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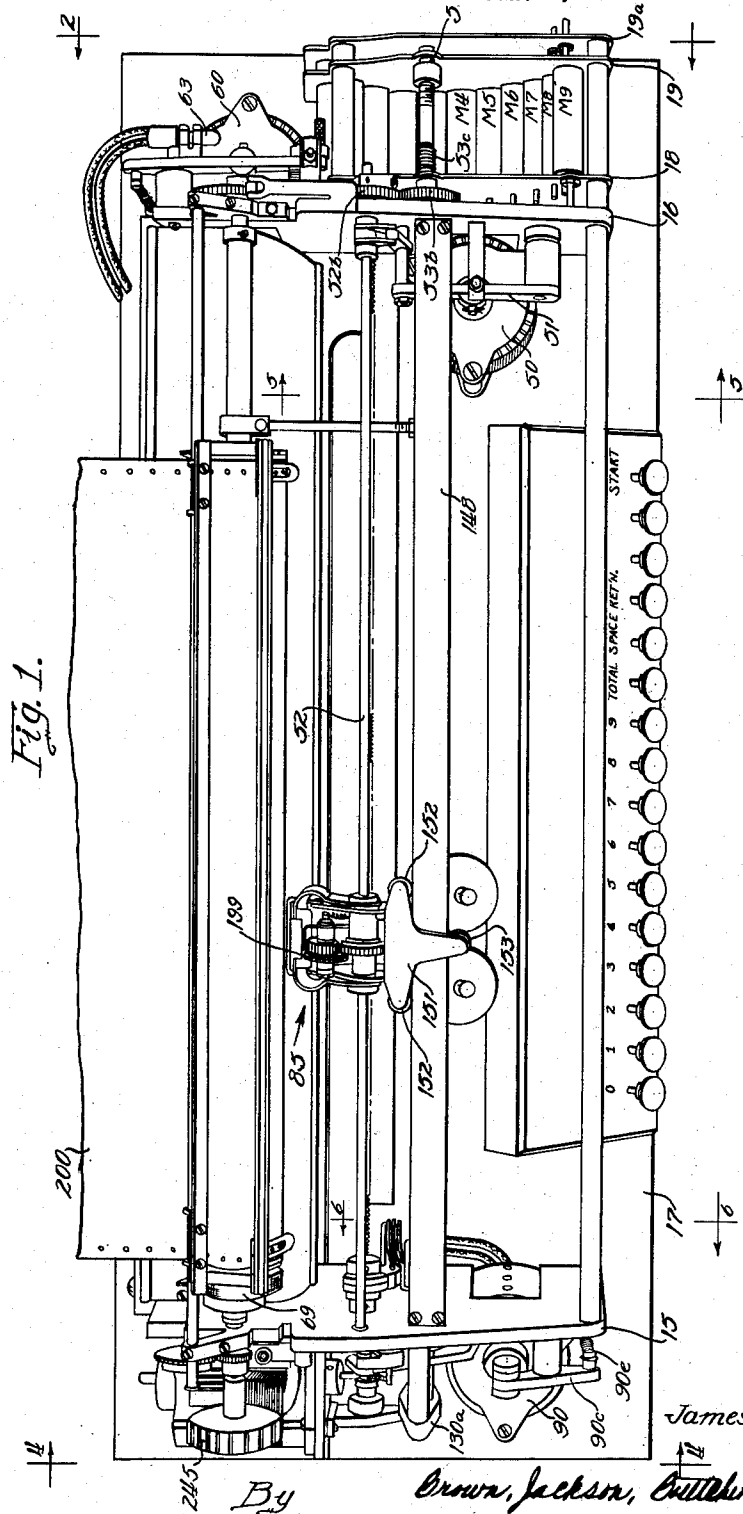
T. G. LE CLAIR ET AL

2,366,914

PRINTING MECHANISM

Filed Jan. 4, 1941

7 Sheets-Sheet 1



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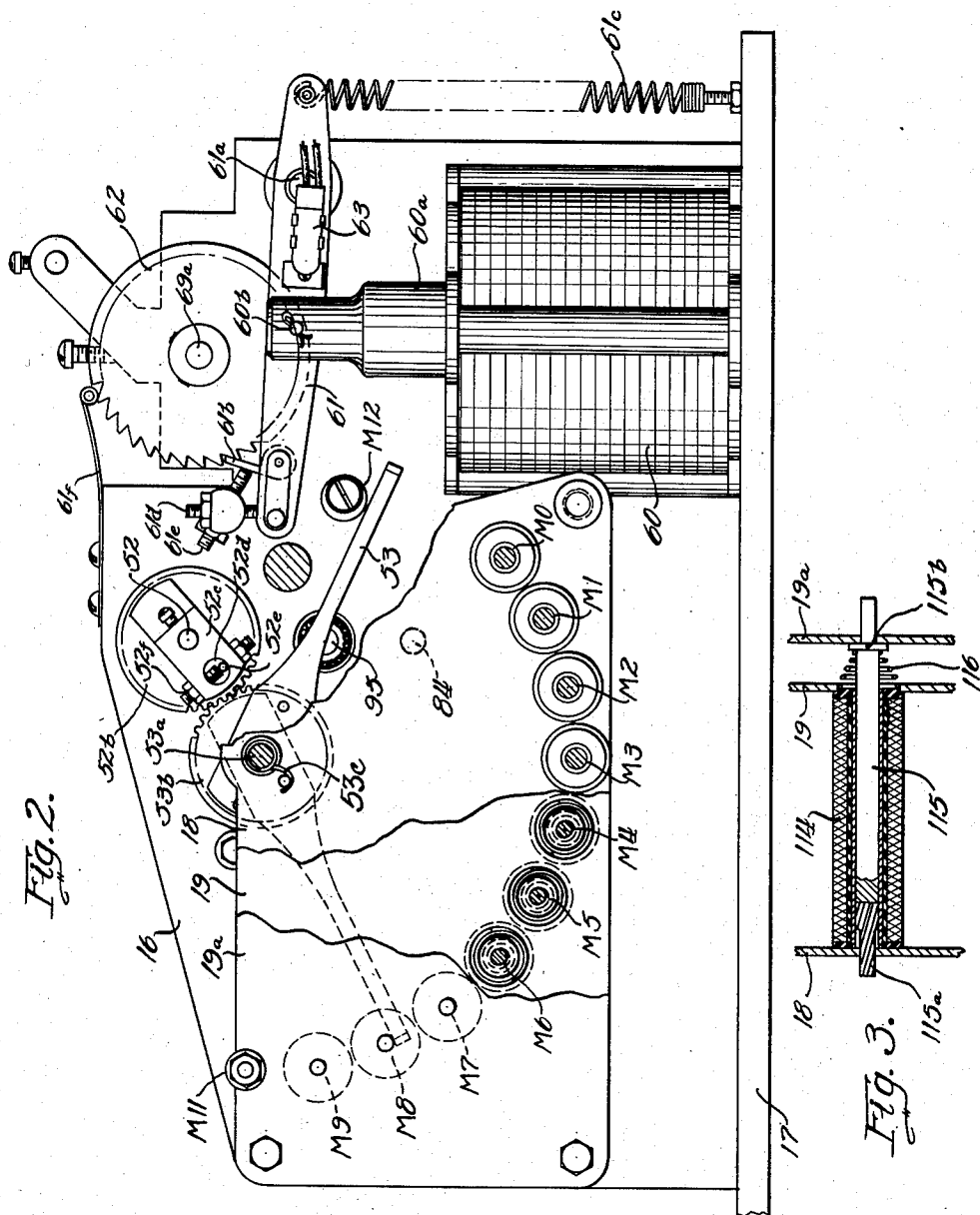
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PRINTING MECHANISM

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7 Sheets-Sheet 2



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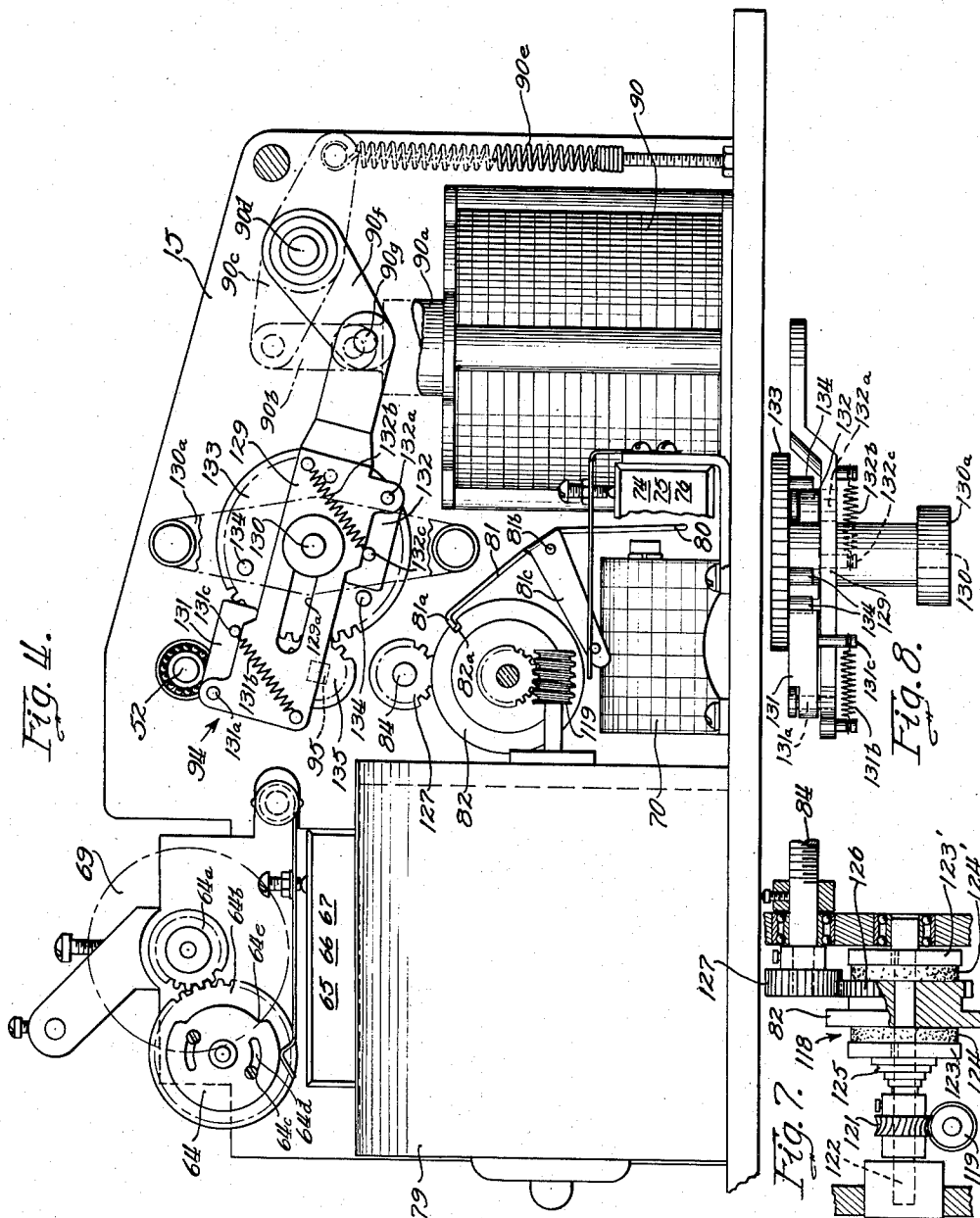
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PRINTING MECHANISM

