Aug. 27, 1963 C. A. CHRISTOFF ETAL 3,101,664

PRINTER

Filed Feb. 6, 1961 4 Sheets-Sheet 1

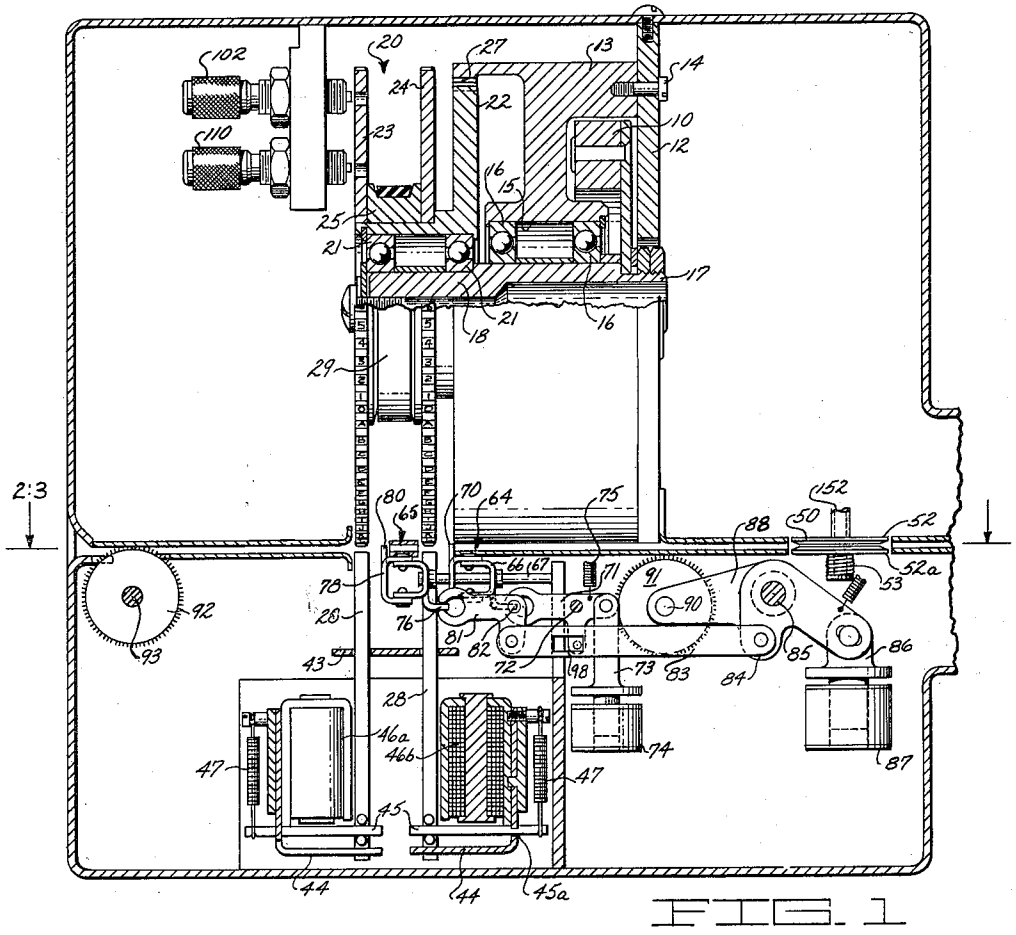

FIG. 1

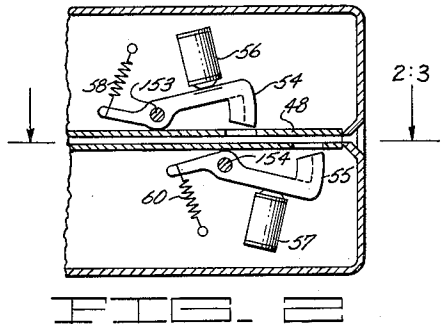

FIG. 2

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PRINTER

