

Jan. 11, 1966

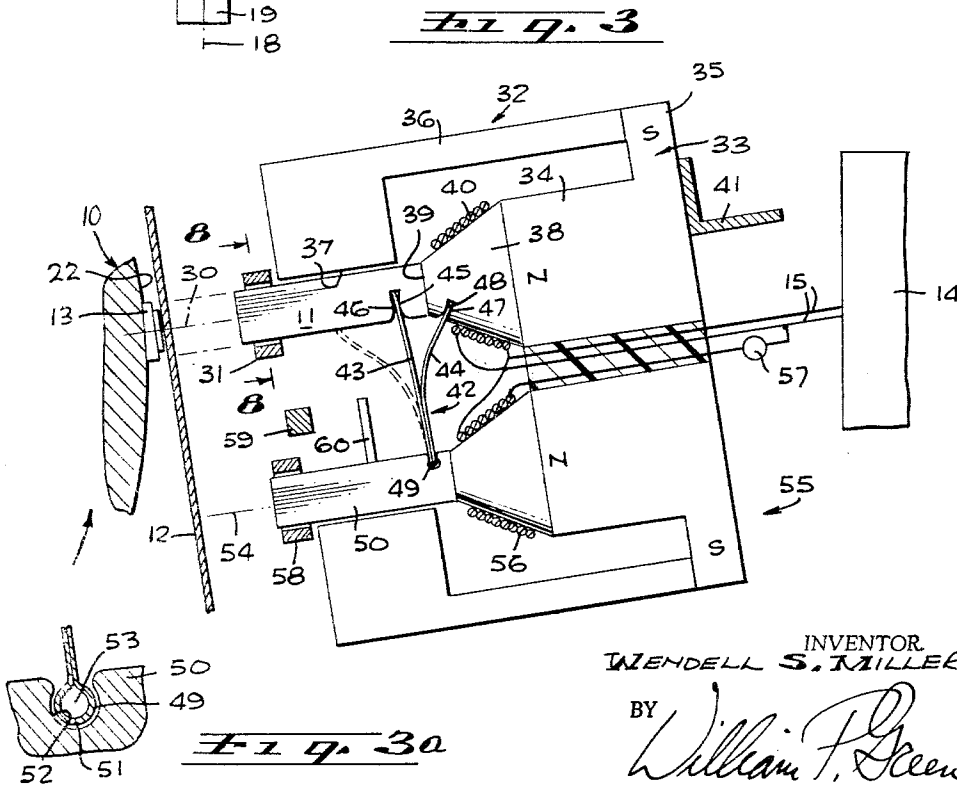
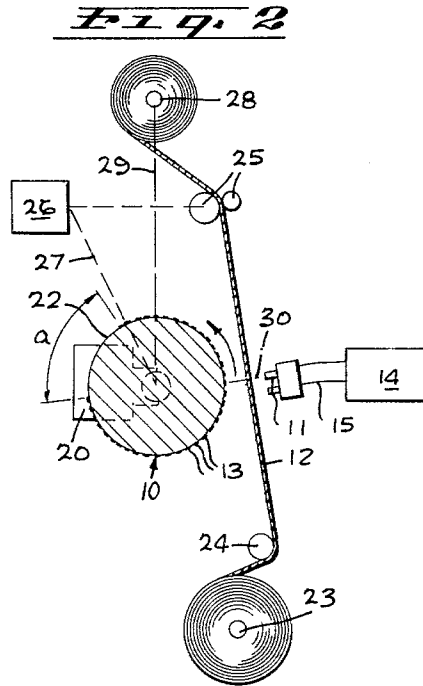
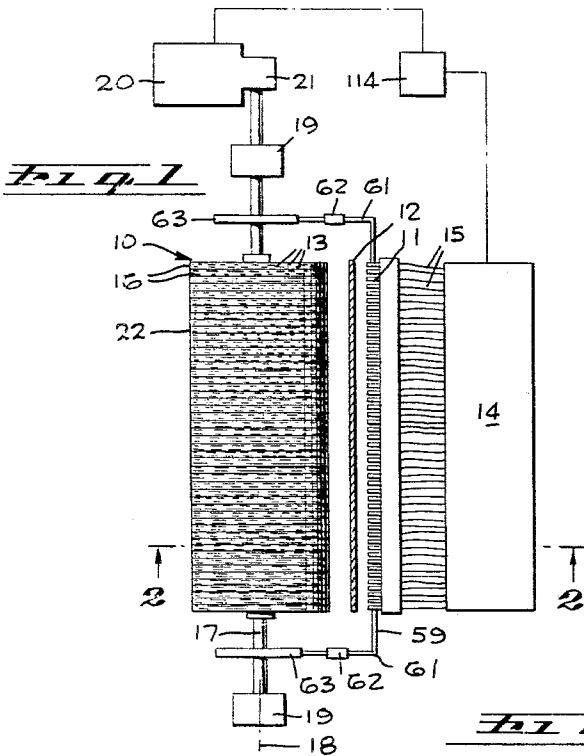
W. S. MILLER

