

- [54] **METHOD OF POSITIONING DRUM FOR PRECISION PRINTING**
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[51] Int. Cl..... **B41j 1/32**

[58] Field of Search..... 197/49, 48, 51, 55; 178/34; 74/409, 424.8

[56] **References Cited**

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[57] **ABSTRACT**

In a precision printing machine utilizing a cylindrical drum on which are characters for printing on an adjacent tape, the drum is rotatable in either direction and slidable along an axis in either direction by means of pulse motors. The machine is so designed that the final steps in the printing operation prior to the printing itself always consist of motion of the drum in the same predetermined axial direction and rotation of the drum in the same preselected rotational direction. By this means, possible errors due to gear backlash, and imprecision in machine components are minimized.

3 Claims, 2 Drawing Figures

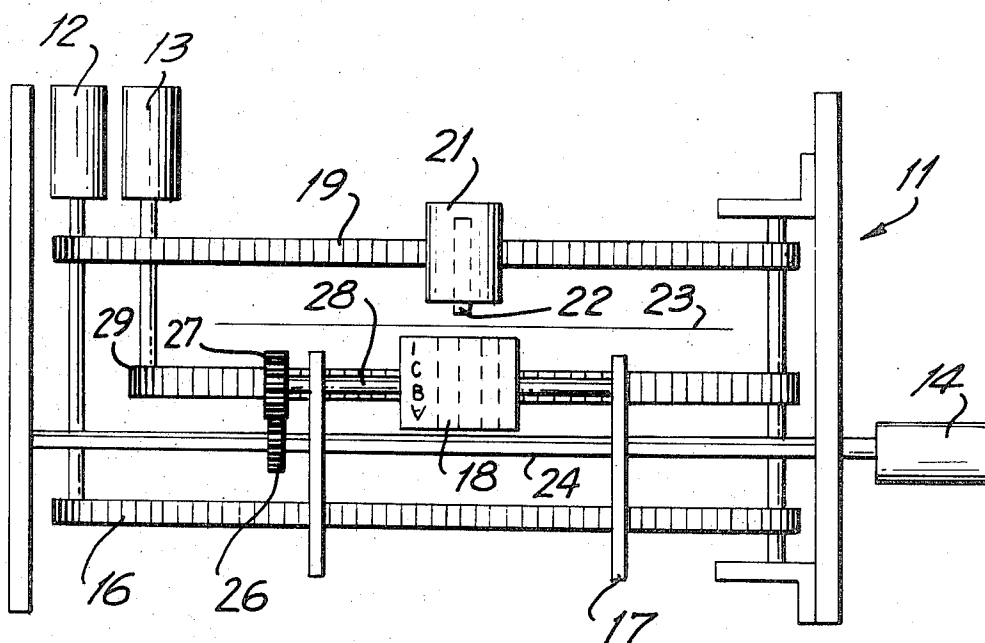


FIG. 1

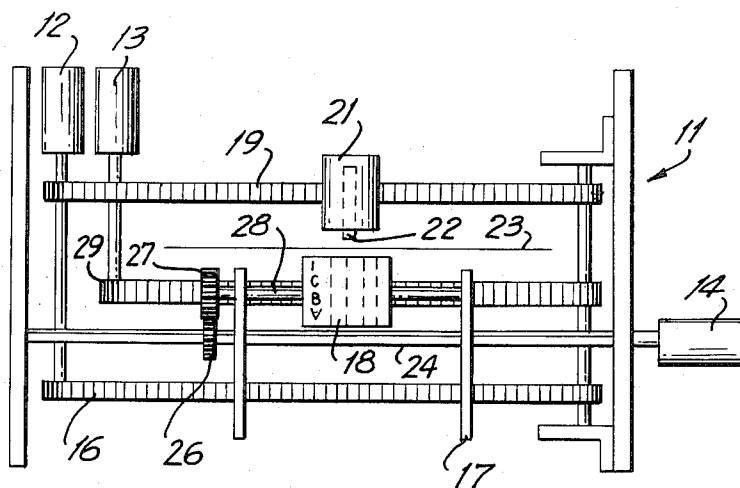
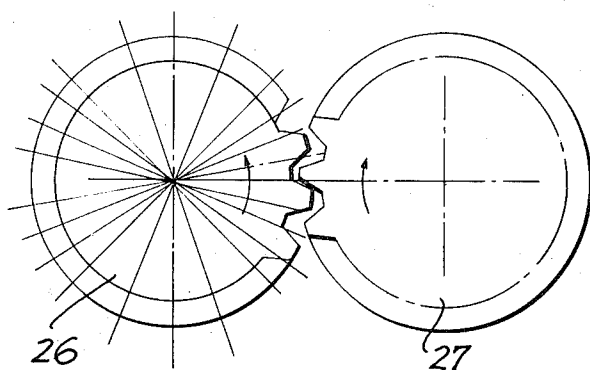


FIG. 2



METHOD OF POSITIONING DRUM FOR PRECISION PRINTING

BACKGROUND OF THE INVENTION

As is well known, in the art of printing it is highly desirable that the characters, as applied to the substrate, should be aligned and spaced with the highest precision possible. As is the case with the design of almost any machine, the achievement of high precision requires that such factors as gear backlash, unwanted flexibility and precision limits in the fabrication and assembly of the system be taken into account. In many situations, particularly, where competition is severe and the problems of mass-production may be present, the attainment of high precision by control of the factors mentioned above may involve an excessive expense.

The present invention concerns a serial printer which is powered by pulse motors operating through timing belts and gears. Since all of the components are designed to be reversible, the factors described above result in undesirable variation in spacing of characters in normal operation.