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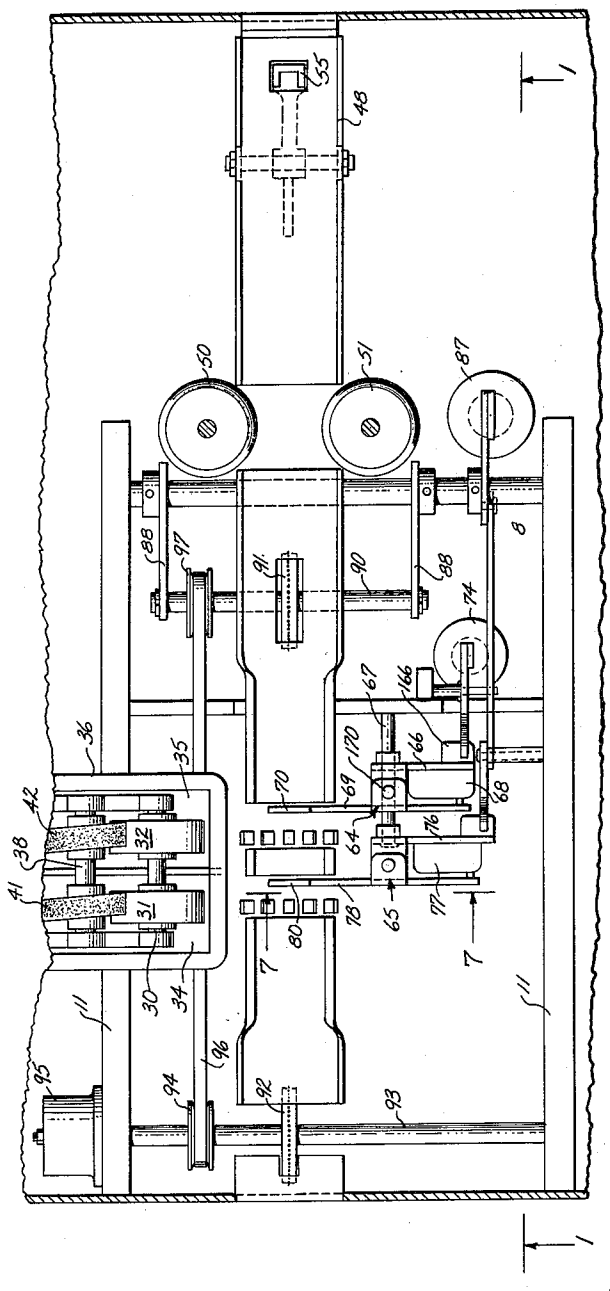

FIG. 2

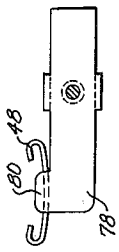

FIG. 4

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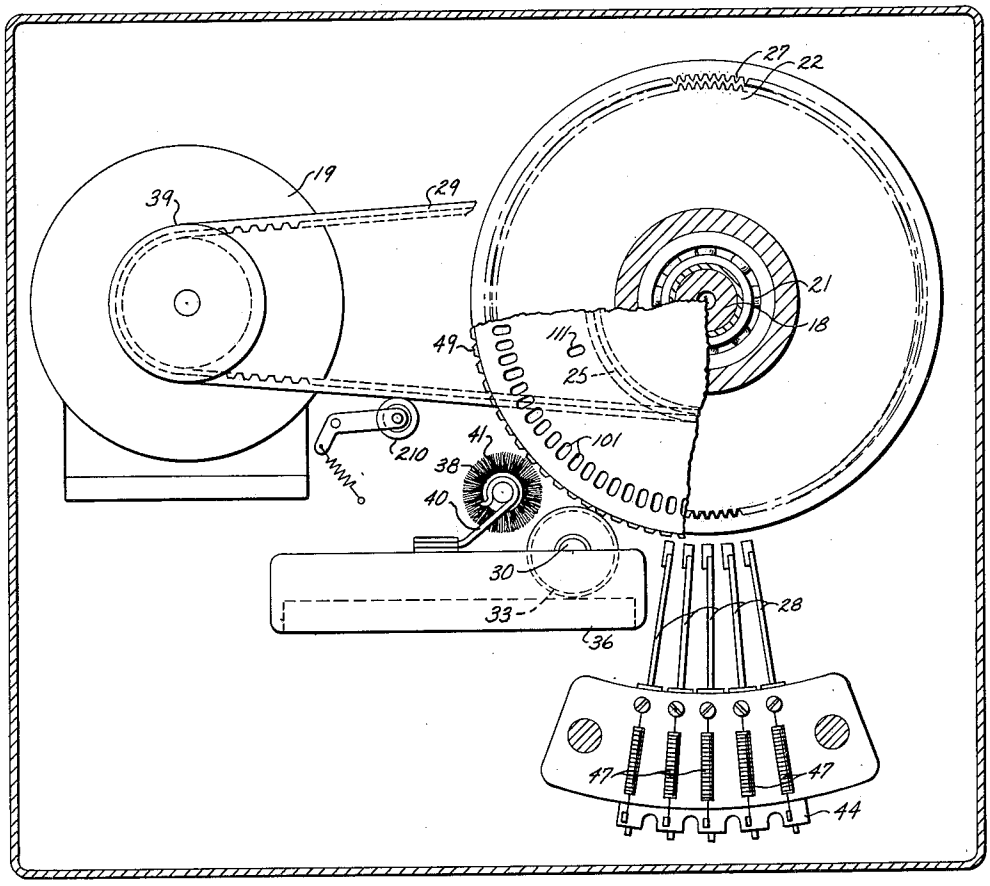

