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Colglazier et al.

[11] **3,910,395**

[45] **Oct. 7, 1975**

[54] **APPARATUS FOR PRINT HEAD RETRACTION TO FACILITATE PAPER INSERTION**

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[52] **U.S. Cl.** ..... **197/1 R;** 197/65; 197/127 R; 197/133 R

[51] **Int. Cl.²** **B41J 3/10**

[58] **Field of Search** ..... 197/1 R, 16, 18, 65, 66, 197/67, 68, 48, 49, 50, 51, 52, 53, 54, 55, 82, 114 R, 120, 114 A, 114 B, 127 R, 133 R; 346/68, 76 R

[56] **References Cited**

UNITED STATES PATENTS

1,116,212	11/1914	Beard	197/120 X
3,200,928	8/1965	Moore	197/55
3,400,798	9/1968	Smith	197/82
3,532,204	10/1970	Sasaki	197/82 X
3,576,164	4/1971	Drejza et al.	101/93 C
3,605,978	9/1971	Kawano	197/1 R X
3,776,340	12/1973	Moser	197/1 R
3,817,365	6/1974	Zimmermann	197/1 R

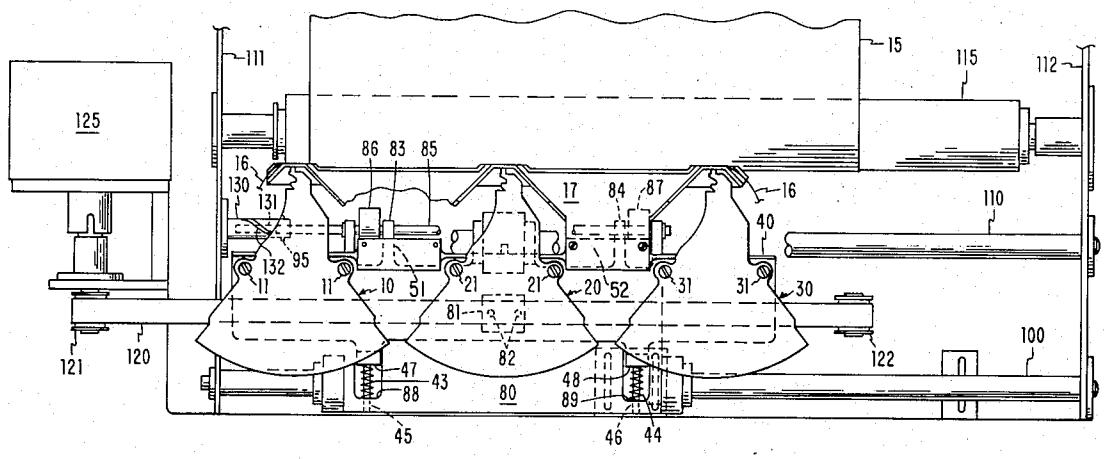
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Attorney, Agent, or Firm—Donald F. Voss

[57] **ABSTRACT**

Print heads mounted on a carriage moveable parallel to the platen are automatically retracted away from the platen when the carriage reaches a home position to facilitate paper insertion and thereafter automatically move to the printing position as the carriage leaves the home position under a start command.