3,228,325

MAGNETIC ACTUATED HAMMERS IN A LINE PRINTER

Filed March 16, 1964

2 Sheets-Sheet 1



INVENTOR
WENDELL S. MILLER
BY *William F. Green*
ATTORNEY

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W. S. MILLER

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MAGNETIC ACTUATED HAMMERS IN A LINE PRINTER

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2 Sheets-Sheet 2

Fig. 4

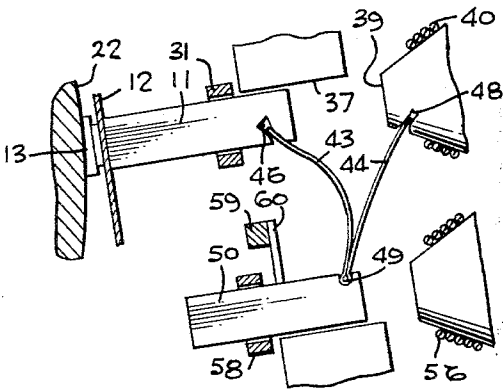


Fig. 5

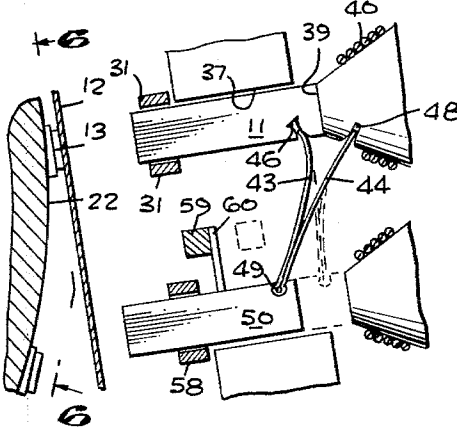


Fig. 6

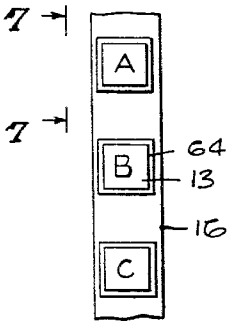


Fig. 7

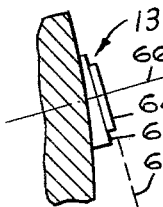


Fig. 8

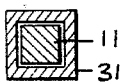


Fig. 9

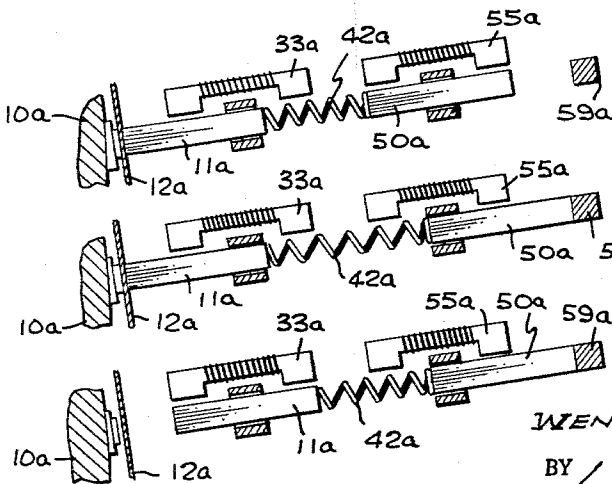
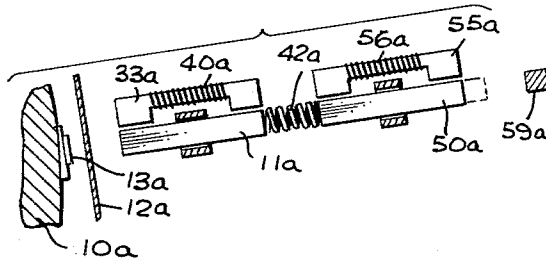


Fig. 10

Fig. 11

Fig. 12

INVENTOR
WENDELL S. MILLER

BY

William F. Green
ATTORNEY

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3,228,325

MAGNETIC ACTUATED HAMMERS IN A LINE PRINTER

Wendell S. Miller, 1341 Comstock Ave.,
Los Angeles, Calif.

Filed Mar. 16, 1964, Ser. No. 352,083
9 Claims. (Cl. 101-93)

This invention relates to printing equipment, and is more particularly concerned with apparatus of the type referred to as a line printer.

A conventional type of line printer currently in use includes a printing roller structure mounted to turn about a predetermined axis, and consisting of a series of discs or portions of the roller each carrying type elements for printing characters at a predetermined space within a printed line. Associated with each of the portions of the roller there is provided a striking element which acts to strike a work sheet of paper or the like against the roller structure to impress on the paper a desired character. All of the various striking elements may be actuated during a particular revolution of the roller, at precisely the correct times to print in the different spaces the desired combination of characters, so that the full line of printed matter is applied to the work sheet. Each disc or portion of the roller may carry type elements corresponding to all of the different letters of the alphabet, or numerals, punctuation marks, or other symbols which may be desired, so that any of these various symbols can be printed at any of the spaces in the line.

