April 15, 1969 V. H. FOERSTERLING 3,438,477

PLATEN REVERSING MEANS FOR A PRINTING APPARATUS

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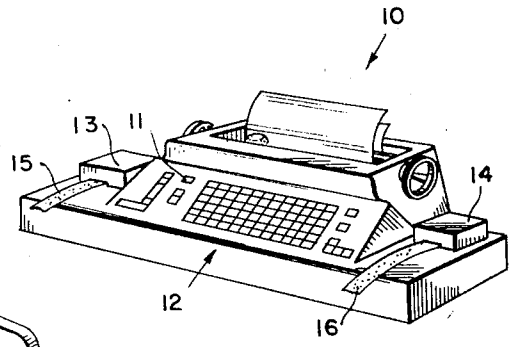


Fig. 1

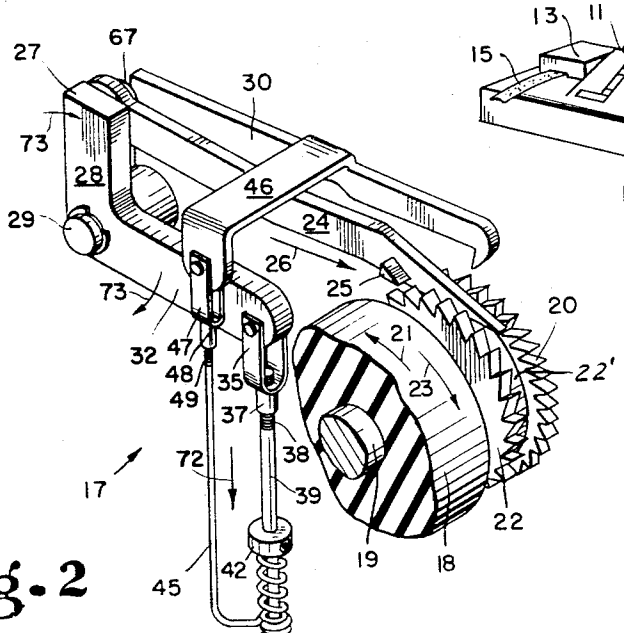


Fig. 2

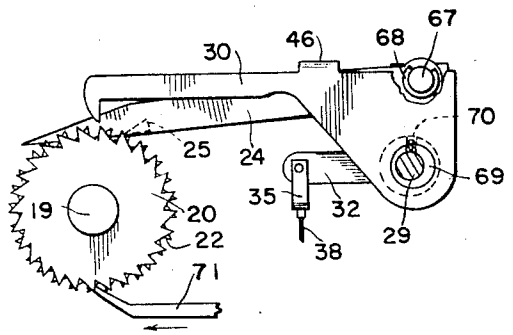
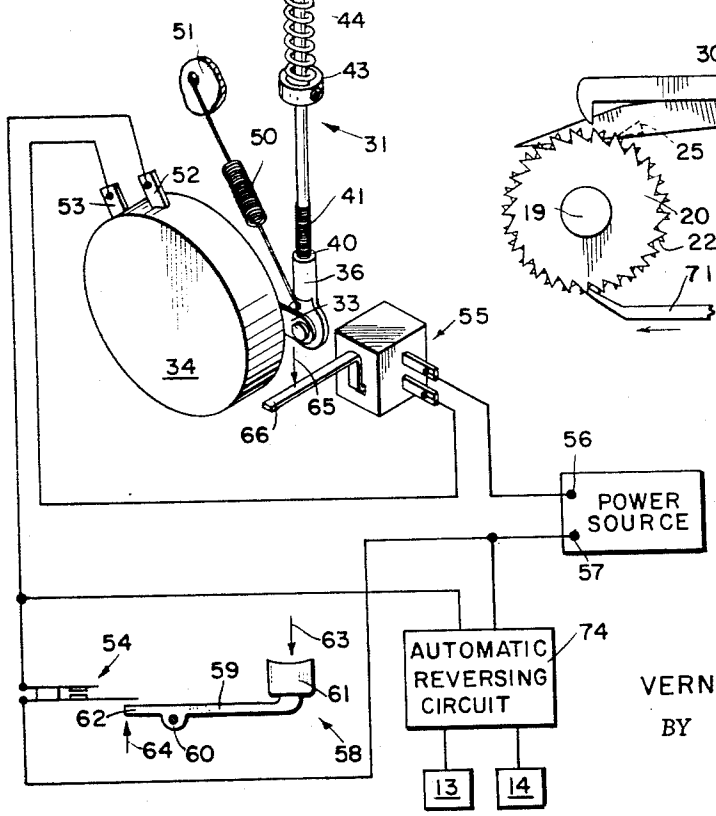


