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[54] **MECHANISM FOR MOVING A PRINTING HEAD IN A PRINTER**

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[58] **Field of Search** ..... 197/1 R, 48, 49, 60, 65, 197/66, 68, 19, 20; 101/93 C

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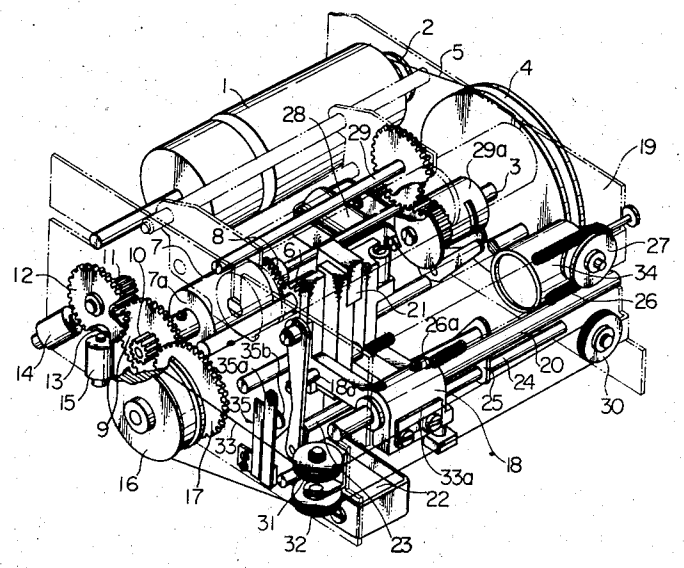
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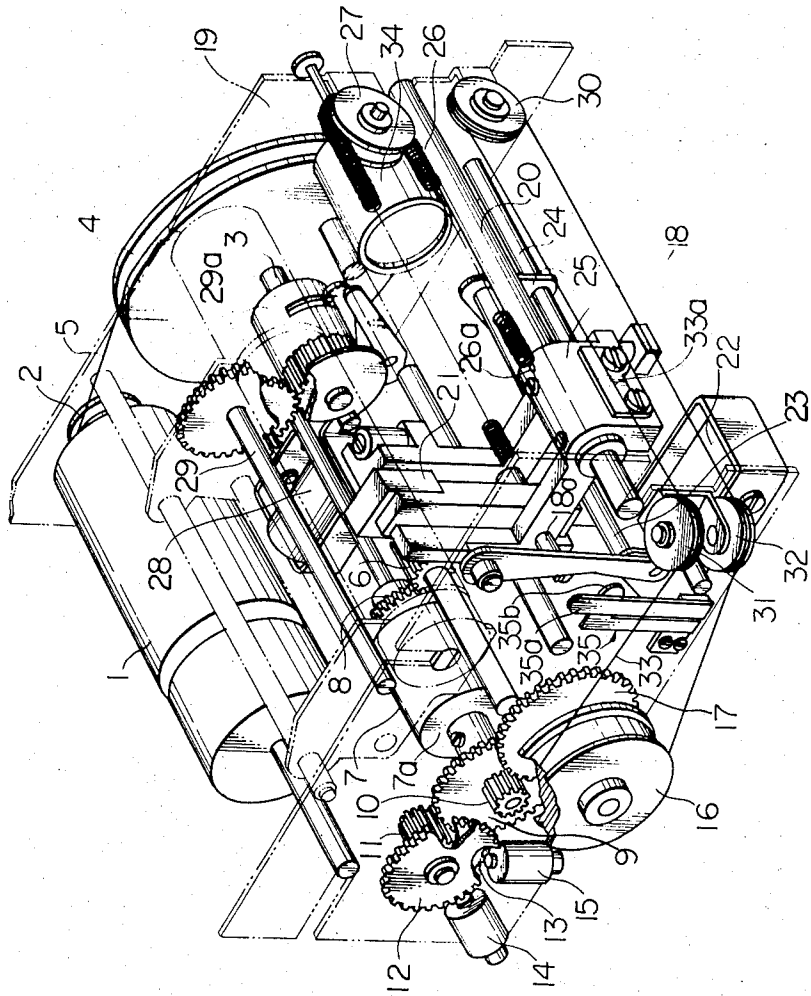
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[57] **ABSTRACT**