9 Claims, 6 Drawing Figures



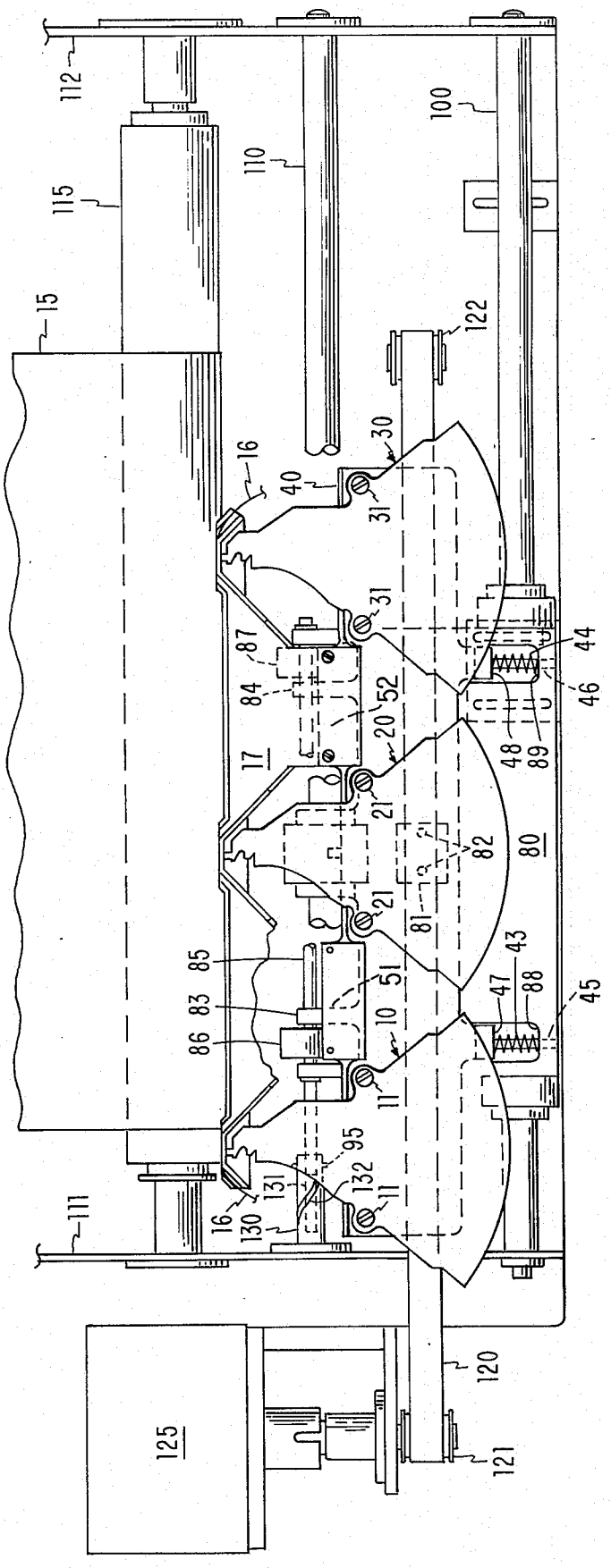

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FIG. 1

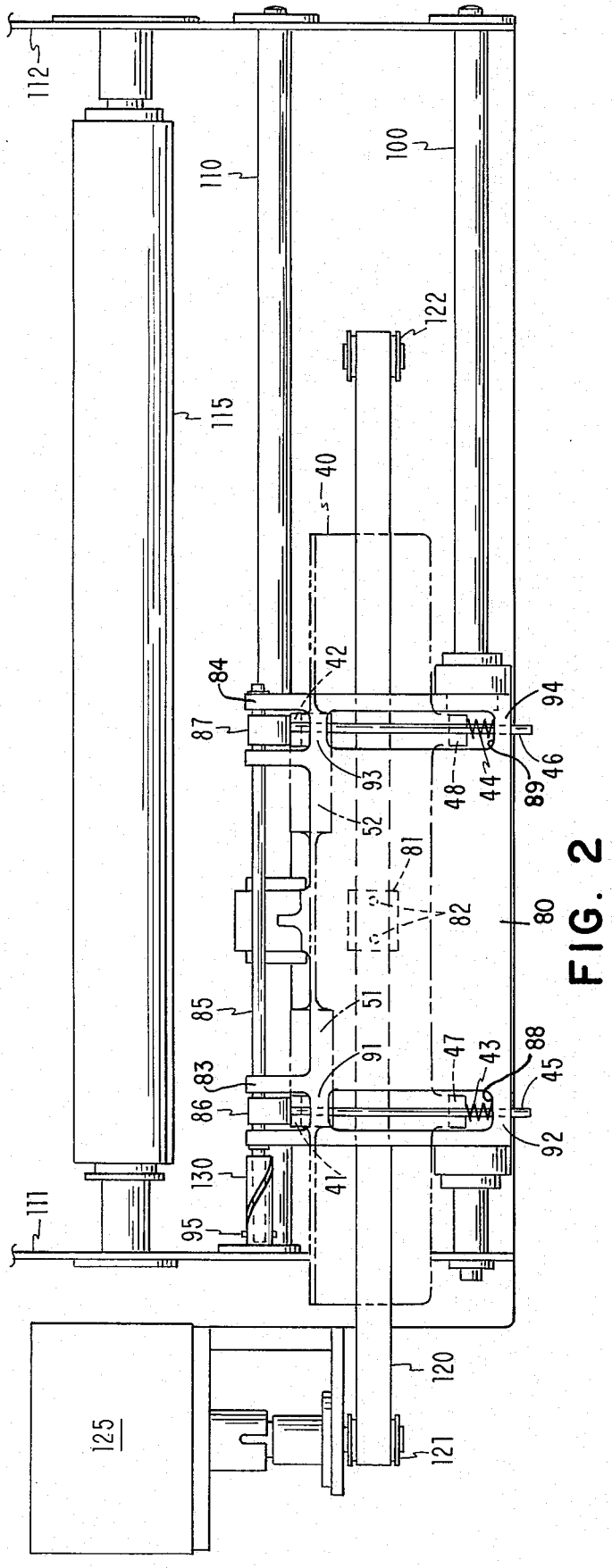

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FIG. 2

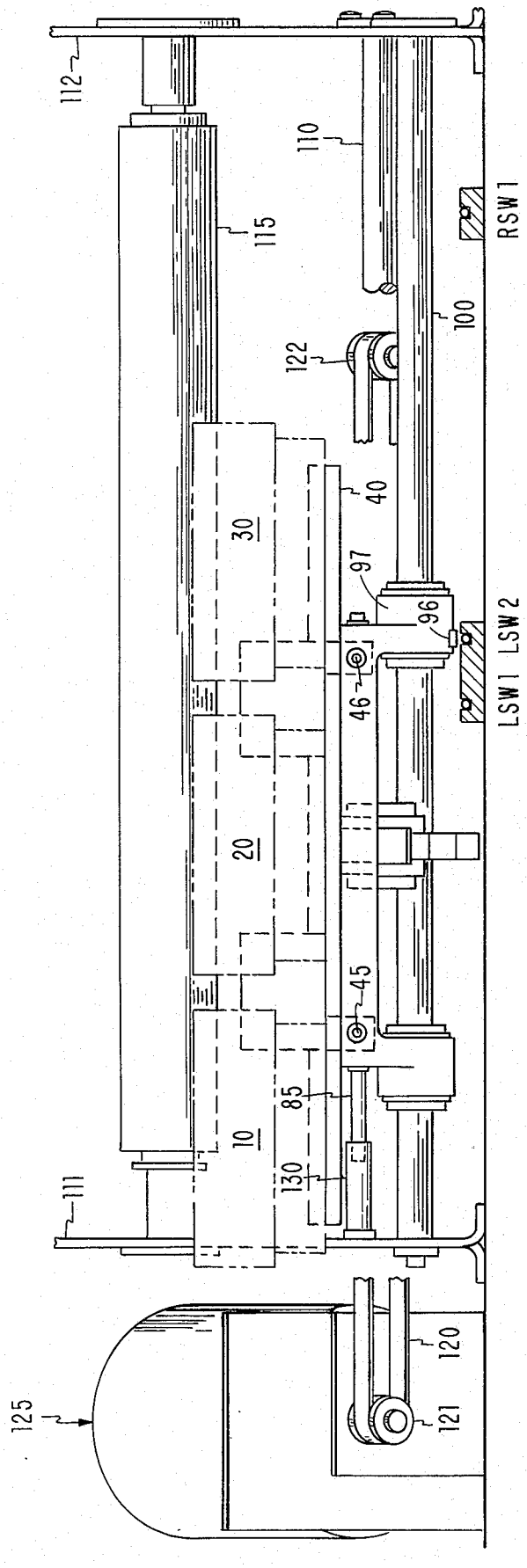

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FIG. 3

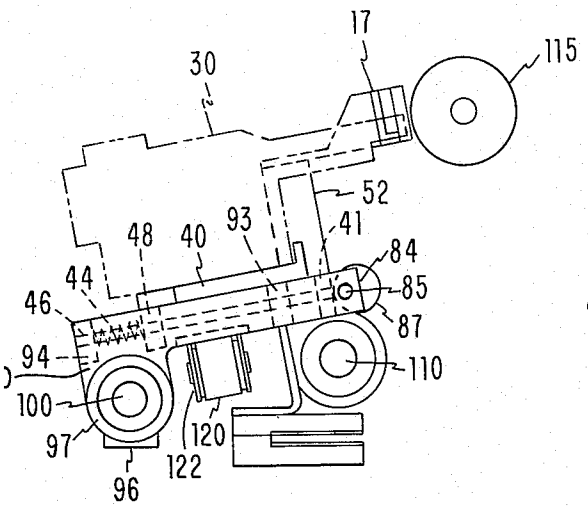


FIG. 4

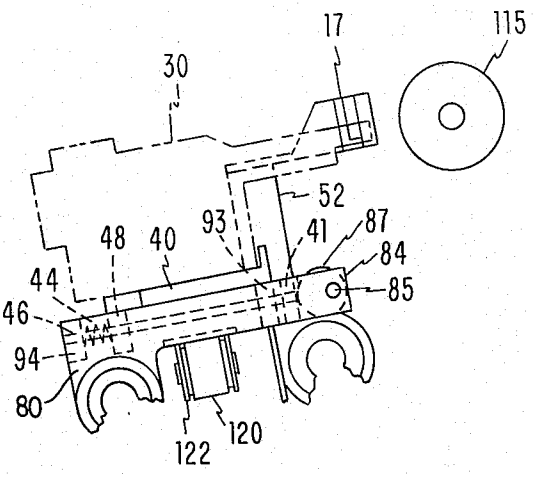


FIG. 5

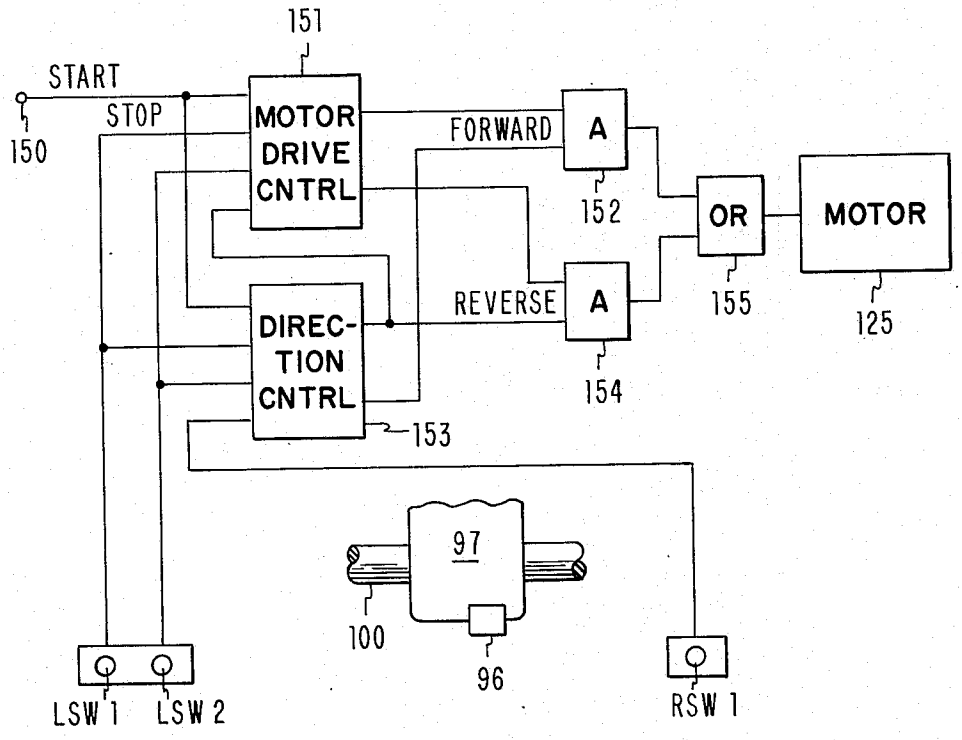


FIG. 6

APPARATUS FOR PRINT HEAD RETRACTION TO FACILITATE PAPER INSERTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to line printers and more particularly to line printers where the print head moves parallel to the print line to complete a line of printing and still more particularly to such line printers where the print head is normally in close proximity to the platen and the paper to be printed upon is inserted directly between the print head and platen.

The invention finds particular utility in line printers used for printing upon cut forms. Insertion and removal of the cut forms must be made easy for the operator to take advantage of the high speed printing capability of a line printer.

2. Description of the Prior Art

In high speed line printers, the print heads are in close proximity to the platen to keep the travel of the printing elements to a minimum and thereby increase the speed of printing. This arrangement, however, makes it difficult to insert paper between the print heads and platen.

