A. T. MacCOY.

ELECTRIC TYPE WRITING MACHINE.

APPLICATION FILED OCT. 15, 1907.

**985,824.** **Patented Mar. 7, 1911.**

4 SHEETS—SHEET 1.

Fig. 2

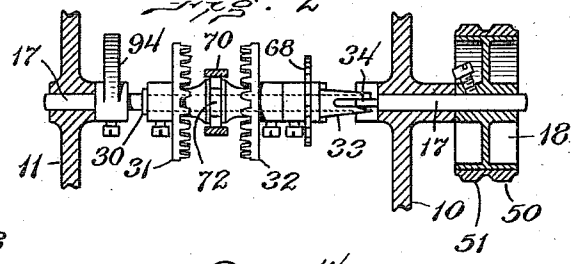



Fig. 3

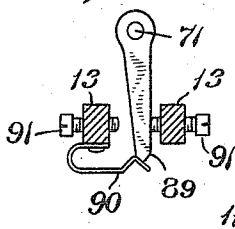



Fig. 1




Fig. 4

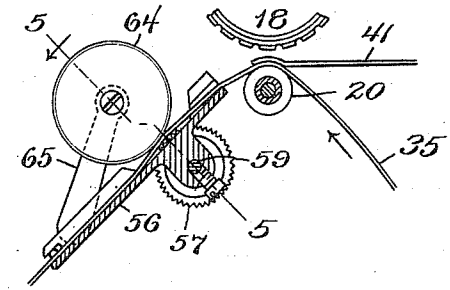
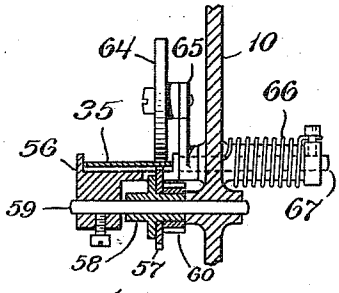



Fig. 5




Witnesses:
A. C. Ratigan
Walter P. Abell

Inventor
Andrew T. MacCoy
by Wright Brown Quinby & Otey
Attorneys

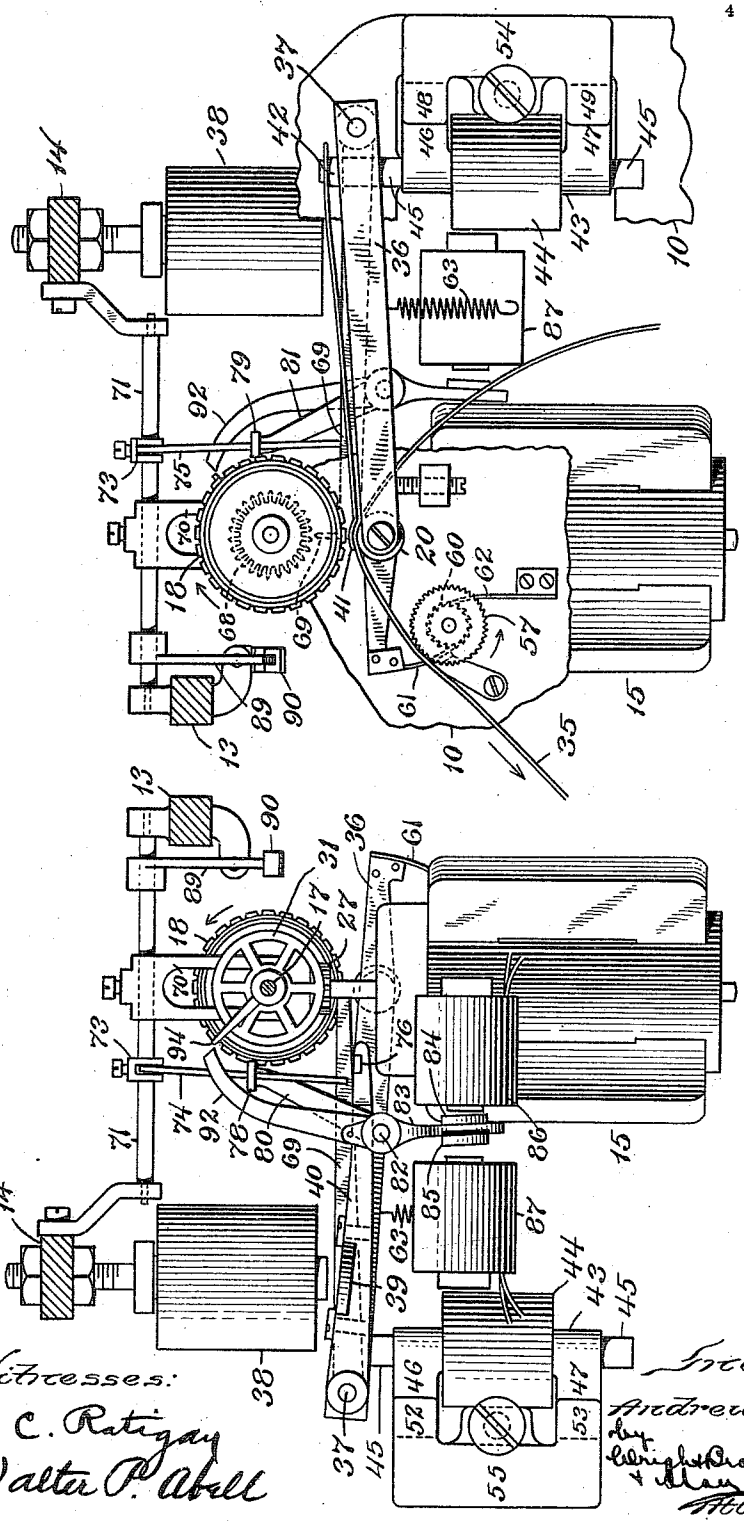
A. T. MacCOY.

ELECTRIC TYPE WRITING MACHINE.

APPLICATION FILED OCT. 15, 1907.

985,824. Patented Mar. 7, 1911.

4 SHEETS—SHEET 2.



Witnesses:

A. C. Ratigan

Walter P. Abell

Inventor

Andrew T. MacCoy

by Wright Brown Quinby & May

Attorneys

A. T. MacCOY.

ELECTRIC TYPE WRITING MACHINE.

APPLICATION FILED OCT. 15, 1907.

985,824. Patented Mar. 7, 1911.

