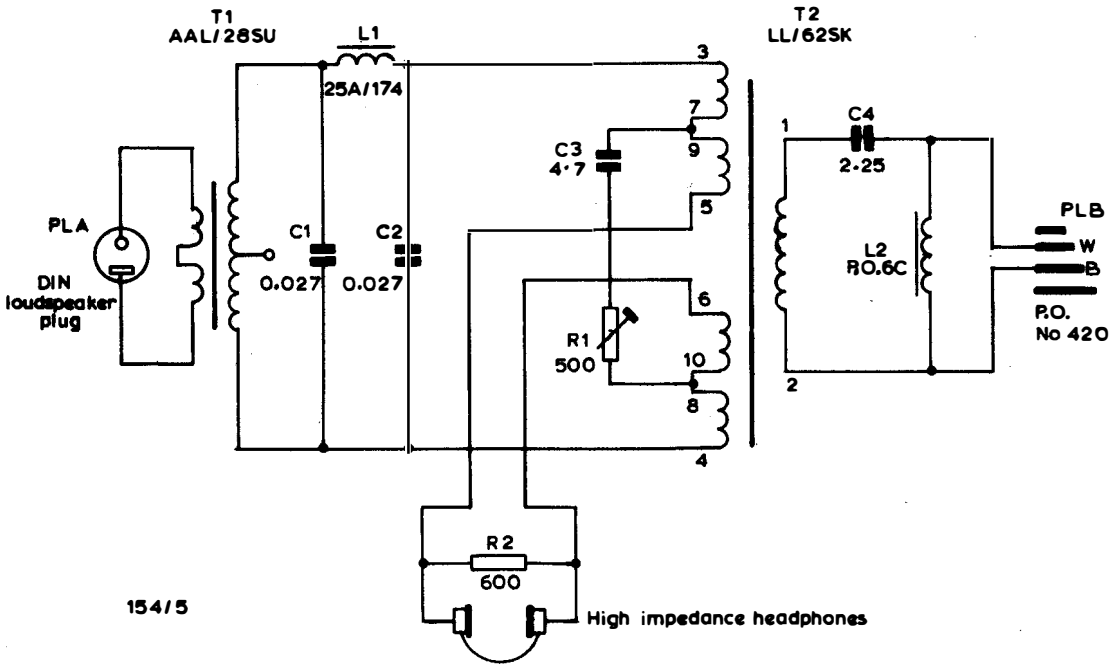


Fig. 5 Circuit of the UN10/17

This is designed for use between the external loudspeaker socket of a Uher 4000 Report-IC or Report-L portable tape machine and an ordinary telephone line.

Referring to the circuit, transformer T1 approximately matches the low output impedance of the tape machine. The filter C1, L1 and C2, following the secondary of T1 serves to cut off frequencies above the audio range including output from the machine at the bias frequency. Beyond the filter, T2 is a hybrid transformer providing an output to headphones with discrimination in favour of signals coming from the telephone line. Signals from the tape machine are adjusted to a minimum by R1.