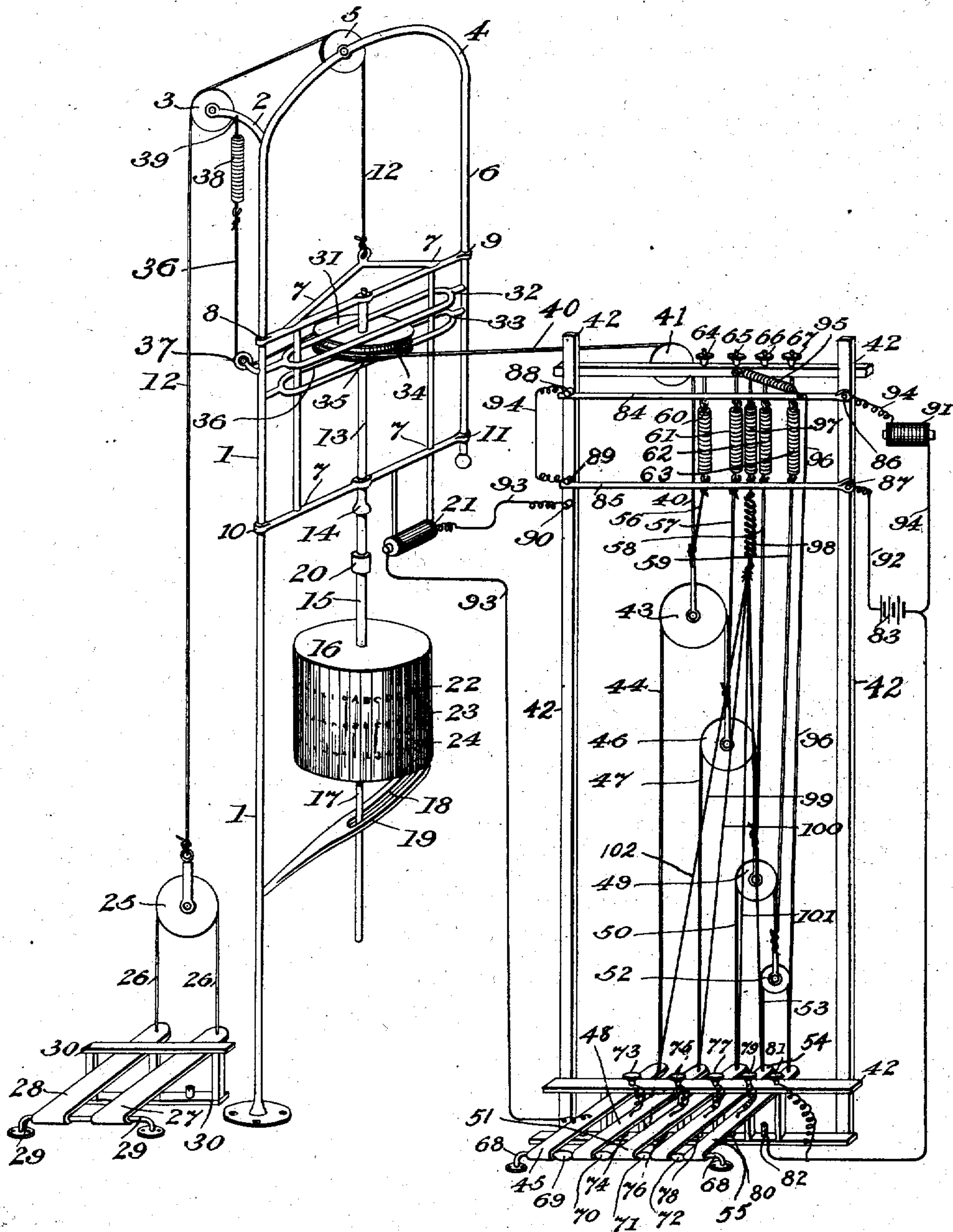


No. 723,567.