In prior apparatus of this type, the striking elements have been electrically actuated by application of electrical signals to electromagnetic coils associated with the elements, so that magnetic fields produced by the signals coact with nearby permanent magnets in a manner causing displacement of the striking elements toward the roller. After the signal applied to a particular element is terminated, the striking element returns to its initial retracted position in preparation for the next successive striking operation. The signals to the various striking elements are supplied by a control circuit, which may take the form of a computer or logic circuit adapted to predetermine accurately exactly when each striking element should be actuated in order to print a particular line on a sheet of paper. The roller may turn continuously about its axis, to print a series of successive lines on the paper on successive revolutions respectively of the roller.

One problem which has been encountered in the past in connection with line printers of the above discussed type resides in the very large amount of electrical energy which must be supplied to each of the striking elements upon each actuation thereof, in order to produce an effective printing operation. This large amount of energy is required because of the very rapid acceleration which must be imparted to the striking elements to assure effective printing of the various characters, and to complete each striking action almost instantaneously while a particular one of the type elements of the turning roller is in proper position opposite the striking element. To produce a series of signals of a value sufficient to properly actuate all of the striking elements of a line printer individually necessitates the use of relatively high output computer or logic circuitry, which greatly increases the complication and expense of the overall printing device.

A major object of the present invention is to provide a line printer of the above discussed general type in which the striking elements are adapted to be triggered or fired in a striking direction by control signals of much smaller electrical energy than has been required in prior equipment. Thus, the outputs of the logic circuitry may be at a lower potential and/or amperage, so that the cost of the control circuitry is greatly reduced. To achieve

this result, I employ unique striking elements which, instead of being displaced magnetically in their striking direction, are driven very effectively in that direction by a spring structure or other yielding means. The signals from the control circuit are then utilized merely to release the striking elements for movement toward the printing roller under the influence of the yielding means. Preferably, the striking elements are latched or retained magnetically in retracted positions, and in response to a predetermined electrical signal are released instantaneously to strike an opposed portion of the paper against a corresponding type element on the roller.

In conjunction with the springs or other yielding means, I find it desirable to employ a cocking structure, for cocking the springs after each striking action. Thus, a relatively strong force may be exerted against the springs by this cocking mechanism, to store in each of the springs a corresponding striking potential, but without the necessity for transmission of the cocking energy through the amplifying means of the logic circuitry.

A further feature of the invention relates to a preferred manner of forming the individual type elements so that some of the striking force is actually supplied by the rotating roller itself, to thereby supplement the effect of the striking elements. For this purpose, I mount the individual type elements on the roller in a relation such that they face primarily radially outwardly, but in a direction having a slight component circularly about the roller, in the direction in which the roller turns, so that this circular component is in effect added to the force of the striking element to make the ultimate impression on the sheet of paper. This discussed orientation of the type elements also has the advantage of imparting to the striking elements a retracting force tending to displace them back toward their initial retracted or latched positions. Preferably, the retracting movement attained in this manner is sufficient to displace the striking elements completely back to their original positions, with partial cocking of the spring or other yielding means, and with further cocking being produced mechanically after such returning displacement of the striking elements. For this purpose, I may employ a unique spring structure formed of a pair of leaf springs actuatable in a particular novel manner to allow for the desired two stage cocking cycle.

The above and other features and objects of the invention will be better understood from the following detailed description of the typical embodiments illustrated in the accompanying drawings, in which:

FIG. 1 is a partially diagrammatic plan view of a line printer constructed in accordance with the invention;

FIG. 2 is a vertical section through the FIG. 1 unit, taken on line 2-2 of FIG. 1;

FIG. 3 is a fragmentary enlarged showing of a portion of FIG. 2, with a detail of the spring further enlarged in FIG. 3a;

FIG. 4 shows the striking element of FIG. 3 after it and the associated cocking part have been released;

FIG. 5 shows the parts of FIGS. 3 and 4 after the first step of the cocking action;

FIG. 6 is a fragmentary view taken on line 6-6 of FIG. 5;

FIG. 7 is an enlarged fragmentary section taken on line 7-7 of FIG. 6;

FIG. 8 is a section taken on line 8-8 of FIG. 3;

FIG. 9 shows somewhat diagrammatically a striking element structure utilizing a coil spring rather than leaf spring, with the apparatus being shown in its fully cocked condition; and

FIGS. 10, 11 and 12 show the parts of FIG. 9 in three other positions which are assumed during operation of the apparatus.

With reference first to the form of the invention shown in FIGS. 1 through 8, and particularly to the first two figures, I have illustrated in those figures a line printer including a printing roller 10 and a series of typically identical individual striking elements 11. Elements 11 act to strike different portions of a work sheet 12 of paper or the like against type elements 13 formed on the periphery of the roller, to print appropriate characters or symbols on the surface of the paper. These striking elements are under the control of a control circuit 14, typically consisting of a computer or logic circuit adapted to produce separate output electrical signals fed to the individual striking elements through separate pairs of leads 15.

