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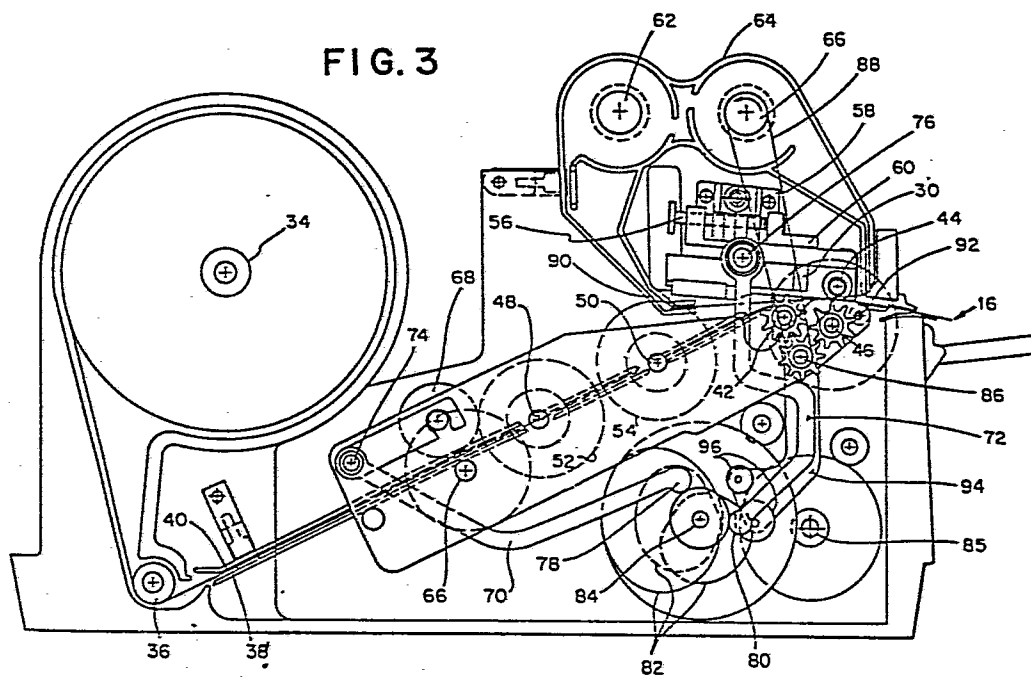
(54) **Thermal printer and postal meter having thermal printer.**

(57) A postage meter which includes a thermal print head (30) for printing indicia, postal value, and the like is disclosed. Thermal elements in the thermal print head are electronically pulsed in appropriate serially timed patterns to provide a complete thermally transferred image on a tape moving past the thermal head (30).

The tape moves from a spool (34) through guides (38,40) to the thermal head (30).

A thermal transfer ribbon is passed from a supply spool (62) between the head (30) and the tape to a take-up spool (66).

FIG. 3



THERMAL PRINTER AND  
POSTAL METER HAVING THERMAL PRINTER

The present invention relates to postage meters and to thermal printing means therefor.

Previously, electronic meters, as well as the more traditional mechanical postage meters have relied upon specifically-manufactured, individually-unique printing dies which were provided to the user and which enabled the printing of the indicia, slogans, and the like in addition to postal value. Once fixed, the information and images replicated by the die could not be changed except by replacing the die.

An object of the invention is to provide a postage meter in which variable data can be easily printed along with the imprint of postal value.

Another object of the invention is to provide a postage meter which is capable of printing different information on a tape or strip in accordance with a received command.

It is a further object to provide a stamp impression printer to provide printing of changeable indicia without changing any mechanical parts.

It is another object to provide a means for interchanging meters, particularly between post offices, without having to order new printing dies.

In accordance with the invention the printing of postal value and other associated indicia is accomplished by using a thermal transfer printer under the control of a microprocessor for forming the images and enabling the input and printing of  
5 selected variable data.

It is further desirable to avoid cutting the paper tape while the tape is moving or while printing is in process. It is therefore an object to provide an apparatus which will cut a strip prior to printing the variable data thereon.