FIG. 4

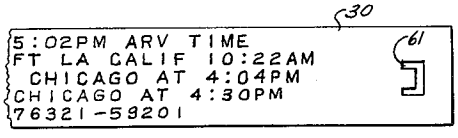

FIG. 5

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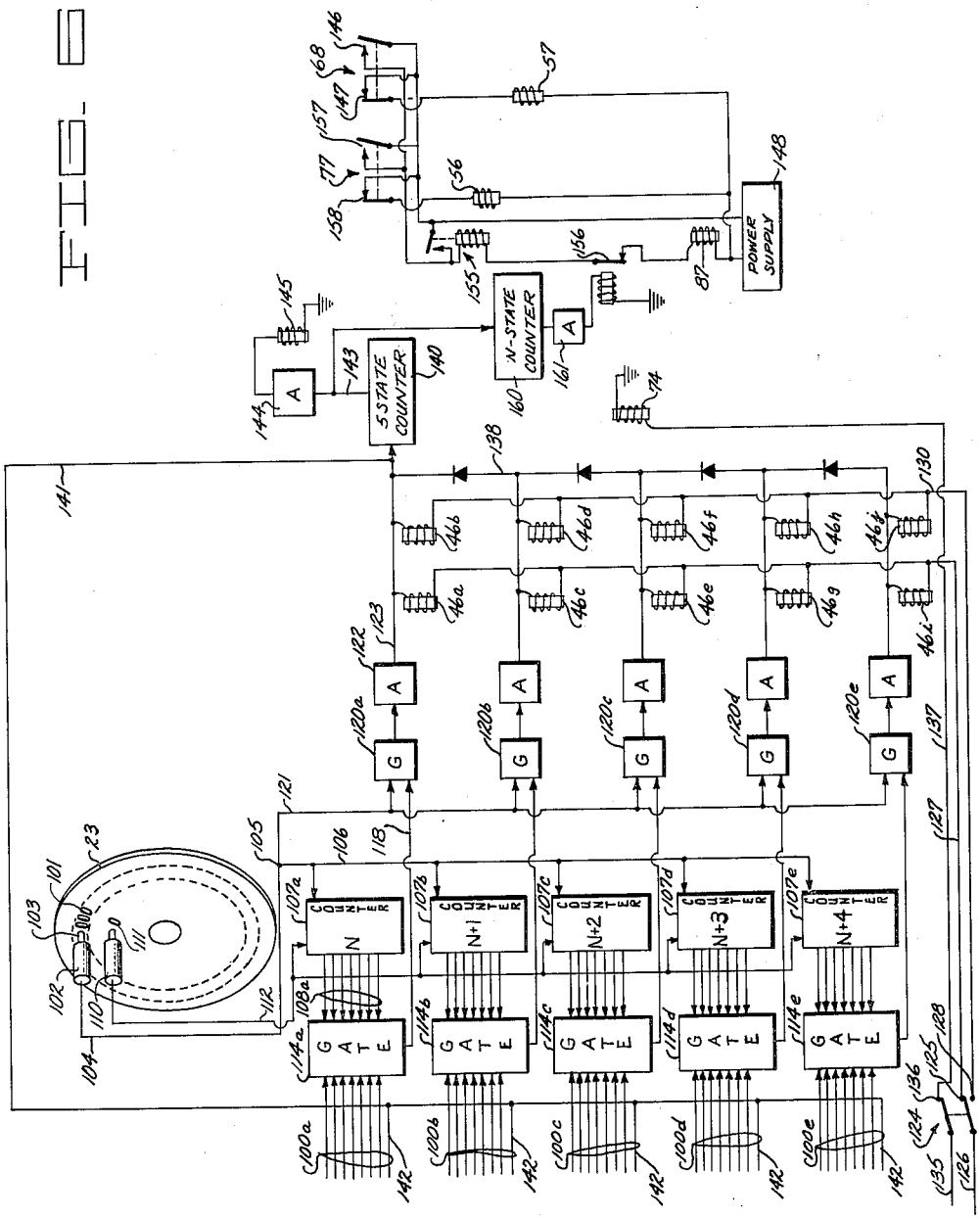
FIG. 5



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United States Patent Office 3,101,664 Patented Aug. 27, 1963

3,101,664

PRINTER

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Filed Feb. 6, 1961, Ser. No. 87,334
5 Claims. (Cl. 101—93)

This invention relates to printers for printing selected data and has particular reference to high speed printers for printing data in different colors or other distinguishing characteristics.

Heretofore, selective color printers of variable data generally comprised multi-color inked printing ribbons which were interposed between the type characters and the record medium. In order to change the color of the printed material when printing data, the ribbon was shifted to bring an appropriate color zone intermediate the type characters and the record medium.