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J. D. WHITE.
TYPE WRITING MACHINE.
APPLICATION FILED FEB. 5, 1902.

NO MODEL.



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UNITED STATES PATENT OFFICE.

JAMES D. WHITE, OF LONDON, ENGLAND.

TYPE-WRITING MACHINE.

SPECIFICATION forming part of Letters Patent No. 723,567, dated March 24, 1903.

Application filed February 5, 1902. Serial No. 92,711. (No model.)

To all whom it may concern:

Be it known that I, JAMES DUNDAS WHITE, a British subject, residing at 66 Clanricarde Gardens, London, England, have invented
5 new and useful Improvements in Type-Writing Machines, of which the following is a specification.

My improvements relate to type-writing machines in which the types are on the periphery of a type-wheel; and the objects of my
10 improvements are, first, to provide a mechanism such that the results which are ordinarily obtained by the use of about thirty keys may be obtained by the use of five keys used
15 singly and in various combinations, and, second, to provide a mechanism in connection with the said keys of such a character that the printing and the spacing may be performed electrically. I attain these objects
20 by the various mechanical devices shown in the accompanying drawing, in which—

1 is a vertical upright rigidly set on the base-board. This upright branches at the top into the short arm 2, which carries on it the
25 wheel or sheave 3, and into a long arm 4, which carries on it the wheel or sheave 5 and is continued downward in the part 6, which is parallel to the upright 1. In the loop thus formed is the frame 7, which is fitted on the
30 upright 1 and the part 6 by means of lugs 8, 9, 10, and 11 in such a way that 11 can be lifted or lowered by means of the line 12, but so that it cannot move otherwise than vertically. Fitted to the frame 7, so that it is
35 lifted and lowered therewith and can revolve freely therein, is the shaft 13, to the lower end of which, by a universal joint 14, is fitted another shaft 15, to which is rigidly fitted the type-wheel 16 and of which the end or tail-
40 piece 17 projects downward and through the slot 18 in the arm 19, which is rigid with and projects from the upright 1. On the shaft 15 is also fitted the circular armature 20, opposite which and carried by the frame 7 is
45 the electromagnet 21, which when energized attracts the armature 20, and so causes the shaft 15 to move and the type-wheel 16 to strike against the paper on the paper-carrier, (which is not shown in the drawing,) thereby
50 by means of an interposed printing-ribbon or other device operating printing. Accuracy of movement is secured by the fact that the

tailpiece 17 can move only along the slot 18, and this tailpiece 17 is of such a length that it will engage in the slot 18, whichever be the
55 height to which the frame 7 and the fittings dependent on it are raised. The type-wheel or type-cylinder 18 has, preferably, thirty-two faces and around the faces are three rows of type, of which the upper one, 22, contains
60 principally the capital letters, the middle one, 23, the corresponding small letters, and the lower one, 24, the figures and the fractions. The height of the type-wheel 16, as of the tailpiece 17 and of the other fittings depend-
65 ent on the frame 7, depends on the height of the frame 7, which, as already said, is regulated by means of the line 12. This line is carried over the wheel 5, thence over the wheel 3 in a downward direction, and it has at its lower
70 end the block or pulley 25, through which is rove the line 26, of which one end is attached to the key 27 and the other to the key 28. These keys are fitted on a pivot 29. Their movement is guided by a framework 30, and
75 their ranges of movement, as well as the other mechanics, are so proportioned that when both are up in the normal position the height of the frame 7 and of the type-wheel 16 is such that the row of type 22 is at what may
80 be called the "printing-level," that the depressing of the key 27 raises them, so as to bring the row of type 23 to the printing-level, and that the depressing of the key 28 raises them higher, so as to bring the row of type 24
85 to the printing-level.

