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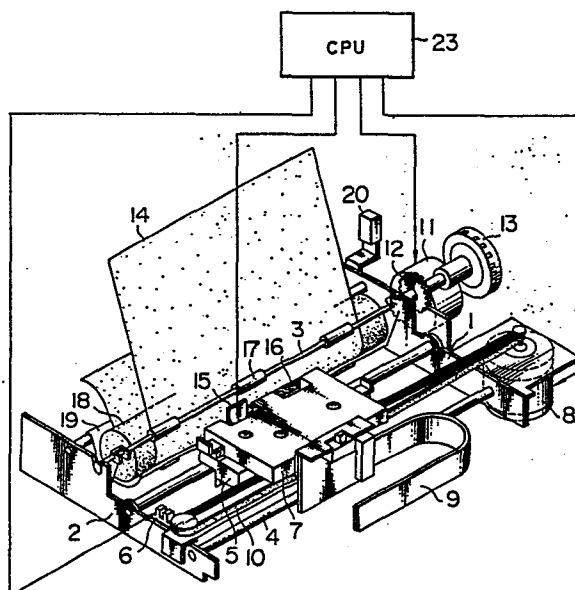
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**Thermal transfer printer.**

A thermal transfer printer including a platen supporting a printing sheet, a carriage mounted for reciprocatory movement axially of the platen, a thermal head supported by the carriage, a plurality of heat generating elements mounted in the thermal head, an inked ribbon cassette detachably attached to the carriage, a pair of ribbon cores located in the inked ribbon cassette for rotation, and an inked ribbon wound on the pair of ribbon cores and extending therebetween. Printing of characters, symbols, etc., is performed on the printing sheet on the platen as the thermal head forces the inked ribbon against the printing sheet by heat generated by the heat generating elements. The inked ribbon has a printing zone of a size large enough to accommodate two lines of characters, symbols, etc., one line superposed above the other, whereby one half-portion of the printing zone is used for printing characters, symbols, etc., along one line to the end of the inked ribbon by moving the inked ribbon as it is wound on one of the pair of ribbon cores and the other half-portion of the printing zone is used, after the inked ribbon is turned over following completion of printing on the one half-portion of the printing zone, for printing characters, symbols, etc., along the other line while winding the inked ribbon on the other ribbon core. The inked ribbon is formed with a ribbon end mark at either end

portion of the printing zone which is sensed by a ribbon sensor for monitoring the inked ribbon.



THERMAL TRANSFER PRINTER

1 BACKGROUND OF THE INVENTION

(1) FIELD OF THE INVENTION

This invention relates to a thermal transfer printer using an inked ribbon.

5 (2) DESCRIPTION OF THE PRIOR ART

In thermal transfer printers of the prior art. It has hitherto been an usual practice to use an inked ribbon having a printing zone with width sized to accommodate one line of characters, symbols, etc, and to use a ribbon sensor  
10 which is located in a position corresponding to a substantially widthwise central portion of the printing zone of the ribbon for monitoring same.

However, the construction in which the ribbon sensor is located in the position described hereinabove would  
15 suffer the disadvantage that when an inked ribbon having a printing zone with width sized to accommodate two lines of characters, symbols, etc., one line superposed above the other, is combined with a ribbon cassette which is used by being turned over, such a ribbon sensor would be impossible  
20 to satisfactorily monitor the ribbon with respect to its availability.

SUMMARY OF THE INVENTION

This invention has as its object the provision of a thermal transfer printer capable of readily monitoring an

1 inked ribbon having a printing zone with width sized to  
accommodate two lines of characters, symbols, etc., one line  
superposed above the other.

The aforesaid object of the invention is  
5 accomplished by the outstanding feature of the invention that  
an end mark is provided to an end portion of each line of the  
inked ribbon, so that the end of the inked ribbon can be  
sensed by the ribbon sensor when the ribbon cassette is used  
by being turned over.

#### 10 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the thermal  
transfer printer comprising one embodiment of the invention,  
showing its external appearance;

Fig. 2 is a top plan view of the ribbon cassette  
15 used with the thermal transfer printer shown in Fig. 1,  
showing the interior of the ribbon cassette by removing the  
top cover;

Fig. 3 is a view showing the ribbon sensor in  
relation to the inked ribbon contained in the ribbon  
20 cassette, in explanation of the operation of the ribbon  
sensor for monitoring the inked ribbon;

Fig. 4 is a diagram showing one example of the  
inked ribbon monitoring circuit; and

Fig. 5 is a diagram showing the wave form of the  
25 output voltages of the ribbon sensor showing the presence  
and absence of the available inked ribbon.