4 SHEETS—SHEET 3.

FIG. 12

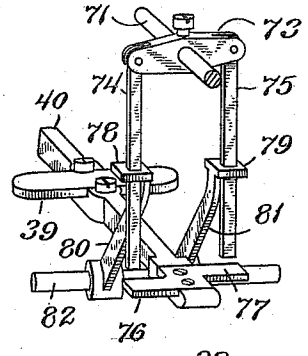



FIG. 10

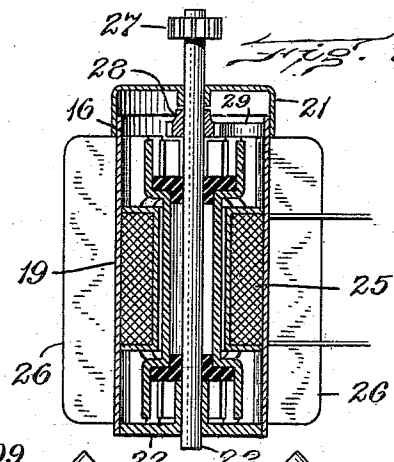
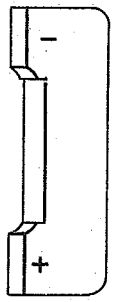



FIG. 11



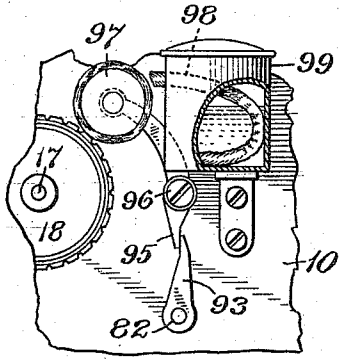




FIG. 13

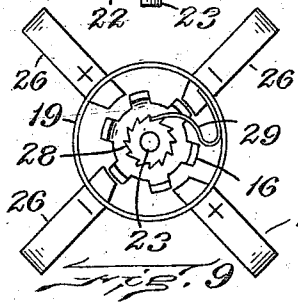



FIG. 9

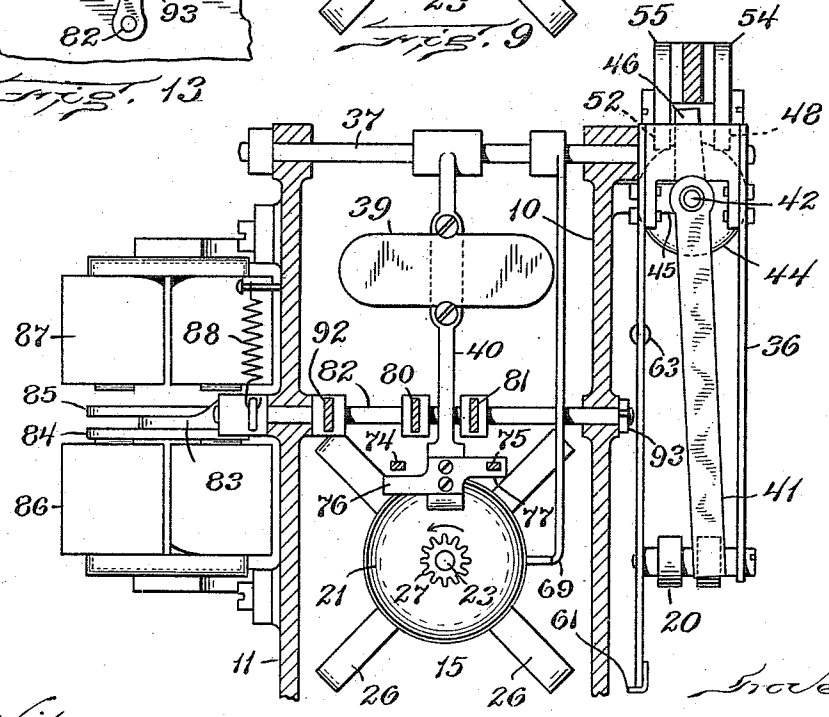



FIG. 8

Witnesses:

A. C. Ratigan

Walter P. Abell

Inventor

Andrew T. MacCoy

by Wright Brown Quinby & May

Attorneys

A. T. MacCOY.

ELECTRIC TYPE WRITING MACHINE.

APPLICATION FILED OCT. 15, 1907.

**985,824.** Patented Mar. 7, 1911.

4 SHEETS—SHEET 4.

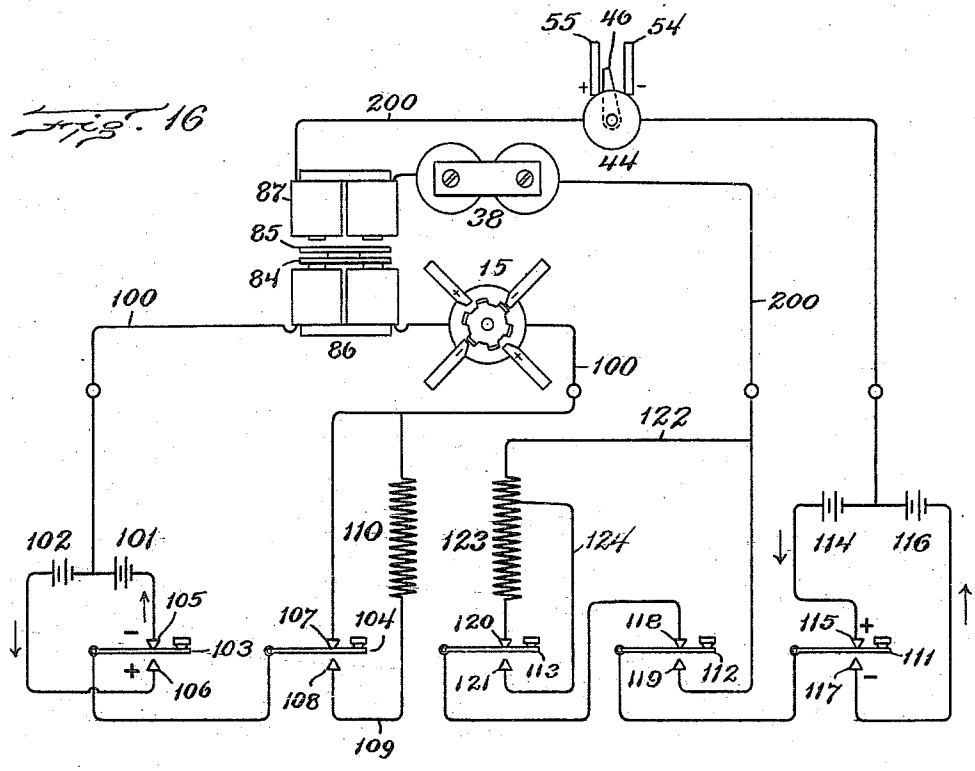



Fig. 16.

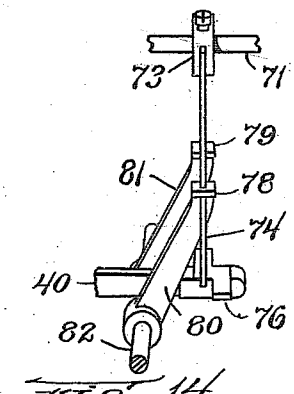



Fig. 14.

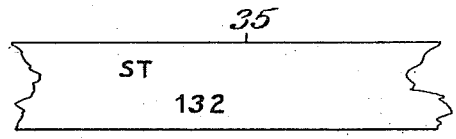



Fig. 17.

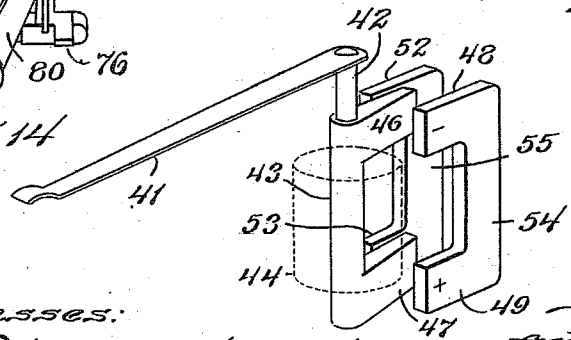



Fig. 15.