Whichever row is at the printing-level, the question of which particular character of the row is printed depends on which side of the type-wheel is opposite the paper, and this,
90 again, depends on the extent to which the type-wheel 16 and the shafts 15 and 13 have been rotated. That movement is controlled thus: On the shaft 13 so fitted that the two must revolve together but that the shaft move up
95 and down through it, is a disk or wheel 31, which is kept at a constant level by the guides 32 and 33, which are rigid with the upright 1 and with the part 6 thereof and between which the disk 31 is set. The proportions are
100 such that the rotation of the disk 31 at its constant level causes a similar rotation of the shafts 13 and 15 and the type-wheel 16 at whichever of the three heights the frame 7

may be. The disk 31 has around its periphery two grooves 34 and 35. Attached to the disk 31 and passing around the groove 34 is the line 36, which is led around the wheel 37 (fitted to the upright 1) and thence to the spring 38, which is fitted to the short arm 2 at 39, the object of this arrangement being to cause the disk 31 to revolve back again, when the contrary tension, presently to be described, is relaxed. This contrary tension is effected by means of the non-elastic line 40, which is also attached to the disk 31 and is led in the direction opposite to that of the line 36 along the groove 35 and thence over the wheel 41. The fittings are such that by drawing out the line 40 the disk 31, the shafts 13 and 15, and the type-wheel 16 may be rotated to the extent of a complete revolution or any part thereof, the degree of the revolution depending upon the degree to which the line 40 is drawn out.

The line 40, as already said, passes over the wheel 41 on the framework 42 and is led downward, having at its lower end the block or pulley 43. Through this is rove the line 44, of which one end is made fast to the key 45, while the other end carries the pulley 46. Through this is rove the line 47, of which one end is made fast to the key 48, while the other end carries the pulley 49. Through this is rove the line 50, of which one end is made fast to the key 51, while the other end carries the pulley 52. Through this is rove the line 53, of which one end is made fast to the key 54 and the other to the key 55. The keys 45, 48, 51, and 54 have all the same range of movement and when depressed draw down their respective lines to similar extents. The key 55 has half that range of movement, so that the depressing of it has half the effect of the depressing of the key 54. The ends of the lines are attached to their respective keys by adjustable screws, and the stops (presently to be described) which restrict the movement of the keys are also adjustable screws. The lines 40, 44, 47, 50, and 53, as well as the lines 36, 12, and 26, are preferably of watchmakers' chain. The general arrangement already described is such that the five keys 45, 48, 51, 54, and 55 when depressed successively draw out the line 40 in proportions which are in geometrical progression. Thus if the extent to which the depressing of the key 45 draws out the line 40 be represented by the number "16" the similar action of the key 48 will be represented by the number "8," that of key 51 by the number "4," and those of the keys 54 and 55 by the numbers "2" and "1," respectively. It has been said that the drawing out of the line 40 by rotating the disk 31 and the shafts 13 and 15 rotates the type-wheel 16, which has preferably thirty-two faces. The various parts are so proportioned that normally the type-wheel has one of its faces (which face is blank) opposite the paper, while the depressing of the various keys singly or in combina-

tions rotates the type-wheel so as to bring the various faces into that position. Thus the key 55 when used alone brings around what may be called the "first" face, the key 54 brings around what may be called the "second" face, the key 51 the "fourth" face, the key 48 the "eighth" face, and the key 45 the "sixteenth" face. The intermediate faces, as well as the faces from the seventeenth to the thirty-first, inclusive, are brought around by the combined movements of the various keys. Thus, for instance, the combined movement of keys 55 and 54 brings around the third face, that of the keys 54 and 51 the sixth face, that of the keys 54, 51, and 58 the fourteenth face, while the combined movement of all the keys 55, 54, 51, 48, and 45 brings around the thirty-first face. The keys and combinations of keys are assimilated to the characters on the type-wheel in some convenient order. To assist the operator, the five keys may be enameled in five different colors—as, for instance, red, white, blue, green, and yellow—and there may be fitted on the base-board a dial setting out in order the various letters and other characters and indicating the corresponding keys or combinations of keys by bands of the corresponding color or colors. Each key or combination of keys will of course correspond to three different characters—as, for instance, to a small letter, the corresponding capital letter, and a figure—and which of these it makes will depend on which row of characters 22, 23, or 24 is at the printing-level, which, as already said, is regulated by the keys 27 and 28. Of the thirty-two faces of the type-wheel it has been already said that the one which is normally opposite the paper is blank. There is also another blank one, that corresponding to the key which when used alone is intended to effect spacing without printing. How this is done will be described presently. In the drawing the key which is so used is the key 55, which brings opposite the paper what has been called the "first" face, and therefore that face, as well as the face which is normally opposite the paper, is blank. Excluding these two blank faces it will be seen that there are thirty faces, and as each has three rows of type there may be ninety different characters.

