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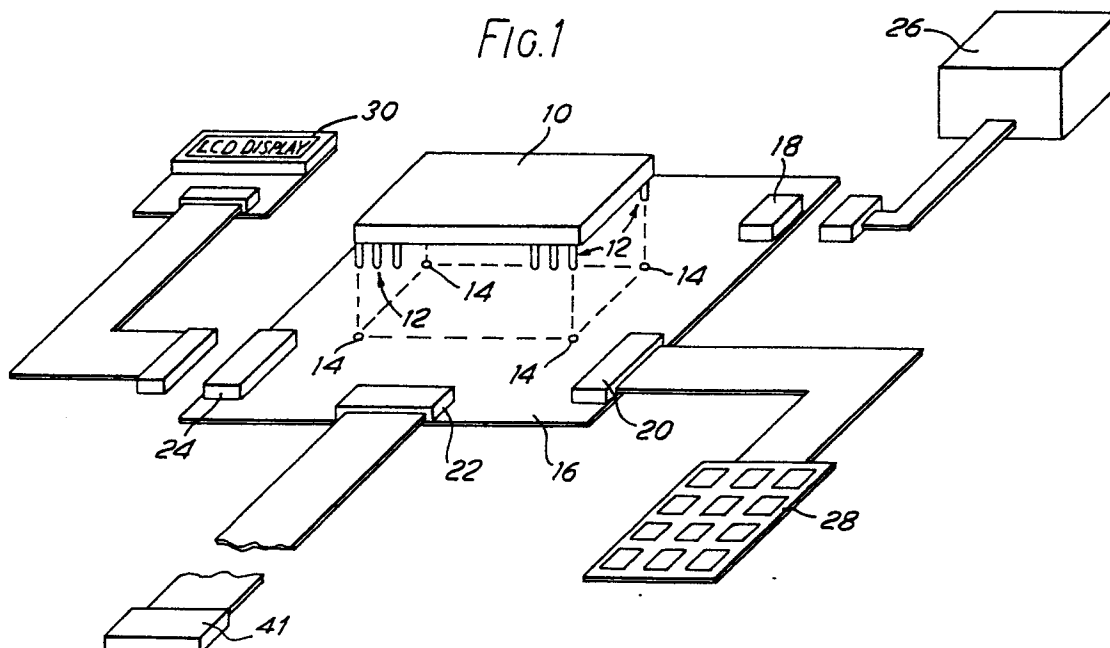
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AT BE CH DE ES FR GB GR IT LI LU NL SE(71) Applicant: **Pitney Bowes PLC**
The Pinnacles
Harlow Essex CM19 5BD(GB)(72) Inventor: **Bannister, Ray L.**
14 Capel Lodge Kew Road
Richmond Surrey, TW9 3JU(GB)(74) Representative: **Cook, Anthony John et al**
D. YOUNG & CO. 10, Staple Inn
London, WC1V 7RD(GB)(54) **Electronic postage meter.**

(57) A microprocessor in an electronic postage meter is mounted in a hybrid circuit 10 together with various peripheral circuits, so that the complete control circuit of the postage meter is essentially within the one circuit. The hybrid circuit 10 is mounted on a mother board 16 resulting in easy replacement and also leading to a very compact arrangement.

FIG.1



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ELECTRONIC POSTAGE METER

The present invention relates to an electronic postage meter, particularly such a meter under the control of a microprocessor.

Postage meters including microprocessor control circuits are known, and such meters can theoretically be smaller than conventional mechanical postage meters since certain functions such as value setting, display and accounting can be performed electronically rather than by means of complex mechanical linkages. In principle, such postage meters can also be constructed more cheaply since, assuming a sufficiently large volume of production, electronic components (even if some need to be custom-made) and their assembly should be less expensive than the complex mechanical counterparts and their assembly.

However, despite the existing use of microprocessors in postage meters, it has been found in practice that the above-mentioned advantages have not been fully realised. One reason is that the assembly of peripheral components external to the microprocessor has been complex and thus expensive; moreover once the necessary peripheral components have been added, there may be little or no difference between the space requirements within the casings of this type and those of mechanical postage meters. Another reason is that it has been found necessary to include more than one microprocessor if specific functions are to be provided, and this clearly involves both cost and space penalties.

Servicing of these types of control circuits has also involved disadvantages since a circuit board carrying the microprocessor and its peripheral components would in the event of failure need to be subjected to complicated diagnostic techniques. In such cases, the service engineer would have to remove the postage meter from the customer's premises in order to carry out the diagnostic tests at his workshop.