10 For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Fig. 1 is a perspective drawing of a postage  
15 meter in accordance with one embodiment of the invention;

Fig. 2 is a block diagram of the electronic portion of the meter in accordance with one embodiment of the invention; and

Fig. 3 shows a preferred tape and thermal transfer ribbon drive apparatus for the meter.  
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In Fig. 1, a postage meter in accordance with one embodiment of the invention is shown generally at 10. The unit is provided with a keyboard 12 for inputting data into the unit and a display 14 which may be a conventional LED display. Similar keyboards and displays  
25 are shown and described in U.S. Patent 3,938,095 to

Check, Jr. et al, the disclosure of which is hereby incorporated herein by reference. A slot or opening 16 is provided through which is ejected an imprinted tape. An input/output connector (not shown) may be optionally  
5 provided if desired for interconnection and communication with other devices.

Fig. 2 is a block diagram of an electronic portion of the postage meter. The meter preferably incorporates a central processing unit 18 connected  
10 through a conventional bus arrangement to a multi-purpose ROM/RAM/IO device 20. A keyboard 22 and display 24 are scanned and driven, respectively, in conventional manner through use of conventional decoders 26 to enable input and readout of desired data. A bus arrangement likewise preferably provides  
15 in conventional manner for input and output between ROM/RAM/IO device 20 and accounting registers, peripheral units, or the like.

Printer logic and driver circuits shown at 28 receive data input from the device 20 and translate the data into a  
20 pattern of suitable sequential electrical pulses to individual thermal heating elements of a thermal print head 30 for heating the elements in conventional fashion. Suitable thermal print heads for use in a meter as disclosed herein are available from RICOH Company Ltd., San Jose, California or KYOCERA Company,  
25 Kyoto, Japan. A typical device is shown and described in U.S. 4,429,318 issued January 31, 1984 to Kobata.

In the print head for use in the present postage meter it is preferable that the heating elements be formed in a single row and arranged perpendicular to the direction of travel of a paper tape as described below. For best results, there are about 224 elements in the row. The elements are heated as required for the purpose of melting an ink composition on a thermal transfer ribbon and causing it to be lifted off the ribbon at the point of heating and transferred to a paper tape travelling in conjunction with the thermal transfer ribbon. CPU 18 further controls the sequencing of motor drivers 32 as is described in connection with Fig. 3.

Referring now to Fig. 3, there is shown a suitable tape drive unit for the postage meter. Paper tape (not shown) spools off a roll of tape rotatably mounted on shaft 34 passing around roller 36 and between tape guides 38 and 40 and thence portions of tape feed into the bite between heating elements of the thermal head 30 (numbered the same as the block shown in Fig. 2) and the impression roller indicated at 42 to the bite between upper exit roller 44 and lower exit roller 46. Tape cutting knives 48 and 50 are provided for cutting the tape into one of two different lengths depending upon whether a printed slogan or other such information is desired or not. Each knife 48 and 50 comprises a movable cutting blade in contact with a rotationally biased blade operated preferably by means of a rotary solenoid (shown schematically at 52 and 54) which operate upon command of the microcomputer to cut the tape prior to transport of a cut section past the thermal head 30.

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It has been found desirable to avoid cutting the paper strip as the strip is moving and the printing is in process. Cutting while the tape is stopped aids in the avoidance of paper jams at the knife and simplifies timing and mechanical complexity of the knife mechanism. It also avoids any possible distortion of the thermal transfer printing which might be caused by the paper strip hesitating during the cutting action.

Typically, the knife should usually be located a significant distance either upstream or downstream of the area of printing. Thus, normally a non-printable border will be present at either the leading or the trailing edge of the printed strip if the strip is cut after printing takes place unless the strip is retracted. Such a border is avoided and any retraction mechanism is avoided by situating the knives as shown in Fig. 3 and by cutting the tape before the printing takes place.

The thermal head 30 is able to both translate and rotate so as to align the row of heating elements with the impression roller nip. Suitable adjustment means, for example, are shown as threaded screw 56 threadingly mounted on bracket 58 and carrying mounting member 60 to which the thermal head 30 is fixed.

A roll of thermal transfer ribbon (not shown), typically .00025" Mylar® ribbon having a suitable meltable ink composition coating, is rotatably mounted on shaft 62 and preferably housed in a molded cassette housing 64. The tape is threaded coating-side down so as to travel adjacent to the paper tape through a bite between the thermal head 30 and the impression roller 42 and then through the bite between the exit rollers to a take-up spool mounted on shaft 66, also preferably a part of cassette 64.

