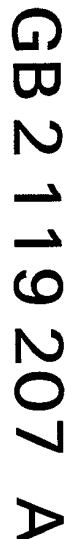
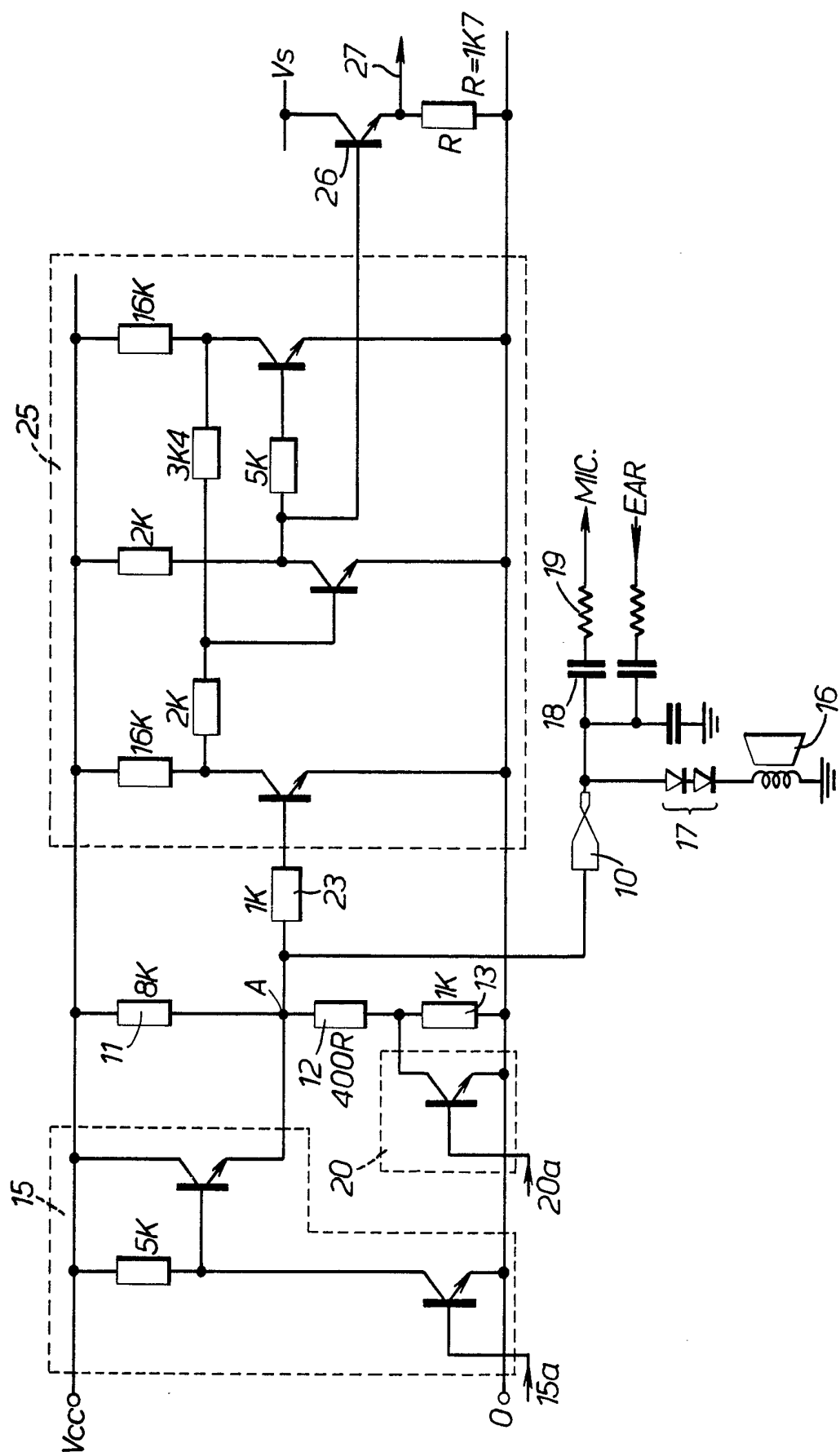


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(57) A serial input and output circuit arrangement for a computer comprises a single terminal 10 arranged for connection to a number of input and output terminals, a conditioning circuit 11, 12, 13 including a circuit connection A connected to said single terminal 10, the conditioning circuit causing a balance potential to exist in use at said circuit connection A, a receiving circuit 25 connected to the circuit connection for receiving signals from the single terminal, and a

transmitting circuit including switching means 15, 20 connected to the conditioning circuit and responsive to signals from the computer to cause a respective balance potential to exist at said circuit connection A dependent on whether the circuit arrangement is to be an input circuit or an output circuit. As shown a loudspeaker 16 and tape recorder inputs and outputs are connected to the single terminal 10 and the switching means 15, 20 alter the balance potential between three different values to allow audio signals to be supplied to the loudspeaker 16 and data and program signals to be sent to and received from the tape recorder respectively.





## SPECIFICATION

### Computer input/output circuit

- 5 The present invention relates to computers and more particularly to computers which utilise a microprocessor. Specifically, the invention resides in an input/output circuit which is used as an interface between the  
10 computer and ancillary equipment such as a tape recorder.

- It has already been proposed to store data and programmes on a magnetic recording medium such as magnetic tape and to transfer  
15 the data or programme between the processor and the tape. Further, it has also been proposed to provide a computer with a sound facility so that the computer can generate sounds which can, for example, accompany a  
20 computer game or can be used to simulate speech.

- A difficulty is that while these facilities can easily be provided, a substantial number of input/output terminals are usually required.