In order to relieve the line 40 of the weight of the pulleys, lines, and keys, the pulleys 43, 46, 49, and 52, besides the attachments already mentioned, are suspended from the framework 42 by the lines 56, 57, 58, and 59, respectively. These lines are close to and parallel to the lines which form part of the pulley system, though in the drawing in order the better to distinguish them they are drawn as slightly angling to the others. They are made elastic by the insertion in them of the springs 60, 61, 62, and 63, respectively, these springs being sufficiently stiff to sustain the pulley system, but sufficiently soft to yield when the keys are depressed. The lines

are made fast to the framework 42 by the screws 64, 65, 66, and 67, respectively, each of these being adjustable, so that the pressure required for each key may be regulated thereby. These supporting-lines do not, of course, interfere with the operation of the pulley system, their object being merely to neutralize the weight of the pulleys and the other parts.

The electrical arrangements may now be described. The keys 45, 48, 51, 54, and 55, which are preferably pivoted from the ends next the operator, are electrical conductors pivoted on the rod 68, which is at right angles to them. This rod is a non-conductor of electricity, and on it between the keys, so as to keep these apart, are beads 69, 70, 71, and 72, which are also non-conductors. The other ends of the keys are guided by the lower part of the framework 42, which is also a non-conductor and is so designed as to prevent them from moving laterally and to insulate each from the next. They are, however, free to move vertically within the limits already described, which limits are set to each key by the stops above and below it—that is to say, the movement of key 45 is restricted by the stops 73 and 74, that of the key 48 by the stops 75 and 76, that of the key 61 by the stops 77 and 78, that of the key 54 by the stops 79 and 80, and that of the key 55 by the stops 81 and 82. These various stops, which are adjustable screws, are conductors of electricity and make contact with their respective keys when the latter press against them. The circuit is made through series as follows: The stops opposite the key 45 are connected to the key 48, those opposite the key 48 are connected to the key 61, those opposite the key 51 are connected to the key 54, those opposite the key 54 are connected to the key 55, and these stops opposite the key 55 are connected together and to one pole of the battery 83. This order may of course be reversed, or any other order may be adopted; but the essential feature of the system is that the circuit through the keys and stops is closed only when every key is pressing against one or other of its stops and is open so long as any key is in the intermediate position. The object of this arrangement is to secure that when a combination of keys is used the circuit will not be closed till all are pressed home. This is secured even though the manual synchronism is imperfect, all the synchronism required being that in any combined movement the lagging key should have started before the leading key has stopped.

The following arrangement is adopted to close what may be called the "printing-circuit" as often as the keys are operated, so as to bring a character into the required position, and to close what may be called the "spacing-circuit" as often as the keys revert to the normal position, provision being made so that the depressing of the key 55 singly does not close the printing-circuit, though the

