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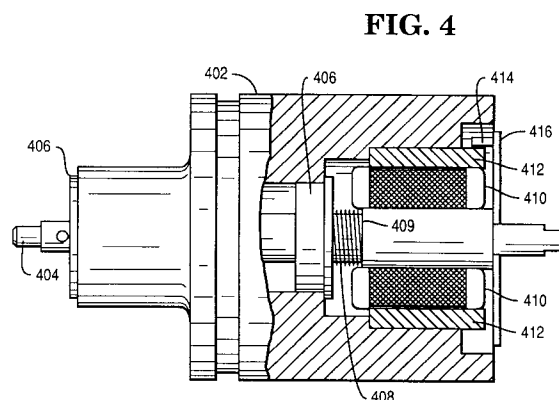
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(54) **Printer apparatus.**

(57) The present invention provides for a rotating drum-type printer having an electric motor which is located internally of the print drum (402). Using the components of a brushless, direct current (d.c.) motor, the stator windings (410) are attached to a stationary shaft (404), while the inside wall of the print drum (402) is attached to the permanent magnet rotor (412) for rotation therewith.



The present invention relates to drum printer apparatus.

Known rotating drum printers, employ a rotating drum with printing characters permanently affixed to the drum's outside surface. There is a circumferential column of printing characters on the print drum for each possible printing position along a print line. Printing paper is placed inbetween an ink ribbon and a bank of printing hammers or print actuating means (one hammer for each possible printing position).

The hammer bank has for each printing position, a hammer tip, a hammer frame and a hammer flag assembly, which function together to activate the hammer tips in a manner well known in the art. During printing, selected printing hammer tips are made to strike the paper, forcing it and the ink ribbon against the print drum, thus transferring ink from the ink ribbon to the paper in the form of a character.

One such arrangement is known from US patent 4 009 655. Prior art rotating drum printers typically have a print drum driven using either an external electric motor and pulley and belt means, or pulley and gear means.

The use of such prior art drive means disadvantageously restricts the efficiency, compactness and reliability of known rotating drum printers. Further, production costs and product life are often unsatisfactory and the use of belts, pulleys and gears often leads to mechanical coupling backlash, which may adversely affect character alignment on the printing paper.

It is an object of the present invention to provide a compact, reliable and efficient rotating drum apparatus.

In accordance with the present invention, there is provided drum printer apparatus characterised by an electric motor having a stationary shaft, a stator member attached to said shaft and a rotor member arranged to rotate around said stator member, and a print drum member attached to said rotor member for rotation therewith and having print characters on an external surface thereof located coaxially around said rotor member and said stator member, whereby in operation said motor causes said rotor member and said print drum to rotate so that any of the characters on the print drum can be selected for printing.

Advantageously, the drive means eliminates mechanical backlash between the drive means and the drum.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is an end view of a rotating drum printer of the type compatible with the teachings of the present invention, and shows a print drum, paper/print medium, an ink ribbon, and a printing hammer bank;

Fig. 2 is a perspective view of a prior art print

drum drive arrangement using a belt and pulleys to drive the print drum;

Fig. 3 is a perspective view of a prior art print drum drive arrangement using a belt, pulleys and gears to drive the print drum; and

Fig. 4 is a part cut-away view of a print drum and print drum drive embodying the present invention.

Prior art rotating drum printers typically drive the print drum using either of the arrangements shown in Figs. 2 or 3. In the arrangement of Fig. 2, an external electric motor 202 transfers torque via two pulleys 204 and 208 and a belt 206 to the print drum 102. In the arrangement of Fig. 3, the electric motor 202 is coupled to a pulley 306 via gears 302 and a shaft 304. The pulley 306 drives a belt 308 which drives another pulley 310. The pulley 310 turns a shaft which rotates the print drum 102.

The present invention satisfies the objects identified above by locating the drive means in the interior of a print drum 402 (see Fig. 4), which functions in the place of the print drum 102 in Fig. 1, which shows a drum 102, a print medium 106, ink storage ribbon 104, print actuating means 107, hammer tip 108, hammer frame 110 and hammer flag assembly 112. The drive means utilizes the major components of a prior art brushless, direct current (d.c.) electric motor as described below

The print drum 402 is rotatably connected to a fixed or stationary shaft 404. Shaft bearings 406 reduce friction during rotation of the print drum 402, and are pre-loaded by a bias spring 408, which pushes the print drum leftward in Fig. 4 against a locating surface (not shown). The bias spring 408 is supported at its right end by a stop 409 on the stationary shaft 404.