Though roller 10 may be formed integrally of a single part, it is typically illustrated in the figures as formed of a series of identical discs 16 rigidly mounted on a shaft 17 and disposed transversely of the axis 18 about which that shaft turns. The shaft may be mounted for its rotary motion by means of bearings 19, and be driven rotatably by a uniform speed synchronous electric motor 20 connected to the shaft by gearing 21. Thus, the roller turns continuously at a uniform rate during operation of the apparatus. Each of the discs 16 may have an outer cylindrical surface 22 centered about axis 18, and on which the series of type elements 13 are formed. Elements 13 may be carried at uniformly spaced locations continuously about the periphery of each disc, except at the location of a non-printing area designated by the angle a in FIG. 2. As will be apparent, the type elements 13 take the form of the various letters of the alphabet, numerals, punctuation marks, and other characters which are to be printed. The type elements may be identical for all of the different discs or portions 16 of the roller, so that any one of the characters may be printed at any space along the entire printing line.

The paper 12 is initially carried on a feed roll 23, from which it may pass upwardly about an idler roller 24, then between two feed rollers 25 which are power driven by a timed intermittent drive mechanism typically represented at 26. This mechanism 26 is in turn driven by or timed with respect to motor 20, as represented by the broken line 27 of FIG. 2, to intermittently advance paper 12 upwardly through a distance corresponding to one line of printing, during the interval when the non-printing portion of roller 10 designated by angle a is opposite and passing striking elements 11. Paper advancing rollers 25 may typically be a pair of opposed rollers of rubber or other high friction material, adapted to positively advance the paper when the rollers are intermittently turned. Upwardly beyond rollers 25, a takeup roll 28 may be provided, on which the printed paper is wound, with this roller being driven by motor 20 through a slip clutch drive diagrammatically represented at 29, to properly take the paper while allowing intermittently driven rollers 25 to have complete control over the actual rate of intermittent paper advancement.

Referring now to FIG. 3, each of the striking elements 11 may take the form of an elongated piece of magnetic metal extending and movable along an individual striking axis 30, and typically of uniform square cross section along its length (see FIG. 8). Suitable guide means are provided for guiding each striking element 11 for bodily longitudinal movement along its axis 30, these guide means being typically illustrated as sleeves 31 within which elements 11 are close sliding fits.

Each striking element 11 has associated with it a magnetic latching structure 32, including a permanent magnet 33 having north and south poles at 34 and 35 respectively. To this permanent magnet 33, there is connected a piece of iron or other magnetizable material 36, which is magnetically soft and forms a continuation of the flux path from south pole 35 to a pole face 37 received in close proximity to striking element 11 when the latter is in its retracted position of FIG. 3. Similarly, the north pole 34

of magnet 33 carries a piece of magnetically soft iron or other material 38, forming a pole face 39 against which the end of element 11 abuts in its retracted position. An energizing coil 40 is disposed about soft iron element 38, and is capable when energized of creating a magnetic field substantially exactly counteracting the field of permanent magnet 33. The various elements 33, 36 and 38 forming portions of the stationary flux path are suitably secured rigidly together and to an appropriate rigid mounting frame 41 in any suitable manner.

Each striking element 11 is yieldingly urged to the left in FIG. 3, against one of the type elements 13 of roller 10, by a spring assembly 42. When coil 40 is de-energized, the flux produced by permanent magnet 33 flows about a substantially continuous magnetic path, from the north pole 34 of magnet 33 through soft iron element 38, then through the retracted striking element 11 which is also formed of a magnetically soft iron or other magnetic material, then through pole face 37 into part 36, and through the material of that part into the south pole of permanent magnet 33 for return through the material of that magnet to its north pole. The magnetic attraction developed in this manner is sufficient to effectively retain element 11 in its retracted position against the tendency of spring assembly 42 to displace that element leftwardly. When, however, an electrical signal is supplied to coil 40 from logic circuitry 14, that signal sets up a magnetic polarity in iron element 38 which may substantially exactly equal but be reversed with respect to the polarity of magnet 30, so that the electromagnetically developed polarity within element 38 produces a north pole at its right end adjacent north pole 34 of magnet 33, and a south pole at the left end of element 38 adjacent the striking element 11. The polarity of electro-magnetically energized element 38 thus opposes the magnetic polarity of element 33, and terminates the flow of magnetic flux previously induced through elements 38 and 11 by permanent magnet 33. Thus, the signal applied to coil 40 releases the magnetic hold on striking element 11 and allows that element to be rapidly actuated with a heavy striking force to the left to impress on paper 12 a desired character or symbol.

