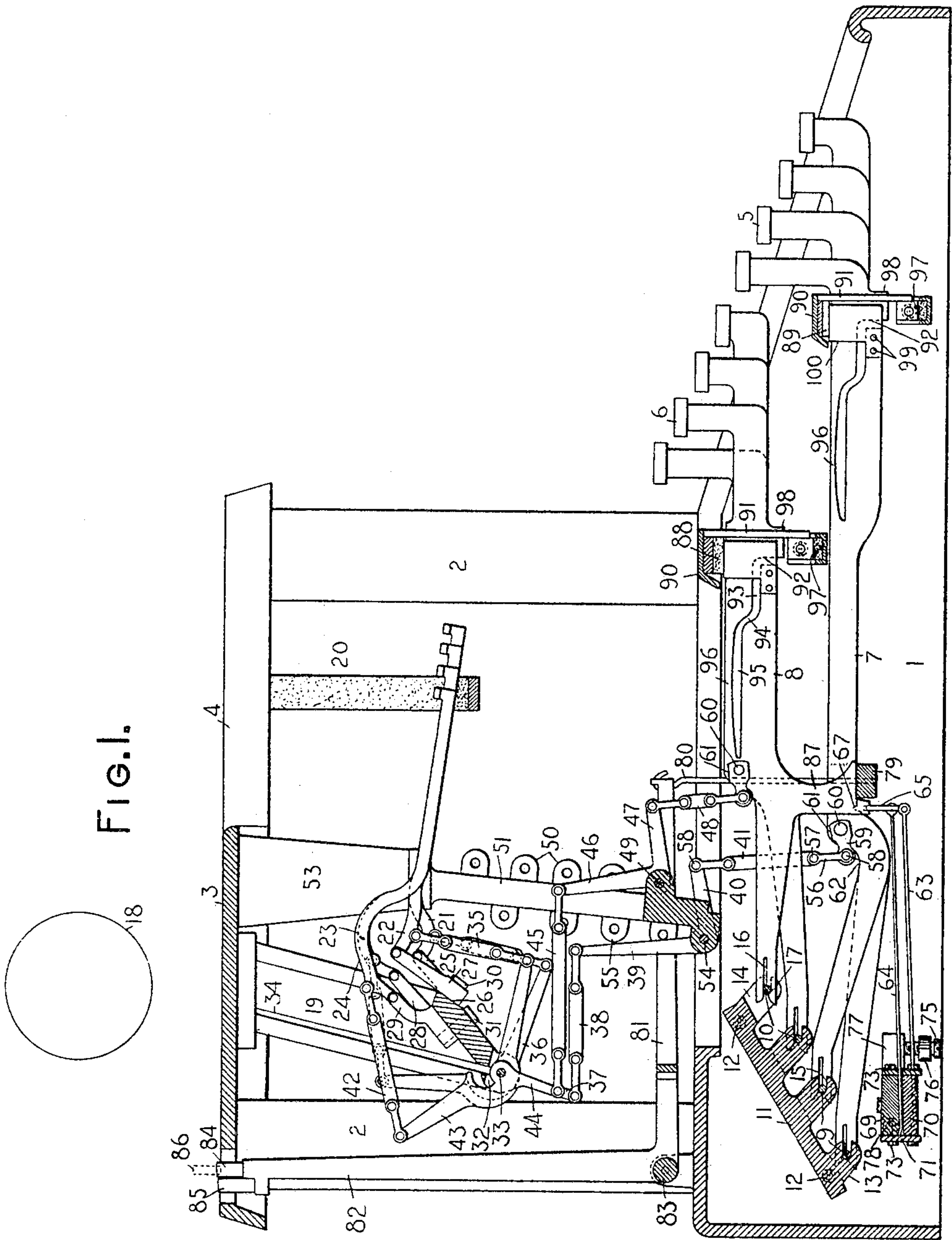


No. 799,121.

PATENTED SEPT. 12, 1905.