Witnesses:
A. C. Ratigan
Walter P. Abell

Inventor
Andrew T. MacCoy
by Wright Brown Quinby & May
Attorneys

# UNITED STATES PATENT OFFICE.

ANDREW T. MacCOY, OF DOVER, MASSACHUSETTS, ASSIGNOR TO CHARLES B. STRECKER, OF BROOKLINE, MASSACHUSETTS.

## ELECTRIC TYPE-WRITING MACHINE.

985,824. Specification of Letters Patent. Patented Mar. 7, 1911.

Application filed October 15, 1907. Serial No. 397,477.

*To all whom it may concern:*

Be it known that I, ANDREW T. MacCOY, of Dover, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Electric Type-Writing Machines, of which the following is a specification.

In stock tickers, or electromagnetically-controlled or operated type-writing machines which are employed for printing stock quotations upon a paper tape, there is a type-wheel (sometimes two) which bears upon its periphery a row of numerals, letters and punctuation marks, and the wheel is rotated unidirectionally to bring any desired character into potential printing relation to the platen or paper strip thereon. Frequently it has been necessary to impart to the wheel nearly a complete rotation for the printing of each succeeding character. For instance, assuming that the numerical types on the printing wheel are arranged in sequence from 0 to 9, in printing 654, it is necessary, after printing the numeral 6, to rotate the type-wheel almost a complete rotation to bring the numeral 5 into proper position and then once more to bring the numeral 4 into position. Thus much time is taken in properly positioning the type-wheel and, as a result, the printing of a given list of stock quotations is accomplished at a slow speed.

The object of my invention is primarily to reduce the time necessary to position the type-wheel and to thereby increase the speed of stock tickers, and other type-writing machines to which the invention is applicable.

In the present instance, the invention consists in making the type-wheel capable of reverse rotation, and providing mechanism by which it may be rotated an unlimited number of rotations, and yet by which it will be rotated in one direction or the other through the shortest arc which connects any character in potential printing position with the character which is next to be printed. In the example previously cited, instead of rotating the type wheel through a long arc of nearly 360 degrees to bring the numeral 5 to potential printing position, the type-wheel, according to my invention, is rotated in a reverse direction through a short arc of but a very few degrees. Thus the time taken to print the numerals 654 with an instrument embodying my invention, would require only a fraction of the time expended in printing the same numerals in the machines as heretofore constructed.

The motor and the power-transmitting mechanism are capable of rotating the type-wheel an unlimited number of steps or rotations in either direction, and are under such control that the reversal of the type-wheel may be accomplished at any time or at any point in its rotation. According to the illustrated embodiment of the invention, I may employ a motor having a unidirectionally moving driving shaft, and hence, to effect the reversal of rotation of the type-wheel, I, in such case, employ a movable member, with an electrically operated actuator therefor, which shifts the motor driven gearing so as to effect the desired reversal of the type-wheel. The actuator is vibrated or oscillated by the same electromagnet which operates the platen in the illustrated embodiment of the invention, and between it and the said member is interposed a selecting mechanism which determines in which direction the member shall be moved and the type-wheel correspondingly rotated to print the next succeeding character. The selecting mechanism comprises electromagnets and guides controlled by the armature thereof, which interpose one or the other of two rods, connected to said member, in the path of the actuator. Hence, by means of the selecting mechanism, the actuator may be caused to move the gear-shifting member in one direction or the other to cause the subsequent rotation of the type-wheel to be forward or back so as to traverse the shortest arc connecting the type or character in potential printing position with the type or character next to be printed.

To further increase the speed of the machine, I employ a type-wheel having two rows of twenty-six characters each. Two wheels placed side by side, each bearing a single row, may be used with equal facility. The characters of one row comprise the letters of the alphabet from A to Z inclusive.

The characters of the other row comprise numerals, fractions, dots, and the letter S which is used in designating bonds. Heretofore it has been customary to employ a greater number of characters than twenty-six arranged in a row, and as in such machines the type-wheel is advanced by a step-by-step movement due to electrical impulses or pulsations, I am able in my machine to impart a complete rotation to the type-wheel or wheels with a smaller number of impulses or pulsations than are necessary to effect a complete rotation of the type-wheel in previous machines referred to.

The invention further consists in the employment of a movable guard in connection with the type-wheel or wheels, interposed between them and the platen and movable to prevent printing of the characters in either row. In the illustrated embodiment of the invention described in the following specification, this guard consists of a pivoted lever, the free end of which is adapted to be interposed between the platen and either row of characters on the type-wheel or wheels, and an electromagnet for swinging the lever in one direction or the other about its pivot.

The invention further consists in an improved inking mechanism for the type-wheel by which I am able to insure that the ink is supplied in proper quantities automatically without the necessity of manually inking the ink-supplying wheels as heretofore.

Referring to the accompanying drawings forming a part of this specification, Figure 1 is a front elevation and partial section of one embodiment of a type-writing machine constructed in accordance with this invention. Fig. 2 is a plan view of the type-wheel shaft and transmission gearing set so as to drive the shaft in the opposite direction with relation to the same mechanism as it appears in Fig. 1. Fig. 3 is a front elevation of a spring detent for holding the transmission gearing in either of two positions. Fig. 4 is a side elevation and partial section of the paper-feeding device. Fig. 5 is a section on the line 5—5 of Fig. 4. Figs. 6 and 7 are respectively left and right side elevations of the magnetic actuators together with the various mechanical devices which they operate. Fig. 8 is a sectional plan view of the principal mechanism below the horizontal plane of the top of the type-motor. Fig. 9 is a top plan view of the type-motor without its armature cap. Fig. 10 is a vertical section of the type-motor. Fig. 11 is an elevation of one of the permanent magnets which make up the magnetic field of the type-motor. Fig. 12 is a perspective view of the devices which shift the transmission gearing of the type-motor. Fig. 13 is a right side elevation of an ink-feeding device. Fig. 14 is another perspective view of the shifting devices recited in connection with Fig. 12. Fig. 15 is a perspective view of a shifting guard which intervenes between the type-wheel and the platen. Fig. 16 is a diagram of the complete electromagnetic system in its simplest form. Fig. 17 represents a fragment of tape adapted to receive the printed characters.

Before proceeding to a detailed description of the machine, two things should be understood, one of which is, that the drawings are intended merely to illustrate the invention conventionally and in the simplest form, omitting as much as possible such structural features as would tend to obscure the essential features. The other is, that the terms and phraseology employed are merely descriptive and are not intended to limit the invention to any one form.

The same reference characters indicate the same parts wherever they occur.