1 DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the invention will now be described by referring to the accompanying drawings.

Referring to Fig. 1, a plurality of shafts 4 are  
5 joined at opposite ends to side plates 1 and 2 for supporting  
a carriage 5 thereon for sliding movement. The carriage 5  
supports thereon a ribbon cassette 7 that can be used by  
being turned over and a thermal head 15. An inked ribbon 16  
having a printing zone with width sized to accommodate two  
10 lines of characters, symbols, etc., are contained in the  
ribbon cassette 7.

The carriage 5 is driven by a carriage motor 8  
through a timing belt 10 for movement leftwardly and right-  
wardly in Fig. 1.

15 A line feed motor 11 transmits a driving force to  
a gear 12 supported by a shaft of a platen 18 to feed a  
printing sheet 14. Alternatively, the printing sheet 14 can  
be fed manually by turning a platen knob 13. The numeral 19  
designates a sheet guide.

20 By moving a release lever 20 forwardly and rear-  
wardly, sheet keep rollers 17 slidably supported by a shaft  
3 can be moved between a position in which they are maintain-  
ed in pressing engagement with the surface of the printing  
sheet 14 would on the platen 18 and a position in which they  
25 are out of engagement with the surface of the printing sheet  
14.

The numeral 6 designates a home position sensor,  
and the numeral 9 a flat cable for passing a electric current

1 to the thermal head 15.

The home position sensor 6, carriage motor 8, line feed motor 11, thermal head 15 and a ribbon sensor 21 subsequently to be described is controlled by a central  
5 processing unit (CPU) 23 serving as a control unit.

The thermal transfer printer of the aforesaid construction is of a one-way printing system in which printing is performed only when the carriage 5 moves rightwardly. When the carriage 5 moves rightwardly, the inked  
10 ribbon 16 is taken up; the inked ribbon 16 is not take up when the carriage 5 moves leftwardly.

The ribbon cassette 7 that can be used by being turned over contains, as shown in Fig. 2, the inked ribbon 16 having a printing zone with width sized to accommodate two  
15 lines of characters, symbols, etc., one line superposed above the other.

The ribbon cassette 7 is formed, as shown in Fig. 2, at its top surface and bottom surface with openings C and D for receiving the ribbon sensor 21. The ribbon sensor 21  
20 mounted to the carriage 5 is removably inserted in the openings C and D. In Fig. 2, the ribbon sensor 21 is shown as being inserted in the openings D.

The thermal head 15 is inserted in a cutout A formed in the ribbon cassette 7. In this case, the lower  
25 half-portion G of the inked ribbon 16 shown in Fig. 3 is used for performing printing.

When the printing operation using the lower half-portion G of the inked ribbon 16 is finished, the ribbon

1 cassette 7 is turned over, and the thermal head 15 is inserted in the cutout B formed in the ribbon cassette 7.

Since the thermal head 15 is rigidly secured to the carriage 5, an upper-half portion F of the inked ribbon 5 16 as shown in Fig. 3 is switched to a lower position and used for performing printing when the ribbon cassette 7 is turned over.

In a thermal transfer printer using the ribbon cassette 7 of the aforesaid construction, the ribbon sensor 10 21 described hereinabove monitors the inked ribbon 16 in such a manner that, as shown in Fig. 3, it is positioned against the lower half-portion of the inked ribbon 16 to see if there is still a space in the printing zone in which printing can be performed.

15 More specifically, the inked ribbon 16 has a ribbon end mark E attached to an end portion of the inked ribbon 16 where the lower half-portion G ceases to exist. The ribbon end mark E may be provided by doing without the application of an ink to the end portion of the inked ribbon 20 16, so that the ribbon sensor 21 will sense the absence of ink.

Fig. 4 shows one example of the inked ribbon monitoring circuit including the ribbon sensor 21 which produces a voltage  $V_i$ . The voltage  $V_i$  becomes a voltage 25  $V_H$  when the sensor 21 is positioned against a portion of the inked ribbon 16 to which the ink is applied, and becomes a voltage  $V_L$  when it is positioned against a portion of the inked ribbon 16 having the end mark E (where no ink is

1 applied to the ribbon). Thus, the different voltages  $V_H$  and  
2  $V_L$  are transmitted through a voltage comparator 22 to the  
3 CPU 23.