Fig. 3



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PLATEN REVERSING MEANS FOR A PRINTING APPARATUS

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ABSTRACT OF THE DISCLOSURE

In a printing apparatus of the type including a platen for supporting a printing medium and means for driving the platen forwardly, means for reversing the platen in a step-by-step manner. The reversing means comprises first ratchet means arranged to move the platen in the reverse direction, second ratchet means arranged to stop movement of the platen in the reverse direction and electrically operated means for substantially simultaneously operating the first and second ratchet means to move said platen a predetermined amount in the reverse direction. Manually operated means is provided for energizing the electrically operated means and switch means is provided for deenergizing the electrically operated means when the platen is moved said predetermined amount, the switch means being responsive to movement of the electrically operated means. Preferably, circuit means is provided for automatically operating the electrically operated means, the circuit means being connected in parallel with the manually operated means and responsive to coded input means. Also, preferably, means for imparting a code index to a tape is provided, the circuit means being arranged to actuate the code index imparting means when the electrically operated means is energized by the manually operated means.

The present invention relates to printing apparatus and the primary object of the invention is to provide a simple means for reversing a platen of a printing apparatus in a step-by-step manner.

A further object of the present invention to provide a platen reversing means for a printing apparatus of the type including a platen movably supported therein for supporting a printing medium thereon.

Another object of the present invention is to provide such a reversing means wherein a manually operated means or an automatic circuit means may be utilized to reverse the platen.

Still another object of the present invention is to provide, in such a reversing means, a first and second ratchet means operatively connected to said platen and an electrically operated means for operating said first and second ratchet means so as to move the platen a predetermined amount in the reverse direction.

Further objects of the present invention will become apparent as this specification proceeds.

FIG. 1 is a perspective view of a typical printing apparatus of the type which may utilize the platen reverse mechanism of the present invention;

FIG. 2 is a fragmentary perspective view of the platen reverse mechanism of the present invention; and

FIG. 3 is a side view of the ratchet wheels for driving a platen in a forward and reverse direction and the drive pawls cooperating with said ratchet wheels.

Generally speaking, the present invention resides in

a printing apparatus of the type including a platen for supporting a printing medium and is a means for reversing the platen in a step-by-step manner. There is a first ratchet means operatively connected to the platen and arranged so as to move the platen in a reverse direction. A second ratchet means is also operatively connected to the platen and arranged so as to stop movement of the platen in the reverse direction. Electrically operated means are provided for operating the first and second ratchet means so as to move the platen a predetermined amount in the reverse direction. A manually operated means for energizing the electrically operated means is provided and a circuit means for automatically energizing the electrically operated means may be connected in parallel with the manually operated means. The circuit means is adapted to operate in response to a coded input means. There is a switch means responsive to movement of said electrically operated means so as to deenergize the electrically operated means when the platen is moved a predetermined amount in the reverse direction.

In a specific embodiment of the present invention, the aforementioned electrically operated means comprises solenoid means and linkage means. The linkage means is connected between the solenoid means and the aforementioned ratchet means.