reverting of it to the normal position closes the spacing-circuit. Above and across the row of keys and fitted on the non-conducting framework 42 are two arms 84 and 85, which are electric conductors. These are pivoted to the framework 42 at the points 86 and 87, respectively, so that they can be moved vertically at the end opposite the pivot. The upward movement of the arm 84 is restricted by the stop 88, which is an electric conductor and makes contact with the arm 84 when the latter presses against it. The upward and the downward movements of the arm 85 are restricted by the stops 89 and 90, respectively, both of which are electric conductors, and the arm 85 makes contact with whichever of them it presses against. One pole of the battery 83 is connected to the arm 85. The stop 90 is connected with the electromagnet 21, (which operates printing,) and thence to the key 45, whence the circuit is led through the series of keys and stops, as described, to the other pole of the battery. This forms the printing-circuit. The spacing-circuit is formed as follows: The stop 89 is connected to the stop 88, the arm 84 is connected with the electromagnet 91, (which operates spacing,) and thence, like the printing-circuit, to the battery 83. The electromagnet 91 controls a mechanism (not shown in the drawings) in such a way that, as seen, as the magnet is energized the paper-carriage is caused or permitted to move one space on from right to left. Both this particular mechanism and the general mechanism of the paper-carriage may be of either of several well-known patterns, and it is only necessary to mention them here in order to indicate what is effected by the closing of the spacing-circuit. In order more clearly to indicate the course of the circuits, the connecting-wire which is common to both is marked 92, while those peculiar to the printing-circuit are marked 93, and those peculiar to the spacing-circuit are marked 94.

The arms 84 and 85 are suspended from the framework 42 and connected with the keys, as follows: The arm 84 is normally kept up by a spring 95, which makes it press against the stop 88, and is also connected by the line 96 with the key 55, as that the depressing of that key draws down the arm 84 and breaks circuit at 88, the circuit being closed again there as often as the return of the key permits the arm 84 to return to the stop 88. The arm 85 is normally kept up by the spring 97, and attached to its lower side is the spring 98, from the lower end of which the lines 99, 100, 101, and 102 are led to the keys 45, 48, 51, and 54, respectively. These lines are so proportioned as to be about equally tight when the keys are in normal position, but so that the depression of any of these keys by drawing down the corresponding line or lines draws down the arm 85, thus breaking contact at 89 and making contact at 90, while the releasing of the key or keys permits the arm 85 to return to the normal position, thus

breaking contact at 90 and making contact at 89. The spring 98 is stiffer than the spring 87, so that the first effect of depressing the key or keys is to stretch the spring 97 till the arm 85 comes into contact with the stop 90, while the spring 98 yields to any further movement of the key or keys. These lines between the arms and the keys are either behind or in front of the other moving parts. They do not interfere with the working of those, and the springs in them are not sufficiently stiff to effect materially the operation of the keys.

Taking the circuits as a whole, the results are as follows: When all the keys are in normal position, the spacing-circuit (through 92 and 93) remains closed. When the key 55 is depressed singly, that spacing-circuit is broken at 88; but the printing-circuit is not closed, and as soon as the key is released it reverts to its normal position, thereby closing the spacing-circuit and operating spacing without printing; but when any of the other four keys 45, 48, 51, or 54 is depressed (whether singly or in combination and whether or not the combination includes the key 55) the spacing-circuit (through 92 and 93) is broken at 89 and the printing-circuit (through 92 and 94) is closed at 90, to be closed also through the series of keys and stops (thereby being completed) as soon as the key is or all the keys of the combination are pressed home, while as soon as the key or keys are released that printing-circuit is broken, and the spacing-circuit is closed again as soon as the key or keys revert to the normal position, thus operating printing of the character which the key or combination of keys has brought around, followed by spacing. In order to avoid exhausting the battery, a switch may be fitted, so that the spacing-circuit may be left open when the machine is not in use.

I have described and shown this invention with special reference to a type-writing machine having five keys to operate the rotation of the type-wheel; but the invention is not limited to one having that particular number of keys. The series of keys may be more or fewer in number, the series of pulleys and lines being correspondingly varied and the type-wheel being constructed to suit the arrangement adopted.