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7 Sheets-Sheet 3



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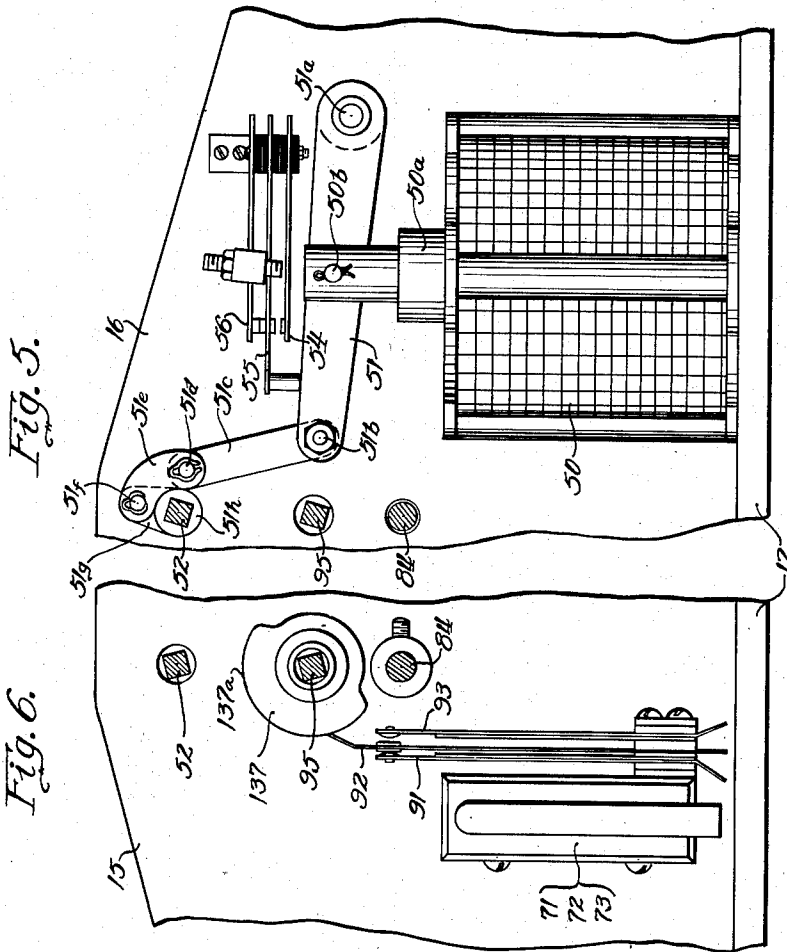
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PRINTING MECHANISM

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7 Sheets-Sheet 4



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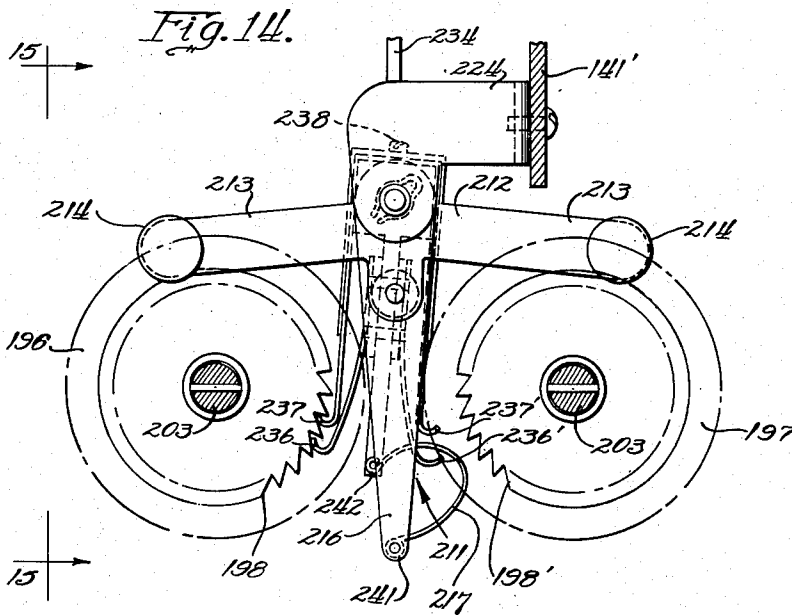
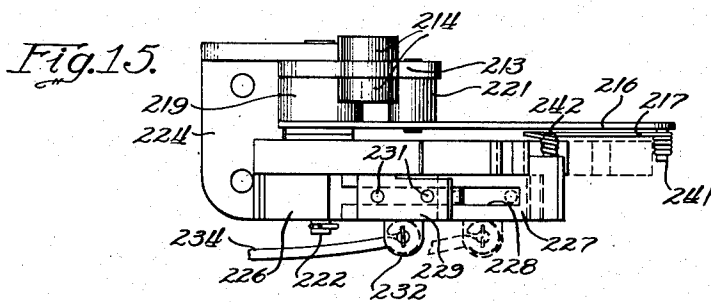
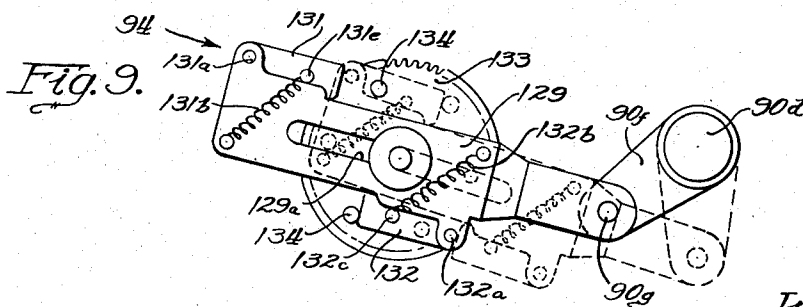
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PRINTING MECHANISM

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7 Sheets-Sheet 5



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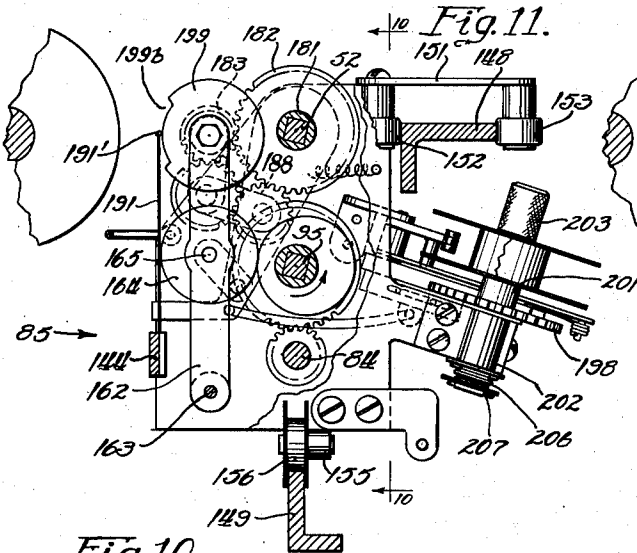
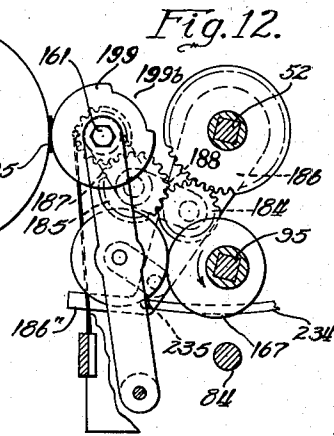
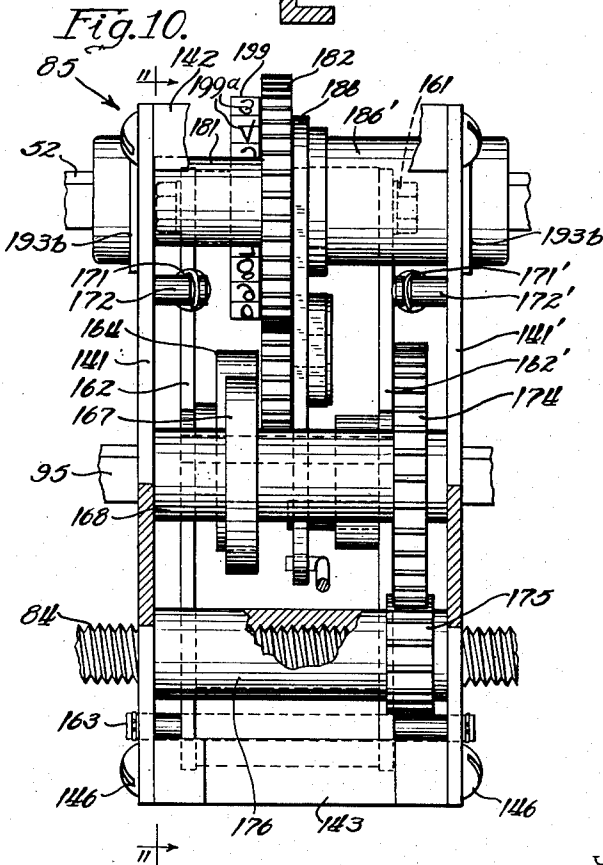
T. G. LE CLAIR ET AL