The various mechanisms are installed in a frame consisting of two parallel upright members 10 and 11 affixed upon a base 12. The members 10 and 11 are tied together at the front by a crossbar 13 (see Figs. 6 and 7) and at the rear by a crossbar 14. Between the members 10 and 11 is installed the type-motor 15 whose armature 16 is adapted to rotate step-by-step in one direction. This type of motor is the same as that for which Letters Patent 843,287 were granted me Feb. 5, 1907. The type-motor is driven by an electrical current of alternately opposite polarity, and is connected to a shaft 17 having a type-carrier consisting of a type-wheel 18, so as to rotate the latter an unlimited number of rotations in either direction for the purpose of bringing the types or type units thereon selectively into operative position relatively to a movable platen 20. The motor 15 briefly described comprises a cylindrical casing 19 (see Fig. 10) having caps 21 and 22 closing its ends, a rotatable armature shaft 23, an armature 16 thereon, a stationary armature coil 25 surrounding the armature, and a permanent magnetic field comprising a plurality of permanent bar magnets 26. The shaft 23 is mounted in bearings in the end caps 21 and 22 and has on one end a pinion 27. The armature 16 is spool shaped and surrounds the shaft, being affixed thereon by suitable pieces of nonconducting material. The ends or poles of the armature are divided into a plurality of fingers which, when magnetized by the coil 25 coöperate with the poles of the permanent magnets 26 and effect a rotary movement of the armature. A ratchet 28 affixed to the shaft, and a spring pawl 29 affixed to the casing coöperate to prevent the shaft from rotating in one direction. By successively reversing the polarity of the current which energizes the coil 25, the armature polarity is successively reversed

and the armature is made to revolve step by step in one direction, each reversal of current effecting one step of the armature.

The step-by-step movement of the motor is transmitted to the type-wheel shaft 17 by a sleeve 30 loosely mounted on the shaft and having two oppositely disposed gears 31 and 32 either of which may intermesh with the pinion 27 on the motor shaft. As shown in Fig. 1 the gear 31 is in engagement with the driving pinion 27. The two gears 31 and 32 are rigidly affixed upon the sleeve 30 so as to rotate the latter which also carries a slotted arm 33 embracing a dog 34 affixed upon the shaft 17. By means of these connections rotation of the motor shaft is transmitted to the type-wheel shaft upon which the type-wheel is affixed. The type units or characters are arranged in two series 50 and 51 about the periphery of the type-wheel, and the spacing of the characters in each series is such that one step of the motor 15 rotates the type-wheel one space, or from one character to the next.

The platen 20 is in the form of a roll between which and the type-wheel a tape 35 passes to receive the imprint of the type. When the desired type character is brought to a point adjacent the platen, the latter is moved toward the type-wheel causing the tape 35 to strike the type thereon. A convenient method of effecting the imprint is to mount the platen, as shown, in an oscillatory yoke or carrier 36 affixed to a rock-shaft 37, and to provide an electromagnet 38 to rock the shaft by means of an armature 39 affixed to an actuating arm 40 also affixed to the shaft. The electrical circuit for exciting the magnet 38 and the type-motor circuit are hereinafter fully explained in connection with a method of controlling the same.

Inasmuch as the type-wheel has two series of characters side by side, it is necessary to prevent the imprint of one of each pair in order to protect the tape 35 against any false or undesired impressions. For this purpose, a guard 41 is provided to intervene between the strip and the type-wheel. The guard is very thin and of sufficient width to cover one series of characters, and is shifted from side to side, as the occasions demand, to uncover the desired character, and to cover the one opposite.

Referring to Figs. 8 and 15, it will be seen that the guard 41 is mounted on a staff 42. The latter, formed preferably of non-magnetic material, is rigidly affixed to an iron core 43 extending loosely through the center of a magnet spool or winding 44. The core 43 is mounted between two brackets 45 45 in which it is free to oscillate, and the spool 44 is independently and stationarily supported. The ends of the core extend beyond the spool and then radially in the same direction, forming poles 46 and 47. The poles extend between similar pole pieces 48, 49 and 52, 53 formed on permanent magnets 54 and 55 of opposite polarity. The latter magnets are stationarily mounted sufficiently far apart to permit free movement of the poles 46 and 47, and also of the type-guard 41 from one to the other of the type series 50 and 51. The spool 44 is in circuit with a current capable of a reversal of polarity, and when subjected to reversals, it causes the pole pieces 46 and 47 to be alternately attracted and repelled by the magnets 54 and 55.

The tape 35, which records the impressions, is drawn from any convenient source such as a roll (not shown) below the platen 20. It extends between the arms of the yoke 36, over the platen, and through a stationary guide 56, through which it is advanced by a toothed feed-wheel 57. Figs. 4, 5 and 7. The feed-wheel is affixed to a sleeve 58, which is rotatably mounted on a staff 59 projecting from the frame member 10. The sleeve carries a ratchet-wheel 60 in addition to the feed-wheel, all three being fastened rigidly together. The ratchet 60 is rotated step-by-step in one direction by a spring pawl 61 affixed to an extension of one of the arm of the yoke, holds the latter normally 62 prevents it from rotating in the opposite direction. A spring 63, connected to one arm of the yoke, holds the latter normally away from the type-wheel as shown more clearly in Figs. 1, 4 and 7. When the platen is moved toward the type-wheel, the pawl 61 moves from one tooth of the ratchet 60 to the next, but, when the platen, after having struck an impression, is retracted by the spring 63, the pawl 61 rotates the ratchet and feed-wheel 57 one step in the direction of the arrow in Fig. 7. An idle roll 64 presses the tape 35 yieldingly against the teeth of the feed-wheel so that the tape is advanced thereby. The roll 64 is mounted at the free end of an oscillatory arm 65 and is held against the feed-wheel by a spring 66 which exerts its tension on the rock-shaft 67 on which the arm is mounted.

When the platen 20 is relatively close to the type-wheel, the latter is locked against rotation by a toothed wheel 68 and an arm 69 which coöperates therewith. The number of teeth in the periphery of the wheel is the same as the number of characters in a series of the type-wheel (see Fig. 7). The toothed wheel is affixed to the sleeve 30 on the type-wheel shaft, while the arm 69 is affixed to the rock-shaft 37. The end of the arm is bent and shaped so as to enter between the teeth of the wheel when the platen approaches the type-wheel.

The type-wheel, by reason of having two series of characters, produces a double row of impressions on the strip 35, provided first

one and then the other of the series is covered by the guard 41. For the purpose of explanation, the series 50 may be said to be composed of numerals, fractions, punctuation marks, etc., and the series 51 of alphabetical characters from A to Z, as hereinafter explained. It has been hereinbefore stated that the driving shaft of the type-motor 15 is capable of revolving in one direction only, and were this limitation true also of the type-wheel shaft 17, considerable time would be wasted in moving the letter Z into operative position if the letter A had occupied that position immediately prior thereto. To state the case explicitly, an entire revolution minus one space of the type-wheel would be wasted. In order to overcome this objectionable feature, the sleeve 30, carrying the two gears 31 and 32, is adapted to be moved endwise on the type-wheel shaft so as to move either of the said gears into intermeshed relation with the motor pinion 27. The gears, being on opposite sides of the pinion, cause the shaft 17 to rotate in opposite directions, the direction being determined by whichever gear is engaged with the pinion. When the sleeve 30 is moved endwise, it carries not only the gears 31 and 32, but the locking-wheel 68 and the slotted arm 33 which transmits the rotation of the sleeve to the dog 34. The fact that the arm 33 is slotted, as shown in Fig. 2, and the end of the arm 69 is broad, as shown in Figs. 1 and 8, maintains cooperative relation between the members 33 and 34, and 68 and 69 notwithstanding the endwise movement of the sleeve 30. In lieu of the gearing described, any mechanical equivalent therefor may be employed, there being many such which might be used with equal facility.