4 When the ribbon cassette 7 is turned over after the  
5 end mark E is sensed following a printing operation performed  
6 on the lower half-portion G of the inked ribbon 16 as shown  
7 in Fig. 3, the upper half-portion F shown in Fig. 3 will now  
8 be used as the lower half-portion on which printing is  
9 performed. By providing an end mark E similar to the end  
10 mark E attached to the end portion of the half-portion G  
11 shown in Fig. 3 to an end portion of the half-portion F, it  
12 is possible for the ribbon sensor 21 to sense the absence  
13 of the ink in a portion of the inked ribbon 16 where the  
14 half-portion F ends in the same manner as it senses the  
15 absence of the ink in the portion of the inked ribbon 16 where  
16 the half-portion G ends as described hereinabove.

17 If the thermal transfer printer is of a type in  
18 which printing is performed on an upper half-portion of the  
19 inked ribbon 16 by means of the thermal head 15, then  
20 monitoring of the inked ribbon is performed by arranging the  
21 ribbon sensor 21 to be positioned against the upper half-  
22 portion of the inked ribbon 16 and sense the absence of the  
23 ink in the same manner as described hereinabove by referring  
24 to the use of the lower half-portion of the inked ribbon 16  
25 for printing purposes.

26 In the embodiment shown and described hereinabove,  
27 the ribbon end mark E has been shown and described as being  
28 provided by doing without the application of an ink on either  
29

1 end portion of the inked ribbon 16. However, the invention  
is not limited to this specific form of the end mark, and  
the end mark E may be applied by any known means, such as  
the provision of a projection or application of silver paper.

5 The use of the ribbon sensor 21 in combination  
with the end mark E is not limited to the inked ribbon 16  
having a printing zone for two lines of characters, symbols,  
etc., but may be used with an inked ribbon having a printing  
zone large enough only for one line of characters, symbols,  
10 etc.

In the embodiment shown and described hereinabove,  
the ribbon sensor 21 has been described as being mounted to  
the carriage 5. However, when the thermal transfer printer  
is of a type in which the ribbon cassette does not move in  
15 synchronism with the carriage, the ribbon sensor may be  
mounted to one of the side plates as is the case with a home  
position sensor.

From the foregoing description, it will be  
appreciated that the invention provides means for readily and  
20 positively sensing the absence of a printing zone on the  
inked ribbon contained in a ribbon cassette that can be used  
by being turned over. This is conducive to a fall in  
running costs which is the greatest advantage offered by the  
ribbon cassette that can be used by being turned over.



C L A I M S

1. A thermal transfer printer comprising:
  - a thermal head having a plurality of heat generating elements;
  - a carriage for moving the thermal head;
  - a ribbon cassette containing an inked ribbon having a printing zone extending from edge to edge of the ribbon in a direction perpendicular to the direction in which printing is performed and sized to accommodate two lines of characters, symbols, etc., one line superposed above the other, said ribbon cassette being turned over when it is put to use; and
  - a ribbon sensor for monitoring either a lower half-portion or an upper half-portion of said inked ribbon to sense the absence of the inked ribbon.
2. A thermal transfer printer as claimed in claim 1, wherein said inked ribbon contained in the ribbon cassette has a ribbon end mark on either end portion thereof.
3. A thermal transfer printer comprising:
  - a platen supporting a printing sheet;
  - a carriage mounted for reciprocatory movement lengthwise of the platen;
  - a thermal head supported by the carriage;
  - a plurality of heat generating elements mounted in the thermal head;
  - an inked ribbon cassette detachably attached to the carriage;
  - a pair of ribbon cores located in the inked ribbon