A stator 410 with a number of windings is attached to the stationary shaft 404 as shown. A rotor 412 including several permanent magnets is adhesively attached to the inside wall of the print drum 402 as shown, leaving only a small clearance between it and the stator windings. Hall effect sensors 414 which are mounted on a circuit board 416, monitor the movement of the permanent magnet rotor, and output motion indicating signals to commutation logic control circuitry on the circuit board.

The commutation logic control circuitry determines the precise currents (commutation logic) to be applied to the drive windings of the stator 410 in response to the output signals of the Hall effect sensors 414 in a manner well known in the art. Power is supplied to the drive windings of the stator 410 directly from the circuit board 416.

Two side frames (not shown) are attached to both sides of the print drum 402, and also to the sides of the hammer frame 110, to correctly align the printing hammers 108 with their respective printing positions along the print drum 402.

In operation, the Hall effect sensors 414 send ro-

tor position information signals to the control circuitry on the circuit board 416. The control circuitry determines the correct current sourcing for the drive windings (of the stator 410) needed to rotate the print drum at a given speed. As the drive windings are energized, the permanent magnet rotor 412 turns in response to the controlled magnetic fields produced. Since the rotor 412 is glued to the print drum, the print drum rotates simultaneously with the rotor.

Thus, a rotating drum printer is described in which:

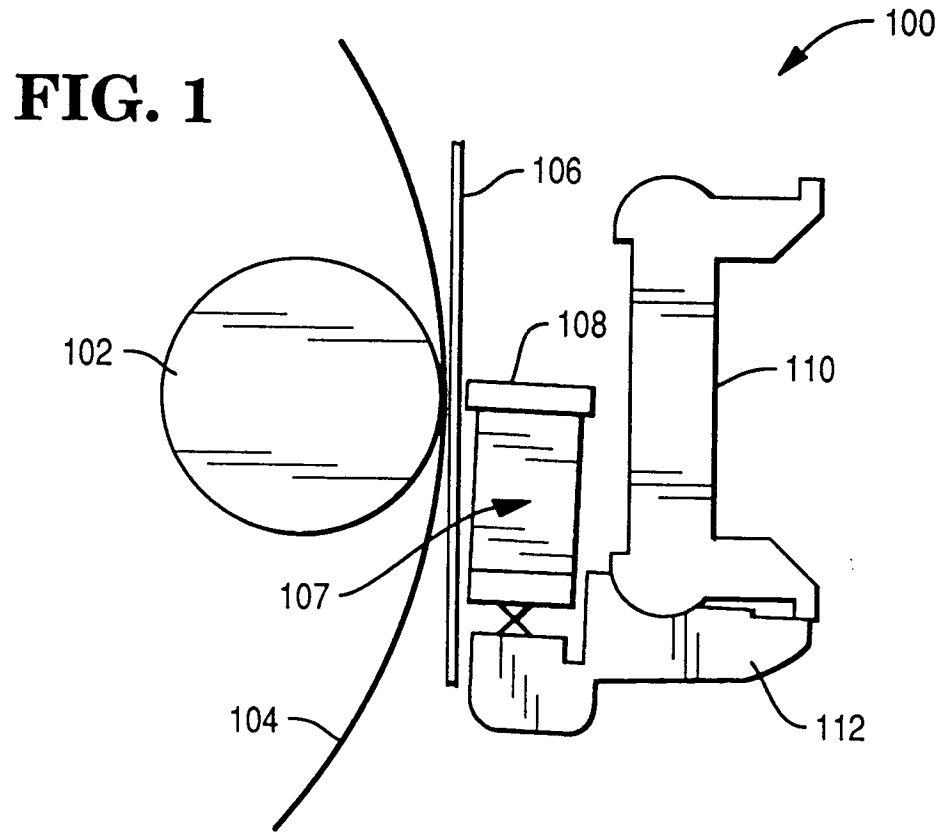
- 1) the drive means of the print drum is entirely internal; and
- 2) the print drum is integrated with the components of the drive means.

The invention is not restricted to the details of the foregoing embodiment. For example, the drive means need not be limited to components of brushless, d.c. motors, and can therefore utilize the components of other types of motors, as well.