SUMMARY OF THE INVENTION

In the present invention, a drum having characters thereon is adjacent a tape on which selected carriers are to be printed. The drum is movable both axially and rotatably so that any desired character can be brought in proximity to any portion of the tape. Imprinting of the desired character on the desired location on the tape is effected by striking the tape with a plunger and thereby forcing the tape against the character. To avoid positional errors the printer is operated so that the final steps prior to striking the tape with a printing hammer involve moving the drum in a given axial direction and rotating the drum in a given direction, the axial direction and the rotational direction being the same for imprinting of any of the characters.

Accordingly, an object of the present invention is to provide an improved method of operating a printer whereby high precision in the location of characters imprinted on a tape is achieved.

Another object of the present invention is to provide an improved method of printing characters on a tape whereby errors introduced by such factors as backlash, flexibility of driving components and lack of precision in construction are avoided.

A further object of the present invention is to provide an improved method of printing whereby high precision is achieved at low cost.

Still other objects and advantages of the invention will in part be obvious and will in part be apparent from the specification.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others thereof, which will be exemplified in the method hereinafter disclosed, and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWING

For a fuller understanding of the invention, reference is had to the following description taken in connection with the accompanying drawing, in which:

FIG. 1 shows diagrammatically a serial printer suitable for operation in accordance with the present invention; and

FIG. 2 is a pair of pinion gears illustrating the problem of backlash.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A serial printer generally indicated by the reference numeral 11 is powered by pulse motors 12, 13 and 14. Pulse motor 12 drives timing belt 16 which moves frame 17. Since all of the pulse motors are reversible, frame 17 which carries drum 18 is movable in either direction parallel to the axis of drum 18. Pulse motor 12 also moves timing belt 19 which carries printing hammer body 21 containing printing hammer 22.

Timing belts 16 and 19, both being driven by pulse motor 12 keep printing hammer body 21 and frame 17 in registry with each other. However, in order to select a character which is to be imprinted on tape 23, drum 18 must be rotated and moved axially with respect to printing hammer 22. Rotation of the drum 18 is effected by pulse motor 14 which rotates square shaft 24 on which pinion gear 26 is slidably mounted. Pinion gear 26 drives a second pinion gear 27 which is rigidly connected by shaft 28 to drum 18. Drum 18 is moved axially by timing belt 29 driven by pulse motor 13.

In preparation for imprinting a character, serial printer 11 is operated so that drum 18 rotates in a given direction and moves in a given direction as the last two steps immediately prior to carrying out the printing operation. The rotational direction and the direction of movement immediately prior to carrying out the printing operation must be the same for the printing of any character on the drum 18. Alternatively, it may be said that the drum is slidable axially in a normal direction and in a reverse direction and that the drum is rotatable in a normal direction and in a reverse direction. Then, as the final steps in bringing a character into registry with the printing hammer, the drum must be moved by sliding and by rotation in the normal sliding and rotating directions. The choice of the normal directions for sliding and rotation is, of course, completely arbitrary, but must be the same for all characters on the drum.

As an example of the above method, let it be assumed that the drum 18 must always move leftward and that the nearer face of the drum as viewed must always move downward immediately prior to printing. Further, let it be assumed that the position of drum 18 is such that a net movement of the drum to the right and a net rotation of the drum so that the nearer face of the drum moves upward is required to bring a desired character into registry with printing hammer 22. In this case, the machine 11 is operated so that pulse motor 13 first drives drum 18 to the right by an amount exceeding that necessary to bring the desired character into registry. The excess displacement may correspond to a predetermined number of pulses such as two. The pulse motor then reverses itself, moving the drum to the left by an amount corresponding to two pulses. Similarly, pulse motor 14 operates to rotate drum 18 with the nearer face of the drum moving upward by an excessive amount corresponding to, say, two pulses, after which pulse motor 14 reverses itself and rotates by an amount corresponding to two pulses.

Obviously, where bringing a desired character into registry with printing hammer 22 moves or rotates the drum in either or both of the axial or rotational directions which have been preselected, then such overriding by the specified number of pulses is unnecessary. In

this way, a character is always brought into registry by moving in a given axial direction and by rotating in a given directional sense, the direction and sense being the same for all characters. Since the drum is always brought into position for printing by movement in the same preselected normal axial direction and the same preselected normal rotational direction, the problem of backlash is eliminated and any errors resulting from flexibility of the timing belts or imprecision in the construction of components and assembly of the system will be essentially constant for the imprinting of any of the characters on drum 18.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in carrying out the above method without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed is:

1. An improvement in a method of operating a printing machine wherein a cylindrical drum slidable axially in a preselected direction termed normal or in a reverse direction, and rotatable in a preselected direction termed normal or in a reverse direction and having

characters on its cylindrical surface is positioned by pulse motors with reference to a printing hammer and an adjoining tape for printing on said tape and said hammer is then actuated to bring a selected character into contact with said tape, wherein said improvement comprises the steps of sliding said drum in the normal axial direction and rotating said drum in the normal rotational direction as the final steps in the positioning of said drum immediately prior to printing a character on said tape, said normal axial direction and normal rotational direction being the same for the printing of any of said characters, thereby minimizing errors in the positioning of said drum due to gear backlash, flexibility of machine components and imprecision in machine components which would result from bringing the drum into printing position from the reverse directions as well as from the normal directions.

2. The improvement as defined in claim 1, wherein said drum is mounted in a movable frame which is moved in either axial direction by means of a timing belt drivable in either direction by a pulse motor.

3. The improvement as defined in claim 2, wherein said drum is rotatable in either direction by means of a pair of pinion gears attached to said frame for axial movement therewith, one of said gears being mounted slidably on a polygonal shaft rotatable in either direction by a pulse motor, said gear mounted on said polygonal shaft being the driving gear of said pair of pinion gears.

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