G. B. WEBB.
TYPE WRITING MACHINE.
APPLICATION FILED JUNE 28, 1901.

4 SHEETS—SHEET 1.



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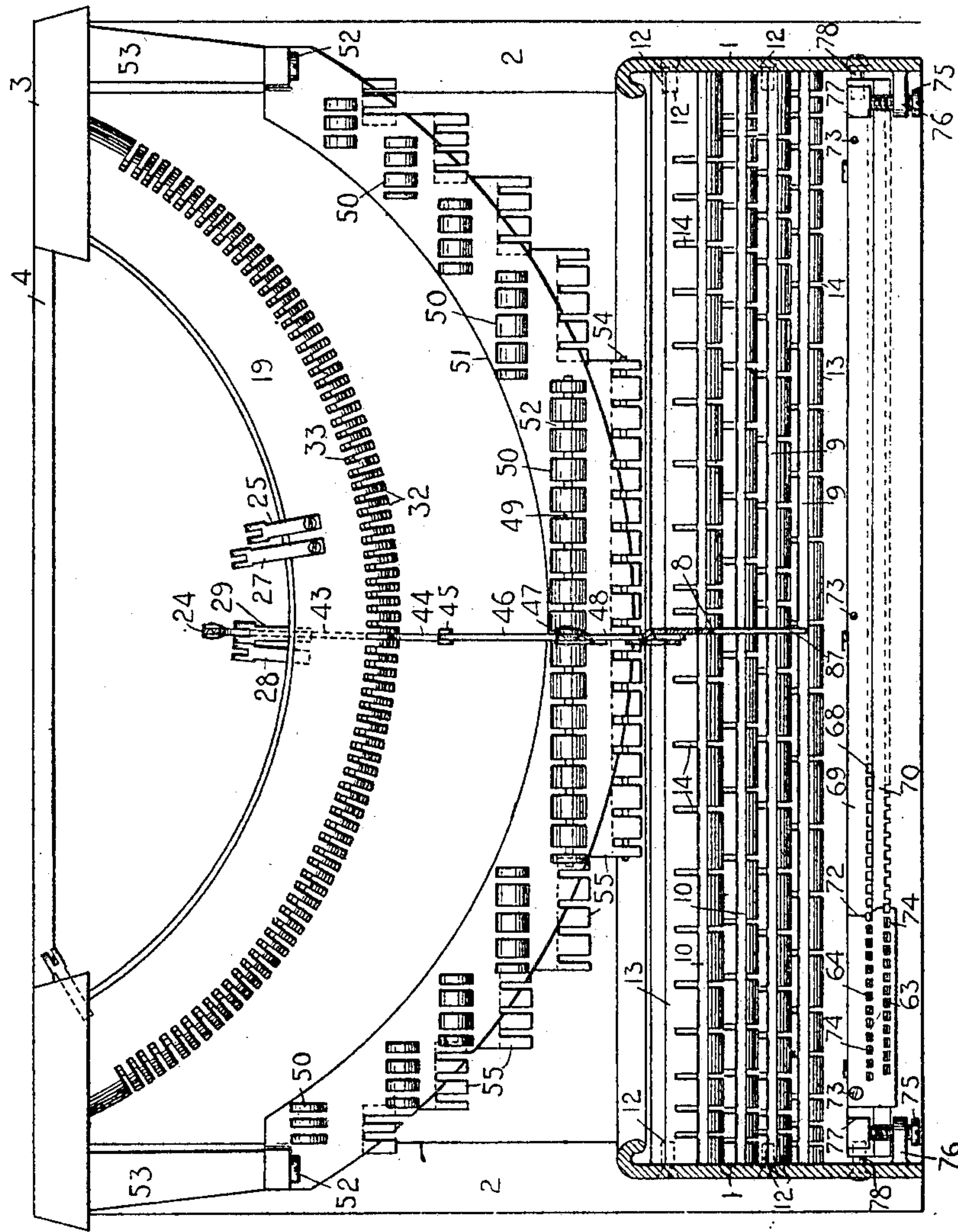
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4 SHEETS—SHEET 2.

FIG. 2.