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Drive or feed roller 66 and pinch roller 68 are provided to advance tape to the position for the next cycle.

Under conditions of high humidity, gummed paper tape may in time adhere to the rollers if the tape stays in position under pressure for long lengths of time. This may cause jamming of the paper strip on start up and during rotation of the drive rollers. To avoid problems with such sticking,

the rollers are made to retract from the paper strip at the conclusion of each printing cycle. To achieve this result, arms 70, 72 and 94 are pivoted about pivot shafts 74, 76 and 86. The distal ends 78, 80 and 96 of these arms are normally made to rest against camming surfaces 82 fixed on shaft 84. The camming surface is arranged such that upon rotation in one direction, the ends 78, 80 and 96 move inwardly toward the shaft 84 as pinch roller 68, impression roller 42 and upper exit roller 44 are driven by springs (not shown) into pressure abutment against the feed roller, the thermal head and the lower exit roll. Upon rotation in the opposite direction, the camming surfaces cause the distal ends to move outwardly which again causes the pinch roller 68, the impression roller 42 and the upper exit roller 44 to move away from the tape to relieve the pressure thereon.

The positioning of the upper exit roller 44 away from the tape enables a very simplified loading of the cartridge and threading of the ribbon so as to avoid any need to touch the ribbon or to feed it around any roll-



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ers or guides. As brought out above, at the end of each machine cycle the rollers are automatically moved out of contact with the thermal print head and the lower exit roller. The ribbon bridging the distance between guides  
5 90 and 92 is easily inserted into the large gap existing between the thermal head and the impression roller and the bite between the exit rollers when the rollers are in this condition.

Preferably, feed roller 66, impression roller 42, and  
10 exit roller 46 are driven from a single reversible stepping motor (not shown) located at drive shaft 85. For best results, the lower exit roller 46 is driven by a drive belt from the stepping motor and lower exit roller 46 drives an idler wheel 86 which in turn drives the impression roller 42. Suitably,  
15 belt 88 transmits the motion from idler wheel 86 to the take-up spool mounted on shaft 66.

In accordance with the invention, the reversible stepping motor is geared in a one-to-one ratio with the shaft 84 which carries both the camming surfaces 82 and the timing belt pulley.  
20 One or the other of these will be driven by shaft 84, depending on the direction of rotation, through suitable overrunning clutches. When the stepping motor turns in a first direction, the Polyclutch arrangement transmits the motion to the camming surface for movement of the distal ends of the arms 70, 72, and  
25 94. At the same time the over-running clutch will not transmit any motion through the belt drive. Conversely, when the motor turns in the opposite direction, the motion is transmitted through the belt drive for driving the feed roller, impression roller, and exit rollers.

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The operation of the drive mechanism will now be described assuming that the paper tape is loaded such that it lies between guides 38 and 40 and the free end is situated approximately at the bite between the thermal head 30 and the impression roller 42. It is also assumed that the pinch roller 68, the impression roller 42 and upper exit roller 44 are in the pressure-relief position away from the tape.

As the printing operation commences, the camming surface 82 is rotated so as to enable the arms 70, 72 and 94 to move inwardly toward shaft 84 to in turn bring the pinch roller 68 and impression roller 42 into pressure abutment against the paper tape. With the rollers in such abutment, one of the knives 48 or 50 is actuated under command of the microprocessor depending upon the length of the meter strip desired, that is, whether a slogan or the like is desired. The drive rollers are then actuated to drive the cut segment of tape past the thermal print head and through the bite of the exit rollers 44 and 46 and from thence out the slot 16. At the same time, feed roller 66 is driving the remaining tape into pre-position for the next printing cycle.

As the tape is traveling past the thermal head, the thermal transfer ribbon is also traveling in conjunction with the tape. In response to output commands from the microcomputer, the thermal elements of the thermal head are heated in a patterned sequence to create the desired image line-by-line on the tape traveling past the head as the ink coating on the thermal transfer ribbon is heated and lifted from the thermal transfer ribbon and deposited on the paper tape.