The sleeve is straddled and moved back and forth on the shaft 17 by a yoke 70 affixed to a rock-shaft 71, and having pins which project toward each other into an annular groove 72 in the periphery of the sleeve. The ends of the shaft 71 are journaled in brackets on the cross-pieces 13 and 14 (Figs. 6 and 7). The yoke 70 constitutes a member which controls the direction of rotation of the type-wheel, and it is actuated by selective key-controlled electromagnetic mechanism.

The mechanism for oscillating the rock-shaft comprises a beam 73, rods 74 75 pivoted thereto, and lips 76 and 77 on an extension of the arm 40, the latter constituting what may be termed an actuator. The beam 73 is affixed to the shaft 71 and has oppositely-extending arms from which the rods 74 and 75 extend, said rods constituting selectors for selecting the direction of movement of the member 70. The pivotal connections of the beam with the rods are so loose as to permit limited free movement in any direction of the free ends of the rods or selectors which extend through the guides 78 and 79. The guides, which are controlled by electromagnets, are for the purpose of positioning the ends of the rods with relation to the lips 76 and 77 on the actuator, and are formed on arms 80 and 81 rigidly attached to a rock-shaft 82 which has its bearings in the frame members 10 and 11. One end of the rock-shaft carries a fixed arm 83 on which are two magnetic armatures 84 and 85 adapted to be attracted by their respective electromagnets 86 and 87. A spring 88 connected to the arm 83 exerts its tension to hold the arm normally toward the magnet 86. When the arm 83 and rock-shaft 82 are in this position, the guides 78 and 79 maintain the free ends of the rods in the position shown by Figs. 6, 7, 8, 12 and 14. The lips or engaging portions 76 and 77 on the arm or actuator 40 are offset or staggered with respect to each other, so that, when the rods are in the position shown and stated, the former lip is out of alinement with the rod 74 and the latter lip is in alinement with its rod 75. So long as the rods are held in this position by their guides 78 and 79, a movement of the arm or actuator 40, in response to magnetization of the magnet 38, causes the lip 77 to engage the rod 75. The lip 76, however, in moving with the arm 40, passes from a position beyond the end of the rod 74 to a position overlapping the rod though not touching it. This movement of the arm or actuator 40, with the guides 78 and 79 and the rods in the positions named is ineffectual, but, when an electrical current is passed through the coils of the magnet 87, the magnet 86, being weakened as subsequently explained, the said magnet 87 draws the arm 83 away from the magnet 86 and moves the guides 78 and 79 so as to swing the free end of the rod 74 into the path of movement of the lip 76, and the free end of the rod 75 out of the path of the lip 77. Subsequent movement of the arm or actuator 40 causes the lip 76 to engage the rod 74 and to move it so as to rock the beam 73 and shaft 71. This movement is imparted to the member or yoke 70 which moves the sleeve 30 endwise on the shaft 17, and the gears 31 and 32 are moved respectively out of and into engagement with the driving pinion 27. Under these conditions, the shaft 17 may be reversely rotated by the motor 15. After the guides 78 and 79 have been moved to one position, only the first subsequent movement of the arm 40 has effect in shifting the rock-shaft 71 so long as said guides remain in such position and all movements of the arm thereafter have no effect upon the rods 74 and 75. In order to keep the rock-shaft 71 in the desired position, after once placing it there, it is provided with a finger 89 hav-

ing a beveled end which engages a spring detent 90 affixed to a stationary support such as the cross-piece 13. Set screws 91 serve to limit the movement of the finger 89 and of the gears 31 and 32 in moving toward or from the driving pinion. By means of the mechanism last described, it will be seen that the operation which causes the platen 20 to strike the type-wheel also serves to prepare the type-wheel driving mechanism for subsequent rotation in the opposite direction, provided the shaft 82 is rocked either way prior to or substantially simultaneously with closing the circuit in which the magnet 38 is included.

In addition to the arms 80 and 81, the rock-shaft 82 carries arms 92 and 93. The arm 92 is adapted to extend into the path of movement of a rotatable arm or unison stop 94 affixed to the type-wheel shaft, but, when held in its normal position by the spring 88, the arm 92 is out of the other arm's path. The position of the guides 78 and 79, due to the action of the same spring, determines which of the gears 31 and 32 shall be moved into or held in engagement with the pinion 27, and consequently the type-wheel shaft may be said to have a normal direction of rotation as indicated by the arrows in Figs. 6 and 7. The function of the arms 92 and 94 is to stop the type-wheels of a plurality of machines in a circuit, at the same initial starting position, with, for instance, the letter A adjacent the platen, and it is performed as follows: The type-wheel shaft 17 is first placed in the forward gear, and the rock-shaft 82 rocked by closing a circuit through the soils of the magnet 87 so as to place the arm 92 in the path of the unison arm 94. The arm 92 is held in this position while the motor is given a series of impulses sufficient to cause the arm 94, in its forward rotation, to engage the stationary arm. The movement of the shaft 17 and consequently that of the motor is arrested regardless of any impulses which the motor may subsequently receive. After a cessation of impulses in the motor, the circuit including the magnet 87 may be broken leaving all of the mechanisms in their normal positions with the type-wheel at the starting point. The other arm 93, carried by the rock-shaft 82 is adapted to engage and move one end of a lever 95 pivoted upon a stud 96 in the fraem member 10. The other end of the lever 95 carries an ink roll 97 having a yielding facing which is normally held by gravity against the periphery of the type-wheel. Whenever the shaft 82 is rocked away from its normal position, the arm 93 tilts the lever 95 so that the roll 97 is moved away from the type-wheel and into engagement with a wick 98 projecting out of an ink reservoir 99. By this means, the roll 97 receives a supply of ink, which it transfers subsequently to the type-wheel, as often as the shaft 82 is rocked.

The description thus far has dealt individually with all of the mechanisms and the operations thereof, and the following description relates to an extremely simple and efficient system of operating and controlling the various mechanisms so as to cause them to properly coöperate in printing stock quotations or other information upon the tape. The system, which I have illustrated diagrammatically, may be replaced by any other which will accomplish the purpose.

Referring now to Fig. 16, it will be seen that all of the electrical instrumentalities are included in two normally-closed electrical circuits, indicated at 100 and 200. The circuits are provided with controlling devices by which they may be subjected to reversals of polarity and varying degrees of potentiality which may be combined so as to cause the several instrumentalities to operate as desired. The circuit 100 includes either of two sources 101 and 102 of current, two keys 103 and 104, the winding 25 of the type-wheel motor 15, and the windings of the forward drive magnet 86. The key 103 is adapted to make contact either with a terminal 105 leading from the source 101, or with a terminal 106 leading from the source 102, the two sources being such as to produce in the circuit 100 currents of opposite polarity according to which of the terminals is engaged by the key. The key 103 is in series with the key 104, which likewise is adapted to engage either of two terminals indicated at 107 and 108. The terminal 107 is in the main line of the circuit but the terminal 108 is in a branch circuit 109 which joins the main line between the terminal 107 and the first of the electromagnetic instrumentalities. The branch circuit 109 includes a resistance winding 110 by which the strength of the current in the main circuit may be reduced when the current is directed through the circuit 109.