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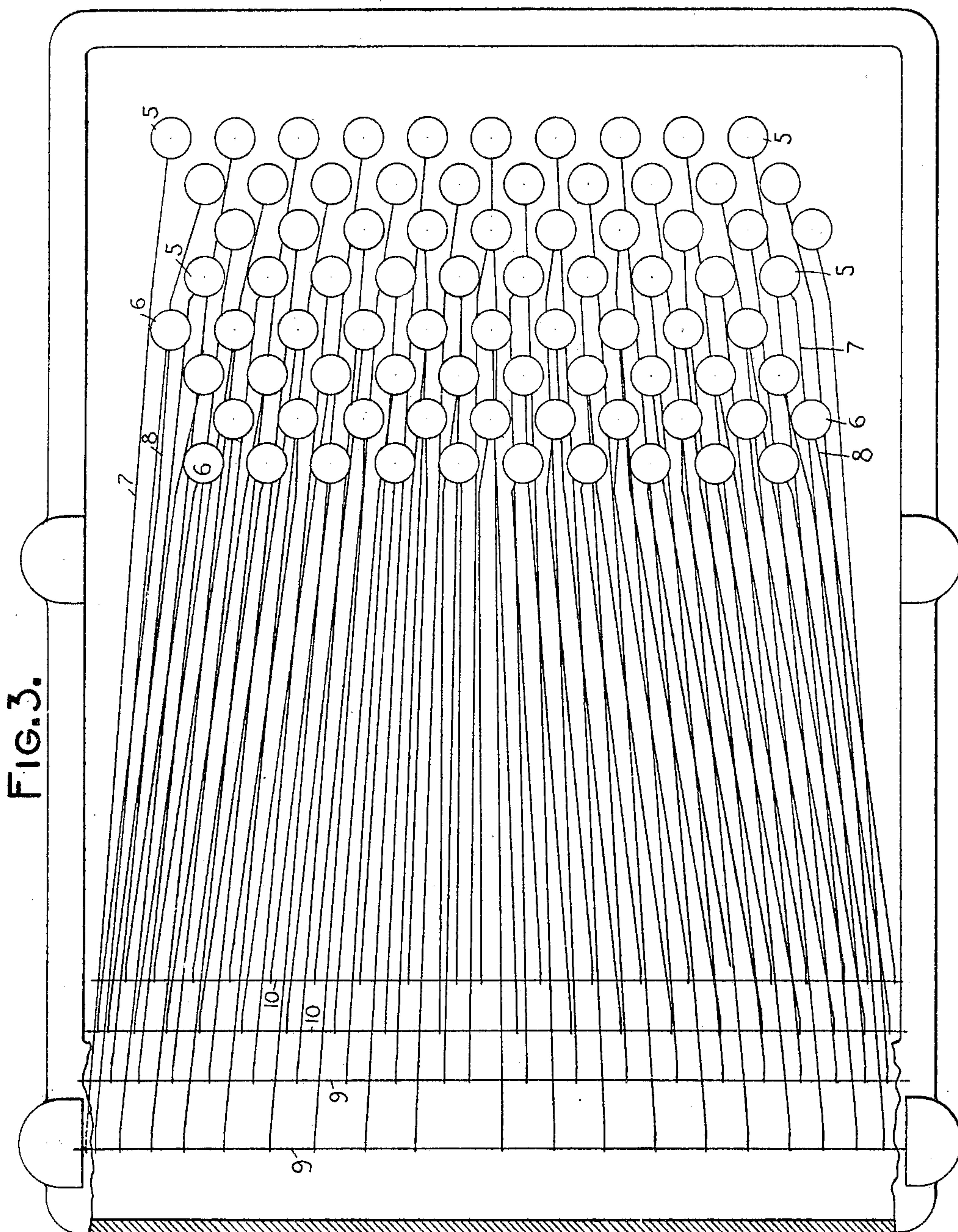
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4 SHEETS—SHEET 4.