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When the printing has finished and the tape has been pre-positioned for the next cycle, pressure is then relieved on the feed roller and the impression roller by the rotation of the camming surface 82 into its initial position to again lift  
5 pinch roller 68 and to pivot impression roller 42 away from the paper tape.

It will be understood that the claims are intended to cover all changes and modifications of the disclosed embodiment, herein chosen for the purpose of illustration, which do not  
10 constitute departures from the scope of the invention.

Claims:

1. Thermal printing means for use in an electronic postage meter (10) of the type including accounting means (18) and means (22) for inputting postal data, for printing postal value along with said other indicia, said printing means characterized by:
  - (a) a thermal print head(30) which includes a plurality of thermal heating elements operative to receive voltage pulses for heating thereof to a predetermined temperature;
  - (b) a tape moving means (44,46) for moving a tape past the individual elements of the print head, said tape moving means including knife means (48,50) for cutting tape prior to the printing of data; and
  - (c) a thermal transfer ribbon transportation means (62,66) for transporting a transfer ribbon having a meltable ink composition thereon, so that portions of said thermal transfer ribbon can be carried into juxtaposition between said thermal elements and said tape whereby when said thermal elements are heated to said predetermined temperature the meltable composition adjacent said heated elements is transferable to the tape.
2. An electronic postage meter (10) comprising accounting means (18) and means (22) for inputting postal data characterized by a thermal printing means according to claim 1.