In order to overcome, or at least reduce the above-mentioned disadvantages, the present invention provides an electronic postage meter comprising:

means whereby data can be fed into the meter, said data including at least numerical information relating to the value to be franked;
 means for printing postage;
 microprocessor means within the meter for controlling the printing of postage;
 accounting means for keeping an account of postage printed;
 an electronic memory for storing therein digital values corresponding to the total of postage that has been printed;

a program memory incorporating a postage meter program to enable the microprocessor means to control the operation of the meter;
 a clock circuit for generating timing signals for the microprocessor means; and
 circuitry connecting the aforesaid parts together; characterised in that the microprocessor means, the accounting means, the program memory, the electronic memory, or a socket arrangement for retaining at least the electronic memory, the clock circuit, and at least part of the interconnecting circuitry are mounted together to form a so-called hybrid circuit.

The hybrid circuit is preferably fabricated by a technique in which thin ceramic plates have the microprocessor and peripheral circuits mounted thereon in layers, electrical connections between these components being made during the hybridisation process, pins being provided for electrical connection to circuits outside the hybrid circuit.

In one embodiment, all the circuits of the postage meter which would normally be provided on a control circuit printed circuit board can be arranged within the hybrid circuit. Thus in the event of a malfunction, the service engineer merely needs to replace the faulty hybrid circuit with another, and there is no need for the postage meter to be removed from the customer's premises.

In another embodiment, the hybrid circuit has mounted thereon a socket for receiving the microprocessor or at least a non-volatile memory storing the cumulative total of postage printed. In the event of failure of other parts of the hybrid circuit, the memory component can be unplugged from the socket and its stored data unloaded for recording and subsequent inputting to a replacement component.

The hybrid circuit may be mounted as the sole electronic component on a mother board; alternatively, switching devices such as field effect transistors (FETs) for activating external components, e.g., solenoids of the postage meter can also be mounted on the mother board.

The use of such a hybrid circuit leads to a significant space reduction, thereby making it possible to design a more compact postage meter.

Furthermore, the incorporation of all or most of the components within the hybrid circuit leads to a more rugged construction, since the circuit is much less vulnerable to effects such as vibration.

The invention will now be further described, by way of illustrative and non-limiting example, with reference to the accompanying drawings, in which:

Figure 1 shows a partially-schematic perspective view of the assembly of the electronic parts of a postage meter in accordance with an embodiment of this invention; and

Figure 2 is a circuit diagram of the electronic parts of a postage meter, which circuit can be used in the assembly of Figure 1.

Referring to Figure 1, electronic components of a postage meter include a hybridised control circuit 10 with conductive pins 12 for mounting within apertures 14 of a mother board 16 and for electrical connection thereto, for example by soldering. Details of the components within the hybrid circuit 10 will be given below in connection with Figure 2, but at this stage it is sufficient to say that the hybrid circuit 10 includes a microprocessor and its peripheral circuits, preferably mounted on ceramic plates, layer by layer, with interconnections being made between the parts by conventional hybridisation techniques.

The mother board 16 preferably carries just the hybrid circuit 10 and input/output connectors such as a power supply connector 18, a membrane keypad connector 20, a connection port 22 and a display connector 24. The connection port 22 is provided to allow signals to be sent to actuating devices for changing the positions of print wheels in order to change print wheel values. Such actuating devices could be solenoids but alternatively could be stepper motors or DC motors. Any electrical-mechanical transducer could be used which produces from an electrical signal a linear motion of a rack or the like, which is then used to change a print wheel value. Connection between the hybrid circuit 10 and these connectors can be achieved by any suitable conventional means, such as conductive tracks underneath the mother board 16. The mother board 16 can be connected to external parts such as a power supply and filters 26, a membrane keypad 28, solenoid (not shown) and LCD display device 30 via the appropriate connectors and ribbon cable. The connectors can be in the form of IDC (insulation displacement connection) headers which are particularly suitable for use with ribbon cable.

In one particular arrangement, switching devices such as field effect transistors (FETs), for the actuating devices can be included within the hybrid circuit 10; in another arrangement, the FETs are instead mounted on the mother board.

-----can be included within the hybrid circuit 10; in another arrangement, the FETs are instead mounted on the mother board.

It will therefore be seen from Figure 1 that if there is a malfunction within the hybrid circuit 10, repair can be effected simply by unplugging the various connectors and removing the complete

mother board 16 with its hybrid circuit 10. A new unit can be inserted as a replacement, and if required, servicing can be carried out on the faulty circuit subsequently at the workshop.