I have described the system of moving pulleys as being of such a character that the number of pulleys is less by one than the number of the keys, the line rove through the last pulley of the series being connected to the two last keys; but as an alternative arrangement there may be as many pulleys as keys, the system being the same as that described, except that the line which is connected with the last key but one instead of having its other end connected with the last key has its other end connected with a pulley through which is rove another line, of which one end is made fast to the last key and the other to

the fixed framework. In this variation the last key has the same range of movement as the others.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. A type-writing machine comprising a support, a type-wheel supported thereby and capable of vertical, rotary and swinging movement, a plurality of keys, a system of lines and pulleys connecting said keys with said type-wheel and giving rotary movement thereto, a plurality of supplemental keys, a plurality of lines and pulleys connecting said supplemental keys with said type-wheel and giving vertical movement thereto, and an armature secured to a swinging rod of said type-wheel, an electromagnet secured to said frame adjacent to said armature, electrical circuits connecting said electromagnet with said first-mentioned keys, and means for opening and closing said circuits and thereby giving swinging movement to said type-wheel, substantially as shown and described.

2. In a type-writing machine, a support, a frame vertically movable in said support, a type-wheel suspended to said frame, a plurality of circumferential rows of characters on said type-wheel, a plurality of keys, a plurality of lines and pulleys connecting said frame to said keys, each or all of said keys being adapted to impart different degrees of vertical movement to said frame and said type-wheel, substantially as shown and described.

3. In a type-writing machine, a support, a vertically-movable frame in said support, a rod pivotally suspended from said frame, a guide at the lower end of said rod and limiting the movement thereof, a type-wheel mounted on said rod above said guide, an armature secured to said rod above said type-wheel, an electromagnet mounted on said support adjacent to said armature and adapted to operate therewith, a plurality of keys, a plurality of open electrical circuits connecting said keys with said electromagnet, each or all of said keys being adapted to close the corresponding or all of said circuits and attract said armature, and means for turning the type-wheel substantially as shown and described.

4. In a type-writing machine, a support, a vertically-movable frame in said support, a rod provided with a double-grooved wheel rotatably mounted on said frame, a type-wheel pivotally suspended from said rod and rotatable therewith, a supplemental support adjacent to said first-mentioned support, a pulley mounted on said supplemental support, a line passing thereover one end thereof passing around and being secured in one groove of said grooved wheel, a pulley suspended from the other end of said line, a plurality of keys mounted in said supplemental support, a plurality of supplemental pulleys, a line passing through each of said last-named pulley and supplemental pulleys one end of each

of said lines being secured to a corresponding one of said keys, the other end of each of said lines serving as a support for the succeeding one of said supplemental pulleys, a line passing through the last or lowest one of said supplemental pulleys, one end thereof being secured to the last of said keys and the other end thereof being secured to the next before the last of said keys the operation of one or more than one of said keys thereby imparting determinate degrees of rotation of said type-wheel, and means for returning said type-wheel to its normal position consisting of a spring-operated line secured at one end in the other groove of said grooved wheel the other end thereof being secured to said first-named support, substantially as shown and described.

5. In a type-writing machine, a pivotally-supported type-wheel, means for giving vertical movement to said type-wheel, an armature on the swinging support of said type-wheel, an electromagnet adjacent to said armature and adapted to operate therewith, a plurality of keys connected with said type-wheel by a system of lines and pulleys, said lines and pulleys giving rotary movement to said type-wheel, spacing devices for said

machine, consisting of spring-operated arms composed of conductive material pivoted above said keys, lines connecting each of said keys with the lower one of said arms, permanent and operative contacts for said lower arm at the outer end thereof, an electrical conductor connecting said operative contact, electromagnet and keys with a battery and the pivoted end of said lower arm, a supplemental electrical circuit connecting said permanent contact of said lower arm to the upper of said arms with a supplemental electromagnet in connection with the carriage of said machine and with said battery, the operation of said keys closing said first-named circuit and opening said supplemental circuit and the releasing of said keys closing said supplemental circuit and opening said first-named circuit, substantially as shown and described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

J. D. WHITE.

Witnesses:

JAMES A. S. BARRETT,
ELIZA A. KILBY.