Spring assembly 42 is formed in essence of two leaf spring arms 43 and 44, which may be formed separately if desired and be rigidly secured together at their lower ends, or may be integral at their lower ends, as shown, and be portions of a single continuous spring. The upper end of the first spring arm 43 is connected to striking element 11 to exert leftward force thereagainst, as by reception of the upper end 45 of spring arm 43 loosely within a slot or recess 46 extending upwardly in element 11. Recess 46 extends upwardly far enough to enable upward and downward movement of spring element 43 to different positions within this recess in order to allow for the relative movements of the different parts which will be discussed below. The second spring arm 44 has its upper end 47 similarly received within an upwardly elongated slot or recess 48 formed in the stationary pole piece element 38. The lower joined ends of the two spring arms are movably received within a recess 49 formed in a cocking element 50, with one such cocking element being associated with each of the striking elements. In the particular arrangement illustrated, the lower ends of the two spring arms are represented as joined together by an integral circular or cylindrical portion 51 (FIG. 3a), which is confined within a partial cylindrical recess 52 formed in element 50, to mount the lower end portion 51 of the spring assembly for swinging movement relative to part 50 about an axis 53 extending parallel to axis 18 of roller 10.

The resilience of spring arm 43 is such that this arm tends to return by its own resilience from the generally straightened full line condition of FIG. 3 to the more curved broken line condition of that figure. Further, even in this curved condition, arm 43 still has potential

energy stored therein, inasmuch as arm 43 tends to move considerably beyond the broken line FIG. 3 position, to a still more curved normal condition, to thereby assure a fully effective spring induced striking action against the roller. Arm 44 may tend by its own resilience to be actuated from the curved full line condition of FIG. 3 to the more straightened condition of FIG. 5.

The cocking elements 50 associated with the various striking elements 11 may typically be constructed substantially the same as the striking elements themselves, and be mounted for movement along individual axes 54 which are parallel to the striking element axes 30. Further, each cocking element 50 has associated with it a magnetic latching unit 55 which may be formed substantially the same as unit 32 associated with the striking element, to magnetically retain element 50 in its retracted position until a triggering electrical release pulse is supplied to coil 56 of unit 55. This pulse is timed accurately with respect to the pulse supplied to the associated coil 40, and is taken from the same leads 15 as is the pulse fed to coil 40, but is delayed a predetermined very slight interval with respect to the pulse of coil 40 by a delay element 57 connected into the circuit of coil 56. Cocking elements 50 are guided for their axial movement by suitable guide means, typically represented at 58 as sleeves of the type shown at 31 in FIG. 8. These sleeves 31 and 58 are of course stationarily mounted with respect to bearings 19, stationary magnet structures 32 and 55, and the mountings for the various other rollers, motors, etc.

The leftward movement of cocking elements 50 is limited in the FIG. 4 position of the apparatus by engagement of a main cocking rod 59 with a series of upstanding lugs or arms 60 rigidly carried by and projecting upwardly from the various cocking elements 50. Rod 59 may extend parallel to main axis 18 of roller 10, to simultaneously engage and act against the lugs 60 of all of the different cocking elements 50. Rod 59 is mounted for movement, in a direction parallel to axes 30 and 54 between the full line and broken positions of FIG. 5. To thus actuate the main cocking rod 59, this rod may be connected at its opposite ends to a pair of mounting arms 61 (FIG. 1) which are guided in stationary sleeves 62 for sliding movement in the direction in which rod 59 is to move, and which are actuated by cams 63 carried by roller shaft 17 to move rod 59 between its full line and broken line positions of FIG. 5 in accordance with the rotation of roller 10. As will be apparent, rod 59 may of course be suitably spring returned leftwardly in FIG. 1, against the rightward displacing tendency of the cams. Obviously, any of numerous other actuating mechanisms may be employed as the cocking means.

In conventional roller type line printing mechanism of the present general character, the individual type elements 13, for forming the various letters and other characters on paper 12, face directly radially outwardly from the axis of roller 10. In my arrangement, however, I prefer to dispose these type elements so that they face in a direction which is primarily radially outwardly, but which has a slight component in a circularly advancing direction, relative to the direction of rotation of the roller. With particular reference to FIG. 7, the type element 13 there shown has the outer edges of the letter or other character 64 which is formed thereon disposed in a plane 65 which would normally be directly perpendicular to a line extending through axis 18 of the roller. However, in accordance with the present invention, the plane 65 is perpendicular to a line 66 which defines the direction in which elements 13 may be considered as facing, and which line 66 misses axis 18 substantially. When a particular one of the type elements 13 is in printing position directly opposite the corresponding striking element 11, the line 66 of FIG. 7 related to that particular type element coincides with axis 30 of the striking element, so that element 11 can strike paper 12 properly against the face of the type element. In the figures, it is

assumed that roller 10 turns in a counter-clockwise direction, as seen in FIGS. 2, 3, 4, 5 and 7, so that the slight discussed angularity of element 13, to face in a slightly advancing circular direction, causes the type element to itself add a component of force to the striking action of element 11, thus utilizing the rotary motion of the roller to increase the effective striking force of the overall combination. Further, this angularity of the type element tends to assist in causing rightward retracting movement of the striking element after completion of its leftward movement, and is in effect sufficient to fully retract element 11 to its FIG. 5 position.