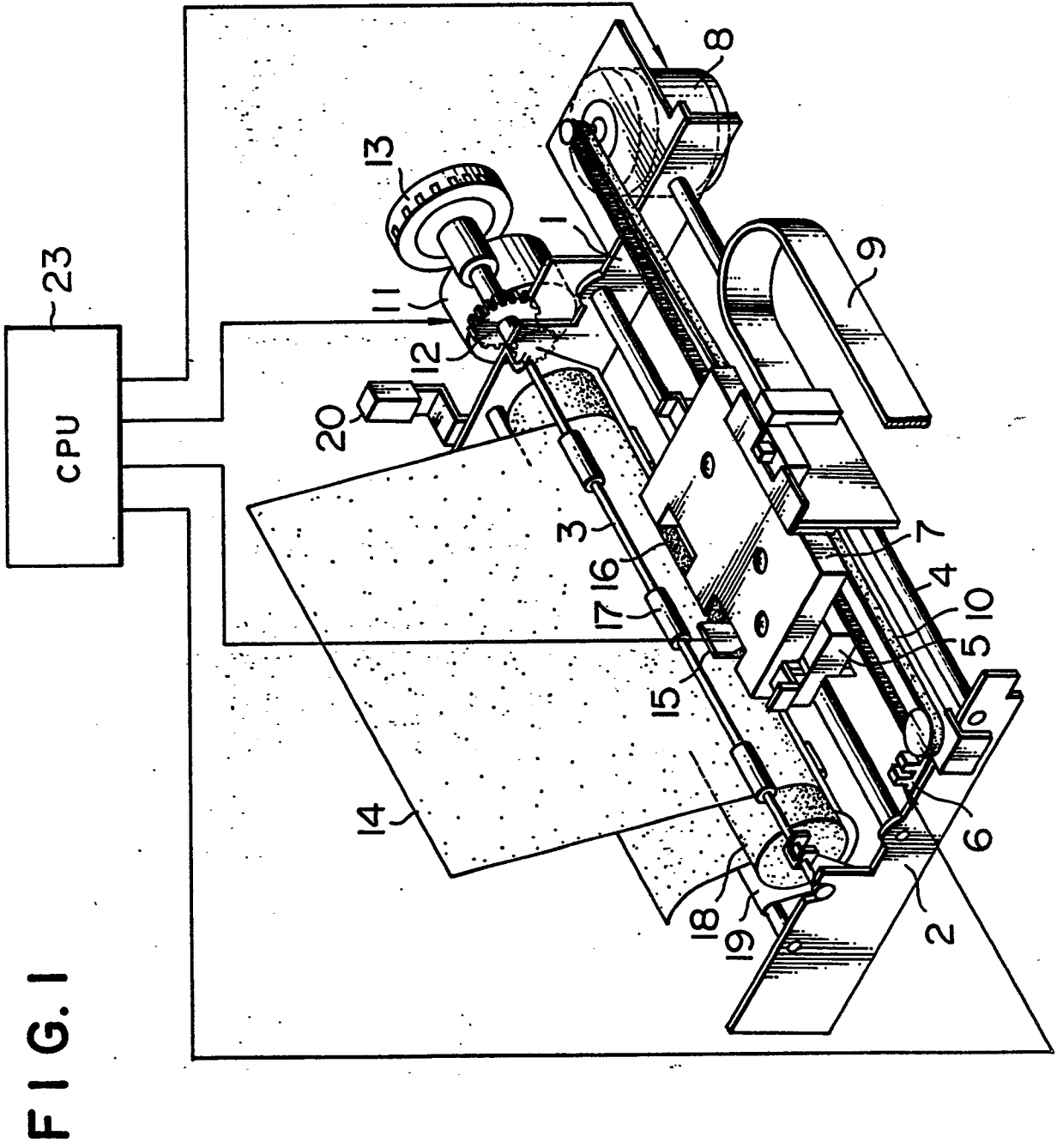
cassette for rotation; and

an inked ribbon wound on the pair of ribbon cores and extending therebetween, said inked ribbon being interposed between the printing sheet on the platen and the thermal head supported by the carriage and, as the thermal head forces the inked ribbon against the printing sheet, performing printing of characters, symbols, etc., on the printing sheet by transferring ink from the inked ribbon to the printing sheet by heat generated by the heat generating elements;

wherein the improvement resides in that:

said inked ribbon is constructed to have a printing zone of a size large enough to accommodate two lines of characters, symbols, etc., one line superposed above the other, whereby one half-portion of the printing zone is used for printing characters, symbols, etc., along one line to the end of the inked ribbon as it is wound on one of the pair of ribbon cores and the other half-portion of the printing zone is used, after the inked ribbon cassette is turned over following completion of printing on the one half-portion of the printing zone, for printing characters, symbols, etc., winding the inked ribbon on the other ribbon core, said inked ribbon being provided at either end portion thereof with a ribbon end mark; and

a ribbon sensor is provided for monitoring the inked ribbon for sensing the presence of the ribbon end mark.