Referring now to the drawing, the structure of an illustrative embodiment of the present invention can be visualized in conjunction with the following description.

Referring specifically to FIG. 1, it can be seen that a typical printing apparatus, indicated generally by the reference number **10**, is illustrated. The printing apparatus **10** may typically be an electric typewriter, but may also be any type of business machine having a platen supported on a carriage and adapted to support a printing medium, such as paper. For purposes of illustration, however, the following description will be directed toward the provision of a platen reversing mechanism for an electric typewriter.

The printing apparatus **10**, hereinafter referred to as the typewriter **10**, is provided with a manually operated means **11** for actuating the platen reverse mechanism. The manually operated means, hereinafter referred to as the key **11**, is disposed near the top and lefthand side of a keyboard, indicated generally by the reference number **12**. There are means **13** and **14** on the typewriter **10** for receiving code tapes **15** and **16**, respectively. In accordance with conventional practice, one of said means, for instance **14**, is effective to impress a code upon the tape **16** as the typewriter **10** is operated, while the other of said means is effective to operate the typewriter **10** automatically to print out the information stored on a previously coded tape **15**. The operation of the means **13** and **14** which correspond, respectively, to the means **23**, **21** of the Davidson et al. Patent 2,832,455 issued Apr. 29, 1958, will be discussed further in conjunction with FIG. 2.

The balance of the typewriter **10** elements illustrated in FIG. 1 are typical of all typewriters of the character hereunder consideration and need not be discussed in this description.

Referring now to FIG. 2, the structure of an illustrative platen reverse mechanism, indicated generally as **17**, can be discussed.

A platen **18** is mounted on a shaft **19** so as to be rotated thereby. There is a ratchet wheel **20** mounted on the shaft **19** so as to rotate the platen **18** in the direction of the arrow **21**. There is a second ratchet wheel **22** mounted

on the shaft **19**, adjacent to the ratchet wheel **20**, so as to rotate the platen **18** in the direction of the arrow **23** shown thereon.

The ratchet wheel **20** is normally used in typewriters of the type shown in FIG. 1 for advancing the platen step-by-step in a forward direction as the typewriter is operated. In accordance with the present invention, the ratchet wheel **22** is added to provide a means for reversing the direction of the platen **18**.

There is a drive arm **24** arranged so as to ride on a cylindrical surface **22'** in the space between the ratchet wheels **20** and **22**. The drive arm **24** has a pawl tooth **25** fastened thereto so as to drive the ratchet wheel **22** in the direction of the arrow **23** when the drive arm **24** is driven in the direction of the arrow **26**. In most instances, gravity will hold the arm **24** in contact with surface **22'**; but if desired spring means (not shown) may be provided to bias said arm **24** resiliently to such contact.

The drive arm **24** is pivotally connected to the end of a first extension **27** of an L-shaped member **28**. The L-shaped member **28** is pivotally mounted on a shaft **29** at a point where the two extensions of said member **28** meet. The shaft **29** is rigidly supported in the typewriter **10**.

There is a stop pawl **30** pivotally mounted about the shaft **29** and adapted to engage the ratchet wheel **20** when actuated. A specific means for mounting the stop pawl **30** about the shaft **29** will be discussed in conjunction with FIG. 3.

There is a linkage, indicated generally by the reference number **31**, connecting the end of the second extension **32** of the L-shaped member **28** to a lever **33** connected to the armature of a solenoid **34**. The linkage **31** has a pivotal connection means **35** connected directly to the end of the extension **32** and a second pivotal connection means **36** connected directly to the armature lever **33**. The pivotal connection means **35** has an internally threaded shank portion **37** for receiving a first threaded end **38** of a connecting bar **39**. Similarly, the pivotal connection means **36** has an internally threaded shank portion **40** for receiving a second threaded end **41** of the connecting bar **39**. The internally threaded shank portions **37** and **40** and the threaded ends **38** and **41** of the connecting bar **39** provide a means for adjusting the position of the drive arm **24**.