Although the above system of employing multi-colored inking ribbons is generally satisfactory, problems arise in connection with certain types of high speed printers which make the use of inking ribbons generally unsatisfactory for use in connection with such printers.

It therefore becomes a principal object of the invention to selectively print data in different colors or other distinguishing characteristics without the employment of printing ribbons.

Another object is to selectively print data in different colors or other distinguishing characteristics on preformed strips of paper or the like.

Another object is to selectively print data on strips of paper or the like from any of a plurality of serially-arranged printing devices.

The manner in which the above and other objects of the invention are accomplished will be readily understood on reference to the following specification when read in conjunction with the accompanying drawings, wherein:

FIG. 1 is a sectional elevation view, with parts broken away, of a printer embodying a preferred form of the present invention, and is taken substantially along the line 1—1 of FIG. 3.

FIG. 2 is a sectional elevation view showing a portion of the guide chute and strip arresting devices.

FIG. 3 is a sectional plan view taken substantially along the line 3—3 of FIGS. 1 and 2 when combined.

FIG. 4 is a transverse sectional view illustrating particularly the type wheel element and platen positioning means, and is taken substantially along the line 4—4 of FIG. 1.

FIG. 5 is a plan view of a strip having data printed thereon.

FIG. 6 is a schematic diagram of the wiring circuit for controlling the printer.

FIG. 7 is a transverse view taken along line 7—7 of FIG. 3 showing one of the strip sensing levers and its relation to the strip guide chute.

Referring to the drawings, the printer is of the hypocycloidal type basically similar to that disclosed and claimed in the patent to Witt et al., No. 2,915,968, issued on December 8, 1959, and in the application of C. A. Christoff, Serial No. 859,349, filed December 14, 1959.

The printer comprises a frame including a pair of spaced vertically extending base plates 11 having a transversely extending wall 12 therebetween. A generally circular casting 13 is secured by screws 14 to the wall and has a bore 15 extending therethrough, in which are mounted a pair of spaced ball bearings 16. The latter rotatably support a shaft 17 having an eccentric shaft portion 18 formed on the left-hand end thereof. The eccentric portion 18 rotatably supports a type wheel element generally indicated at 20 through spaced ball bearings 21.

The type wheel element 20 comprises an assembly consisting of an external gear 22 and type wheels 23 and 24 maintained in spaced relation by a belt pulley 25. Suitable fastening means (not shown) clamp the type wheels, gear 22 and pulley together as an integral unit. A counterbalance 10 is attached to the shaft 17 to balance the assembly mounted on the shaft.

The wheel element 20 is rotated by a motor 19 through a flexible endless belt 29 wrapped around the pulley 25 and a second pulley 39 on the motor shaft. A spring-pressed idler 210 is held against the belt to maintain the same taut at all times.

Each of the type wheels has a row of equally spaced type characters 49 therearound. In the present case, two sets of alpha-numerical type characters are provided on each wheel in addition to certain symbol characters, there being 80 character spaces altogether. Also, the type characters on wheel 24 are arranged identically to the type characters on wheel 23, duplicate characters on the two wheels being directly in line with each other.

The gear 22, which is concentric with the eccentric portion 18 of the shaft 17, meshes with an internal gear 27 formed in the casting 13, the internal gear being arranged concentrically of the main portion of its shaft 17.

The gear 22 contains twice the number of teeth as the number of character spaces therearound, i.e., 160 teeth, and the internal gear 27 contains the same number of teeth plus one such multiple, i.e., 162 teeth. Thus, upon each rotation of the shaft 17 due to rotation of the type wheel assembly, and consequent orbital movement of the type wheels about the center of the shaft proper, such type wheels will creep from one type character position to the next relative to a printing station established by any one of five platens 28, there being five such platens for each type wheel. The platens of each set are spaced apart distances equal to the spacing between adjacent type characters 49.

The type wheels 23 and 24 are only slightly larger in diameter than the gear 22. Accordingly, as the type wheel element moves in an orbit about the center of the internal gear 27, each type character will describe a substantially hypocycloidal curve as set forth in the aforementioned Witt et al. Patent 2,915,968 so that as the type character reaches the apex of its outward travel, it will be moving substantially radially outward. If, at this time, a printing platen 28 has been positioned inwardly toward its respective type wheel against a paper strip 30 which has been positioned intermediate the type wheels and the platens, printing contact will occur to transfer a printing impression from the type character to the strip, as will appear presently.