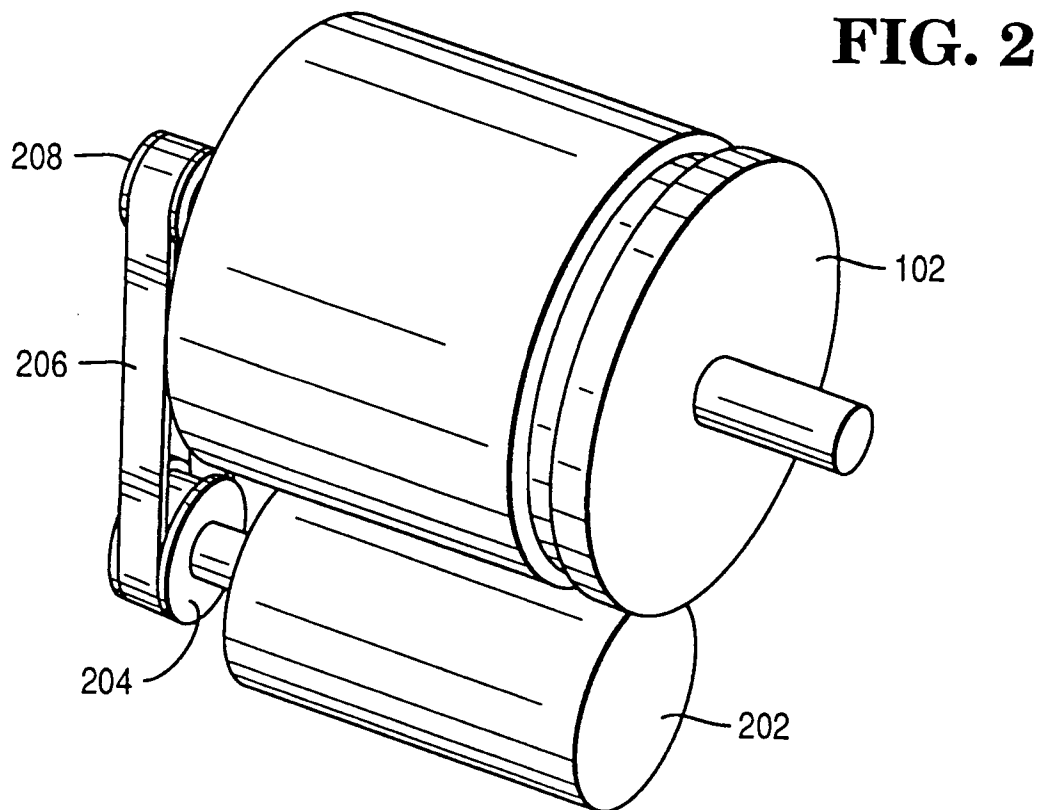
dium to contact said ink storage ribbon.

Claims

1. Drum printer apparatus, characterised by an electric motor having a stationary shaft (404), a stator member (410) attached to said shaft (404) and a rotor member (412) arranged to rotate around said stator member (412), and a print drum member (402) attached to said rotor member for rotation therewith and having print characters on an external surface thereof located coaxially around said rotor member (412) and said stator member (410), whereby in operation said motor causes said rotor member (412) and said print drum (402) to rotate so that any of the characters on the print drum can be selected for printing.
2. Apparatus according to claim 1, characterised by position sensor means (414) for sensing movement of said rotor member (412) and outputting signals corresponding to said movement.
3. Apparatus according to claim 1 or 2, characterised in that said position sensor means (414) comprises hall effect sensor means.
4. Apparatus according to claim 1, 2 or 3, characterised in that said electric motor is a brushless d.c. motor.
5. Apparatus according to any one of claims 1 to 4, characterised by ink storage ribbon for storing printing ink and located adjacent said external surface of said drum member (402), and a plurality of print actuating means for selectively displacing a print medium to cause said print me-



