

- [54] **PAPER FEED SYSTEM FOR HIGH-SPEED
PRINTER**
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- [73] Assignee: **Xerox Corporation**, Stamford,
Conn.
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Related U.S. Application Data

- [63] Continuation of Ser. No. 229,446, Feb. 25, 1972,
abandoned.
- [52] **U.S. Cl.**..... 197/114 R; 197/133 R
- [51] **Int. Cl.**..... B41j 19/76
- [58] **Field of Search**..... 197/1, 114 R, 127, 133 R,
197/114 A; 310/49; 271/DIG. 3, 109, 114

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Primary Examiner—Edgar S. Burr

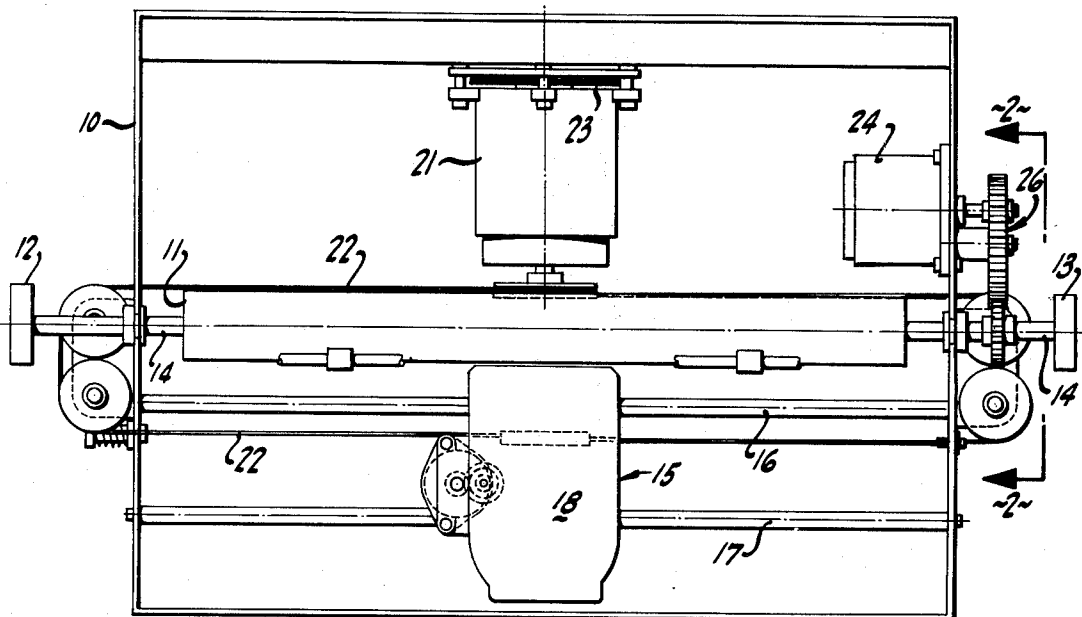
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[57] **ABSTRACT**

A paper feed system for a high-speed printer in which a stepping motor drives the platen through a gear train which provides for a one-half line space movement of the platen for every four steps of the stepping motor, the stepping motor having a natural detent when its rotor is manually moved four steps.