There is a pair of spaced apart stop rings **42** and **43** independently adjustably fixed to the connecting bar **39**, and spring means **44** is sleeved upon the connecting bar **39** and constrained between the stop rings **42** and **43**. There is a link **45** having a first end sleeved on the bar **39** and resiliently supported intermediate the ends of the spring **44**, and having a second end connected to an extension **46** of the stop pawl **30** by a pivotal connecting means **47**. It can be seen that the pivotal connecting means **47** has an internally threaded shank portion **48** for receiving a threaded end **49** of the link **45**. The internally threaded shank portion **48** and threaded end **49** are a means for determining the tension on the member **45** and, consequently, the holding power of the stop pawl **30**. The link **45**, therefore, is resiliently connected to the linkage **31** and pivotally connected to the stop pawl **30**. Because of this resilient connection, the stop pawl **30** is resiliently engaged with the ratchet wheel **20** when the drive arm **24** is operated.

There is a spring means **50** connected between the pivotal connecting means **36** and a stationary portion **51** of the structure of the typewriter **10** so as to return the armature lever **33** to its normal position when the solenoid **34** is deenergized. In many solenoid structures, the spring return feature may be built into the solenoid.

The solenoid **34** has a pair of terminals **52** and **53**. The terminal **52** is connected directly to a first side of a normally-open switch **54** and a first side of an automatic reversing circuit **74**. The terminal **53** is connected to a first side of a normally-closed switch, indicated generally by the reference number **55**, and through said switch to

a first side **56** of a power source. The second side **57** of the power source is connected directly to a second side of the automatic reversing circuit **74** and to a second side of the switch **54**. There is a manually operated means, indicated generally by the reference number **58**, for energizing the solenoid **34**. In the illustrative embodiment shown in FIG. 2, the means **58** comprises a lever member **59** pivoted on a shaft **60**, a button **61** on one end of the lever member **59** and an extension **62** on the opposite end for closing the switch **54**. Thus, whenever the operator of the typewriter **10** presses the button **61** in the direction of the arrow **63**, the extension **62** will move in the direction of the arrow **64** to close the switch **54**, thereby energizing the solenoid **34** through the switches **54** and **55**.

The switch **55** is constructed and arranged so that movement of the armature lever **33** in the direction of the arrow **65** strikes the actuator arm **66** of the switch **55** to open the energizing circuit for the solenoid **34**.

The automatic reversing circuit **74** is connected in parallel with the switch **54** and is electrically associated with the means **13** and **14** so that a suitable code index will be impressed on the tape **16** whenever the button **61** is depressed, and so that the solenoid **34** will be energized whenever the requirement for such an energization is programmed into the coded tape **15**. Therefore, the automatic reversing circuit **74** is a circuit means for automatically energizing the solenoid **34** and operates in response to coded input means. Specific circuits for providing an electrical output to operate a solenoid or for closing a circuit to permit current to flow to the solenoid are well known in the art. For instance, a proper transistor having a base electrode adapted to receive inputs from a tape reader and an emitter-collector circuit connected between a power source and a solenoid will operate the solenoid whenever a sufficient biasing voltage is applied to the base electrode. Similarly a silicon controlled rectifier having a gate electrode adapted to receive inputs from a tape reader, an anode electrode connected to a power source and a cathode electrode connected to a solenoid will operate the solenoid whenever a sufficient current is applied to the gate electrode. Since such circuits are well known in the art, it will not be necessary to describe an automatic reversing circuit, in detail, in this specification. See, for instance, the Bryce Patent 2,254,931 issued Sept. 2, 1941 showing a reader corresponding to means **13**, which reader is connected to a "work circuit" by means of an amplifying circuit; the Dodge Patent 2,555,734 issued June 5, 1951 showing an automatic typewriter comprising a reader and the manner in which the reader is electrically connected to solenoid-operated keys; and the Prince Patent 2,897,267 issued July 28, 1959 showing a reader and an amplifier for connecting the reader to a relay.