Mechanism for moving a printing head in a printer. The printing head is mounted on a head holder movable between a start position and a terminal position for the printing operation and the head holder is urged by a spring toward the start position. A winding drum is driven by an electromagnetic clutch through reduction gearing and the clutch is in turn releasably driven by an electric motor through a control circuit adapted to supply a signal to the clutch to release the same. An endless belt is stretched around the winding drum and pulley means so as to be driven by the drum. A portion of the wire stretched between the pulley means extends in parallel and close to the path of movement of the head holder and a portion on that portion of the wire is secured to the head holder so as to move the same with the movement of the wire. A detecting coil is operably coupled with the electro magnetic clutch and connected to the control circuit so that, when the clutch drives the head holder to the terminal position through the drum and the wire, the signal for releasing the clutch is generated so as to release the clutch thereby moving the head holder to the start position by the action of the spring. A switch is provided near the start position and connected to the control circuit so that, when the head holder reaches the start position, the switch is actuated to actuate the electromagnetic clutch through the control circuit thereby moving the head holder toward the terminal position for the printing operation of the printing head.

2 Claims, 1 Drawing Figure




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MECHANISM FOR MOVING A PRINTING HEAD IN A PRINTER

BACKGROUND OF THE INVENTION

The present invention relates to a mechanism for moving a printing head in a printer.

In a prior art printers such as so-called non-impact printers using printing heads of the thermosensitive type, various types of mechanisms have been developed to move the printing head holder in a printer for the printing operation, including the types such as those manufactured by Friden, Inc., Ing. C. Olivetti & C., S.p.A. and Hewlett-Packard Co. All of these types utilize a feed shaft provided with a helical groove, and a pin secured to the head holder movable in parallel to the feed shaft guided by a guide bar or guide bars is engaged with the groove so that the head holder is moved axially of the guide bar as the feed shaft rotates. Such a construction is complicated and is expensive in manufacture and requires high accuracy of the parts to be assembled thereby making the cost very high.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a novel and useful mechanism for moving the printing head in a printer which avoids the above mentioned disadvantages of the prior art printer.

Another object is to provide a novel and useful mechanism of the type described above which is simple in construction and easy in adjustment and accurate in operation without false function.

A further object of the present invention is to provide a novel and useful device for preventing excessive movement of the printing head in a printer which might result in injury of the printer.

The above object is achieved in accordance with the present invention by the provision of a mechanism for moving a printing head mounted on a head holder of a printer movable between the start position and the terminal position for the printing operation, the printer having a control circuit for supplying printing signals to the printer in accordance with the demand for the printing operation, an electric motor for driving the head holder, the mechanism being characterized by a spring attached to the head holder and the printer frame for urging the head holder toward the start position, an electromagnetic clutch operably coupled with the electric motor and connected to the control circuit, the electromagnetic being released upon receipt of a signal from the control circuit, a winding drum, a reduction gear connecting the winding drum to the electromagnetic clutch so as to drive the drum at a reduced speed with respect to the speed of the latter, a plurality of pulleys rotably mounted on the printer frame, an endless wire stretched around the winding drum and the plurality of pulleys with a point on the wire secured to the periphery of the drum so as to be driven thereby, the pulleys being so arranged that a portion of the wire stretched around the adjacent two pulleys extends in parallel and close to the path of movement of the head holder, a point on that portion of the wire being secured to the head holder so as to move the head holder together with the movement of the wire toward the terminal position against the action of the spring when the electromagnetic clutch is actuated, a detecting coil operably interrelated with the electromagnetic clutch and connected to the control circuit, the detecting coil being so located in relation to the actuation of the electromagnetic clutch as to generate the signal for releasing the electromagnetic clutch when the head holder is moved to the terminal position by the action of the electromagnetic clutch thereby moving the head holder toward the start position by the action of the spring, and a switch connected to the control circuit and so positioned that it is actuated when the head holder reaches the start position so as to actuate the electromagnetic clutch through the control circuit.