In the prior art, it had been the practice to move the print head into a position where it would not interfere with insertion of the paper or cut form. However, there is not always practical because when using a wide print head or multiple print heads, the width of the printer would have to be increased substantially so as to provide a home position for the print head or heads whereby they would not be in line with the paper insertion area. The present invention provides another alternative and that is to permit the print heads to overlap the paper insertion area but to automatically retract the print heads when they are moved to the paper insertion or home position.

SUMMARY OF THE INVENTION

The principal objects of the invention are to provide an improved line printer which: (a) can print upon cut forms as well as continuous forms; (b) provides a simple mechanism for automatically retracting the print heads to facilitate paper insertion and (c) automatically returns the print heads from a retracted position to a print position when a line of printing is to take place.

The above objects are achieved by mounting the print heads on a plane which is slideable relative to and moves with the print head carriage. The plate is moved to and fro by a pair of rotatable eccentrics. the shaft for rotating these eccentrics is carried by the carriage and is provided with a cam follower pin. This cam follower pin rotates the shaft and thereby rotates the eccentrics as the carriage brings the cam follower pin into engagement with a fixedly mounted rotator cam. After the print heads have been retracted and the operator has inserted a sheet of paper into the printer, the print head carriage moves away from the rotator cam whereby the cam follower pin disengages from the rotator cam and in doing so rotates the eccentrics to return the print heads automatically to the printing position.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial top plan view with the print heads in the printing position;

FIG. **2** is a partial top plan view with the print heads retracted away from the platen to facilitate paper insertion;

FIG. **3** is a partial front elevational view showing the print head carriage, the carriage drive, the print heads and the platen;

FIG. **4** is a fragmentary side elevational view showing the print heads in the printing position;

FIG. **5** is a fragmentary side elevational view showing the print heads in the retracted position; and

FIG. **6** is a schematic circuit diagram of the logic circuitry for controlling the stepper motor for driving the print head carriage.

DESCRIPTION

With reference to the drawings and particularly to FIG. **1**, the invention is illustrated by way of example as being incorporated in a line printer of the type having three separate matrix print heads **10, 20** and **30.** These print heads are of the type shown and described in U.S. Pat. No. 3,592,311 for Wire Printing Head by Albert S. Chou et al. Moreover, the line printer is a modified form of the type shown and described in the IBM Technical Disclosure Bulletin, Volume 15, No. 11, April 1973, on page 3370. In this invention, print heads **10, 20** and **30** are secured to slideable plate **40** by screws **11, 21** and **31** respectively. Plate **40,** which serves as the printing element support means, is slideably supported by moveable carriage **80.** Carriage **80** is suitably journaled on parallelly spaced shafts **100** and **110** fixed between side frames **111** and **112.**

Carriage **80** is moved along shafts **100** and **110** relative to platen **115** by means of an endless belt **120** trained about driven pulley **121** and idler pulley **122.** Belt **120** is attached to carriage **80** by means of plate **81** and screws **82.** Pulley **121** is driven by stepping motor **125.** Stepping motor **125** is operable to rotate pulley **121** both clockwise and counterclockwise so as to move carriage **80** from left to right and vice versa.