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PRINTING MECHANISM

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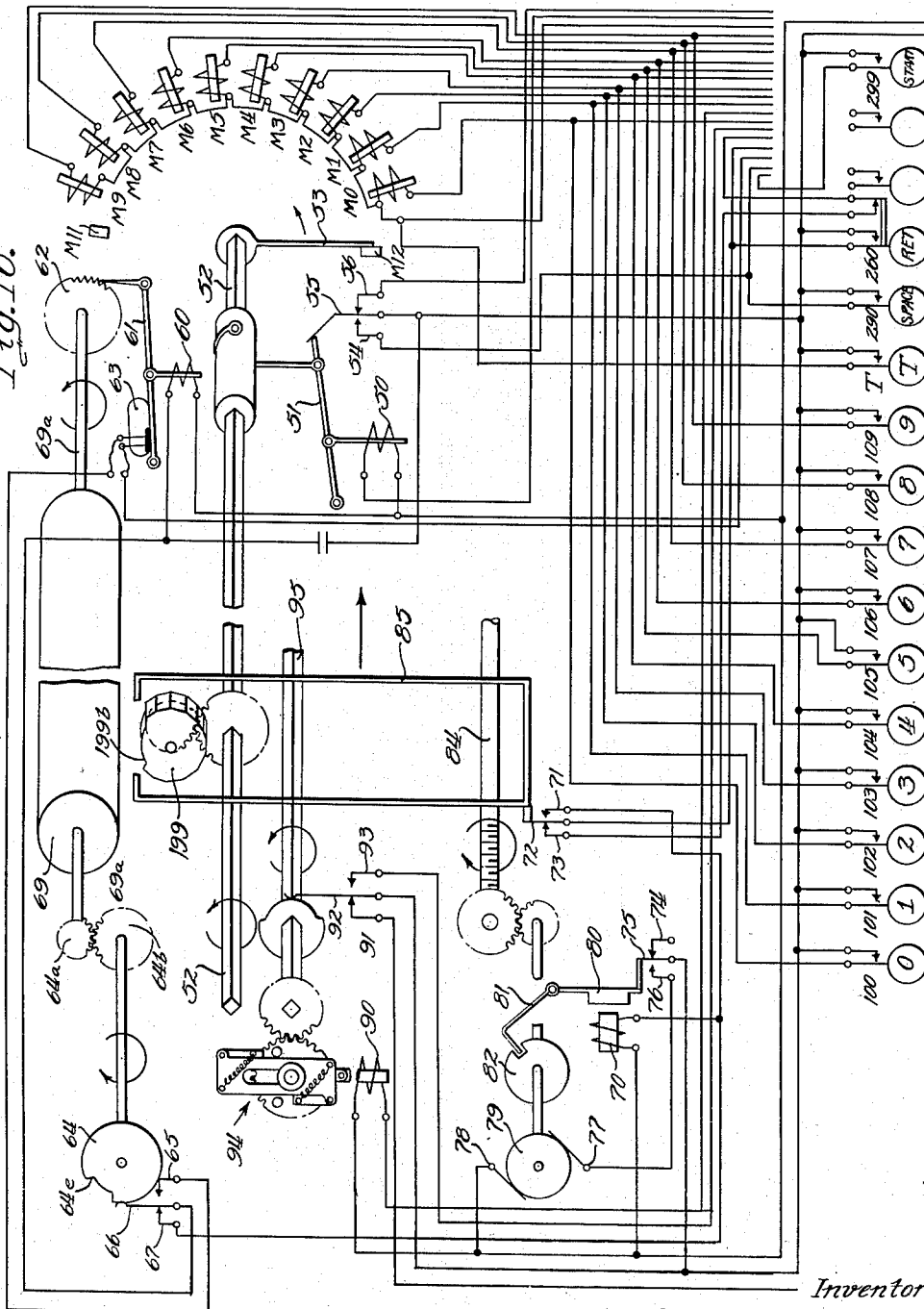
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PRINTING MECHANISM

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7 Sheets-Sheet 7

Fig. 16.



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UNITED STATES PATENT OFFICE

2,366,914

PRINTING MECHANISM

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Application January 4, 1941, Serial No. 373,158

31 Claims. (Cl. 197—12)

The present invention relates to printing mechanism of the general class characterized by a rotatable printing wheel which performs the printing operation by making successive printing impressions across a record sheet. This printing wheel has a series of type characters around its periphery, and the type selecting operation is performed by merely rotating the printing wheel different distances to present the desired type character into printing position facing the record sheet. The spacing operation which occurs between printing impressions is brought about by shifting or advancing the printing wheel laterally across the width of the record sheet in successive stepping operations.

In our improved printing mechanism, the printing wheel or type wheel is mounted in a printing carriage which is given this lateral stepping motion so as to advance the type wheel across the width of the record sheet. This lateral motion of the printing carriage occurs along three parallel shafts which are disposed on separate fixed axes extending across the front of the record sheet.

One of these shafts is the type selection shaft which is rotated different distances so as to present the desired type character of the printing wheel into printing position facing the record sheet.

Another of these shafts is a threaded feed screw or shaft which passes through a threaded nut mounted in the printing carriage. In the operation of advancing the carriage across the record sheet during the printing operation, the nut is revolved while the shaft is held against rotation, and in the reverse operation of restoring the printing carriage back to its starting position at the lefthand side of the record sheet the feed shaft is revolved while the nut is held against rotation.

The third of these shafts is the printing shaft which is operative through rotary movement to throw the printing wheel with an oscillatory motion into printing contact against the record sheet.

The above described operations of (1) rotating the printing wheel on its axis in selecting the desired type character, (2) stepping the printing wheel laterally in its advancing motion, and (3) throwing the printing wheel with an oscillatory motion into printing contact against the record sheet, are all performed without necessitating any shifting or physical displacement of the aforesaid three shafts, nor any physical displacement of the

record sheet and the platen roll on which it is mounted. Also, the oscillatory throw of the printing wheel into printing contact against the record sheet occurs independently of the printing carriage, so that no oscillation or throw of the carriage is necessary. By virtue of the above operating characteristics, there are no large masses or parts of substantial inertia to be started and stopped in the making of each printing impression. Hence, our improved printer can operate with a higher speed than conventional printers of this general class. Also, in view of the fact that it is not necessary to shift the platen roll to obtain horizontal traverse between the record sheet and the type wheel, the entire space available for accommodating a platen roll can be used for handling an extremely wide record sheet, there being no need of end space to accommodate shifting movement of the platen roll. In our improved printer we can employ a log sheet of sufficient width to accommodate fifty or more vertical columns of double digits, such as for recording the loads in individual circuits, and the totalized loads in groups of circuits, when functioning in this capacity in an electrical generating station or substation.

Another feature of the invention resides in the manner in which the printing carriage is stepped or advanced to the right during the printing operation. Half of the stepping motion of the carriage occurs as the type wheel swings toward the record sheet, and the other half of the stepping motion occurs as the type wheel swings back to its normal position. That is to say, as the type wheel starts its oscillatory throw toward the record sheet for making a printing impression thereon, the printing carriage starts moving to the right concurrently therewith, and moves half of its total stepping distance during the time that the printing wheel is making its throw toward the sheet. Similarly, as the type wheel starts its return throw back toward its normal position, the printing carriage continues moving to the right concurrently therewith, completing the other half of its stepping motion during such return motion of the type wheel. This feature affords a longer time interval for each stepping motion of the printing carriage, and results in a more quiet operation and a greater printing speed.

Another feature of the invention cooperating with the above resides in the manner in which a unidirectional motion is imparted to the printing shaft, and to the manner in which this unidirectional motion imparts the oscillatory throw

to the printing wheel, and also rotates the advancing nut which threads along the feed screw in producing the above stepping or advancing motion of the carriage.

Other features, objects and advantages of the invention will appear in the following detail description of one preferred embodiment of the invention. In the accompanying drawings illustrating such embodiment:

Figure 1 is a plan view in perspective of the printing mechanism;

Figure 2 is a right hand end view of the mechanism taken on the plane of the line 2—2 of Figure 1, certain portions being broken away to illustrate the blocking solenoids;

Figure 3 is a detail sectional view through one of these blocking solenoids;

Figure 4 is a left hand end view of the mechanism, taken on the plane of the line 4—4 of Figure 1, with certain of the parts being broken away for clarity of illustration;

Figure 5 is a fragmentary transverse sectional view taken approximately on the plane of the line 5—5 of Figure 1;

Figure 6 is a similar fragmentary sectional view taken approximately on the plane of the line 6—6 of Figure 1;

Figure 7 is a fragmentary axial sectional view through the slippage clutch through which carriage return rotation is transmitted to the feed screw;

Figure 8 is a fragmentary plan view of the stepping or ratchet mechanism through which the printing and stepping motions are imparted to the printing shaft;

Figure 9 is a front elevational view of this latter mechanism at the other limit of its throw;

Figure 10 is a fragmentary vertical sectional view through the printing carriage, corresponding substantially to a section taken on the plane of the line 10—10 of Figure 11;

Figure 11 is a transverse sectional view through the printing carriage, taken approximately on the plane of the line 11—11 of Figure 10;

Figure 12 is a fragmentary sectional view generally similar to Figure 11 but showing the parts in other positions;

Figure 13 is another fragmentary sectional view showing the ribbon shifting apparatus;

Figure 14 is a fragmentary plan view showing the reversible pawl mechanism through which take-up motion is imparted alternately to the two ribbon reels;

Figure 15 is a side view of the latter mechanism, corresponding to a view taken on the plane of the line 15—15 of Figure 14; and

Figure 16 is a schematic circuit diagram of the electrical connections between the different electrical devices of the printing mechanism.

The printing mechanism herein disclosed has been developed primarily for use with or as a part of an automatic printing and totalizing metering system which forms the subject matter of the copending application of Titus G. Le Clair, Serial No. 373,013, filed January 3, 1941. While this is the field of utility for which the printing mechanism was primarily designed, it will be understood that the invention is not limited thereto in its entirety. In order to facilitate cross reference between this application and the above mentioned copending application, particularly in connection with the description of the electrical operation of the printer, we shall use the same reference characters as are used to designate corresponding

parts in the copending application, as far as possible.

The printing mechanism is designated M in its entirety, and comprises the rotatable and shiftable printing wheel 199 which is adapted to make printed impressions on the record sheet 200. The aforesaid copending application shows the system and the printing mechanism employed for measuring and recording one or more of the load characteristics of electrical generating station and substation transmission lines, and in such situation the record sheet 200 is preferably in the form of a continuous strip comprising a plurality of log sheets connected together end to end, with a line of perforations between adjacent log sheets for tearing them apart. Each log sheet is divided into columns and rows, with appropriate circuit and totalizing designations for the columns, and with appropriate time designations for the rows. The column position of a given reading on the log sheet signifies the circuit from which the reading was taken. To facilitate the use of the log sheet or load computation, the readings of one group of circuits will usually be grouped in one location on the log sheet, the readings of another group of circuits will usually be grouped in another location on the log sheet, etc. The totals of these different groups of readings are printed in totalized columns at the end of each group of circuits. The row position of each reading on the log sheet signifies the time when the reading was taken. For example, the readings are preferably taken at regular 30 minute intervals, and the log sheets as supplied to the mechanism have these 30 minute intervals permanently printed thereon. Each log sheet is also provided with a space at the top for the date or other notation, and space is further provided at the bottom for the making of appropriate observations, operating notations and the like following the completion of the printing cycle for that particular day. The entire strip of log sheets may be of considerable length, arranged in a row or stack, and supported in any suitable manner adjacent to the printing mechanism for feeding thereto the successive log sheets for each day's operation. If desired, several copies of the record may be obtained by the use of successive log sheets with interposed strips of carbon paper therebetween.