The circuit 200 includes in series the windings of the magnet 44 which controls the type-guard, the windings of the reverse drive magnet 87, and the windings of the impression or platen magnet 38. This circuit also includes in series a key 111, a key 112, and a key 113 which may be cut out by the key 112. The circuit 200 receives its current from either of two sources 114 116 of opposite polarity, in local branch circuits having terminals 115 117 adapted to be engaged by the key 111. The key 112 is always in series with the key 111 and is adapted to engage either a terminal 118 or the terminal 119 of the other main circuit.

The terminal 118 is in series with the key 113 which is also adapted to engage either of two terminals indicated at 120 and 121. The terminal 120 is in a branch circuit 122

which includes a resistance winding 123 and which joins the main circuit between the terminal 119 and the first electromagnetic instrumentality on that line of the circuit. A supplementary or branch circuit 124 connects the terminal 121 and any suitable point of the winding 123.

Assuming that the keys have normal positions, as shown in Fig. 16, and that the type-wheel is at the unison point, the method of operating may be as hereinafter described. It will be noticed that the pole piece 46 is attracted toward the pole piece 52, the result of being excited by the source 114, and the cause of holding the type guard 41 under the numerical series of type 50 and exposing the alphabetical series 51. It will be noticed also, that the armatures 84 and 85 are nearer the magnet 86, although both that and the magnet 87 are excited by their respective sources of current. This position of the armatures is due to the advantage given to the magnet 86 by the spring 88 (see Fig. 8) and to the disadvantage of inserting the resistance 123 into circuit 200.

Suppose, for instance, it should be desired to print "ST 132", a term such as might be used to designate a stock quotation; in order to rotate the type-wheel in a forward direction so as to bring the letter S into printing position, it would be necessary to advance it eighteen spaces, but to rotate it in a reverse direction would require a movement of only eight spaces. The first desired operation then is to put the type-wheel shaft into the reverse gear. This is done by first moving the key 104 to the terminal 108 for the purpose of weakening the current in the magnet 86 by inserting the resistance 110. Then, by moving the switch 112 to and from the terminal 119, the circuit 200 receives an impulse of maximum current which causes the magnet 87 to attract its armature. This also causes the magnet 38 to attract its armature with the arm 40, and the rock-shaft 71 is moved to throw in the reverse gear 32. Incidentally, the platen 20 strikes the type-wheel and the tape is subsequently fed forward, but a false impression may be avoided by leaving a blank space in the series 50 at the unison point and covering the letter A by first moving the key 111 to the terminal 117 and keeping it there while the keys 104 and 112 are being actuated to put the type-wheel shaft in the reverse gear. After this is done, the key 104 is returned to the terminal 107 and the key 111 is returned to the terminal 115 thereby restoring the type guard to its normal position adjacent the type series 50.

The next step is to reverse eight times the polarity of the current which drives the type-motor. This is done by moving the key 103 back and forth between the terminals 105 and 106 making eight contacts in all, and advancing the motor shaft 23 eight steps. The type-wheel is also advanced in a reverse direction eight steps, bringing the letter S into printing position. The armature 84 is meanwhile attracted to the magnet 86 upon the restoration of the key 104 to the terminal 107, thereby placing the free ends of the rods 74 and 75 in position to effect a change to the forward gear upon the next movement of the arm 40. The latter is accomplished simultaneously with the printing of the letter S when the key 112 is momentarily moved to the terminal 119 to throw into the circuit 200 a current of sufficient strength to render the magnet 38 active. The letter T, one space in advance of the letter S, is then brought into printing position by shifting the switch 103 once, and is subsequently printed by once more moving the switch 112 to and from the terminal 119. If the type-wheel has a dot in the type series 50 opposite the letter A, it may be brought into potential printing position by advancing the type-wheel, still in the forward gear, seven spaces. Therefore, after shifting the key 103 seven times and the key 111 to the terminal 117, the tape may be advanced by again moving the switch 112 to the terminal 119 and back again. It will be remembered that the tape is fed forward after each impresion is struck by the platen. Inasmuch as the numerals, which are the next characters needed, are in the same series of type as the dot, the switch 111 is left in contact with the terminal 117. Assuming that the numerals 1, 3 and 2 are opposite B, D and C respectively, the type-wheel, still in the forward gear, is advanced one step by the shifting of the switch 103 and the impression of the first digit is secured by again moving the printing key 112 to and from the terminal 119. After another advance of two more steps of the type-wheel, the digit 3 is brought into printing position. Inasmuch as the digit 2 is the next preceding character, it will be desirable to have the type-wheel in the reverse gear after having printed the digit 3, so before printing the latter, the key 104 is moved to and held on the terminal 108 so as to insert the resistance 110 into the circuit 100. Subsequent contact of the terminal 119 by the printing key causes attraction of the armature 85 by reason of the weakened current in the circuit 100, with the result that, after the printing of the digit 3, the type-wheel is in the reverse gear. The key 104 is then restored to the terminal 107 to cut out the resistance 110, and a single shift of the key 103 places the last digit in printing postion. Since it is desired to leave the type-wheel at the unison point when through printing, and that can be made positive only when the wheel is in the forward gear, the key 104 is again held

on the terminal 108 while the key 112 is moved to cause the printing of the last character. After the printing, the type-wheel shaft is in the forward gear, and the key 113 is then held on the terminal 121, thus cutting out some of the resistance 123, but not enough to cause a movement of the printing armature 38. The current in the circuit 200 is now, however, strong enough to cause a movement of the armature 85 toward its magnet with the result that the shaft 82 is rocked to place the stop arm 92 in the path of the unison arm 94. With the key 113 still on the terminal 121, the key 103 is given a series of vibrations which cause rotation of the type-wheel shaft until the latter is arrested by contact of the arm 94 with the arm 92. By then placing the several keys in their normal positions, the entire system is restored to its initial state.

It will be understood that, instead of a single type-wheel employing two rows of characters, two type-wheels each bearing one row could be secured side by side upon the actuating shaft, and hence, when I refer to the element as a type-wheel, I mean thereby to include two type-wheels each bearing a row of characters. The characters in the series 51 of the type-wheel are the letters A to Z inclusive arranged in sequence. The characters in the series 50 consist of numerals, fractions, dots, or periods, and the letter S. These are arranged as follows:

| A | B | C | D | E | F | G | H | I | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| . | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | . | 1/8 |

| N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 7/8 | . | 1 | 2 | 3 | 5 | 0 | S |

This is a new arrangement of the characters and provides for a complete rotation of the type-wheel with a smaller number of impulses or pulsations in the electric circuit than where a greater number of characters are arranged in each row. Under the letters A, L and T, I have shown dots or decimal points. In lieu of any one of these, however, I may leave a blank space as for instance under the letter A.