In an alternative arrangement, the hybrid circuit 10 can include a socket mounted thereon, the socket being arranged to carry at least a non-volatile memory component of the control circuit. In the event of a circuit malfunction elsewhere with the hybrid circuit, the memory component can be unplugged and its data unloaded so as to preserve the cumulative accounting information.

It will be seen from Figure 1 that the arrangement is extremely compact and takes up a small amount of space within the casing of a postage meter.

Figure 2 shows a circuit diagram of a postage meter control circuit, parts of which can be included within the hybrid circuit 10 of Figure 1.

Referring to Figure 2, the main component of the circuit is a microcontroller 40, shown as a Motorola MC68HC11A8 device. This is a particularly powerful HCMOS (high-density high-performance silicon gate) 8-bit device, including, as well as the processor, 8K bytes of ROM, 512 bytes of EEPROM and 256 bytes of static RAM. Within the microcontroller is located the accounting means, i.e., circuits affecting the arithmetic operations involved in accounting for postage, the program memory, and the electronic memory. The microcontroller 40 is connected to the power supply and filter 26 (only the filter part being shown in Figure 2), to the membrane keypad 28 via four signal diodes 42, to the solenoids via four inverting buffers 44 (in association with four pull-up resistors 46) and via appropriate switching FETs (not shown), and to the LCD display device 30. The remaining circuits shown in Figure 2 (that is other than the power supply 26, keypad 28, print actuators and LCD display device 30), including logic circuits and a 4MHz crystal oscillator 48 providing clock or timing signals for the microcontroller, form part of the hybrid circuit 10 and, as previously mentioned, are mounted with the microcontroller 40 in a layer structure on ceramic plates. A preferred arrangement, however, is for the microcontroller 40 to be removable from the hybrid circuit 10. For this purpose, an integrated circuit type socket can be incorporated in the circuit 10 during hybridisation and the microcontroller 40 simply plugged in. The advantage of this arrangement is that should there be a malfunction of any other circuit within the hybrid circuit 10, the microcontroller 40 can be unplugged and the relevant data, including the cumulative accounting data, can be unloaded for records purposes and for subsequent entry into a replacement component.

Operation of the circuit is conventional, postage values to be printed being input by means of the membrane keypad 28. The appropriate data is then fed to the microcontroller 40 along the matrix lines from the keypad 28. The postage value information is displayed on the LCD display device 30 and the appropriate accounting operations are performed by the microcontroller 40 in known manner, which also controls the actuating devices, e.g., solenoids, associated with the electromechanical parts of the postage meter, such as the printing head 41. The Figure 1 operation can be broadly similar to that described in UK Patent No. 2 062 312.

The use of a powerful microprocessor such as the MC68HC11A8 permits current account mode operation, as well as maintaining the usual ascending and descending accounts. Also, a batch account capability can be provided, as well as automatic date change if required.

If a less powerful microprocessor is used, it may be necessary to provide a separate non-volatile memory for storing cumulative accounting data. In that case, the non-volatile memory could be removably mounted with the hybrid circuit 10 using a socket arrangement similar to that described above.

Although as shown in Figure 2, the power supply is shown external to the hybrid circuit 10, parts of the power supply 26 could be incorporated within the hybrid circuit. In particular, the voltage regulator (referenced by its type number 7805) and associated filter resistor/capacitor components could be hybridised within the circuit 10 as long as the regulated supply was only fed to the microcontroller and associated components. The relatively heavy current requirements of the solenoids would then be met directly from the unregulated supply.

A comparison of the circuit diagram of Figure 2 with the assembly drawing of Figure 1 should make apparent how much space can be saved by providing all possible circuit functions within the hybrid circuit 10, rather than providing these as discrete circuits on the board 12.

Claims

1. An electronic postage meter comprising:
means (28) whereby data can be fed into the meter, said data including at least numerical information relating to the value to be franked;
means (41) for printing postage;
microprocessor means (40) within the meter for controlling the printing of postage;
accounting means (40) for keeping an account of postage printed;
an electronic memory (40) for storing therein digital values corresponding to the total of postage that

has been printed;

a program memory (40) incorporating a postage meter program to enable the microprocessor means to control the operation of the meter;

5 a clock circuit (48) for generating timing signals for the microprocessor means; and

circuitry connecting the aforesaid parts together;

characterised in that the microprocessor means, the accounting means, the program memory, the electronic memory, or a socket arrangement for retaining at least the electronic memory, the clock circuit, and at least part of the interconnecting circuitry are mounted together to form a so-called hybrid circuit.

15 2. A postage meter according to claim 1, wherein the microprocessor means, the accounting means and the program memory are constituted by a single integrated circuit component mounted in the hybrid circuit.