To now describe a cycle of operation of the form of the invention shown in FIGS. 1 through 8, assume first of all that motor 20 is continuously energized to drive roller 10 rotatably about axis 18 continuously and at a uniform rate. As the motor turns, it also drives paper advancing mechanism 26 to intermittently advance paper 12 upwardly for the printing of successive lines thereon and in timed relation to the rotation of the motor. Further, the computer or logic circuit 14 which controls the striking elements has its output signals timed with respect to the rotation of motor 20, by means of a suitable timing unit typically represented at 114 in FIG. 1.

With all of the striking elements 11 initially in the position of FIG. 3, we may assume that roller 10 is in a position in which the non-printing area *a* has just passed the location of striking elements 11, and the first of the type elements 13 of each disc 16 of the roller has just reached a position directly opposite the corresponding striking element 11. These first type elements may typically represent the letter "A." If logic circuit 14 determines that the subject matter to be printed on a first line on paper 12 is to include the letter "A" at any particular space or spaces, then signals are sent from logic circuit 14 to the coils 40 associated with the corresponding striking elements 11, to energize those coils and release those striking elements in the manner previously discussed. The initial signals are applied only to coils 40 and not to the associated coils 56, so that the striking elements 11 are released for movement by the related spring arms 43 from the full line position of FIG. 3 to the broken line position of that figure. Spring arm 43 has sufficient resilience to effectively move the striking element to that broken line position, and in fact tends to move the striking element considerably beyond that position, to print the desired character on the paper. As soon as element 11 reaches its printing position in which it strikes the paper against the type element, the delay element 57 allows application of the triggering pulse to the associated coil 56, to release the related cocking element 50 for movement under the influence of spring 44 to the position of FIG. 4. This movement of the cocking element allows spring arm 43 to turn to a more curved condition, thus relieving the tension of spring 43 so that element 11 may be bounced back to the FIG. 5 retracted position by virtue of its striking action against the paper and roller. In FIG. 5, spring arm 43 is curved considerably more than in FIG. 3, so that less force is exerted against striking element 11 than in FIG. 3, to thus facilitate the returning or initial cocking action of the striking element 11. By the time element 11 reaches the FIG. 5 setting, the signals to coils 40 and 56 have been cut off by control circuit 14, so that element 11 is magnetically retained in its retracted position. As the roller 10 continues to turn through a particular revolution, each striking element 11 is actuated in this same manner at precisely the instant when the desired one of the type elements 11 is directly opposite that striking element, to thus print at each space along a line on paper 12 a desired character. In this way, a full line is printed on each revolution of the roller. When the roller reaches a position in which non-printing area *a* is again opposite the striking element, cams 63 actuate rod 59 to the right, to thereby displace all of the indi-

vidual cocking elements 50 rightwardly from their full line positions to their broken line positions of FIG. 5, so that the cocking elements will again be retained in retracted positions by magnetic units 55, with rod 59 then returning to the left so that the entire apparatus is again in the FIG. 3 setting in preparation for the next revolution of the roller. During the portion of the cycle when non-printing area *a* is opposite the striking elements, paper feed rollers 25 advance the paper to move the first printed line upwardly and place the paper in position for printing of the next successive line. The actuation of cocking elements 50 from their FIG. 5 positions to their FIG. 3 positions, against the tendency of spring arm 44, causes the main firing spring arm 43 to be actuated to a more straightened condition, to thus supplement the initial cocking action and develop a relatively great force in the spring 43 sufficient to produce the printing action, and greater than the force required in the initial cocking step to displace element 11 from the FIG. 4 setting to the FIG. 5 setting. The rightward displacement of element 50 also develops in spring 44 enough force to again return element 50 to the left when the element is released during the next cycle of operation.

Referring now to FIGS. 9 through 12, these figures show somewhat diagrammatically a variational form of the invention which may be considered as identical with that of FIGS. 1 through 8 except for the substitution of a coil spring 42*a* in lieu of the leaf spring assembly 42 of the first form, and for alteration of certain other parts to enable use of this coil spring. In FIG. 9, one of the striking elements is illustrated at 11*a*, and is yieldingly urged leftwardly against one of the type elements 13*a* of roller 10*a* by the coil spring. The element 11*a* is retained in the FIG. 9 retracted position by a permanent magnet 33*a*, corresponding to magnet 33 of FIG. 3, with this magnetic latching effect being releasable by the application to a coil 40*a* of the triggering signal from a logic circuit, of a value to equal and oppose the magnetic effect of element 33*a*, and thereby release the holding effect on the magnetic striking element 11*a*. Similarly, a cocking element 50*a* is urged rightwardly by coil spring 42*a*, and is retained in the FIG. 9 cocked position by a permanent magnet 55*a*, whose effect is nullified by energization of a triggering and opposed coil 56*a*. When cocking element 50*a* is released, it moves to the right against a main cocking rod 59*a*, corresponding to rod 59 of FIG. 1 and similarly actuable in timed relation to the rotation of the roller, but with the movement of rod 59 being essentially reversed as will be discussed below.