Referring now to FIG. 3, a fragmentary side view of the platen reversing mechanism **17** can be discussed.

As stated previously the drive arm **24** is pivotally connected at the end of the first extension **27** of the L-shaped member **28**. Specifically, and as shown in FIG. 3, the drive arm is pivotally mounted on a stud **67** extending from the extension **27** and is secured thereon by a snap ring **68**.

The stop pawl **30** is adjustably mounted on a cam **69** which is rotatably mounted on the shaft **29**. The cam **69** may be rotated with respect to the stop pawl **30** so as to adjust the position of said stop pawl **30** with respect to the ratchet wheel **20**. There is a set screw **70** for securing the stop pawl **30** to the cam **69**. The cam **69**, therefore, is a cam means for determining the amount of travel of the platen **18** in the reverse direction.

There is a drive pawl **71** engaged with the ratchet wheel **20** so as to advance the ratchet wheel **20** in a forward direction when the pawl **71** is actuated. The drive pawl **71**, therefore, is the conventional drive pawl for advancing the platen **18**.

With the above description in mind, and by making reference to the drawing, the following operation analysis will serve to convey the functional details of the present invention.

The platen **18** is advanced, step-by-step, in the normal forward direction of the arrow **21** by means of the pawl **71** engaging and driving the ratchet wheel **20**. The pawl **71** may be actuated by any number of techniques normally utilized in electric typewriters. However, in many cases, the operator of the typewriter **10** will desire to reverse the platen **18**, step-by-step, for a predetermined amount. If the typewriter **10** is of the type which may be automatically operated by a coded tape, the tape may contain coded instructions for reversing the platen **18**.

When the operator desires to reverse the platen **18**, she will press the button **61** to close the switch **54**. When the switch **54** is closed, current can flow from the power source through the switch **54** to energize the solenoid **34**, thereby rotating the armature lever **33** in the direction of the arrow **65**. When the armature lever **33** strikes the actuator arm **66**, the switch **55** is opened to deenergize the solenoid **34** and the spring **50** returns the armature lever **33** to its non-operated position.

When the solenoid **34** is energized to rotate the armature lever **33** in the direction of the arrow **65**, the linkage **31** is moved in the direction of the arrow **72** to pivot the L-shaped member **28** in the direction of the arrow **73**, thereby moving the drive arm **24** in the direction of the arrow **26**. When the linkage **31** is moved in the direction of the arrow **72**, the link **45**, resiliently connected thereto, is also moved in the direction of the arrow **72** to engage the stop pawl **30** with the ratchet wheel **20**, thereby stopping the reverse movement of the platen **18**. The stop pawl **30** may be adjusted on the cam **69** so as to permit the advancement of one or more teeth of the ratchet wheel **20**.

The key **58** is a manual means for reversing the platen one step at a time. That is, the button **61** must be pressed each time that the platen **18** is reversed manually.

The platen reversing mechanism **17** of the present invention is particularly advantageous because it can be energized by an automatic reversing circuit **74** cooperating with a coded tape receiver means **13** and **14** or the like. If the reversing mechanism **17** was purely mechanical, electrical outputs as provided by the automatic reversing circuit **74** could not be utilized to reverse the platen **18**.

An electric typewriter having a platen reverse mechanism, such as described supra, can ideally be used to draw figures, such as are used to depict chemical formulae, and to type information at any point on a chart in any sequence. With the automatic reversing circuit and coded tape receiving means, discussed supra, the typewriter can be programmed to perform the above-mentioned functions automatically. It may also be used to fill out forms or form formats having a sequence that does not correspond to the sequence of the data contained in the tapes.