4 Claims, 3 Drawing Figures



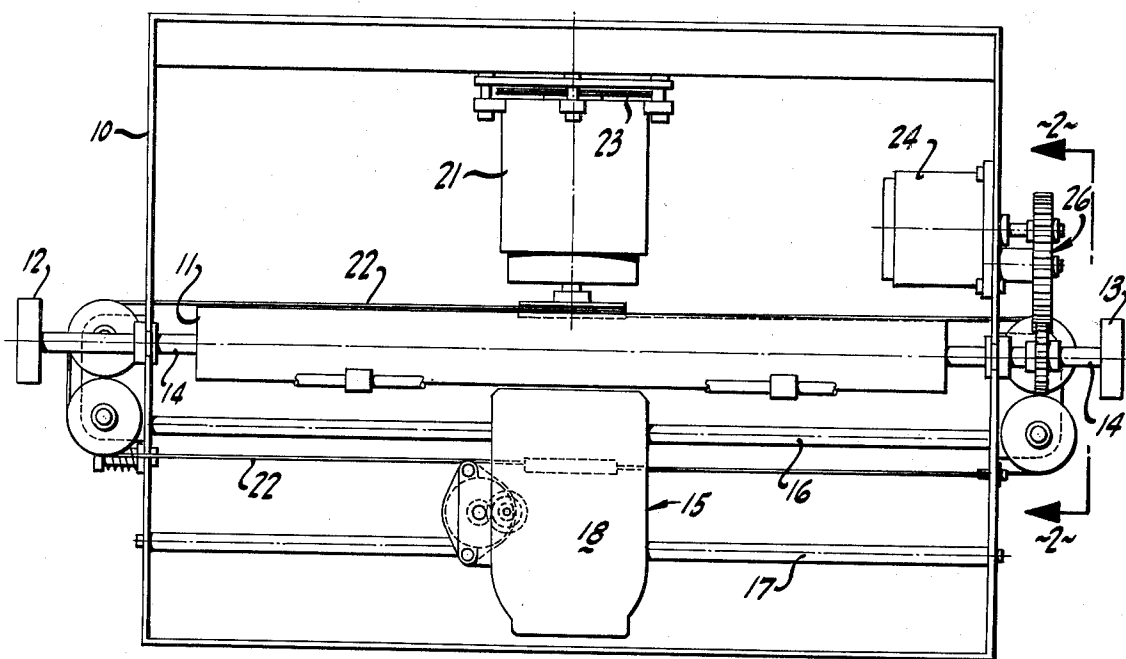


FIG. 1

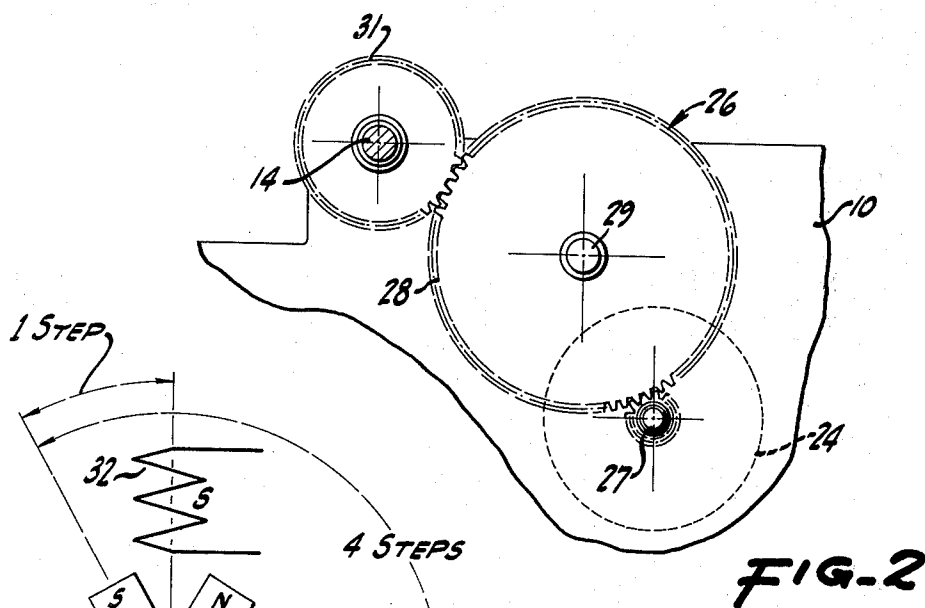


FIG. 2

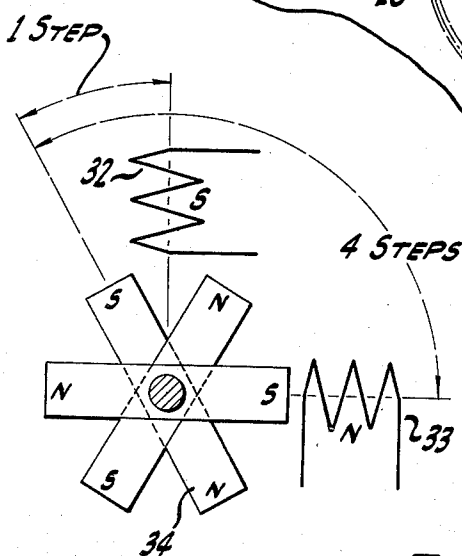


FIG. 3

PAPER FEED SYSTEM FOR HIGH-SPEED PRINTER

This is a continuation of application Ser. No. 229,446, now abandoned, filed Feb. 25, 1972.