During the cycle of operation of the arrangement of FIGS. 9 through 12, the parts 11*a* and 50*a* initially are magnetically held in their FIG. 9 settings, until the application of the triggering signal to coil 40*a* releases striking element 11*a* for leftward movement against the paper 12*a* and type element 13*a* to type an appropriate character on the paper (FIG. 10). Coil 56*a* is energized by a time delay element as soon as striking element 11*a* has completed its leftward motion, to release the cocking element 50*a* of magnetic material for rightward movement to the FIG. 11 position against rod 59*a*. Thus, the force of spring 42 is relieved substantially to enable rightward bouncing of retracting movement of the striking element 11*a* to the FIG. 12 position with minimum resistance, to be retained in that position by permanent magnet 33*a* whose coil 40*a* has by this time been de-energized. During the non-printing portion of the revolution of roller 10*a*, corresponding to portion *a* of FIG. 2, the main retracting rod is actuated to the left, to the broken line position of FIG. 9, to simultaneously return all of the cocking elements 50 to their fully cocked positions.

It is noted that the drawings have not been confused by any showing of inking means such as a ribbon or the like. Consequently, it may be assumed in the drawings that the paper illustrated at 12 or 12*a* is of the known type carrying a coating formed of minute particles of encapsu-

lated ink, which will produce markings in response to the application of pressure alone. However, it will be apparent that a conventional ribbon, carbon paper, or ink applying mechanism may be utilized if desired.

I claim:

1. A line printer comprising a roller structure mounted to turn about an axis and having a series of different printing portions positioned to print characters at a series of different predetermined spaces respectively along a line, individual ones of said portions having a number of different type elements at different locations circularly about the roller structure to print different characters, means for advancing a paper relative to said roller structure to print successive lines thereon, a series of striking elements positioned to strike said paper against said different portions of the roller structure respectively and mounted for movement relative to one another and toward and away from said roller structure between retracted and striking positions, a series of yielding means operable to yieldingly urge said striking elements respectively toward said different portions of the roller structure, a series of magnetic holding units operable to magnetically retain said different striking elements respectively in retracted positions and electrically releasable separately by predetermined signals to release said striking elements for separate striking movements under the influence of said yielding means, followed by retracting movement of the striking elements, means for partially relieving the force of said yielding means following a striking movement of an associated striking element to facilitate retracting movement of the latter, and means for cocking said yielding means to increase the force thereof after said retracting movement of the striking element.

2. A line printer comprising a roller structure mounted to turn about an axis and having a series of different printing portions positioned to print characters at a series of different predetermined spaces respectively along a line, individual ones of said portions having a number of different type elements at different locations circularly about the roller structure to print different characters, means for advancing a paper relative to said roller structure to print successive lines thereon, a series of striking elements positioned to strike said paper against said different portions of the roller structure respectively and mounted for movement relative to one another and toward and away from said roller structure between retracted and striking positions, a series of yielding means operable to yieldingly urge said striking elements respectively toward said different portions of the roller structure, a series of magnetic holding units operable to magnetically retain said different striking elements respectively in retracted positions and electrically releasable separately by predetermined signals to release said striking elements for separate striking movements under the influence of said yielding means, followed by retracting movement of the striking elements, individual cocking elements for cocking said yielding means respectively and thereby increasing the force with which said yielding means urge the corresponding striking elements in striking directions, said cocking elements being movable between cocked and released positions, means for releasing said cocking elements from said cocked positions in predetermined slightly delayed relation to said release of the striking elements respectively to facilitate retracting movement of the striking elements, and cocking means actuable in predetermined timed relation to the rotation of said roller structure to return said cocking elements to cocked positions.

3. A line printer as recited in claim 2, in which an individual one of said yielding means includes a leaf spring arm having a first end exerting force against one of said cocking elements and a second end exerting force against the corresponding striking element, and there being a second leaf spring arm resisting cocking movement of each of said cocking elements.

4. A line printer comprising a roller structure mounted

to turn about an axis and having a series of different printing portions positioned to print characters at a series of different predetermined spaces respectively along a line, individual ones of said portions having a number of different type elements at different locations circularly about the roller structure to print different characters, means for advancing a paper relative to said roller structure to print successive lines thereon, a series of striking elements positioned to strike said paper against said different portions of the roller structure respectively and mounted for movement relative to one another and toward and away from said roller structure between retracted and striking positions, a series of yielding means operable to yieldingly urge said striking elements respectively toward said different portions of the roller structure, a series of magnetic holding units operable to magnetically retain said different striking elements respectively in retracted positions and electrically releasable separately by predetermined signals to release said striking elements for separate striking movements under the influence of said yielding means, followed by retracting movement of the striking elements, individual cocking elements for cocking said yielding means respectively and thereby increasing the force with which said yielding means urge the corresponding striking elements in striking directions, said cocking elements being movable between cocked and released positions, an individual one of said yielding means including a first leaf spring arm having a first end exerting force against one of said cocking elements and a second end exerting force against the corresponding striking element, a second leaf spring arm having a first end connected to said first end of the first spring arm and having a second end exerting reactive force against the corresponding holding unit to yieldingly resist cocking movement of the cocking element, second holding units for magnetically holding said cocking elements in cocked positions, means for releasing said second holding units in predetermined slightly delayed relationship to the release of the corresponding first holding units respectively, and cocking means actuable in predetermined timed relation to the rotation of said roller structure to return said cocking elements to cocked positions.