The strip of log sheets passes around a suitable platen roll 69 for presenting the successive sheets to printing position opposite the type wheel 199. The printing position is the front surface of the platen roll. This platen may be provided with any suitable or well known registration means, comprising registration pins which move into and out of vertical rows of registration apertures formed in the opposite edges of the record strip. This apparatus prevents the possibility of relative slipping between the platen roll and the record strip, but in as much as such apparatus is old and well known there is no need of describing it in detail here.

The shaft 69a of the platen is journaled at its opposite ends in upright frame plates 15, 16 extending upwardly from a base 17. Referring to Figure 2, advancing motion is adapted to be imparted to the platen 69 by the energization of an advancing electromagnet 60. This actuates a solenoid core 60a which is pivotally connected at 60b to a rocker arm 61. The latter is pivotally mounted at one end on a pivot stud 61a projecting from the end frame plate 16, and the other end of the rocker arm carries an advancing pawl 61b which is adapted to impart stepping motion

to a ratchet wheel 62 secured to the platen shaft 69a. A tension spring 61c extends between the rear end of the rocker arm and a part of attachment on the base 17, this spring normally tending to hold the rocker arm in the elevated position shown with the solenoid core retracted upwardly in the solenoid 60. Adjustable limit screws 61d and 61e limit the motion of the rocker arm 61 and pawl 61b. A detent spring or tooth 61f is secured to the frame plate 16 and engages resiliently in the teeth of the ratchet wheel 62 for preventing reverse rotation or overthrow of the ratchet wheel and platen. Mounted on the rocker arm 61 is a mercury tube switch 63 which functions in the electrical operation of the apparatus, as we shall presently describe.

The other end of the platen shaft 69a is arranged to drive a timing or control cam 64, as shown in Figure 4. A pinion 64a on the platen shaft 69a meshes with a larger gear 64b which carries the cam 64. The cam is angularly adjustable relatively to the gear 64b through the instrumentality of screws 64c which pass through arcuate slots 64d in the cam and thread into holes in the gear. This arrangement enables the cam to be adjusted in timed relation to the platen roll 69. A low spot or gap 64e in the cam is adapted to cooperate with the contact switch 65, 66, 67. Figure 16 diagrammatically illustrates this switch as comprising a movable contact 66 adapted to engage selectively with the laterally disposed contacts 65 and 67. Figure 4 illustrates this as being an enclosed type of micron switch adapted to be actuated through an actuating arm or leaf spring 64f. It will be observed from Figure 16 that contacts 65 and 66 are connected in series with the contacts in the mercury tube switch 63. These switches cooperate in the stepping of the platen roll, as will be hereinafter described.

The printing wheel 199 has a series of type characters 199a engraved therein on successive faces around the periphery of the type wheel. For use with the aforementioned automatic printing and totalizing metering system, the type wheel is provided with successive numerals from 0 to 9, and also includes the letter "T" for applying a designating heading to the top of each totalizing column. Cut in one point of the wheel periphery is a gap or notch 199b of substantial length. In the normal position of the type wheel, this gap or notch lies directly opposite the printing position or the printing row along which the printing impressions are to be made on the record sheet. Hence, if no rotative movement is given to the type wheel for selecting a type character, the oscillatory throw of the type wheel toward printing position will merely present the gap or notch 199b to the record sheet so that no printing impression will be made. This is what happens each time that a spacing step is to be made, as between the spaced vertical columns corresponding to the readings taken on the separate load circuits.

The type wheel is mounted for oscillatory throw within the traveling carriage 85 which travels back and forth across the width of the record sheet. The mounting of the type wheel in this carriage will be hereinafter described in the detailed description of this carriage. The rotary type selecting movement imparted to the type wheel is transmitted through the rotary selecting shaft 52. This shaft has bearing support at its ends in the end supporting walls 15, 16, and substantially the entire span of the shaft between these walls is of square or other polygonal cross

section for transmitting rotation to the type wheel in the lateral travel of the carriage. This shaft extends directly through the carriage, but the type wheel is mounted so as to be capable of oscillatory motion relatively thereto for swinging into and out of printing contact against the record sheet.

The energy for rotating the selecting shaft 52 to its different angular positions of selection is obtained through the energization of a solenoid 50 (Figure 5). The core 50a operating within this solenoid is pivotally connected at 50b to a lever arm 51. One end of said lever is supported on a pivot stud 51a projecting from the end frame wall 16, and the other end of said lever is pivotally connected at 51b to an upwardly extending link 51c. The upper end of said link carries a transverse pivot pin 51d, the ends of which project laterally for pivotally supporting the lower ends of a pair of arcuate link straps 51e. The upper ends of the arcuate links are pivotally connected at 51f to the end of a short crank arm 51g extending from a hub 51h which is secured fast to the square selecting shaft 52. It will be evident that energization of the solenoid 50 causes downward movement of the core 50a, lever 51 and links 51c and 51e for oscillating the selecting shaft 52 in a clockwise direction, as viewed in Figure 5. Suitable spring means hereinafter described operates to restore the shaft and the above described operating parts to their normal positions upon the deenergization of the solenoid 50.

Responding to the operation of the lever 51 and shaft 52 is a switch comprising contacts 54, 55 and 56 (Figure 5). This switch may be arranged in any suitable relation so that the middle contact 55 normally stands spaced from contact 54 and in engagement with contact 56 while the solenoid 50 is deenergized and the lever 51 is in its uppermost position, but which middle contact engages contact 54 and separates from contact 56 as soon as the solenoid is energized and the lever 51 starts its downward motion. In the exemplary arrangement illustrated in Figure 5, an insulating button carried on the lever 51 normally holds contact 55 separated from contact 54 and in engagement with contact 56, but permits contact 55 to move out of engagement with contact 56 and into engagement with contact 54, and to remain engaged therewith as long as the solenoid is energized with the lever 51 in a position out of normal. This switch 54, 55 and 56 has electrical connection with the solenoid which operates the printing shaft, as will be later described.

Referring now to the arrangement of selective stop solenoids which selectively gauge the amount of rotation which the solenoid 50 and lever 51 are permitted to impart to the shaft 52 (for determining the type character to be printed), a swinging stop arm 53 is arranged to be oscillated simultaneously with each oscillation of the selecting shaft 52 (see Figure 2). This stop arm 53 is mounted for swinging motion in a vertical plane between the main supporting wall 16 and an outer supplementary frame plate 18. Spaced outwardly beyond this latter frame plate are two additional frame plates 19 and 19a disposed in laterally spaced relation (Figures 1 and 3). As shown in Figure 2, the stop arm 53 is supported on a shaft 53a which has journaled mounting in the two outer frame plates 18 and 19. This supplementary shaft 53a carries a spur gear 53b which meshes with a spur gear 52b secured to

the selecting shaft 52. A coiled return spring 53c encircles the supplementary shaft 53a, having one end secured to the shaft and the other end anchored to the frame plate 19. This spring restores the square selecting shaft 52 to its normal position as soon as the actuating electromagnet 50 is deenergized, in which normal position of the parts the stop arm 53 abuts against an adjustable stop shoulder M12 which is anchored to the main frame wall 16. A micrometer adjustment for adjusting the angular relation between the selecting shaft 52 and the stop arm 53 is embodied in the operating connection between the shaft 52 and its gear 52b (Figure 2). This adjustment comprises a coupling block 52c made fast to the selecting shaft by a set screw or the like, and this block has an aperture 52d therein which engages over a pin 52e projecting laterally from the face of the gear 52b. Adjusting screws 52f thread into opposite sides of the block and serve to establish a very fine angular adjustment of the position of the gear 52b with respect to the block 52c, through lateral shifting of the pin 52e in the aperture 52d. This fine adjustment enables the type characters on the printing wheel to be accurately disposed in their proper printing positions when the stop arm 53 is stopped in any one of the selected positions. When said stop arm is in engagement against its normal stop M12, the gap 100b in the printing wheel is in registration with the printing position on the record sheet, so that no printing operation occurs at this time.

As the stop arm 53 oscillates in a clockwise direction (Figure 2) under the driving energy of the actuating electromagnet 50, it moves through an arcuate path athwart which any one of a series of different solenoid stop pins can be projected. There are ten of these electrically actuated solenoid stops designated M0 to M9 inclusive, all disposed at equally spaced intervals along the arcuate path of the stop arm 53. These electrically energized stops are all of identical construction, an exemplary form of which is illustrated in Figure 3. Each comprises a solenoid coil 114 which is confined between the frame plates 18 and 19, and within which reciprocates the magnetically responsive core 115. A stop projection 115a, preferably of non-magnetic metal, extends from the inner end of the core 115 and projects through an aligned aperture in the plate 18. The outer end of the core is guided within an aperture in the outer plate 19a, and a shoulder 115b is formed on the core for engaging a compression spring 116 which is confined between the shoulder 115b and the frame plate 19. The spring 116 holds the core and stop projection 115a in a retracted position, where the stop projection is disposed entirely clear of the path of the stop arm 53. However, upon the energization of the solenoid coil 114, the core is shifted axially to project the stop extension 115a into the path of the stop arm 53, whereby said arm is brought to an abrupt and positive stop against the projection 115a. Such predetermines the location of the desired type character in proper printing position. The energization of either one of the ten solenoid stops M0 to M9 stops the type wheel 199 with the corresponding numeral 0 to 9 thereof in proper printing position. When neither one of these solenoid stops is energized, and the stop arm 53 is permitted to move on past the same into engagement with the end limiting stop M11, such disposes the letter character "T" of the type wheel in proper

printing position, this letter character being used to print a totalizing heading at the top of each totalizing column, as previously described.

Referring now to the mechanism which drives the feed screw 84 in the operation of returning the printing carriage back to the left hand margin of the record sheet after printing each horizontal row of figures, this mechanism is driven by an electric motor 79, the terminal connections of which are indicated at 77 and 78 in Figure 16. Interposed in the driving train between the motor 79 and the feed screw 84 is a registration stop device 81, 82 which positively insures that the printing carriage will always be returned to the same starting point at the left hand side of the record sheet, in order to insure vertical alignment of the printed characters in their respective columns. A friction slippage clutch 118 is associated with this registration stop apparatus so as to avoid objectionable shock in bringing the electric motor to rest after further travel of the printing carriage to the left has been abruptly and positively stopped in establishing the above registration. This registration means and slippage clutch are best illustrated in Figures 4 and 7, from which it will be seen that the shaft of the motor 79 carries a worm 119 meshing with a worm wheel 121 mounted on a countershaft 122. The stop disk 82 and friction clutch 118 are both mounted on this shaft, the friction clutch comprising two driving clutch disks 123, 123' which are keyed to the shaft 122 on opposite sides of the disk 82. Friction disks 124, 124' are interposed between the driving disks 123, 123' and the driven disk 82, this assembly of driving, driven and friction disks being resiliently maintained in constant frictional engagement by a spiral compression spring 125 which is mounted on the shaft 122 and is arranged to act endwise thereof in holding the aforesaid disks pressed together. It will thus be seen that when the driven disk 82 is abruptly and positively stopped in its rotary motion, the friction clutch 118 absorbs the shock load which would otherwise be thrown upon the electric motor 79, the provision of the clutch enabling the motor to be brought to a stop more gradually. Pinned to or formed integral with the driven stop disk 82 is a gear 126 which meshes with a pinion 127 secured to the end of the threaded shaft 84.