BACKGROUND OF THE INVENTION

The present invention relates generally to a paper feed system for a high-speed printer and more specifically to a system which is compatible with standard manual typing.

Normal office typewriters have their platens detented for one-half the normal line space. When a printer is to be used as an input/output device where it is to be both manually operated by a keyboard and also to serve as an output device for a computer such line spacing must allow the computer to utilize its inherently greater capability; for example, for plotting or other unusual print formats.

OBJECT AND SUMMARY OF THE INVENTION

It is, therefore, an object of this invention to provide a paper feed system for a high-speed printer which while being compatible with standard manual typing is also adaptable to complex computer driven printouts.

In accordance with the above object there is provided a paper feed system for a high-speed printer in which the line spacing is a predetermined distance consisting of a predetermined number of increments. Rotatable platen means receive and feed the paper to be printed upon and include manual rotating means. Stepping motor means is coupled to the platen means for incrementing the platen means. The stepping motor has a plurality of rotor poles and a plurality of stator poles which may be energized to alternately change polarity to thereby produce rotation or stepping of the motor. The motor has a natural detent for a predetermined number of steps when the rotor is manually rotated while the stator poles are continuously energized with a constant polarity. Gear means are provided to couple the stepping motor means to the platen means. The gear means have a gear ratio to provide for movement of the platen for a distance equal to one-half the number of increments which constitute a line space when the stepping motor is driven by the alternate energization of the poles the predetermined number of steps which constitute the natural detent. Thus, when the manual rotating means are actuated and the poles are continuously energized, the natural detent occurs every one-half line space.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a printer embodying the present invention;

FIG. 2 is a cross sectional view taken along line 2—2 of FIG. 1; and

FIG. 3 is a simplified schematic of a stepping motor.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, an overall view of the printer is illustrated. Mounted on frame 10 is a platen 11 with left and right knobs 12 and 13 extending therefrom for rolling the platen. More specifically, knobs 12 and 13 are coupled to a shaft 14 which extends through the platen. The shaft is mounted for rotation on frame 10.

A carriage 15 is mounted for linear movement on rods 16 and 17 and includes a rotary printing wheel having type elements and a hammer assembly for striking a selected type element for printing on paper carried on platen 11. Carriage 15 also includes a ribbon cartridge 18 having an inked ribbon which is interposed between a type element and the paper to be printed upon.

Movement of carriage 15 along the line of printing is accomplished by a motor 21 which is coupled to the carriage by cable system 22. Motor 21 has mounted on one end of its shaft a transducer 23 which consists of two disks for providing position signals which are used in a servo system to provide incremental movement of carriage 15. Details of such transducer and its associated servo system are claimed in a copending application Ser. No. 157,283 filed June 28, 1971, entitled "Apparatus For the Measurement of Relative Velocity Between Two Relatively Movable Members," in the name of Andrew Gabor and assigned to the present assignee. Overall details of the printer itself including the carriage 15 are disclosed and claimed in a copending application Ser. No. 229,314 filed Feb. 25, 1972, entitled "High-Speed Printer With Intermittent Print Wheel and Carriage Movement" in the name of Andrew Gabor and assigned to the present assignee.

To provide for paper feed, a stepping motor 24 is coupled to the shaft 14 by a gear train 26. Stepping motor 24 has mounted on its shaft a small pinion gear 27 which drives a larger gear 28 mounted on a shaft 29 for rotation on frame 10 which in turn drives a gear 31 mounted on shaft 14 which is also the shaft for platen 11. Stepping motor 24 is of the type as illustrated in FIG. 3 having two fixed poles 32 and 33 here designated S and N respectively and a rotor 34 having a number of rotatable poles; in this specific case, six. In a stepping motor of the type used in the present invention it is apparent that one step is one-half the distance of rotation between adjacent poles of opposite polarity. This is because the fixed poles 32 and 33 alternately change polarity in order to provide the stepping movement, that is, the polarities reverse alternately with winding 33 changing polarity first, followed by a reversal of the polarity of winding 32, with the sequence continuing with winding 33 changing polarity and then winding 32 changing polarity. Thus, assuming a clockwise rotation of rotor 34 if the fixed pole 33 changes polarity, the resultant field will have a south pole between poles 32 and 33 and this resultant field will attract the north pole of the rotor segment between poles 32 and 33, thereby causing a clockwise rotation of rotor 34. With further changes in the polarity of windings 32 and 33, the resultant field of the stator winding will change direction resulting in further clockwise rotation of rotor 34.