I have herein illustrated and described the simplest form of circuit-controlling mechanism for supplying current for the actuation of the various electromagnetic mechanisms herein described, but I have invented and will illustrate and describe in a subsequent application an automatic key-controlled transmitting mechanism, by means of which the reversal of the type-wheel is effected automatically and the guard is shifted in one direction or the other automatically merely upon the depression of a key bearing the character which it is desired to print on the tape.

Having thus explained the nature of my said invention, and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made or all of the modes of its use, what I claim is:

1. In a type-writing machine, a rotary type wheel, a motor for rotating said wheel step by step an unlimited number of rotations in either direction, and power-transmitting mechanism between the motor and the type-wheel, controlled by type-keys and actuated by the motor, for rotating said type-wheel forward or backward from any point in the rotation of said wheel any number of steps to the next desired point, without returning the type-wheel to a neutral or zero position.

2. In a type-writing machine, a type-wheel, a motor, power-transmitting mechanism driven thereby to rotate said wheel an unlimited number of rotations in either direction, and means controlling said power-transmitting mechanism for effecting the reversal of rotation of said wheel at any point in its rotation and its reverse rotation an unlimited number of rotations.

3. In a type-writing machine, a type-wheel bearing one or more rows of characters to be printed, and mechanism comprising a rotary motor having a rotary driving element for rotating said wheel in one direction or the other through the shortest arc connecting any character in potential printing position with the character next to be printed.

4. In a type-writing machine, a type-wheel bearing upon its periphery a row of characters, a rotary motor having a rotary driving element for rotating said wheel, and means by which said motor is caused to rotate said wheel in either direction between any two characters to be printed.

5. In a type-writing machine, a type-wheel, a rotary motor having a rotary driving element, power-transmitting mechanism interposed between said motor and said type-wheel, and means by which said mechanism may be caused to reverse the rotation of said type-wheel, and rotate it between any two characters to be printed.

6. In a type-writing machine, a rotatable type wheel, a motor for rotating said type wheel and having a unidirectionally rotary driving shaft, and power-transmitting mechanism interposed between said shaft and said wheel for rotating said wheel alternately in opposite directions through the shortest arc between any two characters to be printed.

7. In a type-writing machine, a unidirectionally rotary driving shaft, a type wheel capable of rotation in either direction, between any two characters to be printed, a shaft therefor, and means by which said last-mentioned shaft may be rotated in one direction or the other by the driving shaft.

8. In a type-writing machine, a type wheel capable of rotation in either direction, a driving shaft, power-transmitting mechanism between said shaft and said wheel comprising elements for driving said wheel in opposite directions an unlimited number of rotations, and controlling means by which either of said elements is rendered active at any point in the rotation of the type-wheel without returning said wheel to zero or neutral position.

9. In a type-writing machine, a type wheel capable of rotation in either direction, between any two characters to be printed, key-controlled mechanism for rotating said type wheel an unlimited number of rotations, and key-controlled mechanism for causing the reversal of rotation of said type-wheel.

10. In a type-writing machine, a type wheel capable of rotation in either direction, an actuating motor having a unidirectionally rotatable driving shaft, and a key-controlled power-transmitting mechanism for transmitting power from said shaft to rotate said type wheel in either direction from any position to which it may be rotated.

11. In a type-writing machine, a rotatable type-wheel, an electric motor for imparting a step-by-step rotation to said type-wheel, an electromagnetic mechanism for controlling or varying the direction of rotation of said type-wheel, and mechanism actuated by said motor for rotating said type-wheel in either direction between any two characters to be printed.

12. In a type-writing machine, a rotatable type wheel bearing a row of characters to be printed, and key-controlled electromagnetic mechanisms for rotating said type wheel through the shortest arc in either direction to bring into printing position the next character to be printed, said mechanisms comprising a motor for rotating said type-wheel in either direction through an unlimited number of rotations.

13. In a machine of the character described, a rotatable type wheel, an electric motor, intervening gearing comprising a movable element for rotating said type wheel in either direction, and an electromagnet for shifting the said element to change the direction of rotation of said type-wheel.

14. In a machine of the character described, a type wheel capable of rotation in either direction, a shaft therefor, a driving shaft having a gear thereon, oppositely rotatable gears on the said type wheel shaft, and means by which said last-mentioned gears are alternately engaged with the gear on the driving shaft.

15. In a machine of the character described, a type wheel capable of rotation in either direction, a motor, means actuated by said motor by which said wheel may be rotated in opposite directions an unlimited number of rotations, a member for controlling the direction of rotation of said wheel, and mechanism for shifting said member to change the direction of rotation of said type wheel.

16. In a machine of the character described, a type wheel capable of rotation in either direction, mechanism for rotating said type wheel in opposite directions an unlimited number of rotations from any point in its rotation, a movable member which controls the direction of rotation of said wheel, an actuator for moving said member to change the direction of rotation of the type wheel at any point in its rotation, and electromagnetic mechanism for operating said actuator.

17. In a machine of the character described, a type wheel capable of rotation in either direction, mechanism for rotating said type wheel in opposite directions an unlimited number of rotations, a movable member which controls the direction of rotation of said wheel, an actuator for moving said member to change the direction of rotation of the type wheel at any point in the rotation of said type-wheel, and means intervening between the actuator and said member for determining the direction of movement of said member.

18. In a machine of the character described, a type wheel capable of rotation in either direction, mechanism for rotating said type wheel in opposite directions an unlimited number of rotations, a movable member which controls the direction of rotation of said wheel, an actuator for moving said member to change the direction of rotation of the type wheel at any point in its rotation, and selectively-controlled means by which said actuator is caused to move said member in one direction or the other.

19. In a machine of the character described, a type wheel capable of rotation in either direction, a member movable in one direction or the other to change the direction of rotation of said type wheel, a vibratory actuator, and separate means connected to said member and adapted to be alternately actuated by said actuator.

20. In a machine of the character described, a type-wheel capable of rotation in either direction, a member movable in one direction or the other to change the direction of rotation of said type-wheel, a vibratory actuator, oppositely-acting rods connected to said member, and means for interposing either of said rods at will in the path of said actuator.

21. In a machine of the character described, a type-wheel capable of rotation in either direction, a member movable in one direction or the other to change the direction of rotation of said type-wheel, a vibra-

tory arm having separate engaging portions, oppositely-acting rods connected to said member and adapted to separately engage said arm, means for operating said arm, and means for moving either of said rods at will into position to be engaged by the said arm and the other in a position not to be engaged by said arm.

22. In a machine of the character described, a type-wheel capable of unlimited rotation in either direction, a movable member for controlling the direction of rotation of said type-wheel, an electric circuit comprising a circuit closer and an electromagnet, and means controlled by said magnet for shifting said member to change the direction or rotation of said type-wheel at any point in its rotation without returning it to zero or neutral position.

23. In a machine of the character described, a type-wheel capable of unlimited rotation in either direction, a member movable in one direction or the other to change the direction of rotation of said type-wheel at any point in its rotation without returning it to zero position, an actuator for said member, and an electric circuit comprising an electromagnet for causing the operation of said actuator.