As shown in Figure 4, the registration stop disk 82 has a notch 82a therein at one point of its periphery, into which notch the nose 81a of the stopping pawl 81 is adapted to enter. The arm 81 is mounted for oscillation on a stationary pivot pin 81b, and extending from said arm is an armature portion 80 which is adapted to respond to the energization of an electromagnet 70. The arm 81 comprises another extension portion 81c which is adapted to actuate the switch contacts 74, 75, 76. In the normal condition of these parts (which is the condition existing throughout the printing operation), the stop arm 81 is blocking rotation of the stop disk 82, and the contact 75 is separated from the contact 76 (see Figure 16). The locked relation established between the stop arm 81 and stop disk 82 holds the threaded shaft 84 against rotation, during which time the stepping or advancing motion of the printing carriage 85 to the right is effected by the rotation of a traveling nut which screws along the threaded shaft and advances the carriage to the right. Upon the energization of the electromagnet 70, the stop arm 81 is freed from the notch 82a of the stop disk 82, and the contact 75 is permitted to

engage with the contact 76 (Figure 16). These contacts close a circuit through the motor 79, which thereupon operates the threaded shaft 84 to drive the printing carriage 85 back through its return motion to the left hand edge of the record sheet. The stopping of the printing carriage at a predetermined point in this return motion is secured through the provision of a limit switch 71, 72, 73 (Figure 16) which is actuated when the carriage reaches the predetermined position of registration. As shown in Figure 6, this limit switch 71, 72, 73 is preferably a relatively sensitive micron switch which is mounted on the inner side of the left hand frame wall 15, and is adapted to be actuated by a projection on the printing carriage abutting against said switch. This actuation of the switch opens contacts 71, 72 and closes contacts 72 and 73 (Figure 16), the opening of contacts 71 and 72 deenergizing the electromagnet 70 and causing the immediate stopping of the threaded shaft 84 through the blocking function of the stop arm 81 and stop disk 82, the circuit of the motor 79 also being opened at this time through the separation of the contacts 75 and 76. In the abrupt stopping of the threaded shaft 84, the carriage is always stopped at the same registration point in each operating cycle of the printing mechanism, so that the impressions in corresponding columns are always maintained in true vertical alignment.

Referring now to the stepping or ratchet mechanism which imparts unidirectional motion to the square printing shaft 95, this mechanism comprises a solenoid 90 (Figure 4) within which reciprocates a core 90a which is pivotally connected through a link 90b with a rocker member 90c secured to a rock shaft 90d. The other arm of this rocker 90c is connected with a tension spring 90e which normally tends to hold the rocker and connected parts in the position illustrated in Figure 4. Secured to the rock shaft 90d is a crank arm 90f which is pivotally connected at 90g with the reciprocable ratcheting member 129. The member 129 is formed with a longitudinal guide slot 129a therein which engages over a countershaft 130 which projects outwardly from the frame wall 15. In the oscillation of the crank arm 90f, the stepping member 129 moves back and forth with a substantially rectilinear motion relatively to the shaft 130. The outer end of said shaft is given bearing support in a U-shaped outrigger bracket 130a which extends outwardly from the frame plate 15. Carried at opposite ends of the advancing member 129 are the two advancing pawls 131 and 132, these pawls being pivoted at 131a and 132a to the member 129. Tension springs 131b and 132b are connected to pins 131c and 132c which project laterally from the pawls 131 and 132, the opposite ends of these springs being connected to any suitable points of anchorage on the advancing member 129. These tension springs normally tend to hold the advancing pawls in their inwardly disposed or retracted positions, as shown, in which positions the pins 131c and 132c abut against their respective edges of the advancing member 129. As shown in Figure 8, the pawls 131 and 132 are pivotally mounted in inwardly offset positions with respect to the member 129, whereby these pawls oscillate in a plane between the member 129 and a spur gear 133 which is mounted on the shaft 130. Projecting laterally from the outer face of this gear 133 is a series of ratchet pins 134 which are adapted to be engaged successively by the ratchet pawls 131 and 132. In the exem-

plary arrangement illustrated there are three of these pins in equally spaced relation, and the operating arrangement is such that in the operating motion of the ratchet member to the right the pawl 131 will advance one of these pins one-sixth of a revolution, and in the return motion of the member 129 back to normal position the other pawl 132 will advance one of these pins another one-sixth of a revolution, resulting in a total angular advance of the gear 133 of a one-third revolution in the complete operating cycle of a forward and back movement of the member 129. As the pins 134 pass under the oppositely traveling pawl 131 or 132 at the idling side of the member 129, they merely lift the pawl by contact with a sloping inner surface on the pawl nose, the pawl immediately swinging inwardly to its normal position after the passage of such pin. The gear 133 meshes with a pinion 135 which is secured to the end of the square printing shaft 95. In the exemplary arrangement which employs three ratchet pins 134, the gear 133 will have a diameter three times that of the pinion 135. Hence, the energized stroke of the ratchet member 129 which imparts a one-sixth revolution to the gear 133 will impart a one-half revolution to the printing shaft 95, and, correspondingly, the return stroke of the ratchet member 129 to the left, which imparts another one-sixth revolution to the gear 133, will impart another one-half revolution to the printing shaft, resulting in a complete revolution of the latter shaft for each energization and subsequent deenergization of the solenoid 90. The first one-half revolution of the printing shaft throws the type wheel 199 inwardly to its printing position, and the second one-half revolution of this shaft returns the printing wheel back to its normal position, as will be later described in the description of the printing carriage.

Switch contacts 91, 92 and 93 are made to respond to the motion of the printing shaft 95 through the medium of a cam 137 (Figure 6). This cam is secured to the printing shaft 95, and has a half-revolution dwell 137a which is adapted to hold the contact 92 out of engagement with contact 93 and in engagement with contact 91. This is the normal position of these switch contacts. When the cam 137 is advanced through a half revolution during the throw of the type wheel into printing position, the contact 92 rides down upon the low portion of the cam, thereby breaking circuit with contact 91 and making circuit with contact 93. The electrical function performed by these contacts will be hereinafter described in connection with Figure 16.

Referring now to the printing carriage 85 which effects the horizontal traverse of the type wheel 199 back and forth across the log sheet 200, it will be seen from Figure 10 that this carriage comprises two laterally spaced frame plates 141, 141' which are maintained in spaced relation by transverse frame bars 142, 143 and 144, the side plates being secured to these frame bars by screws 146. The square selecting shaft 52, the square printing shaft 95 and the threaded feed shaft 84 pass transversely through lateral openings in this carriage. In order to brace this type wheel carriage against the reaction of the type wheel when the latter strikes the record sheet and platen, the carriage is preferably arranged to have guided travel in engagement with two guide rails 148 and 149, as shown in Figure 11. These guide rails have their ends rigidly secured to the aforementioned end plates 15 and 16. A

T-shaped bracket 151 is secured by screws to the upper cross strut 142 of the carriage. As shown in Figure 1, the two laterally aligned arms of this bracket carry guide rollers 152 which bear against the rear edge of the guide bar 148; and the forwardly projecting arm of the bracket carries a guide roller 153 which bears against the front edge of the rail 148. The lower cross strut 143 of the carriage supports a bracket 155 (Figure 11), and mounted at the ends of this bracket, to each side of the carriage, are vertically disposed guide wheels 156. These guide wheels have grooved peripheries which engage over the upper edge of the lower guide rail 149. Both guide rails 148 and 149 are of angle cross section for maximum rigidity.

As previously described, the type wheel 199 has numerical type characters 199a extending from 0 to 9, following which is the letter character "T," which is adapted to make the appropriate type impression designating the totalizing columns. As shown in Figures 11 and 12, the type wheel is also formed with a gap or notch 199b of approximately segmental form, this gap preferably occurring between the "T" character and the "0" character. When the type wheel stands in its normal position, prior to any rotative motion being imparted thereto by the selecting shaft 52, this gap or notch 199b is disposed directly opposite the record sheet and platen roll. Hence, oscillatory throw of the printing wheel toward the record sheet at this time will result in no printing operation, because no type character of the wheel is then in printing position. This oscillatory throw of the type wheel occurs each time that a spacing operation is performed between columns of figures, the gap or notch preventing any printing operation from occurring in the performance of these spacing operations.

The type wheel is rotatably mounted on a transverse pivot screw 161 which has its ends supported in an oscillatory frame comprising upwardly extending, laterally spaced frame bars 162, 162'. The lower ends of these frame bars are pivotally mounted on a transverse pivot pin 163 which extends horizontally through the side plates 141, 141' of the carriage. Oscillatory throw is imparted to said type wheel carrying frame 162, 162' through a cam follower roller 164 which is pivotally mounted directly below the type wheel 199 on a transverse pivot pin 165 which has its ends mounted in the oscillatory frame bars 162, 162'. The roller 164 is adapted to ride on the periphery of an approximately circular cam 167 which is revolved directly with each revolution of the square printing shaft 95. The cam 167 is secured to a sleeve 168 which has a square bore engaging over the square shaft 95, this sleeve being confined between the side plates of the carriage and sliding lengthwise of the shaft in the horizontal movements of the carriage. The type wheel and oscillatory frame 162, 162' are normally held in the retracted position illustrated in Figure 11 by the tension springs 171, 171' which have their front ends anchored to posts 172, 172' carried by the carriage side plates, and which have their rear ends suitably connected to the oscillatory frame bars 162, 162'. In each operation of making a printing impression, and in each operation of shifting the type wheel through a one unit spacing distance across the sheet, the square printing shaft 95 is revolved through a complete revolution. From the normal position of the cam 167, shown in Figure 11, a half revolution of said shaft swings the cam rearwardly to the position

shown in Figure 12, which oscillates the type wheel into its rearward position, such resulting either in a printing operation or in a spacing operation, depending upon the angular position of the type wheel 199. When the cam 167 rotates through the other half revolution back to its normal position, the tension springs 171, 171' restore the type wheel and oscillatory frame 162, 162' back to their normal positions.