It is also apparent from examination of FIG. 3 that a stepping motor of the type used in the present invention has a natural detent of four steps. Assuming the continuous energization of the poles 32 and 33 as illustrated and the manual rotation of rotor 34, the rotor must be rotated clockwise four steps before a rotor pole of the correct polarity will line up with the resultant field of the stator. Thus, a natural detent occurs each four steps of the rotor.

Thus, in accordance with the invention the gear train 26 provides for movement of the platen 11 one-half of the nominal line spacing for four steps of the stepping

motor 24. In other words, the platen 11 is moved four increments for each one-half line space. This provides a natural detent of one-half line space when the knobs 12 and 13 are rotated by the operator of the printer.

In the preferred embodiment the stepping motor is of the type which may be purchased from the A. W. Haydon Company of Waterbury, Connecticut under Model No. ID05. A motor of this type has 48 steps to the revolution. Also in the preferred embodiment, since the present printer would be used in the same manner as a standard typewriter and the standard typewriter half-line space is one-twelfth inch, there will be 48 increments per inch of circumferential platen movement. The gear train shown in FIG. 2 thus provides for 1 inch of movement of the periphery of the platen 11 for one revolution of shaft 27. The representational stepping motor of FIG. 3, which has 12 steps per revolution, could theoretically be used but it is found that 48 steps provides for more advantageous gear ratios.

Thus, the present invention provides a paper feed system for a high-speed printer which is compatible with standard manual typing for providing a one-half line detent but is adaptable to a computer driven output device since the stepping motor may be driven in one-eighth line increments thus providing a great number of increments per inch for plotting and similar purposes.

We claim:

1. A paper feed system for a high-speed printer in which the line spacing is a predetermined distance consisting of a predetermined number of increments comprising: rotatable platen means for receiving and feeding paper to be printed upon, said platen means having manual rotating means; stepping motor means coupled to said platen means for incrementing said platen means said stepping motor having a plurality of rotor poles and a plurality of stator poles which may be energized to alternately change polarity to thereby produce rotation or stepping of said motor having a natural detent for a predetermined number of steps when said rotor is manually rotated while said stator poles are continuously energized with a constant polarity; and gear means coupling said stepping motor means to said platen means, said gear means having a gear ratio to provide for movement of said platen for a distance equal to one-half said number of increments which

constitute a line space when said stepping motor is driven by said alternate energization of said poles said predetermined number of steps which constitute said natural detent whereby when said manual rotating means are actuated and said poles are continuously energized said natural detent occurs every one-half line space.

2. A system as in claim 1 where said line spacing is one-sixth inch, said one-half line spacing is one-twelfth inch and said number of steps per revolution is 48.

3. A system as in claim 1 where eight increments constitute a line space, four increments one-half line space and said natural detent occurs every four steps.

4. A paper feed system for a printing device in which the line spacing is a predetermined distance comprising:

a rotatable platen for receiving and feeding paper to be printed upon, said platen being adapted for both manual rotation and motor-controlled rotation with a predetermined number of motor-controlled rotational increments providing movement of said paper through said predetermined distance,

a stepping motor coupled to said platen through gear means for achieving said motor-controlled incremental rotation of said platen, said motor having a plurality of rotor poles and a plurality of stator poles, said stator poles being coupled to means for alternately changing their polarity when said platen is motor-controlled to thereby produce changes in the orientation in the stator field and incremental rotation of said platen, said stator poles being continuously energized with a constant polarity when rotation of said platen is achieved by manual rotation of said rotor poles, said motor having a natural electromagnetic detent for a predetermined fraction of said predetermined number of rotational increments,

said gear means having a gear ratio such that said natural detent occurs when said platen has been manually rotated a distance equal to said fraction of said predetermined number of rotational increments of said platen needed to move said paper through said predetermined distance when said platen is motor-controlled.

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