When a document or cut form is to be inserted into the line printer, carriage **80** is moved under control of motor **125** into an extreme left hand or home position shown in FIG. **2.** When carriage **80** is in this position, print heads **10, 20** and **30** are held in a retracted position away from platen **115.**

Carriage **80** has a spaced pair of bifurcated arms **83** and **84** which rotatably support longitudinal shaft **85.** Eccentrics **86** and **87** are fixed to shaft **85** between the bifurcated arms **83** and **84** respectively. Legs **41** and **42** depend from plate **40** and are held in contact with eccentrics **86** and **87** respectively by springs **43** and **44,** respectively. Springs **43** and **44** are compression springs surrounding shafts **45** and **46** respectively with one of their ends bearing against legs **47** and **48** respectively and the other ends bearing against back slotted surfaces **88** and **89** of carriage **80.** Shaft **45** is secured in depending legs **41** and **47** and is slideably journaled in carriage webs **91** and **92.** Similarly, shaft **46** is secured in depending legs **42** and **48** and slideably journaled in carriage webs **93** and **94.** By this arrangement, plate **40** moves with carriage **80** parallel to platen **115** and is moveable by eccentrics **86** and **87** transversely of carriage **80** toward and away from platen **115.** Eccentrics **86** and **87** function as actuator means for moving plate **40,** and thus print heads **10, 20** and **30,** toward and away from the print line.

When print heads **10, 20** and **30** are in the printing position, the low sides of eccentrics **86** and **87** are in contact with depending legs **41** and **42** respectively. Shaft **85** must be rotated in order to move print heads **10, 20** and **30** to the retracted position. Shaft **85** is rotated through the cooperative action of rotator cam **130** secured to side plate **111** and cam follower pin **95** extending through shaft **85** at right angles thereto.

Rotator **130** has a central longitudinal bore **131** for receiving shaft **85** and a pair of helical grooves **132** for receiving cam follower pin **95.** Thus, as pin **95** enters and follows the helical grooves **132,** shaft **85** is rotated and thereby rotates eccentrics **86** and **87.** The eccentrics **86** and **87** in turn move plate **40** rearwardly away from platen **115** to the retracted position. Thus, rotor **130** and cam follower pin **95** together with shaft **85** function as operator means for operating eccentrics **86** and **87** to move support plate **40** and thereby move print heads **10, 20** and **30** away from the print line when carriage **80** is in the home position and toward the print line as carriage **80** leaves the home position. The print heads **10, 20** and **30** remain in the retracted positions so long as carriage **80** is in the home position with cam follower pin **95** in the helical grooves **132** as in FIG. **2.** Then as carriage **80** moves away from the home position whereby pin **95** follows helical grooves **132** to again rotate shaft **85,** the print heads **10, 20** and **30** are restored to the printing position. The distance between the print heads **10, 20** and **30** and platen **115** when the print heads are in the printing position is best seen in FIG. **4.** Paper insertion is then greatly facilitated by moving the print heads to the retracted position as in FIG. **5.**

Printing takes place a line at a time and carriage **80** is returned to the home position after a line has been printed. Normally, a line printer is attached to a host computer system and the information to be printed is in the form of coded data which selectively operates the print heads **10, 20** and **30** to fire matrix print wires in a sequence so as to generate character patterns on the paper or cut form **15** as the print wires impact print ribbon **16.** Print ribbon **16** is a conventional ribbon and is guided by print ribbon guide **17,** which is attached to support arms **51** and **52** projecting upwardly from plate **40** as seen in FIGS. **2, 4** and **5.**

When print head **30** approaches the right hand margin of paper **15,** a permanent magnet **96,** FIG. **3,** attached to carriage journal **97** operates reed switch RSW1 to generate a signal for reversing stepping motor **125** and thereby moving carriage **80** to the home position. As carriage **80** is returning to the home position, magnet **96** first operates reed switch LSW2 and a signal is generated to cause stepping motor **125** to operate at a slow speed. Carriage **80** then moves to the home position at this slow speed and is stopped when magnet **96** operates reed switch LSW1. Operation of reed switch LSW1 causes a signal to be generated for stopping stepping motor **125.**