Referring now to the manner in which lateral stepping or feeding motion is imparted to the carriage 85 with each printing and spacing operation, it will be seen from Figure 10 that the sleeve 168 which carries the cam 167 also carries a relatively large gear 174. This gear transmits rotation to a smaller gear 175 which is secured to a traveling nut 176 provided with an internal thread 177 which screws over the thread of the feed shaft 84. The nut 176 is in the form of a sleeve confined between the side plates 141, 141' of the carriage, and it will be evident that stepping movement to the right or return traverse to the left can be imparted to the carriage either by holding the feed shaft 84 against rotation and rotating the nut 176, or by holding the nut 176 against rotation and rotating the feed shaft 84. The stepping or shifting of the carriage to the right during printing and spacing operations is performed by rotating the nut 176 around the shaft 84, and the return travel of the carriage back to the left hand margin of the record sheet at the end of a row is performed by rotating the screw 84 within the nut 176. The aforementioned rotation of the printing shaft 95 which revolves the cam 167 through one complete revolution also revolves the gear 174 through one revolution. This gear is preferably considerably larger than the gear 175, such as in the ratio of 2 to 1, so that the carriage can be shifted laterally through a substantial distance even with a feed screw 84 of relatively fine pitch. It will be observed that the first half revolution of the shaft 95 which oscillates the printing wheel inwardly to its printing position is imparting simultaneous rotation to the nut 176, and that the final half revolution of the shaft 95 is continuing to impart a final rotation to the nut 176. Hence, half of the lateral shifting motion of the carriage occurs as the type wheel moves from its normal position to its printing position, and the other half of the shifting movement of the carriage occurs as the type wheel moves from its printing position back to its normal position.

Referring now to the manner in which the drive is transmitted from the selecting shaft 52 to the type wheel 199, this selecting shaft carries a sleeve 181 which is confined between the side plates of the carriage and which has a square bore for sliding, non-rotative engagement over the shaft. Rotating with this sleeve is a relatively large driving gear 182 which is adapted to mesh with a relatively small driven gear 183 secured to the type wheel. The type selecting operation of rotating the type wheel to the appropriate position, for bringing the desired type character into printing position, is preferably performed while the type wheel 199 is standing in its retracted or outward position, shown in Figure 11. At this time, the driving and driven gears 182 and 183 are in direct mesh, and hence the selecting rotation is transmitted directly from the driving to the driven gear. This mesh of the gears is interrupted when the type wheel is oscillated inwardly to its printing position (Figure 12). In order to retain a positively coupled relation be-

tween the driving and driven gears 182 and 183 at this time, so as to make sure that the re-meshing of the gears will occur in the same identical registration, we provide two intermediate gears 184 and 185 which maintain a permanently coupled relation between the driving and driven gears at all times. The first intermediate gear 184 is pivotally supported on an oscillatory arm 186 having a hub 186' (Figure 10) mounted for free oscillation on the sleeve 181. The other intermediate gear 185 is pivotally supported on an oscillatory link 187 which has its upper end mounted for free swinging motion on the pivot stud 161 of the type wheel. The oscillatory arm 186 has coupled connection with the oscillatory link 187 through the connecting link 188, which has its front end connected with the oscillatory arm at the axis of the first intermediate gear 184, and which has its rear end pivotally connected with the oscillatory link at the axis of the second intermediate gear 185. The two intermediate gears 184, 185 remain in mesh with each other and with the driving and driven gears in all forward and backward oscillation of the type wheel 199. This insures that the driven gear 183 will always come back into the same identical registration with the driving gear 182 that it had at the start of the printing or spacing operation. By virtue of the permanently connected relation established through these intermediate gears, the final part of the type selecting rotation can be transmitted to the type wheel as the wheel swings inwardly towards its printing position, particularly if a greater speed of operation is desired. A spring detent 191 is further provided to prevent any rotative play of the type wheel from the time that the driven gear 183 leaves its meshed engagement with the driving gear 182 until it is back in engagement therewith. This detent comprises a relatively stiff wire having its lower end anchored to the cross bar 144 of the carriage, and having its upper end bent laterally to support a relatively small roller 191'. This detent roller is normally disposed in a position out of engagement with the teeth of the driven gear 183 (Figure 11), but when the type wheel is oscillated toward its printing position said detent roller engages in an aligned tooth space in the driven gear 183 and remains in detent engagement therewith until the driven gear 183 is back in mesh again with the driving gear 182.

The traveling carriage 85 carries the inking ribbon 195 and the two ribbon reels 196, 197 directly therewith so that all of the inking ribbon apparatus is a part of the movable carriage unit. The oscillatory motion of the oscillatory arm 186 further performs the dual function of lifting the inking ribbon 195 up into printing position, and also of transmitting stepping motion to the ribbon take-up reel. A finger portion 186'' projects rearwardly from the lower end of the oscillatory arm 186, and this portion is adapted to impart lifting movement to a ribbon shifter 193 (Figures 12 and 13). Said shifter comprises a U-shaped front portion 193a disposed between the normal position of the type wheel and the record sheet, this U-shaped portion having supporting arms 193b which extend forwardly of the machine for oscillatory pivotal mounting concentric of the upper square shaft 52. The inking ribbon extends across the slotted front portion 193a of the shifter, and then extends along the side supporting arms 193b, where the ribbon passes under small guide clips 193c. The projecting finger 186'' at the lower end of the oscillatory arm 186 plays in

a slot in the front portion 193a of the ribbon shifter, whereby upon the inward oscillation of the arm, occurring simultaneously with the inward oscillation of the type wheel, the finger 186'' swings the ribbon shifter upwardly, as indicated in dotted lines in Figure 13. This raises the ribbon up into position to receive the impression of the type character and to imprint the same on the record sheet, assuming that the type wheel has been turned to a printing position. Upon the downward return movement of the ribbon shifter to its normal position, the inward span of the ribbon is returned to a lowered position so that it does not obstruct the view of the last character printed on the record sheet.

Referring now to the ribbon reverse mechanism, the ribbon winds upon and unwinds from the two ribbon reels 196 and 197 which function alternately as a supply reel and as a take-up reel. Associated with each reel is a separate ratchet wheel 198, 198', so arranged that when either reel is functioning as a take-up reel stepping motion is imparted thereto through its respective ratchet wheel. Each ratchet wheel is secured to a long mounting sleeve 201 (Figure 11) which has rotatable bearing support within a bearing bracket 202 projecting from the front side of the printing carriage. Each reel is mounted upon and coupled to the sleeve 201 through a long axial coupling pin 203. The hub of each reel is provided with a drive pin extending transversely therein, and, likewise, the bore of the sleeve 201 is provided with a similar transverse drive pin. The coupling pin 203 is formed with a longitudinal diametrical slot therein (Figure 14) which passes down in embracing relation over these two transverse drive pins of the reel and of the sleeve, releasably coupling the two together. A compression spring 206 (Figure 11), confined between the lower end of the bearing 202 and a cotter key 207 carried by the pin 203, serves to hold the assembly pressed downwardly, with the under side of the ratchet wheel 198 or 198' bearing against a suitable thrust washer disposed at the upper end of the bearing bracket 202.

Stepping motion is imparted to one or the other of the reels through the medium of a transposable or dual pawl mechanism 211 which can be swung to a left hand position for actuating the left hand reel 196 as illustrated in Figure 14, or can be swung to a right hand position for actuating the right hand reel 197. Said pawl mechanism is carried by a T-shaped reversing member 212 comprising laterally extending arms 213 supporting gauge rollers 214 which bear upon that portion of the ribbon wound within each reel. When the diameter of the accumulated turns of ribbon on one reel increases to the point that it indicates that the end of the ribbon is approaching on the other reel, the arm 213 bearing against the greater number of turns is swung outwardly to oscillate the reverser 212. Projecting substantially at right angles from the two arms 213 is an intermediate arm 216 which oscillates the dual pawl mechanism 211 to one side or the other through an over-center snap spring 217. The transverse arm member 213, 213 is disposed above the intermediate arm member 216 (Figure 15), but the two are rigidly secured together by rivets or pins extending through spacing sleeves 219, 221. The spacing sleeve 219 affords a relatively long supporting bearing for the reverser 211, and a pivot pin 222 extends through this bearing for pivotally mounting the reverser on an angle shaped supporting bracket 224. A vertical leg of this

supporting bracket is secured by screws to the inside of the right hand frame plate 141' of the traveling carriage. The pivot pin 222 extends below the reverser 211 and mounts on its lower end a block 226, which can pivot around said pin relatively to the reverser 211. Formed integral with or secured to said block 226 is a guide bar 227 projecting forwardly from the center of the block. A horizontal guide slot 228 extends lengthwise of this guide bar 227. Mounted on said guide bar is a slider 229 comprising two side plate portions connected by laterally spaced rivets 231 which extend through the guide slot 228. Pivot ears 232 projecting downwardly from the slider 229 establish pivotal connection with an actuating link 234 which extends inwardly and establishes pivotal connection at 235 with the lower end of the oscillatory arm 186 (Figure 12). Thus, each time the oscillatory arm 186 is swung rearwardly in a printing operation, the link 234 is pulled rearwardly, causing corresponding sliding motion of the slider 232. Secured to, or formed integral with, each side plate of the slider is a stepping pawl 236, 236', both pawls being duplicates. On the outward or forward motion of the slider at the conclusion of the printing operation, these stepping pawls are shifted outwardly to their new tooth engaging positions, where the active pawl of the two takes hold on a new tooth of its respective ratchet wheel. Upon the rearward movement of the slider at the start of the printing operation, these pawls are drawn rearwardly or inwardly to their fully actuated positions, whereby advancing movement is imparted to that ribbon reel which is then functioning as a take-up reel. The pawl mechanism also comprises holding pawls 237, 237' which are secured directly to the block 226, as by the screws 238. These holding pawls establish latching engagement with the successive teeth of that ratchet wheel which is being stepped forwardly, thereby preventing any reverse motion of said ratchet wheel during the time that the associated stepping pawl is moving outwardly to the next succeeding ratchet tooth. One end of the biasing spring 217 is coiled about a pin 241 projecting downwardly from the arm 216, and the other end is coiled about a pin 242 projecting upwardly from the front end of the guide bar 227. This biasing spring results in a snap throw being imparted to the dual pawl mechanism 211 when the reverser 212 has been turned to the point where the pawl mechanism should be swung out of co-operative engagement with one ratchet wheel and into cooperative engagement with the other ratchet wheel.

For a complete description of the operation of the printing mechanism, including all electrical operations having to do with the operating cycle of the automatic printing and totalizing metering system, attention is directed to the aforementioned copending application of Titus G. Le Clair, Serial No. 373,013, filed January 3, 1941. However, for the purposes of the present disclosure, a brief description of the fundamental mechanical and electrical operations of the mechanism will suffice. Upon the selective energization of any desired one of the stop solenoids M0 to M9 inclusive, the stop plunger of this solenoid is projected into its stop position in the path of the stop arm 53. Substantially simultaneously with the energization of the selected stop solenoid, the selector solenoid 50 is also energized, whereby the lever 51 and connected parts oscillate the

type selector shaft 52 until the stop arm 53 strikes the projected stop plunger, such operations selecting the desired type character on the type wheel 199 and placing this type character in printing position.