Means are provided for continuously applying a film of ink to the surfaces of the type characters on the type wheels 23 and 24. For this purpose, an inking device is preferably employed which is basically similar to that disclosed and claimed in the copending application of C. A. Christoff, Serial No. 21,370, filed on April 11, 1960, now U. S. Patent No. 3,043,214. Such inking device comprises generally a roller 30 divided into two axially spaced sections 31 and 32, each having a layer 33 of felt or the like around its periphery. The roller is yieldably pressed upward by means (not shown) to engage the roller sections with respective ones of the type wheels.

When the type wheels 23 and 24 are in the lowermost portion of their orbit, the roller 30 is lowered slightly causing the roller sections 31 and 32 to contact respective ink supply pads 34 and 35 mounted in separate sections of a container 36 to thereby absorb a minute quantity of ink. The ink pads 34 an 35 contain differently colored inks whereby, as the wheels 23 and 24 are rotated, ink of one color will be applied to the type characters of one type

wheel and ink of another color will be applied to the type characters of the other type wheel.

In order to prevent the ink from unduly accumulating over the surfaces of the type characters, a cleaning roller 38 is provided, being yieldably held against the surface of the type wheels by leaf springs 40, each attached at one end to the container 36 and forming at its opposite end a bearing for the roller 38. The roller 38 carries two radially extending sets of bristles 41 and 42. Each set of bristles is mounted with the plane of each of its end faces extending at an angle to a plane passing transversely through the roller axis so that as the roller is rotated, the bristles tend to wipe laterally to continually remove any accumulated ink from the type characters and from interstices therebetween.

The various platens 28 are slideably mounted for endwise movement in guide plates 43 and 44, and each is pivotally connected to an armature 45 of a respective electromagnet, i.e., 46*a* and 46*b*. The armature is pivoted at 45*a* on the magnet frame and a tension spring 47 urges the armature in a direction to normally hold the platen in its position shown in FIG. 1, out of the path of the respective type wheel. However, when the magnet is energized, the platen will be raised to a position wherein it will cause a printing impression to be made from a selected type character onto a strip 30 which has been positioned between the wheel and the platen when the respective type wheel moves through the lower portion of its periphery.

The strips 30 (FIG. 5) on which data is to be printed are all of equal length and are fed sequentially into the right-hand end of a guide chute 48, FIGS. 1 and 2.

Strip feeding disc assemblies 50 and 51 are located adjacent the opposite edges of the guide chute and are continuously rotated by motor driven means (not shown) to engage opposite edges of an inserted strip so as to advance the same into the printer. Each disc assembly comprises a pair of beveled discs 52 and 52*a* splined on a drive shaft 152 and pressed together by a compression spring 53 so as to yieldably grip the edge of the strip.

A pair of strip arresting arms 54 and 55 are provided adjacent the right-hand end of the guide chute 48. The arms are pivotally supported at 153 and 154 and are urged by springs 58 and 60 toward the chute 48. Such arms are spaced from each other along the chute by an amount equal to the distance between the type wheels 23 and 24 and one or the other is selectively conditioned to arrest an inserted strip, depending on the color in which said strip is to be printed, so that the lines of print will be located in the same relative positions on all strips regardless of which print wheel is to be used to print data thereon.

The arresting arms 54 and 55 are normally held out of the path of the strips 30 by respective electromagnets 56 and 57. As will be noted hereinafter, when a strip is fed into the chute 48, one or both arresting arms are allowed to engage the surface of such inserted strip whereby one or the other of the arms will fall into a notch 61 formed in the strip when the latter reaches a predetermined position in the printer.

Referring to FIGS. 1 and 3, two sensors, generally indicated at 64 and 65, are provided to complete respective control circuits when struck by the leading edge of an inserted strip. The sensor 64 effects intermittent line feeding of a strip when it is to be printed by the type wheel 24 and the sensor 65 effects intermittent feeding when the strip is to be printed by the type wheel 23.

The sensor 64 comprises an arm 66 pivotally mounted on a horizontal shaft 67 and carrying a switch unit 68. A sensing lever 69 is pivotally supported at 170 on the arm 66 for movement about a vertical axis to actuate the switch unit 68. The lever 69 has a projection 70 which normally extends into the path of the strips 30 as they move through the chute 48.

The arm 66 has a portion 166 engaged by jaws formed on a lever 71 which is pivoted at 72 and is pivotally connected to the armature 73 of a solenoid 74. A spring 75 normally holds the linkage in a position wherein the projection 70 of sensing lever 69 is arranged to be actuated by the leading edge of a strip 30 as the latter is fed through the chute so as to actuate the switch unit 68. However, upon energization of the solenoid 74, the arm 66 will be rocked to lower the projection 70 out of the path of the strip, allowing the latter to be further advanced as will appear presently.