PRIOR ART



PRIOR ART

FIG. 3

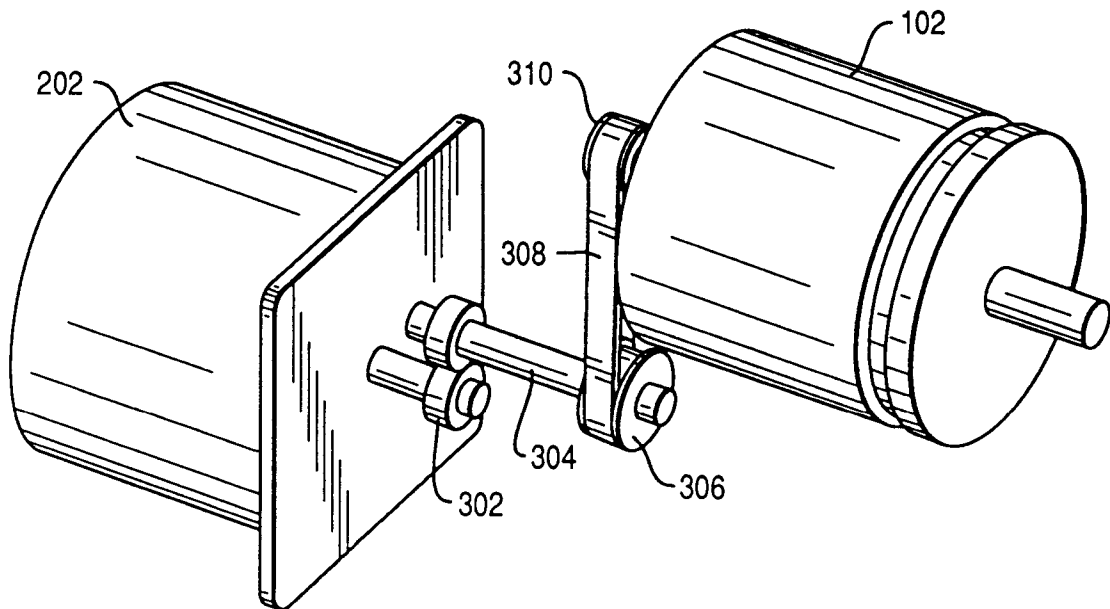
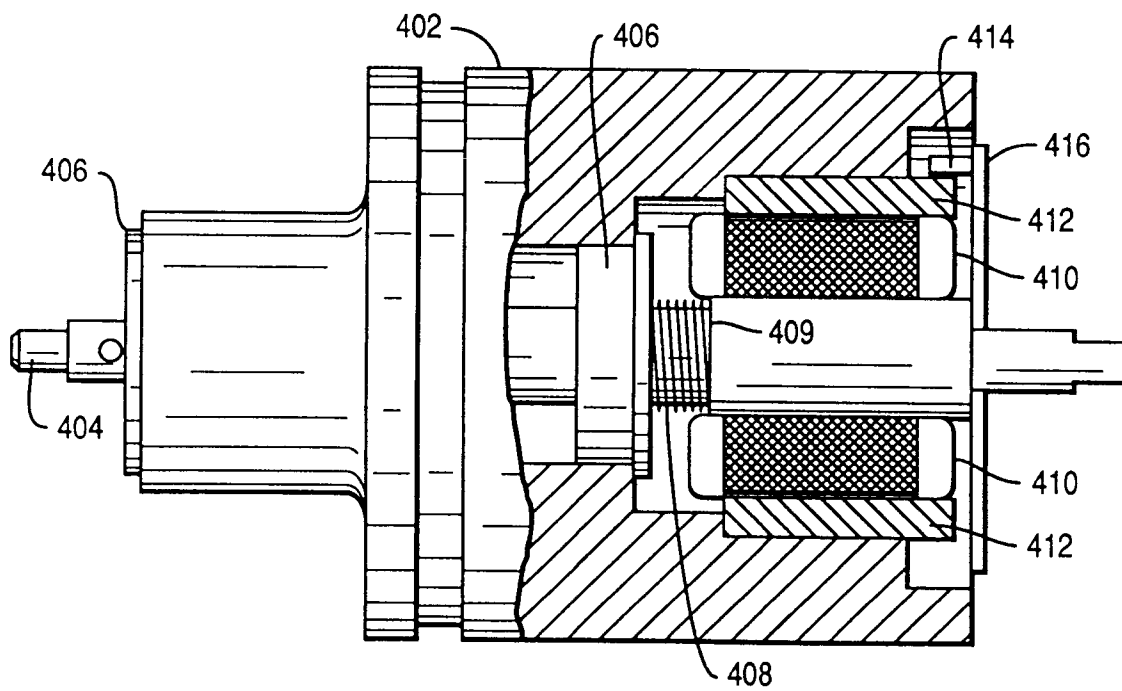


FIG. 4





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 92307810.6
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE - B - 2 234 778 (COPAL K.K.) * Totality *	1	B 41 J 1/34
Y	--	2-5	
Y	DE - A - 3 331 194 (EBM ELEKTROBAU MUFFLINGEN) * Abstract *	2-4	
Y	DE - B - 1 549 773 (INTERNATIONAL COMPUTERS AND TABULATORS) * Column 3, lines 51,52; fig. 1 *	5	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 41 J G 06 K H 02 K
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 23-10-1992	Examiner MEISTERLE
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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