In some electric typewriters of the type having a coded tape receiving means, manual actuation of the platen reverse mechanism of the present invention not only reverses the platen, but causes a code to be punched or otherwise placed in a tape so that the manual operation may be repeated automatically. This, of course, is the theory of operation of the Flexowriter apparatus discussed in the aforementioned Davidson et al. Patent 2,832,455.

The solenoid **34**, linkage **31**, linkage **45** and L-shaped member **28** are an electrically operated means for operating the pawl **25** and stop pawl **30**. If the ratchet wheels **20** and **22** and the pawls associated therewith are considered, broadly, as ratchet means operatively connected to the platen **18**, the solenoid **34**, linkage **31**, linkage **45** and L-shaped member **28** are an electrically operated means for operating said ratchet means.

I claim as my invention:

1. In a printing apparatus of the type including a rotatably mounted platen for supporting a printing medium and means for driving the platen forwardly, means for driving the platen reversely in a step-by-step manner, the last-mentioned driving means comprising a first ratchet wheel mounted on a common shaft with said platen, said first ratchet wheel being arranged to rotate said platen in the forward direction, a second ratchet wheel mounted on said shaft adjacent to said first ratchet wheel, said second ratchet wheel being arranged to rotate said platen in the reverse direction, first pawl means for engaging and driving said second ratchet wheel, second pawl means for engaging and stopping said first ratchet wheel then said platen is rotated a predetermined amount in the reverse direction, electrically-operated means effective, when energized, to shift said first pawl means in a direction affirmatively to engage and move said second ratchet wheel in the reverse direction and substantially simultaneously affirmatively to move said second pawl means into stopping engagement with said first ratchet wheel, manually-operated switch means for connecting said electrically-operated means to a power source, thereby to energize said electrically-operated means, and second switch means for disconnecting said electrically-operated means from such a power source, said second switch means being responsive to movement of said electrically-operated means in response to energization thereof.

2. In a printing apparatus of the type including a rotatably mounted platen for supporting a printing medium and means for driving the platen forwardly, means for driving the platen reversely in a step-by-step manner, the last-said driving means comprising a first ratchet wheel mounted on a common shaft with said platen and arranged to rotate said platen in a forward direction, a second ratchet wheel mounted on said shaft and arranged to rotate said platen in a reverse direction, a first pawl for engaging and driving said second ratchet wheel and said platen in said reverse direction, a second pawl for engaging and stopping said first ratchet wheel when said platen is rotated a predetermined amount in said reverse direction, a solenoid operatively connected to said pawls and effective, upon energization, to move said first pawl affirmatively to drive said second ratchet wheel and substantially simultaneously to move said second pawl to engage and stop said first ratchet wheel, a manually-operated switch for connecting said solenoid to a power source, thereby to energize said solenoid, and a second switch for disconnecting said solenoid from such a power source, thereby to deenergize said solenoid, said second switch being responsive to movement of said solenoid in response to energization thereof.

3. The invention of claim 2 in which the operative connection between said solenoid and said first pawl comprises a bell crank pivotally mounted on said apparatus, said first pawl being drivingly connected to one arm of said crank and said solenoid being drivingly connected to the opposite arm of said crank, whereby, when said solenoid is energized, said crank is pivoted to drive said first pawl.

4. The invention of claim 2 including a cam journal mounted on said printing apparatus, said second pawl being adjustably mounted on said cam, thereby to determine the permissible amount of movement of said platen in said reverse direction, the operative connection between said second pawl and said solenoid including resiliently yieldable means, whereby, when said solenoid is energized, said second pawl and said cam are pivoted about the journal axis of said cam.

5. The invention of claim 3 including a cam journal mounted on said printing apparatus, said second pawl being adjustably mounted on said cam, thereby to determine the permissible amount of movement of said platen in said reverse direction, a first linkage for connecting the armature of said solenoid to said opposite arm of

said bell crank, and a second linkage having a first end connected to said second pawl and a second end resiliently connected to said first linkage.

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