The second sensor 65 is similar in construction to sensor 64, its arm 76 supporting a switch unit 77 which is actuated by a sensing lever 78 (see also FIG. 7) pivotally supported by the arm for movement about a substantially vertical axis. The arm has a projection 80 thereon which is normally located in the path of an inserted strip 30.

The arm 76 is engaged by the jaws of a bell crank 81 which is pivoted at 82 and connected by a link 83 to a second bell crank 84. The latter is attached to a rock shaft 85 and is pivotally connected to the armature 86 of a solenoid 87.

Also attached to the shaft 85 are spaced arms 88 in which are journaled the ends of a shaft 90 having attached thereto a pin wheel 91 located directly below but normally out of the path of the strips 30.

A second pin wheel 92 is provided in the path of the strips and is located adjacent the left-hand end of the chute 48. The latter wheel is attached to a shaft 93 which carries a belt pulley 94 and is arranged to be intermittently advanced by a rotary solenoid unit 95 mounted on one of the frame walls 11. The latter may be of any well-known type such as that disclosed in the patent to Leland, No. 2,496,880, issued on February 7, 1950.

An endless belt 96 connected between the pulley 94 and a second pulley 97 on the shaft 90 drives the pin wheel 91 in time with pin wheel 92.

The pin wheels 91 and 92 each has a series of needle-like pins which extend radially a short distance therefrom to penetrate the strips and thus drive the same leftwardly through the chute 48 and past the type wheels.

Upon energization of the solenoid 87, the pin wheel 91 is raised by bell crank 84 into driving engagement with a strip located thereover. At the same time, the bell crank 84 moves the link 83 to the left, thereby rocking the bell crank 81 clockwise to lower the sensor 65 out of the path of an inserted strip. The link 83 is coupled through a pin and slot connection 98 with a depending projection of the lever 71 so that leftward movement of the link 83 will also be effective to withdraw the sensor 64 from the path of a strip passing through the chute.

As noted in FIG. 5, the printer is capable of printing on five lines of information at a time on the strips 30 as they pass through the printer. After a letter, digit or symbol is printed in each line, the strip is letter spaced toward the left by the rotary solenoid 95 and pin wheels 91 and 92.

For this purpose, data is received in binary form from five sources of information (not shown) over five sets of lines 100*a*, 100*b*, 100*c*, 100*d* and 100*e* (FIG. 6). The lines of each set represent different weighted values in the binary scale of progression. For example, the lines in each set, counting from the uppermost one, represents the decimal values 1, 2, 4, 8, 16, 32, 64 and "blank," respectively. Decimally equivalent values ranging from 1 to 80 which may represent numerical and alphabetical data are registered by relatively high potentials on one or more such lines, except a lowermost line which represents a "blank" only.

The type wheel 23 has a circular row of holes 101 arranged concentrically thereabout, there being one hole for each type character around the wheel. A pulse generating device 102 is mounted in the path of the holes 101 to generate a pulse as each hole passes the same. Such a pulse generating device may be of the well known reluctance pick-up type wherein a magnetic field is generated at the inner end 103 of the device and such field is modified by each hole 101 as it passes the same so as to

cause pulses to be applied over a line **104**. The latter is connected at point **105** to a line **106** which, in turn, is connected to the inputs of five 80-state pulse counters **107***a*, **107***b*, **107***c*, **107***d* and **107***e*. Each of the latter is of the binary type whose outputs, i.e., **108***a*, register different weighted values in accordance with the scale of binary progression. Such weighted values are the same as those registered by the different lines of each set of information lines, i.e., **100***a*. That is, counting from the uppermost one, the lines **103***a* regiser the decimal values 1, 2, 4, 8, 16, 32 and 64. Thus, decimal values ranging from 1 to 80, corresponding to the different type character positions around the type wheels, are successively registered by relatively high potentials on one or a combination of output lines on each of the counters **107***a* to **107***e*.

A second pulse generating device **110**, similar to the device **102**, is mounted in the path of a single hole **111** in the type wheel **23** so as to apply a reset pulse to a reset circuit **112** which is connected to suitable reset circuits in the different counters **107***a* and **107***e*.

The different digital information lines of each set **100***a*, etc., and the different ouput lines **108***a* of a corresponding counter **107***a*, etc., are connected as inputs to an associated multiple input coincidence gate **114***a*, etc. The latter may be of any well known construction such as the type shown in the copending application of R. E. Loudon, Serial No. 172,364, filed January 15, 1962.

When the count registered by a counter, for example, counter **107***a*, matches the data or amount registered by the associated set of information lines **100***a*, an output pulse will be generated in a line **118** which is connected as an input to an "and" gate **120***a*. The second input of gate **120***a* is connected through a line **121** to the line **104** for timing purposes. The output of gate **120***a* is connected through an amplifier **122** to a line **123** connected to the upper ends of two aligned platen magnets **46***a* and **46***b*, the former associated with type wheel **23** and the latter associated with type wheel **24**.