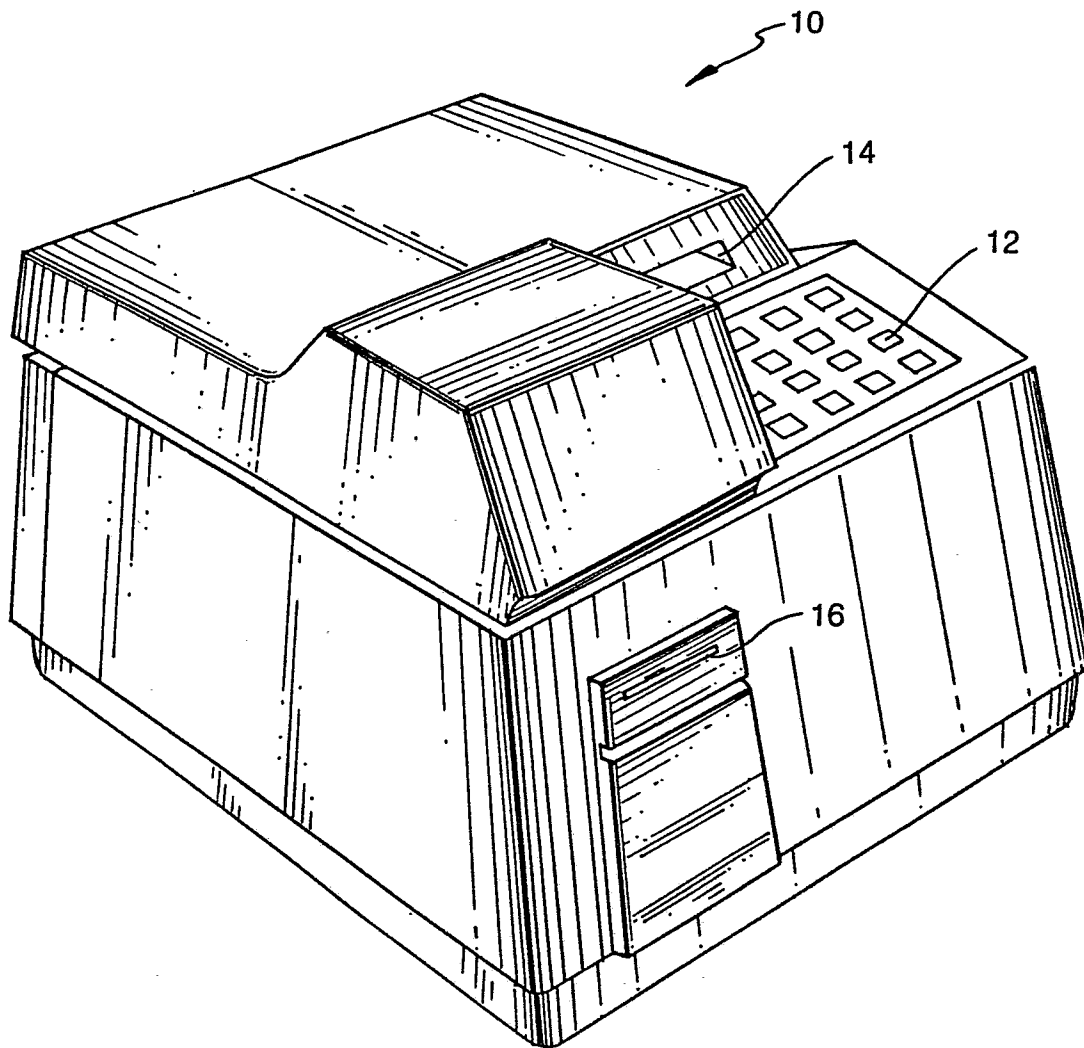


FIG. 1

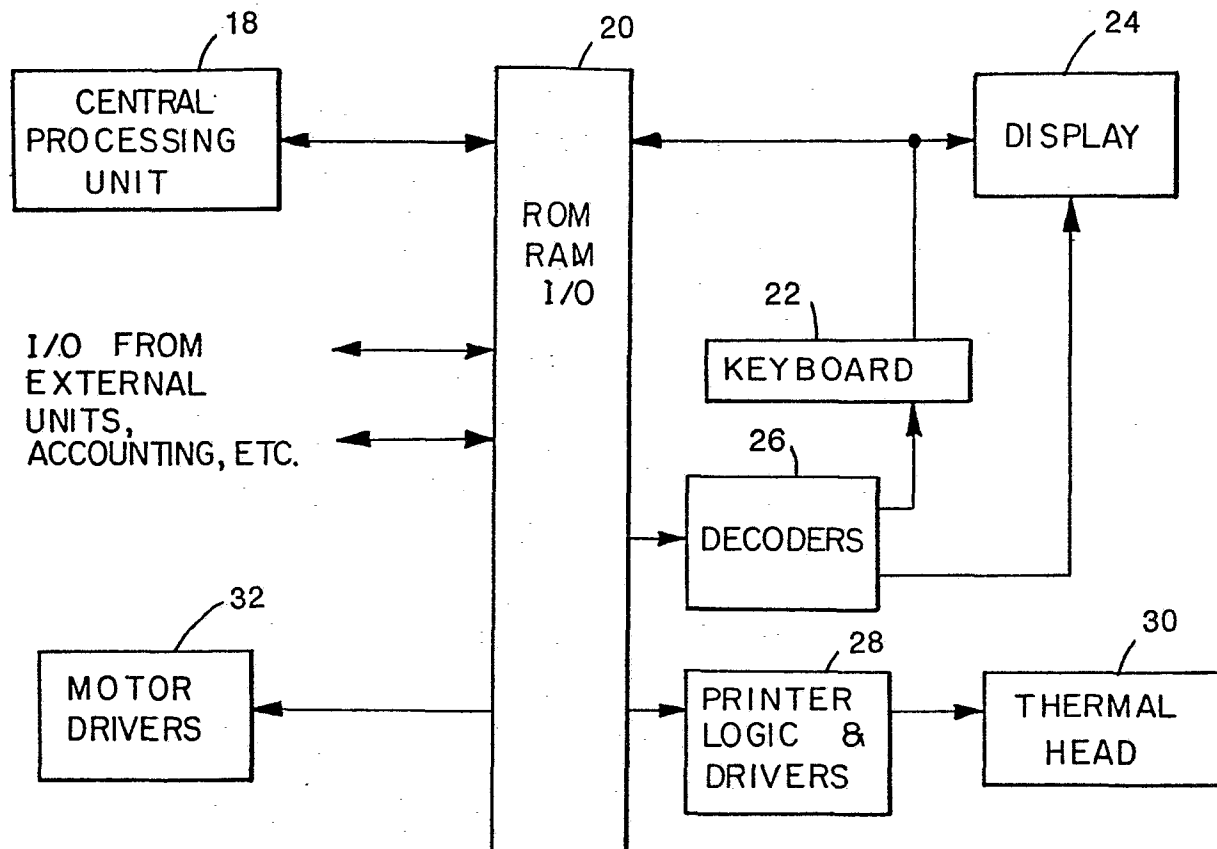


FIG. 2