Following this, the printing solenoid 90 is then energized and deenergized. This operates through the ratchet mechanism 94 to impart successive half-revolution movements to the printing shaft 95. The first half-revolution of said printing shaft throws the type wheel toward the record sheet for effecting the printing operation, and simultaneously therewith the printing carriage 85 is advanced toward the right a half-step. The second half-revolution of said printing shaft 95 swings the type wheel back into its normal position, and simultaneously therewith the printing carriage is advanced toward the right another half-step, thereby making one complete step of lateral advancement for each energization and deenergization of the printing solenoid 90. In the event that it is desired to perform one or more spacing operations without the impression of any type character, the type wheel 199 is permitted to remain in its normal angular position, in which position the gap or non-printing area 199b is presented to printing position. With the type wheel in this angular position, the successive half-revolutions of the printing shaft 95 result in the type wheel being thrown into and out of printing position for advancing the carriage through a spacing operation but without performing a printing operation.

When the printing operation is completed along one row of the record sheet 200, the electric motor 19 is energized through the performance of a suitable control function, such as by the sequence control apparatus disclosed in the aforementioned Le Clair application. The operation of the electric motor 19 drives the threaded feed shaft 84 and causes the carriage 85 to travel back to its starting position adjacent to the left hand edge of the record sheet. At this point the carriage strikes the limit switch 71, 72, 73, thereby deenergizing the electromagnet 70, and the motor 79. The deenergization of the electromagnet 70 permits the positive stop pawl 81 to engage in the stop notch of the disk 82 and block the return motion of the carriage 85 in a predetermined position of registry, the slip clutch 118 preventing undue shock on the motor and other parts in this position stopping operation, as previously described. During this resetting or restoring part of the cycle, the platen roll 69 is also advanced one step to move the record sheet 200 up one more notch, in readiness to start the printing operation along the next row of the sheet. This is accomplished through the energization of the solenoid 60, which operates through the lever 61 and ratchet wheel 62 to advance the platen roll 69 one step. The control of the electrical energization of this solenoid 60 may be effected in any desired manner, such as in the manner disclosed in the aforementioned Le Clair application. The various parts of the printing mechanism now stand ready to start another printing cycle.

At the end of the day's operation, or after a predetermined number of rows have been typed across the face of the record sheet 200, the platen roll 69 is advanced in rapid succession through several spacing steps so as to carry the old sheet or printing area completely out of printing position and to carry the new sheet or printing area into printing position. This multiple operation of the solenoid 60 through a predetermined number

of rapid operating steps is brought about under the control of the switch 65, 66, 67 and timing cam 64, in the manner described in said copending application. The platen roll 69 can be manually revolved for inserting or removing the record strip through the medium of a manual operating knob 245 at the left hand end of the roll (Figure 1). In this regard, greater widths of record sheets can be readily accommodated by using greater widths of platen rolls 69.

The operation of the ribbon shift mechanism and of the reversible ribbon feed mechanism will be evident from the preceding description of Figures 10 to 15 inclusive.

The printing mechanism may be manually operated through the medium of the push-button switches which are designated 100 * * * 109, T, 290, 260 and 299 in Figure 16. This enables the operator to type the line or circuit numbers or other column headings on the record sheet 200; permits the printing of readings or other data at times other than those called for by the automatic timing mechanism of the system; etc. This manual operation is fully described in said copending application.

While we have illustrated and described what we regard to be the preferred embodiment of our invention, nevertheless it will be understood that such is merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

We claim:

1. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a printing shaft and a threaded feed shaft extending transversely of said platen, at least two of said shafts being mounted on fixed axes, a carriage adapted to travel lengthwise of said shafts, a type wheel traveling with said carriage and movable into and out of printing position, said type wheel having type selecting rotation about an axis disposed substantially parallel to one of said latter shafts, means for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means responsive to actuation of said printing shaft for projecting the type wheel into printing position, and means cooperating with the thread on said feed shaft for causing lateral shifting movement of said carriage and type wheel.

2. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a printing shaft and a feed shaft extending transversely of said platen, a carriage adapted to travel lengthwise of said shafts, a type wheel traveling with said carriage and movable into and out of printing position, means for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means responsive to the operation of said printing shaft for projecting the type wheel into printing position, means cooperating with said feed shaft for causing lateral shifting movement of said carriage and type wheel, selecting means for imparting an oscillatory motion to said selecting shaft, actuating means for imparting a unidirectional rotary motion to said printing shaft, and carriage return means for rotating said feed shaft to effect the return of said carriage.

3. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a printing shaft and a threaded feed shaft

disposed on stationary axes in front of said platen, a printing carriage adapted to travel lengthwise of said shafts, an oscillatory frame mounted on said carriage, a type wheel carried by said oscillatory frame for movement into and out of printing position relatively to said carriage, gear mechanism for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means responsive to rotation of said printing shaft for projecting the type wheel into printing position, and a nut engaging said threaded feed shaft and coacting with said carriage for causing lateral movement of said carriage and type wheel.

4. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a printing shaft and a threaded feed shaft extending across said platen, a carriage adapted to travel lengthwise of said shafts, a type wheel traveling with said carriage and movable into and out of printing position, means responsive to motion of said selecting shaft for presenting the desired type character on said wheel to printing position, means responsive to motion of said printing shaft for projecting the type wheel into printing position, a rotatable nut associated with said carriage and engaging over said threaded feed shaft, and means responsive to motion of said printing shaft for rotating said nut.

5. In printing mechanism, the combination of a platen for supporting a record sheet, a printing shaft and a threaded shaft extending across said platen, a type wheel arranged to travel lengthwise of said shafts, means responsive to rotation of said printing shaft for moving said type wheel into printing position relatively to said platen, a threaded nut engaging over said threaded shaft, means for rotating said nut through said printing shaft for effecting feed of said nut along said threaded shaft, and means for transmitting shifting motion from said nut to said type wheel.

6. In printing mechanism, the combination of a platen for supporting a record sheet, a printing shaft and a threaded feed shaft extending across said platen, a carriage adapted to travel lengthwise of said shafts, a type wheel traveling with said carriage, a threaded nut engaging over said threaded feed shaft and operative to impart shifting movement to said carriage, means responsive to motion of said printing shaft for projecting the type wheel into printing position, means responsive to motion of said printing shaft for rotating said nut while said feed shaft remains nonrotative so as to advance the carriage during the printing operation, and means for rotating said feed shaft while said nut remains nonrotative to return the carriage to starting position after each series of printing operations.

7. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a printing shaft and a feed shaft extending transversely of said platen, a carriage adapted to travel lengthwise of said shafts, a type wheel traveling with said carriage and movable into and out of printing position, means for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means responsive to rotation of said printing shaft for projecting the type wheel to printing position, means cooperating with said feed shaft for causing lateral shifting movement of said carriage and type wheel, actuating means operative to impart movement to said selecting shaft through a pre-

determined maximum distance, said actuating means always actuating said selecting shaft in the same direction from a predetermined starting position for all selecting operations to be performed by said selecting shaft, and selective stop means for limiting the rotative movement of said selecting shaft to different shorter distances in selecting the desired type character on said type wheel.

8. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a type wheel adapted to travel lengthwise of said shaft and to be rotated thereby, actuating means operative to impart movement to said selecting shaft through a predetermined maximum distance, said actuating means always actuating said selecting shaft in the same direction from a predetermined starting position, electrically actuated selective stop means for limiting the movement of said selecting shaft to different shorter distances in selecting the desired type character on said type wheel, and means for making the printed impression between said type wheel and record sheet.

9. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft and a printing shaft extending transversely of said platen, a carriage adapted to travel lengthwise of said shafts, a type wheel traveling with said carriage and movable into and out of printing position, means responsive to rotation of said printing shaft for projecting the type wheel into printing position, means for transmitting rotation from said selecting shaft to the type wheel in selecting the type characters for printing, a solenoid operative to impart oscillation to said selecting shaft through a predetermined maximum degree of oscillatory movement, a stop arm oscillating concurrently with said selecting shaft, and a plurality of solenoid stop devices adapted to be projected into the path of said stop arm for limiting the oscillatory movement of said selecting shaft to different shorter distances in selecting the desired type character on the type wheel.

10. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a printing shaft and a feed shaft extending transversely of said platen, a carriage adapted to travel lengthwise of said shafts, a type wheel traveling with said carriage and movable into and out of printing position, means for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means responsive to rotation of said printing shaft for projecting the type wheel into printing position and controlling its return therefrom, means cooperating with said feed shaft for causing lateral shifting movement of said carriage and type wheel, an electromagnet, and means actuated by said electromagnet for imparting unidirectional motion to said printing shaft upon the energization and de-energization of said electromagnet.

11. In printing mechanism, the combination of a platen for supporting a record sheet, a printing shaft extending transversely of said platen, a type wheel adapted to travel lengthwise of said shaft, means responsive to rotation of said printing shaft for projecting the type wheel into printing position and controlling its return therefrom, an electromagnet for actuating said printing shaft, and two-way pawl and ratchet mechanism operatively connecting said electromagnet with said printing shaft whereby unidirectional rotative

movement is transmitted to said printing shaft upon the energization of said electromagnet and also upon the deenergization thereof.

12. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a printing shaft and a threaded feed shaft extending transversely of said platen, a carriage adapted to travel lengthwise of said shafts, a type wheel traveling with said carriage and movable into and out of printing position, means for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means responsive to rotation of said printing shaft for projecting the type wheel into printing position, a threaded member associated with said carriage and cooperating with said threaded feed shaft for causing lateral shifting movement of said carriage and type wheel, an electric motor for driving said threaded feed shaft in effecting the return motion of said carriage, stop means for quickly stopping the rotation of said feed shaft when said carriage arrives substantially in its starting position, and a friction slippage clutch interposed in the driving train between said electric motor and said feed shaft for preventing shock on the motor when the feed shaft is thus stopped.

13. In printing mechanism, the combination of a platen for supporting a record sheet, a threaded feed shaft extending transversely of said platen, a type wheel adapted to travel lengthwise of said shaft, an electric motor arranged to drive said feed shaft for returning said type wheel to its starting position, electrically controlled stop means for abruptly stopping the rotation of said feed shaft when said type wheel arrives substantially in its starting position, and a friction slippage clutch interposed in the driving train between said electric motor and said feed shaft.

14. In printing mechanism, the combination of platen means for supporting a record sheet or the like, a selecting shaft and a printing shaft extending transversely of said platen means, a carriage adapted to travel lengthwise of said shafts, an oscillatory frame mounted on said carriage, a type wheel carried by said frame for oscillatory movement into and out of printing position, cam means actuated by said printing shaft for imparting said oscillatory movement to said oscillatory frame, and a gear train for transmitting rotation from said selecting shaft to said type wheel comprising a driving gear actuated by said selecting shaft, a driven gear connected with said type wheel, and intermediate gear means accommodating the oscillatory movement of said type wheel while remaining in mesh with said driving and driven gears.