The remaining coincidence gates **114***b* to **114***e* are similarly provided with output lines which, when the outputs of the respective counters match the corresponding incoming data lines, apply pulses through respective gates **120***b* to **120***e* and associated amplifiers to the upper ends of additional electromagnets **46***c* to **46***j*.

Magnets **46***a*, **46***c*, **46***e*, **46***g* and **46***i* are associated with the five platens **28** which cooperate with the type wheel **23** while the magnets **46***b*, **46***d*, **46***f*, **46***h* and **46***j* are associated with the five platens which cooperate with the type wheel **24**.

Means are provided to condition a circuit through the magnets associated with either the type wheel **23** or the type wheel **24**. For this purpose, a switch **124** is provided which, when set in its upper illustrated position, completes a circuit from a line **126** through contact **125** and line **127** to the lower ends of the magnets **46***a*, **46***c*, **46***e*, **46***g* and **46***i*. Thus, when a counter output matches the registration on the associated set of information lines, the appropriate one of the latter magnets is energized to effect printing by the appropriate type character on the type wheel **23**.

When the switch **124** is moved to its lower position, one blade **125** thereof completes a circuit from line **126** through point **128** and line **130** to the lower ends of the magnets **46***b*, **46***d*, **46***f*, **46***h* and **46***j*. In this condition, when a counter output matches the registration on the associated set of information lines, the corresponding one of the magnets **46***b*, **46***d*, **46***f*, **46***h* and **46***j* is energized to effect printing by the appropriate type character on the type wheel **24**.

The switch **124** has a second blade thereon which, when the switch is in its upper illustrated position, completes a circuit from a line **135** through a contact **136**, line **137** and the solenoid **74** (see also FIG. 1), thus causing the latter to remove the sensor **64** from the path of the inserted

strip so that the second sensor **65** will become effective to sense the leading edge of such strip. It will be noted that the type wheel element **20** advances across the different platens associated with each type wheel in a step-by-step printing sequence, and in order to accommodate this step-by-step printing action when printing corresponding character spaces in the five lines across the strip **30**, the counters are initially reset to successively higher values and retain this relationship throughout the counting operation. For example, the counter **170***a* may be initially set to zero upon reception of a reset pulse over line **112**. Concurrently, the counter **107***b* is set to 1, counter **107***c* to 2, counter **107***d* to 3 and counter **107***e* to 4.

It should be noted that the data is received over the sets of lines **100***a* to **100***e* in sequence. Therefore, means are provided to cause advancement of a strip **30** one letter space only after printing of a digit in each of the lines or after printing certain of such lines and receipt of an indication of a blank digit positions in others of such lines.

For the purpose, the line **123** and the other similar lines connected to the upper ends of the various magnets **46***a* to **46***j* are connected through a line **138** to the input of a five-state counter **140**. Also connected to the input of counter **140** is a line **141** which is connected to a "blank" indicating line **142**, there being one such line in each of the five sets **100***a* to **100***e*.

Upon counting five pulses indicative of character printing in each of the five lines on the strip or printing in certain of such lines and "blank" spacing through others, the counter resets and also applies an output pulse through line **143**, amplifier **144** and the actuating coil **145** of the rotary solenoid **95**, thereby causing the latter to advance the strip one character space.

Means are provided under control of one or the other of the sensors **64** and **65** to control movement of the aforementioned intermittent strip feed means and to enable one or the other of the arresting arms **54** and **55**. For this purpose, the sensor switch unit **68** (FIGS. 3 and 6) comprising a normally open switch **146** and a normally closed switch **147**. The switch **146** is connected in circuit with a power supply **148**, the coil of a locking relay **155**, normally closed contacts of a relay **156** and the aforementioned solenoid **87** (see also FIG. 1). Thus, as the leading edge of the strip **30** engages the sensing lever **69** of the sensor **64**, the switch **146** will close to energize the solenoid **87** and to lock the relay **155** energized.

Switch **147** is in circuit with the power supply **148**, magnet **57** associated with the arresting arm **55**, contacts of relay **156** and solenoid **87**. Thus, as the switch **147** opens, the arm **55** is allowed to move into the path of the notch **61** in the inserted strip to arrest the same in proper position for printing the first set of characters in the five lines on the strip.

Sensing switch unit **77** also contains a normally open switch **157** and a normally closed switch **158**. Switch **157** is connected in parallel with switch **146** and therefore is effective, when the sensing lever of the senor **65** is actuated by an inserted strip, to energize the solenoid **87**.