- 25 It is an object of the present invention to provide a circuit which enables data and/or programmes to be transferred between a computer and ancillary equipment using a single input/output terminal. Preferably, the circuit  
30 is arranged to provide a further output signal at the single terminal for driving an audio output device.

- Features and advantages of the present invention will become apparent from the following description of an embodiment thereof  
35 when taken in conjunction with the accompanying single figure which shows a circuit diagram of an input/output circuit in accordance with the present invention.

- 40 The drawing shows a circuit arrangement for transferring data and/or programme between a computer and a tape recorder and for providing a sound facility for the computer.

- The circuit comprises at least one switching  
45 circuit which alters the balance voltage of a junction in the circuit which junction is connected to a terminal whereby the terminal can be used for both input and output signals. If two switching circuits are provided the same  
50 terminal can be used to output signals at two different voltage levels.

- In more detail, and with specification reference to the drawing, a terminal 10 is connected to the junction A of a voltage dividing  
55 network comprising a first resistor 11 and the series combination of two resistors 12 and 13 which network is connected across voltage supply rails.

- A first switching network 15 is shown in  
60 broken lines and is arranged to short circuit the resistor 11 whereby to bring the voltage of the junction A to approximately the same level as the voltage rail Vcc. This switching circuit is operated under the control of a  
65 signal from the processor such that when an

- audio output is required, the signals are fed to an input 15a to the circuit 15 so as to switch the resistor 11 in and out of circuit whereby to produce large signals for driving a loud-  
70 speaker 16. The loudspeaker is advantageously a low impedance loudspeaker with an input resistance 17 in the form of two diodes. In this case, it is thus apparent that the signal from the junction A has to be greater than the  
75 voltage drop across the two diodes.

- A second switching circuit 20 is also provided and again is shown in broken lines. The second switching circuit again is arranged to short out one of the resistors of the voltage of  
80 the junction A to a level which is intermediate the normal level of the junction A with all resistors of the network in series and the level of the rail Vcc.

- The number and values of the resistors in  
85 the voltage dividing network are chosen such that when the switching circuit 20 is operated under the control of the processor by signals applied to an input 20a, a voltage signal appears at the junction A whose amplitude is  
90 less than the voltage drop across the input resistance 17 and hence the loudspeaker does not react to such signals. They are, however, sufficient to be supplied through a filter consisting of a series connected capacitance 18  
95 and resistance 19 to the "microphone" input of a conventional tape recorder for recording the signals on magnetic tape.

- Thus, by activating one or other of the switching circuits 15 and 20, either a loud-  
100 speaker may be driven or else material in the form of data or a programme can be recorded on magnetic tape using a single terminal 10.

- In addition, in the absence of a switching signal at both inputs 15a and 20a, the terminal 10 can be used as an input terminal to  
105 allow data or a programme stored on tape to be loaded into the computer via the "ear-piece" input of a conventional tape recorder. With both switching circuits 15 and 20 off, the junction A is at a level determined by the voltage dividing network. The junction A is connected through an input resistance 23 to an amplifying and wave shaping circuit 25 shown in broken lines. The output from the  
110 circuit 25 is fed to a transistor 26 connected as an emitter follower whose output constitutes a data input 27 to the processor.

- It will thus be seen that depending on the condition of the inputs to the switching circuits 15 and 20, the single terminal 10 can be used as an output terminal for driving a loudspeaker, as an output terminal to enable data and/or programme to be recorded on ancillary equipment, or as an input to enable  
125 previously recorded data to be input to the computer. The low impedance speaker does not load the signals to and from the recording medium and the sending of signals to one from the recording medium does not activate  
130 the loudspeaker.

A further advantage of the above arrangement is that a peripheral device such as a loudspeaker may be permanently connected and can be supplied with signals from the same output terminal as other peripheral devices without the need for an isolating switch or disconnection of the device.

#### CLAIMS

1. A circuit arrangement for serial input and output signals for a computer comprising a single terminal arranged for connection to a peripheral device, a conditioning circuit including a circuit connection connected to said single terminal, the conditioning circuit causing a balance potential to exist in use at said circuit connection, a receiving circuit connected to the circuit connection for receiving signals from the single terminal, and a transmitting circuit including switching means connected to the conditioning circuit and responsive to a signal from the computer causing a balance potential to exist at said circuit connection which is dependent on whether the circuit arrangement is to be an input circuit or an output circuit for the computer.

2. A circuit arrangement according to claim 1, wherein the conditioning circuit comprises a plurality of resistors connected across a source of potential, and the circuit connection is a junction between two of the resistors, the switching means being arranged to alter the effective total resistance between first and second values depending on its switching condition whereby to transmit a signal to the single terminal.

3. A circuit arrangement according to claim 2, wherein the switching means comprises first and second switching devices each being arranged to alter the effective total resistance between a common value and one or other respective values.

4. A circuit arrangement for serial input and output signals for a computer comprising a single terminal arranged for connection to a plurality of peripheral devices, a conditioning circuit including a circuit connection connected to said single terminal, the conditioning circuit causing a balance potential to exist in use at said circuit connection, and first and second switching means altering the balance potential between different respective values and responsive to one of a first and second signal from the computer whereby to output a signal indicative of one of the first and second signals to said single terminal.

5. A circuit arrangement according to claim 4, and including an input circuit for each peripheral device, each input circuit being responsive to a signal at a different balance potential.

6. A circuit arrangement according to claim 4, wherein the conditioning circuit comprises a plurality of resistors connected across a source of potential and each switching de-

vice is arranged to alter the effective total resistance whereby to alter the balance potential at said circuit connection.

7. A circuit arrangement according to claim 6, wherein the circuit connection is the junction between two resistors.

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