A schematic diagram of the circuitry for operating stepping motor **125** is shown in FIG. **6.** Motor **125** is started under control of the operator depressing a start key to apply a start signal to start terminal **150** or is started by the host computer applying a start signal to terminal **150.** The start signal from either source is applied to motor drive control circuit **151** which includes conventional logic for generating forward and reverse sequences of stepper motor pulses. The forward sequence of stepper motor pulses is applied to AND circuit **152** which controls the advancement of stepping motor **125** in the forward direction. Motor drive control **151** supplies a reverse sequence of pulses for stepping motor **125** to AND circuit **154** which will pass the reverse sequence pulses to motor **125** via OR circuit **155** only when it is conditioned by a reverse signal from direction control logic **153.** Direction control logic **153** generates a reverse direction control signal when magnet **96** operates switch RSW1. The start signal initially causes direction control logic **153** to generate a forward control signal for conditioning AND circuit **152.**

When magnet **96** operates switch LSW2 and the reverse control signal is present, the motor drive control logic **151** provides the reverse sequence of stepping pulses at a slower rate to AND circuit **154** whereby motor **125** operates at a slower speed. Thereafter, magnet **96** operates switch LSW1 and motor drive control logic **151** ceases to provide a sequence of stepping pulses to either AND circuit **152** or AND circuit **154.**

This causes stepping motor **125** to stop and it remains stopped until a start pulse is again applied to start terminal **150.** During the time that the motor is stopped, the print heads **10, 20** and **30** are held in the retracted position and the operator can insert a new form in the manner described in the aforementioned IBM Technical Disclosure Bulletin.

From the foregoing it is seen that the invention provides a combination of apparatus for automatically retracting the print heads from the printing position to a paper insertion position when the print carriage reaches the home position. It is further seen that as the print carriage moves away from the home position to start a new line of printing, the print heads automatically move from the retracted position to the printing position.

We claim:

1. In a line printer having printing means mounted on a carriage moveable along a carriage path relative to the print line from a home position located at one extreme end of said carriage path to a return position located at another extreme end of said carriage path and back to the home position, said printing means being moveable relative to said carriage toward and away from said print line the improvement comprising:

means normally holding said printing means in a print position relative to said print line, and

means operable in response to said carriage coming into said home position for retracting said printing means away from said print line and holding said print means in the retracted position so long as said carriage remains in said home position and for restoring said printing means toward said print line when said carriage is moved away from said home position.

2. In a line printer having a carriage moveable along a carriage path relative to the print line from a home position located at one extreme end of said carriage path to a return position located at another extreme end of said carriage path and back to the home position, the improvement comprising:

printing element support means moveably mounted to said carriage to move toward and away from said print line,

actuator means for moving said support means toward and away from said print line, said actuator

means normally holding said support means toward said print line, and

operator means for operating said actuator means to move said support means away from said print line when said carriage is in said home position and to move said support means toward said print line when said carriage leaves said home position.

3. The line printer of claim **2** wherein said means for operating said actuator means causes said actuator means to hold said support means away from said print line while said carriage is in said home position.

4. The line printer of claim **2** wherein said actuator means is mounted on said carriage to move therewith.

5. The line printer of claim **2** wherein said operator means for operating said actuator means is stationary.

6. The line printer of claim **4** wherein said actuator means comprises

a rotatable shaft journalled in said carriage,

at least one eccentric mounted on said shaft in a position to bear upon said support means, and

means carried by said shaft for engaging said operator means when said carriage moves into said home position.

7. The line printer of claim **6** wherein said means carried by said shaft is a cam follower pin projecting radially outward from said shaft.

8. The line printer of claim **5** wherein said operator means is a fixedly mounted cam having a hollow interior for receiving said actuator means.

9. The line printer of claim **8** wherein said cam has a pair of longitudinal helical grooves for receiving said actuator means.

* * * * *