Switch **158** is in circuit with the power supply **148**, electromagnet **56** associated with the strip arresting arm **54**, contacts of relay **156** and solenoid **87** whereby to normally hold the arm **54** out of the path of the inserted strip. Thus, as the switch **158** opens, the arm **54** will be allowed to drop into arresting relation with the inserted strip.

Means are provided to de-energize the solenoid **87** when a predetermined number of character spaces have been printed on the five lines of the inserted strip. For this purpose, a pulse counter **160**, set to count to such predetermined number, has its input connected to the output of counter **140** and its output connected through an amplifier **161** and the coil of relay **156** so that when

such predetermined number of letter spaces has been printed, the relay **156** is energized to drop the locking relay **155** and to open the circuit through the solenoid **87**. The counter **160** resets automatically to zero following such count.

The aforementioned counters **107***a* to **107***e*, **140** and **160** may be of any well known type capable of being reset upon reaching the state count indicated.

Although the invention has been described herein in detail and certain specific terms and languages have been used, it is to be understood that the disclosure is illustrative rather than restrictive and that changes or modifications may be made without departing from the spirit or scope of the invention as set forth in the appended claims.

Having thus described the invention, what is desired to secure by United States Letters Patent is:

1. Printing mechanism comprising the combination of a printing wheel element having a plurality of axially spaced rows of type characters around the periphery thereof, means for rotating said wheel element, a first impression device for obtaining a printing impresion of a selected type character in one of said rows, a second impression device for obtaining a printing impression of a selected type character in a second one of said rows, means for guiding a record medium between said wheel element and said impression devices in a direction parallel to the axis of said wheel element, means for selectively conditioning one or the other of said impression devices for operation, means responsive to said last mentioned means for locating said record medium in either of two positions depending on which of said impression devices is conditioned, and means for operating a conditioned one of said impresion devices.

2. Printing mechanism comprising the combination of a printing wheel element having first and second axially spaced rows of type characters around the periphery thereof, means for rotating said wheel element, a first impression device for obtaining a printing impression of a selected type character in said first row, a second impression device for obtaining a printing impression of a selected type character in said second row, a first conditioning means for conditioning said first impression device for operation, a second conditioning device for conditioning said second impression device for operation, means for successively advanding a plurality of record medium strips between said wheel element and said impression devices in a direction parallel to the axis of said wheel element, said first conditioning means controlling said advancing means to advance a said strip to a predetermined position relative to said first row of type characters and said second conditioning means controlling said advancing means to advance said record medium to a predetermined position relative to said second row of type characters.

3. Printing mechanism comprising the combination of a printing wheel element having first and second axially spaced rows of type characters around the periphery thereof, means for rotating said wheel element, a first impression device for obtaining a printing impression of a selected type character in said first row, a second impression device for obtaining a printing impression of a selected type character in said second row, a first conditioning means for said first impression device, a second conditioning means for said second impression

device, means for successively and yieldably advancing a plurality of record medium strips between said wheel element and said impression devices in a direction parallel to the axis of said wheel element, a pair of arresting elements spaced along the path of movement of said strips, each of said arresting devices being adapted to arrest a said strip upon engaging said arresting device, and means controlled by one of said conditioning means for rendering one of said arresting devices ineffective.

4. Printing mechanism comprising the combination of a printing wheel element having first and second axially spaced rows of type characters around the periphery thereof, means for rotating said wheel element, a first impression device for obtaining a printing impression of a selected type character in said first row, a second impression device for obtaining a printing impression of a selected type character in said second row, a first conditioning means for said first impression device, a second conditioning means for said second impression device, means for successively and yieldably advancing a plurality of record medium strips at a constant rate of speed between said wheel element and said impression device in a direction parallel to the axis of said wheel element, a pair of arresting devices spaced along the path of movement of said strips, said arresting devices being adapted to arrest a said strip at different positions respectively relative to said wheel element, means controlled by one of said conditioning means for rendering one of said arresting devices ineffective, and means responsive to operation of either of said arresting devices for thereafter intermittently advancing a said strip.

5. Printing mechanism comprising the combination of a printing wheel element having a plurality of axially spaced rows of type characters around the periphery thereof, said characters being arranged in columns lengthwise of said wheel element, the characters in any one of said columns being identical, means for advancing said wheel element, means for applying ink of one color to the characters of a first one of said rows, means for applying ink of a second color to the characters of a second one of said rows, a first impression device for obtaining a printing impression of a selected type character in said first row, a second impression device for obtaining a printing impression of a selected type character in said second row, means for guiding a record medium between said wheel element and said impression devices in a direction parallel to the axis of said wheel element, means selectively settable in one condition for locating said record medium in position to be printed by said first row of type characters and for enabling said first impression device and disabling said second impression device, said settable means being settable in a second condition for locating said record medium in position to be printed by said second row of type characters and for enabling said second impression device and disabling said first impression device.

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