In accordance with the present invention, since the electromagnetic clutch is coupled with the winding drum through the reduction gear, the electromagnetic clutch may be driven at a high speed, so that the required torque thereof may be made small thereby permitting an electromagnetic clutch of a small capacity can be utilized while the time lag is made very small thus increasing the accuracy in operation.

In accordance with a further feature of the present invention, a normally closed leaf switch is provided adjacent to the terminal position of the head holder and connected in series to the electromagnetic clutch and the control circuit. The normally closed switch is so located that it abuts against the head holder when the same reaches the terminal position so that the switch is opened to release the electromagnetic clutch so as to positively prevent the head holder from moving beyond the terminal position regardless of the false function of the control circuit.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawing is a perspective view showing the internal construction of the printer of the present invention with the casing removed for the illustration purpose.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The printer of the present invention shown in the accompanying drawing comprises a machine frame **19** mounting thereon an electric driving motor **1.** A main shaft **3** is rotatably mounted on the frame **19.** A belt **5** is stretched around a pulley **2** mounted on the drive shaft of the motor **1** and a pulley **4** mounted on the main shaft **3** so that the main shaft **3** is driven by the driving motor **1.**

A pinion **6** is secured to the main shaft **3** as shown and the pinion **6** is coupled with the input gear **8** of an electromagnetic clutch **7** mounted on the frame **19** so as to drive the clutch **7** by the main shaft **3.** A gear **9** and a pinion **10** are secured to the output side **7***a* of the electromagnetic clutch **7** so that rotational driving force is transmitted to the gear **9** and the pinion **10** from the main shaft **3** through the engagement of the gears **6** and **8** when the electromagnetic clutch **7** is electrically energized, while the output side **7***a* and, hence the gear **9** and the pinion **10** are made free to rotate relative to the main shaft **3** when the clutch **7** is electrically deenergized or released.

The gear **9** is engaged with a pinion **11** rotatably mounted on the frame **19** and the pinion **11** mounts thereon a toothed printing signal sensing disc **12** having a plurality of sensing teeth formed in the periphery thereof and a head holder stopping signal sensing disc **13** having a sensing tooth formed in the periphery thereof so that the discs **12** and **13** are rotated when the clutch **7** is electrically energized or actuated.

A printing signal detecting coil **14** is located adjacent to the printing signal sensing disc **12** so as to cooperate therewith so that the coil **14** is actuated each time the respective sensing teeth formed in the periphery of the disc **12** pass across the coil **14** thereby supplying printing signals to a control circuit (not shown) of the printer connected to the coil **14** so that the printing operation is effected by a printing head to be described below. The control circuit per se is well known in the art so that detailed description thereof is not given here.

Similarly, a head holder stopping signal detecting coil **15** is located adjacent to the head holder stopping signal sensing disc **13** so as to cooperate therewith so that the coil **15** is actuated each time the sensing tooth passes across the coil **15.** The coil **15** is connected to the control circuit so that the electromagnetic clutch **7** is released or electrically deenergized through the control circuit when the coil **15** is actuated by the disc **13.** The operation of the clutch **7** will be described later.

The pinion **10** secured to the output side **7***a* of the clutch **7** engages with a gear **17** secured to a winding drum **16** which is rotatably mounted on the frame **19** as shown. Thus, when the electromagnetic clutch **7** is actuated or electrically energized, the drum **16** is driven by the clutch **7** at a reduced rotational speed with respect to that of the output side **7***a* of the clutch **7.** In other words, the electromagnetic clutch **7** may be rotated at a higher speed in comparison with the rotational speed of the drum **16** required for the proper operation of a head holder **18** as described below.