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FIG. 2

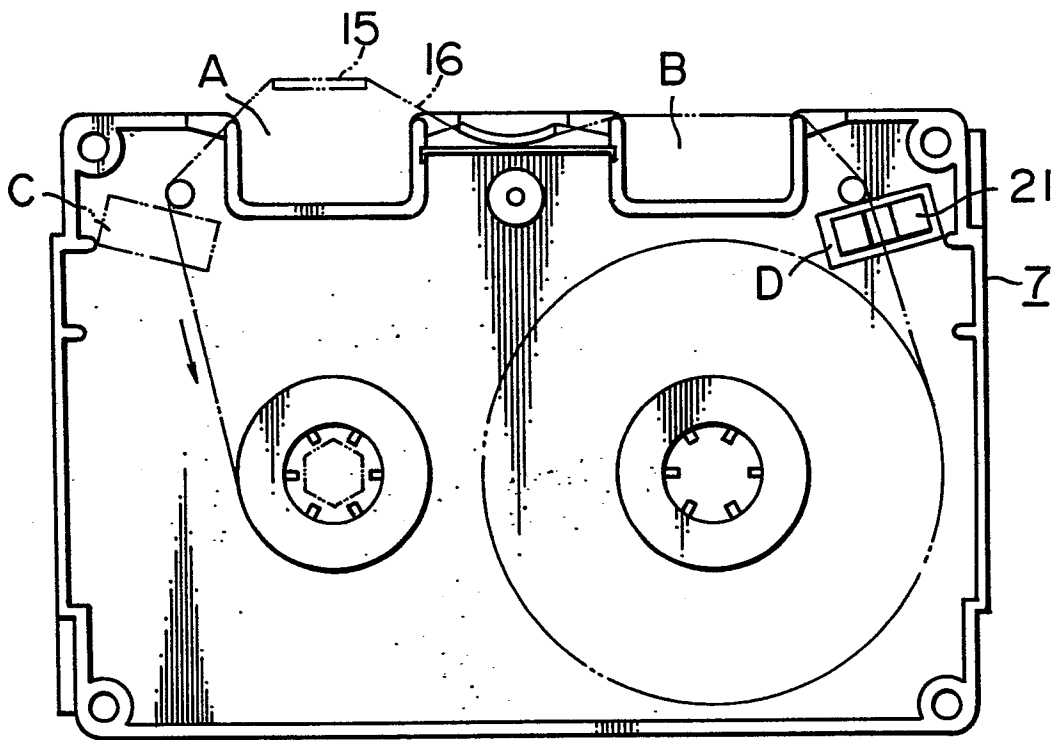


FIG. 3

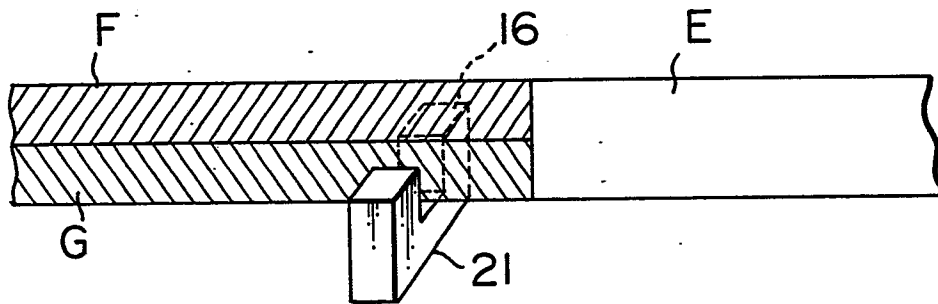
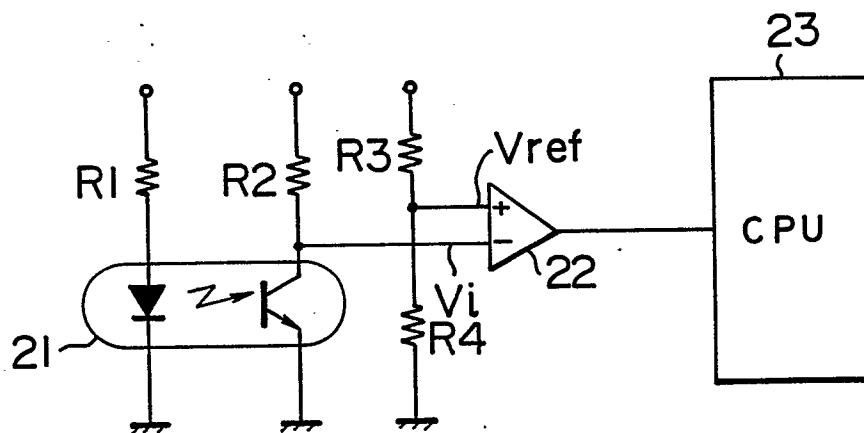


FIG. 4



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FIG. 5