15. In printing mechanism, the combination of a platen means for supporting a record sheet or the like, a selecting shaft, a printing shaft and a feed shaft extending transversely of said platen means, a carriage adapted to travel lengthwise of said shafts, a type wheel traveling with said carriage and movable into and out of printing position, means for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means responsive to operation of said printing shaft for projecting the type wheel into printing position, means cooperating with said feed shaft for causing lateral shifting movement of said carriage and type wheel, an inking ribbon and associated ribbon reels mounted on said carriage, ribbon feed mechanism oper-

able by said printing shaft for advancing the ribbon during printing operations, and means for automatically reversing said ribbon feed mechanism to reverse the direction of motion of the ribbon.

16. In printing mechanism, the combination of platen means for supporting a record sheet, a carriage adapted to travel transversely across the front of said record sheet, a type wheel traveling with said carriage and movable into and out of printing position, means for rotating said type wheel for presenting the selected type character to printing position, printing means for projecting the type wheel into printing position, an inking ribbon and associated ribbon reels mounted on said carriage and traveling therewith, ribbon shifting means operative by said printing means to raise the ribbon to printing position during the printing operation and to lower the ribbon therefrom after the printing operation, ratchet wheels associated with each of said ribbon reels, transposable pawl mechanism operative by said printing means for imparting advancing movement to one of said ratchet wheels during printing operations, and means for automatically transposing said pawl mechanism into cooperative relation with the other ratchet wheel for reversing the direction of motion of the ribbon after a substantial length of the ribbon has traveled in one direction.

17. In printing mechanism, the combination of platen means for supporting a record sheet, a rotary selecting shaft extending across the front of said platen means, said selecting shaft having a normal position and being arranged to rotate solely in one direction away from said normal position in the performance of all selecting functions, a type wheel adapted to travel lengthwise of said selecting shaft across said record sheet, means for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means for projecting the type wheel into printing position, actuating means operative to impart said unidirectional rotary movement to said selecting shaft through a predetermined maximum distance, a rotary stop member rotating with said selecting shaft, electrically controlled stop means coacting with said rotary stop member for limiting the movement of said shaft to different shorter distances in selecting the desired type characters on said type wheel, and a series of manually actuated keys operative to govern energization of said electrically controlled stop means in the manual actuation of said printing mechanism.

18. In printing mechanism, the combination of means for supporting a record medium upon which the printing impression is to be made, a carriage guided for traveling motion across the face of said record medium, a type wheel mounted on said carriage and movable relatively thereto into and out of printing position, said type wheel comprising a series of type characters spaced around its periphery and a gap or non-printing area at one point of its periphery, said gap or non-printing area normally standing in alignment with said printing position, selecting means for rotating said type wheel to present the desired type character to printing position, and means responsive to the motion of said type wheel into its printing position for advancing said carriage laterally in a stepping operation, whereby the motion of said type wheel into its printing position without selective rotation having first

been given said wheel results in a spacing operation wherein the carriage is advanced laterally and no printing impression is made.

19. In printing mechanism, the combination of means for supporting a record medium upon which the printing impression is to be made, a carriage guided for traveling motion across the face of said record medium, a type wheel mounted on said carriage and movable relatively thereto into and out of printing position, means for rotating said type wheel to present the selected type character to printing position, printing mechanism for imparting a translatory throw to said type wheel from its normal position to its printing position and then back to its normal position, and stepping mechanism operative to impart a half-step advancement to said carriage upon the motion of said type wheel from its normal position to its printing position, and to impart another half-step advancement to said carriage upon the motion of said type wheel from its printing position back to its normal position.

20. In printing mechanism, the combination of a platen roll for supporting a record sheet upon which the printing impression is to be made, a printing shaft, a selecting shaft and a threaded feed shaft all mounted for rotation about fixed axes extending substantially parallel to said platen roll, a carriage guided for traveling motion across the face of said platen roll, a type wheel mounted on said carriage for type selecting rotation about an axis extending substantially parallel to the axes of said shafts, means responsive to rotation of said selecting shaft for rotating said type wheel to present the desired type character to printing position, means responsive to rotation of said printing shaft for effecting relative movement between said type wheel and the record sheet for making the printed impression on the latter, a traveling nut responsive to rotation of said threaded feed shaft for effecting traveling motion of said carriage, and advancing means for causing said platen roll to be rotated through a predetermined spacing at the end of each series of printing operations.

21. In printing mechanism, the combination of means for supporting a record medium, a type wheel adapted to make printed impressions on said record medium, a selecting shaft, a printing shaft and a threaded feed shaft all having rotary movement on fixed axes, said type wheel having type selecting rotation about an axis extending substantially parallel to said fixed axes, means responsive to rotation of said selecting shaft for rotating said type wheel so as to present the desired type character to printing position, means responsive to rotation of said printing shaft for causing said type wheel to move into printing position substantially against said record medium, and means responsive to rotation of the thread on said feed shaft for causing relative feeding motion to occur between said type wheel and record medium.

22. In printing mechanism, the combination of means for supporting a record medium, a type wheel mounted for type selecting rotation about a substantially horizontal axis and adapted to make printed impressions on said record medium, a rotatable selecting shaft mounted on a fixed substantially horizontal axis, means for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means for automatically projecting the type wheel into printing position, and a threaded feed shaft for causing

feeding motion of said type wheel lengthwise of said selecting shaft.

23. In printing mechanism, the combination of means for supporting a record receiving medium, a type wheel adapted to make printed impressions on said record receiving medium, a selecting shaft rotating about a fixed axis, means for transmitting rotational motion from said selecting shaft to said type wheel for causing said type wheel to rotate about an axis disposed substantially parallel to the axis of said selecting shaft so as to present a selected type character to printing position, means for projecting said type wheel relatively to said selecting shaft and into printing position, a feed shaft rotating about a fixed axis, and means responsive to rotation of said feed shaft for causing lateral movement of said type wheel in a direction lengthwise of said selecting shaft.

24. In printing mechanism, the combination of means for supporting a record receiving medium, a selecting shaft mounted for rotation about a stationary axis extending across the front of said record receiving medium, a carriage adapted to travel lengthwise of said shaft, a type wheel traveling with said carriage, means for automatically shifting the axis of said type wheel from a non-printing position to a printing position around an axis spaced from the axis of said selecting shaft, and a gear train including a shifting gear remaining coaxial with said type wheel for maintaining a coupled relation between said selecting shaft and said type wheel in each of said positions.

25. In printing mechanism, the combination of means for supporting a record receiving medium, a selecting shaft mounted adjacent said record receiving medium, a type wheel mounted for type selecting rotation about an axis approximately parallel to the axis of said selecting shaft, said type wheel being adapted to travel lengthwise of said selecting shaft and to make printing impressions on said record receiving medium, means for transmitting motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means for imparting rotary motion to said selecting shaft always in the same direction from a predetermined starting position, a stop arm connected with said selecting shaft and rotating through an arcuate path, and electrically energized stop devices at spaced intervals along said arcuate path for controlling the movement of said stop arm.

26. In printing mechanism, the combination of means for supporting a record receiving medium, a selecting shaft mounted for rotation about a stationary axis extending across the front of said record receiving medium, a carriage adapted to travel lengthwise of said shaft, a type wheel traveling with said carriage, and mounted on a shiftable axis, means for transmitting rotational motion from said selecting shaft to said type wheel for presenting the selected type character to printing position, means for imparting translational shifting motion to the axis of said type wheel for projecting said type wheel into printing position relatively to said selecting shaft, means operative to impart rotation to said selecting shaft through a predetermined maximum distance always in the same direction from a predetermined starting position, a stop arm connected with said selecting shaft to rotate through an arcuate path concurrently with the rotation of said selecting shaft, and electrically energized

stop devices at spaced intervals along said arcuate path for interrupting the movement of said stop arm at different desired points in selecting the desired type character of said type wheel.

27. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a printing shaft and a threaded feed shaft extending across said platen, a carriage adapted to travel lengthwise of said shafts, type characters traveling with said carriage and movable into and out of printing position, means responsive to the actuation of said selecting shaft for placing the desired type character in printing position, means responsive to actuation of said printing shaft for causing said type character to strike said record sheet, a rotatable nut associated with said carriage for engaging over said threaded feed shaft, and means responsive to actuation of said printing shaft for rotating said nut.

28. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft, a printing shaft and a threaded feed shaft extending across said platen, a carriage adapted to travel lengthwise of said shafts, type characters traveling with said carriage and movable into and out of printing position, means responsive to the actuation of said selecting shaft for placing the desired type character in printing position, means responsive to actuation of said printing shaft for causing said type character to strike said record sheet, a rotatable nut associated with said carriage for engaging over said threaded feed shaft, means responsive to actuation of said printing shaft for rotating said nut, and means for rotating said feed shaft to return the carriage to starting position after each series of printing operations.

29. In printing mechanism, the combination of a platen for supporting a record sheet, a selecting shaft and a printing shaft extending across said platen, a carriage adapted to travel lengthwise of said shafts, type characters traveling with said carriage and movable into and out of printing position, means responsive to the actuation of said selecting shaft for placing the desired type character in printing position, means responsive to the actuation of said printing shaft for causing said type character to strike said record sheet, a rotatable nut associated with said carriage, means responsive to the actuation of one of the aforesaid shafts for rotating said nut, a threaded feed shaft coacting with said nut, and means for rotating said feed shaft to return the carriage to starting position after each series of printing operations.

30. In printing mechanism, the combination of means for supporting a record medium upon which the printing impression is to be made, a carriage guided for traveling motion across the face of said record medium, a type wheel mounted on said carriage for movement therewith, selecting means for selecting the desired type character on said type wheel, printing means causing the printed impression to be made between the selected type character and said record medium, a threaded feed shaft extending substantially parallel to the path of travel of said carriage, a coacting threaded member associated with said carriage and having cooperative engagement with said threaded feed shaft, carriage shifting mechanism operative to intermittently rotate said threaded member while said threaded feed shaft remains non-rotative whereby to cause said carriage to shift with a step-by-step motion across

the face of said record medium in timed relation to the performance of the printing operations by said type wheel, and carriage return mechanism operative to rotate said threaded feed shaft while said threaded member remains non-rotative whereby to cause said carriage to return to its starting position after each series of printing operations.

31. In printing mechanism, the combination of means for supporting a record medium upon which the printing impression is to be made, a carriage guided for traveling motion across the face of said record medium, type characters traveling with said carriage and movable into and out of printing position, selecting means for se-

lecting the desired type character for printing, printing means for causing the selected type character to be moved into printing position relatively to said record medium, and stepping mechanism for imparting a step-by-step advancement to said carriage, said stepping mechanism comprising means operative to impart a fractional-step advancement to said carriage upon the motion of the selected type character into printing position, and operative to complete the full step advancement of said carriage upon the motion of the selected type character back to normal position.

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