20 3. A postage meter according to claim 2, wherein the integrated circuit component is a microcontroller also including the electronic memory in the form of a non-volatile memory.

25 4. A postage meter according to claim 2 or claim 3, wherein the hybrid circuit includes a socket for receiving the integrated circuit component.

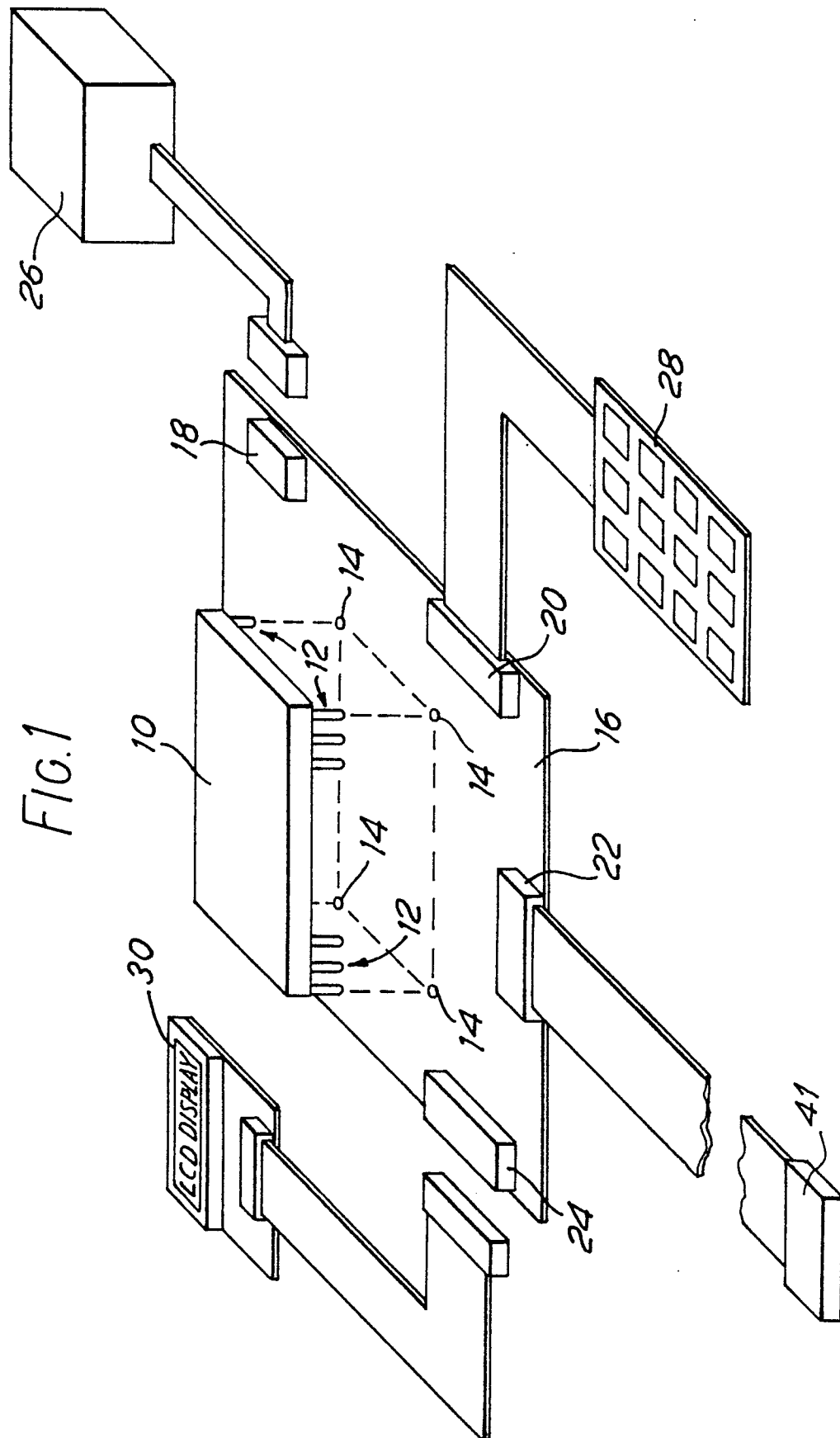
30 5. A postage meter according to any one of the preceding claims, wherein the microprocessor means and other components of the hybrid circuit are mounted on ceramic plates and interconnections are made therebetween during the hybridisation process.

35 6. A postage meter according to any one of the preceding claims, wherein the hybrid circuit is mounted on a mother board as the sole component apart from connection means for external devices.