24. In a machine of the character described, a type wheel capable of rotation in either direction, a member movable in one direction or the other to change the direction of rotation of said type wheel, a vibratory actuator, an electric circuit comprising an electromagnet for causing the vibration of said actuator, and electromagnetic mechanism for causing said actuator to shift said member in one direction or the other.

25. In a machine of the character described, a type wheel capable of rotation in either direction, a shaft therefor, a sleeve slidable on said shaft and having gears thereon, a driving gear, a member for shifting said sleeve in one direction or the other to cause the alternate engagement of its gears with the driving gear, and operative connections between said actuator and said member.

26. In a machine of the character described, a type wheel capable of rotation in either direction, between any two characters to be printed, a movable platen, a member for varying the direction of rotation of said type wheel, and a single mechanism for actuating said member and said platen substantially simultaneously.

27. In a machine of the character described, a type wheel capable of rotation in either direction, a movable platen, a member for varying the direction of rotation of said type wheel, an actuator connected to said platen, and means by which said actuator may be caused to shift said member.

28. In a machine of the character described, a type wheel capable of rotation in either direction, a movable platen, a member for varying the direction of rotation of said type-wheel, a rock-shaft for moving said platen, an actuator connected to said rock-shaft, means for moving said actuator, and operative connections between the actuator and the said member.

29. In a machine of the character described, a type-carrier having a plurality of rows of types, a platen, means for effecting a relative impression stroke or movement of said type-wheel and platen, a guard extending longitudinally of the paper and having a thin end adapted to cover either row of said types, and means for shifting said guard to move its said end to uncover one or the other of said rows of types.

30. In a machine of the character described, a rotary type-carrier, mechanism for reversing the rotation of said type-carrier, an ink reservoir, an inking wheel vibratable between said reservoir and said type-carrier, and means, connected with the mechanism for reversing the rotation of the type-carrier, for moving the said inking wheel alternately from the reservoir to the type-wheel.

31. In a machine of the character described, a rotary type-carrier, mechanism for reversing the rotation of the type-carrier, an ink reservoir, an inking wheel vibratable between the type-carrier and the reservoir and rotatable by contact with the type-carrier, an arm supporting said wheel, and means connected with the type-carrier-reversing mechanism for oscillating said arm.

32. In a machine of the character described, a type wheel capable of rotation in either direction, means for changing the direction of rotation of the type wheel, an inking wheel, an ink reservoir, and mechanism controlled by said means for moving the inking wheel between the reservoir and the type wheel at prolonged intervals.

33. In a machine of the character described, a type wheel capable of rotation in either direction, a movable member which changes the direction of rotation of the type wheel, an actuator therefor, an electromagnet for operating said actuator, and a selecting mechanism for determining the direction of movement of said movable member, comprising electromagnets affected by a variation in the polarity of currents passed therethrough.

34. In a machine of the character described, a type wheel capable of rotation in either direction, a member by which the direction of rotation of said type wheel may be changed, an actuator therefor, an electromagnet which operates the actuator, and a selecting mechanism interposed between the actuator and the said member, comprising

electromagnets arranged in separate circuits, and means controlled by said electromagnets for controlling the movement of said actuator by the first-mentioned electromagnet.

35. In a machine of the character described, a type wheel rotatable in either direction, selecting mechanism for determining the direction of rotation of said type wheel, comprising two electric circuits, each including an electromagnet and a circuit closer, one of said circuits having a branch with resistance therein, and selectors controlled by said magnets.

36. In a machine of the character described, a type wheel rotatable in either direction, selecting mechanism for determining the direction of rotation of said type wheel, comprising two electric circuits, each including an electromagnet and a circuit closer, one of said circuits having a branch with resistance therein, selectors controlled by said magnets, a movable member for changing the direction of rotation of the type wheel, and an actuator for said member operating through said selectors.

37. In a machine of the character described, a type-wheel rotatable an unlimited number of rotations in either direction, a platen, an electromagnet which effects a relative printing stroke of the type-wheel and platen, electromagnets, mechanism operated by the last-mentioned electromagnets for selecting the direction of rotation of said type-wheel at any point in its rotation, and suitable electric circuits including said electromagnets.

38. In a machine of the character described, a type wheel rotatable in either direction, an electromotor for rotating said wheel, electromagnetic mechanism for determining the direction of rotation of said type wheel, and electromagnetic mechanism for changing the direction of rotation of said type wheel, at any given point in its rotation.

39. In a machine of the character described, a type wheel rotatable in either direction, an electromotor for rotating said wheel, electromagnetic mechanism for determining the direction of rotation of said type wheel, electromagnetic mechanism for changing the direction of rotation of said type wheel, and a platen operated by said last-mentioned mechanism.

40. In a machine of the character described, a type wheel normally rotatable in one direction but capable of rotation in a reverse direction, a motor for rotating said type wheel, a member for reversing the direction of rotation of said wheel, an electromagnetically operated actuator for said member, and a magnetically operated selector for connecting said member with said actuator.

41. In a machine of the character described, a type wheel normally rotatable in one direction but capable of rotation in a reverse direction, a motor for rotating said type wheel, a member for reversing the direction of rotation of said wheel, an electromagnetically operated actuator for said member, a magnetically operated selector for connecting said member with said actuator, and electric circuits including the electromagnets for the actuator and the selector and also comprising a circuit closer.

42. In a machine of the character described, a type wheel rotatable in either direction and having separate rows of types, a platen, a movable guard for covering the types of either row, a member for changing the direction of rotation of the said type-wheel, and an electric circuit comprising means controlled by variations in the strength of the current for operating said member, and, means controlled by a variation in the polarity of the current for operating said guard.

43. In a machine of the character described, a type wheel rotatable in either direction and having separate rows of types, a platen, a movable guard for covering the types of either row, a member for changing the direction of rotation of the said wheel, and an electric circuit comprising means controlled by variations in the strength of the current for operating said member, means controlled by a variation in the polarity of the current for operating said guard, and means controlled by variations of the current for operating said platen.

44. In a machine of the character described, a type carrier having a double row of types, a guard movable to render ineffective the types of either row, an electric coil, a core in the lines of force thereof and connected to said guard to operate it, said core having lateral poles, means for varying the polarity of a current through said coil, and permanent magnets of opposite polarity in proper relation to said poles of said core.

45. In a machine of the character described, a rotary type-wheel, a motor and power-transmitting mechanism for rotating said type-wheel an unlimited number of rotations in either direction, and a unison stop for checking the type-wheel in a zero or neutral position.

46. In a machine of the character described, a rotary type-wheel, a motor and power-transmitting mechanism for rotating said type-wheel an unlimited number of rotations in either direction, a movable stop, and means for operating said stop to position said type-wheel in a zero or neutral position.

47. In a machine of the character described, a rotary type-wheel, a motor and

power-transmitting mechanism for rotating said type-wheel an unlimited number of rotations in either direction, a unison stop rotatable with said wheel, a coacting movable stop normally in an inactive position, and means for operating said movable stop to engage said unison stop.

In testimony whereof I have affixed my signature, in presence of two witnesses.

ANDREW T. MacCOY.

Witnesses:
M. B. May,
C. F. Brown.