The head holder **18** is slidably mounted on a guide bar **20** the both ends of which are secured to the frame **19** so that the head holder **18** is movable between the start position and the terminal position for the printing operation. The head holder **18** swingably mounts thereon a printing head **21.**

An electromagnet **22** is arranged in the frame **19** and a bracket **25** is swingably supported on a supporting bar **24** the both ends of which are secured to the frame **19.** A head biasing bar **23** cooperating with the printing head **21,** is mounted on the bracket **25.** The head biasing bar **23** is urged by a spring (not shown) so as to urge the printing head **21** apart from a sheet to be printed which is held on a platen (not shown) provided in the printer, insofar as the electromagnet **22** is deenergized. However, when the electromagnet **22** is energized, it attracts the head biasing bar **23** so that the printing head **21** is urged against the sheet to be printed at an appropriate pressure for the printing operation.

The sheet to be printed is fed in the well known manner by means of sheet feeding magnet **28,** sheet feeding shaft **29** and sheet feeding spring clutch **29***a* so as to permit the printing operation to be effected by the printer.

An end **26***a* of a helically wound coil spring **26** is secured to the head holder **18** and the spring **26** extends in parallel to the guide bar **20** and around an idler pulley **27** rotatably mounted on one side of the frame **19** and back toward the other side of the frame **19** where the other end of the spring **26** is secured as shown so that the head holder **18** is urged by the spring **26** toward the start position for the printing operation.

An idler pulley **30** is rotatably mounted adjacent to the above mentioned one side of the frame **19** while a pair of idler pulleys **31, 32** are rotatably mounted on the other side of the frame **19.** A wire **33** is stretched around the winding drum **16,** the pulley **31,** the pulley **30** and the pulley **32.**

A point on the wire **33** is secured to the periphery of the drum **16** so as to forcibly drive the wire **33** by the drum **16.**

The pulley **31** and the pulley **30** are so positioned that the portion of the wire **33** stretched therebetween extends in parallel to the guide bar **20** adjacent to the head holder **18.** A portion **33***a* of that portion of the wire **33** stretched between the pulley **30** and the pulley **31** is fixedly secured to the head holder **18** so as to positively drive the head holder **18** by the wire **33.**

A damper **34** for cushioning and absorbing the shock of the movement of the head holder **18** toward the start position effected by the spring **26** is provided in the frame **19.**

A switch (not shown) is provided on the previously mentioned one side of the frame **19** and connected to the control circuit. The switch is so positioned in relation to the head holder **18** that it is actuated by the head holder **18** when it reaches the start position for the printing operation by the action of the spring **26** so that the electromagnetic clutch **7** is energized through the control circuit so as to actuate the output side **7**a thereof and, hence, the gear **9** and the pinion **10,** thereby driving the winding drum **16** so as to move the head holder **18** against the action of the spring **26** from the start position toward the terminal position through the wire **33,** while the printing signal sensing disc **12** and the head holder stopping signal sensing disc **13** are rotated through the gear **9** and the pinion **11** engaging therewith in timed relation to the rotation of the winding drum **16** and, hence, the movement of the head holder **18** toward the terminal position for the printing operation.

The head holder stopping signal sensing disc **13** is so arranged in relation to the head holder stopping signal detecting coil **15** that the coil **15** is actuated when the head holder **18** reaches the terminal position, so that a signal is supplied from the coil **15** to the control circuit for releasing or deenergizing the electromagnetic clutch **7** thereby freeing the winding drum **16** so as to permit the head holder **18** to return from the terminal position toward the start position by the action of the spring **26** with the damper **34** effecting the cushioning action at the end of the movement of the head holder **18.** When the head holder **18** reaches the start position, the switch for initiating the movement of the head holder **18** toward the terminal position is actuated as described previously, and the sequence of the above operations is repeated during the printing operation.

The printing signal sensing disc **12** is so positioned in relation to the printing signal detecting coil **14** that printing signals are successively supplied from the coil **14** to the control circuit during the time the head holder **18** is moving from the start position toward the terminal position, thereby permitting the printing head to be actuated through the control circuit so as to effect the printing of the sheet according to the program set in the control circuit in the well known manner.