5. A line printer as recited in claim 2, in which an individual one of said yielding means includes coil spring means operatively interposed essentially between each of said striking elements and a corresponding cocking element and exerting force in opposite directions thereagainst.

6. A line printer comprising a roller structure mounted to turn about an axis and having a series of different printing portions positioned to print characters at a series of different predetermined spaces respectively along a line, individual ones of said portions having a number of different type elements at different locations circularly about the roller structure to print different characters, means for advancing a paper relative to said roller structure to print successive lines thereon, a series of striking elements positioned to strike said paper against said different portions of the roller structure respectively and mounted for movement relative to one another and toward and away from said roller structure between retracted and striking positions, a series of yielding means operable to yieldingly urge said striking elements respectively toward said different portions of the roller structure, a series of magnetic holding units operable to magnetically retain said different striking elements respectively in retracted positions and electrically releasable separately by predetermined signals to release said striking elements for separate striking movements under the influence of said yielding means, followed by retracting movement of the striking elements, individual cocking elements for cocking said yielding means respectively and thereby increasing the force with which said yielding means urge the corresponding striking elements in striking directions, said cocking elements being movable between cocked and released positions, an in-

dividual one of said yielding means including coil spring means operatively interposed essentially between one of said striking elements and a corresponding cocking element and exerting striking and reactive forces respectively in opposite directions thereagainst, second magnetic holding units for magnetically holding said cocking elements in cocked positions against the force of said coil spring means, means for releasing said second holding units in predetermined slightly delayed relationship to the release of the corresponding first holding units respectively, and cocking means actuable in predetermined timed relation to the rotation of said roller structure to return said cocking elements toward said striking elements and to cocked positions after return of the striking elements to their retracted positions.

7. A line printer comprising a roller structure mounted to turn about an axis and having a series of different printing portions positioned to print characters at a series of different predetermined spaces respectively along a line, individual ones of said portions having a number of different type elements at different locations circularly about the roller structure to print different characters, means for advancing a paper relative to said roller structure to print successive lines thereon, a series of striking elements positioned to strike said paper against said different portions of the roller structure respectively and mounted for movement relative to one another and toward and away from said roller structure between retracted and striking positions, and means for actuating said striking elements, said different type elements facing essentially radially outwardly from said axis but in a direction having a small component in a circularly advancing direction.

8. A line printer comprising a roller structure mounted to turn about an axis and having a series of different printing portions positioned to print characters at a series of different predetermined spaces respectively along a line, individual ones of said portions having a number of different type elements at different locations circularly about the roller structure to print different characters, means for advancing a paper relative to said roller structure to print successive lines thereon, a series of striking elements positioned to strike said paper against said different portions of the roller structure respectively and mounted for movement relative to one another and toward and away from said roller structure between retracted and striking positions, a series of yielding means operable to yieldingly urge said striking elements respectively toward said different portions of the roller structure, holding means for latching said striking elements in retracted positions and releasable to release the striking elements, cocking means for applying force to said yielding means and for relieving said force at predetermined intervals, means for actuating said cocking means to at least partially relieve said force of the yielding means in time delayed relation to the release of said holding means and at a time to enable rebounding movement of said striking elements against reduced resistance, said different type elements facing essentially radially outwardly from said axis but in a direction having a small component in a circularly advancing direction sufficient to enable full retraction of a striking element by said rebounding action, said mechanism for actuating said cocking means to recock said yielding means.

9. A line printer comprising a roller structure mounted to turn about an axis and having a series of different printing portions positioned to print characters at a series of different predetermined spaces respectively along a line, individual ones of said portions having a number of different type elements at different locations circularly about the roller structure to print different characters, means for advancing a paper relative to said roller structure to print successive lines thereon, a series of striking elements positioned to strike said paper against said different portions of the roller structure respectively and mounted for movement relative to one another and toward and away

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from said roller structure between retracted and striking positions, a series of yielding means operable to yieldingly urge said striking elements respectively toward said different portions of the roller structure, a series of magnetic holding units operable to magnetically retain said different striking elements respectively in retracted positions and electrically releasable separately by predetermined signals to release said striking elements for separate striking movements under the influence of said yielding means, followed by retracting movement of the striking elements, individual ones of said holding units including a magnet operable to retain a corresponding striking element in retracted position, and an electromagnetic triggering coil electrically energizable by said signals and operable when energized to counteract the holding flux of said magnet and thereby release the striking element for striking movement, cocking elements for cocking said yielding means and movable between cocked and released positions, a series of second magnetic holding units for retaining said cocking elements respectively in said cocked positions and including magnets and triggering coils for

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counteracting said magnets to release said cocking elements, and delay circuitry for energizing said triggering coil of one of said second holding units in predetermined slightly delayed relation to the energization of the triggering coil of a corresponding first holding unit.

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ROBERT E. PULFREY, *Primary Examiner*.

WILLIAM B. PENN, *Examiner*.