40 7. A postage meter according to any one of the preceding claims, wherein switching devices for the printing means and for other external devices are provided in the hybrid circuit.

45 8. A postage meter according to any one of claims 1 to 5, wherein the hybrid circuit is mounted on a mother board as the sole component apart from (a) connection means for external devices and (b) switching devices for controlling the printing means and other external devices.

50 9. A postage meter according to any one of the preceding claims, including, in the hybrid circuit, one or more of logic circuits, a clock circuit comprising a crystal controlled oscillator, and a voltage regulator for regulating the voltage supplied to the other components in the hybrid circuit.



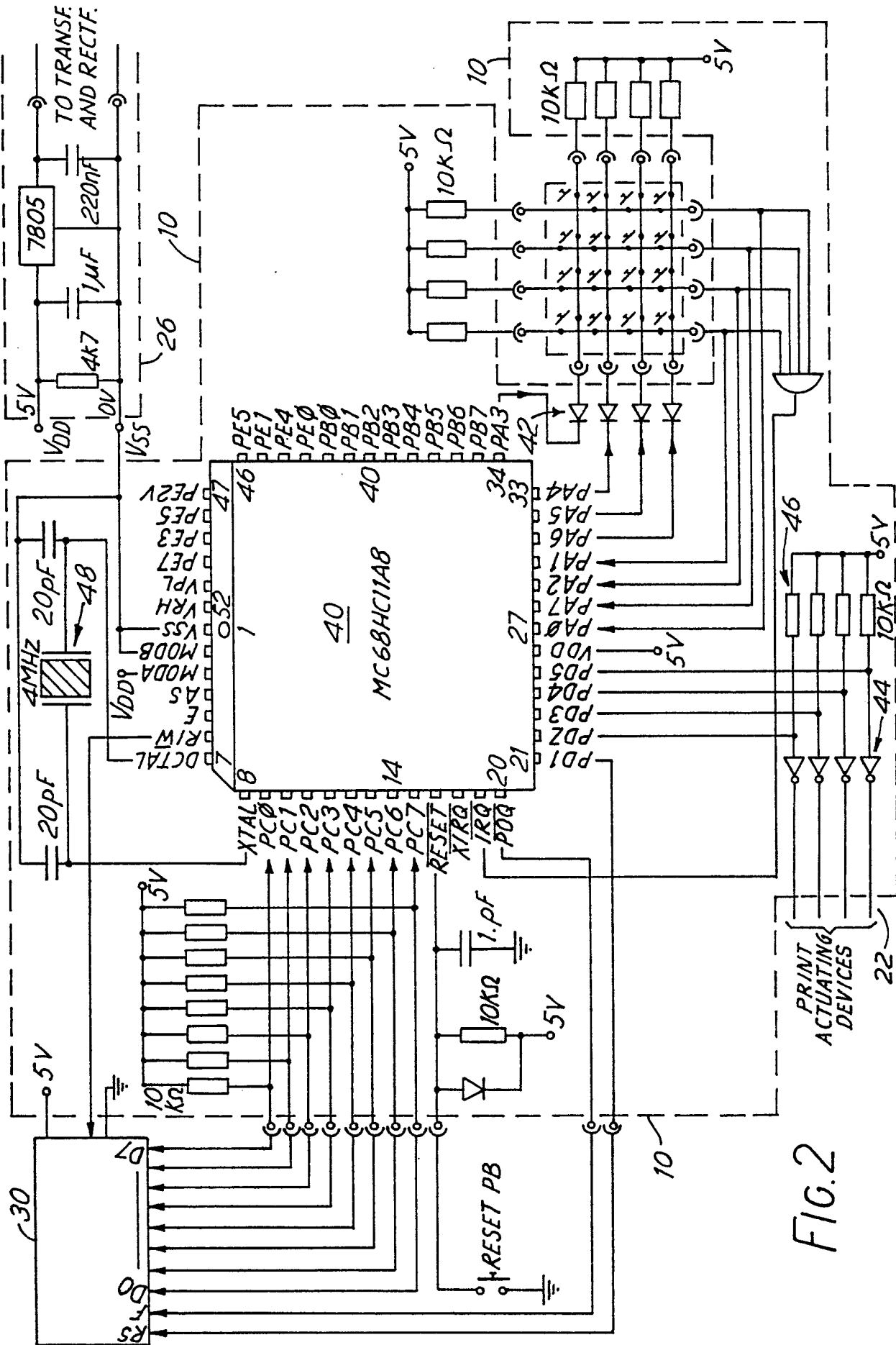


FIG. 2