The operation of the printer of the present invention will be apparent from the above description. In the present invention, since the electromagnetic clutch is rotated at a higher speed in comparison with the rotational speed of the winding drum required for the proper driving of the head holder, the clutch may be made very compact and the construction of the printer

can be made simple while exact operation of the printer is insured and the adjustment is made easy.

In accordance with a further feature of the present invention, a normally closed leaf switch **35** comprising a leaf contact **35***a* and a leaf contact **35***b* normally held in contact with the leaf contact **35***a* is provided in the frame **19** adjacent to the terminal position of the head holder **18.** The switch **35** is connected in series to the electromagnet **7** and the control circuit. The head holder **18** is provided with a projection **18***a* secured thereto. The projection **18***a* is so positioned in relation to the switch **35** that the projection **18***a* abuts against the leaf contact **35***a*of the switch **35** so as to move the leaf contact **35***a* apart from the leaf contact **35***b* when the head holder **18** has just reached the terminal position so as to open the switch **35.**

Thus, the electromagnetic clutch **7** is positively released by the opening of the switch **35** when the head holder **18** reaches the terminal position even though false function of the detecting coil **15** or sensing disc **13** will take place, thereby positively preventing the head holder **18** from moving beyond the terminal position causing damage to the printer.

In the present invention, a thermally sensitive printing head, an electronic printing head or an ink jet printing head can be used as the non-impact printer. However, a mechanical printing hammer can be used in place of the above mentioned non-impact printing head by replacing a printing wheel or drum for the platen described previously.

I claim:

1. Mechanism for moving a printing head in a printer having a frame, a head holder mounting thereon said printing head and movable between a start position and a terminal position in said frame, means cooperating with said printing head for the printing operation of a sheet interposed between said printing head and said cooperating means while said printing head is moving from said start position to said terminal position, control circuit means for supplying printing signals to said printing head in timed relationship to the movement of said head holder from said start position to said terminal position, an electric motor for driving said head holder, wherein the improvement comprises spring means connected at its one end to said head holder while the other end is connected to said frame so as to urge said head holder toward said start position, an electromagnetic clutch mounted on said frame and operably coupled with said motor so as to be driven thereby when said electromagnetic clutch is actuated, said electromagnetic clutch being connected to said control circuit means so as to be released upon receipt of a signal from said control circuit means, a winding drum rotatably mounted on said frame, a reduction gear means connecting said winding drum to said electromagnetic clutch so as to releasably drive said winding drum at a reduced speed with respect to that of said electromagnetic clutch, pulley means rotatably mounted on said frame, an endless wire stretched around said winding drum and said pulley means so as to be driven by said drum, said pulley means being so arranged that a portion of said wire stretched around said pulley means extends in parallel and close to the path of movement of said head holder over the length thereof, a point on said portion of said wire being secured to said head holder thereby permitting said holder to be moved toward said terminal position against the action of said spring means by said winding drum through said wire when said electromagnetic clutch is actuated, a detecting coil operably coupled with said electromagnetic clutch and connected to said control circuit means, said detecting coil being so arranged in timed relation to the actuation of said electromagnetic clutch as to generate said signal for releasing said electromagnetic clutch when said head holder is moved to said terminal position thereby permitting said head holder to be moved back toward said start position by the action of said spring means, and switch means connected to said control circuit means, said switch means being so positioned that the same is actuated when said head holder reaches said start position so as to actuate said electromagnetic clutch through said control circuit means.

2. Mechanism according to claim **1,** further comprising normally closed switch means connected in series to said electromagnetic clutch and said control circuit means, said normally closed switch means being so located that the same abuts against said head holder when the same reaches said terminal position so as to be opened thereby so that said electromagnetic clutch is released to positively prevent said head holder from moving beyond said terminal position regardless of the false function of said control circuit means.

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