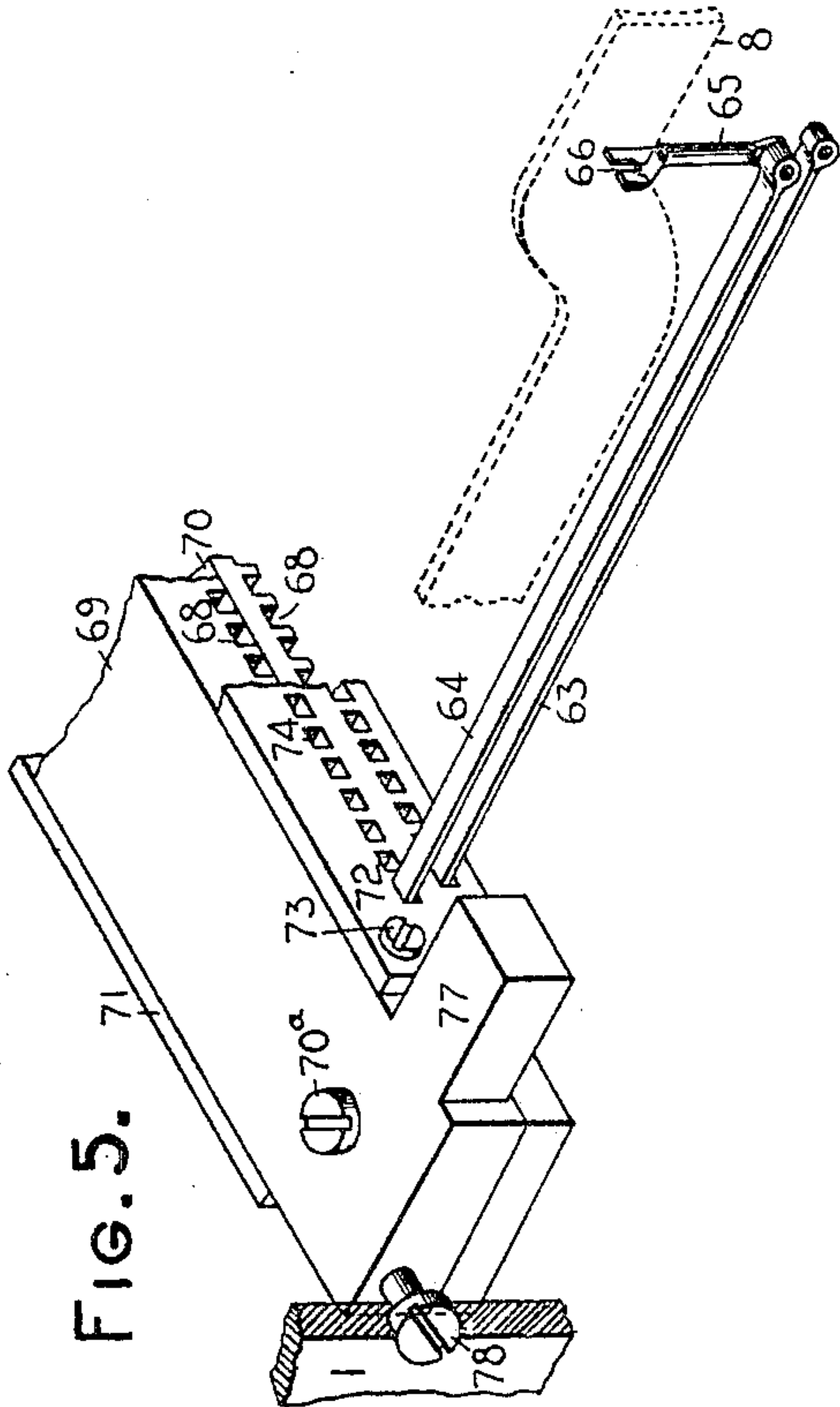


FIG. 5.

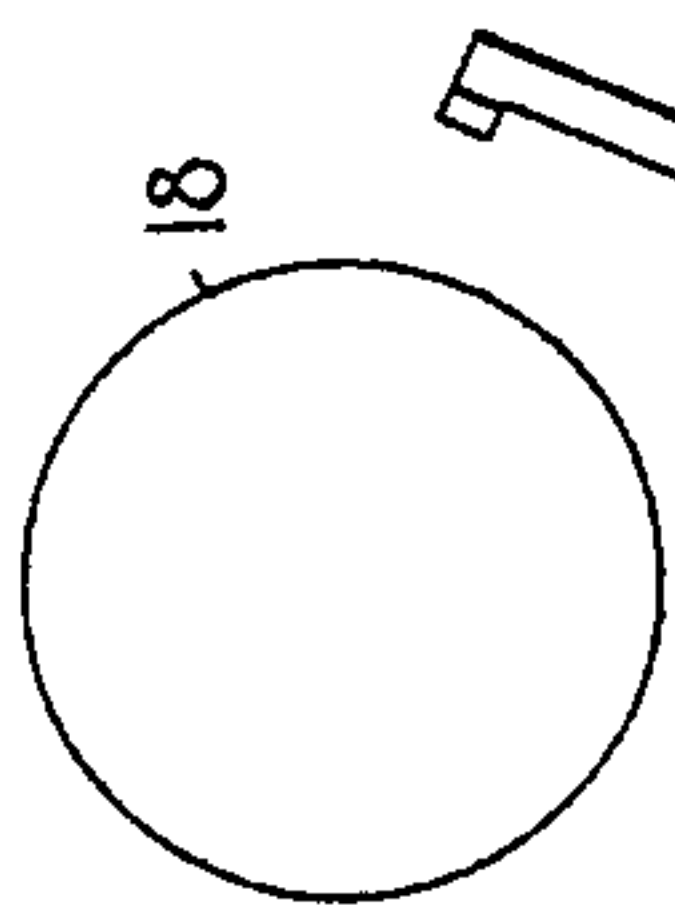
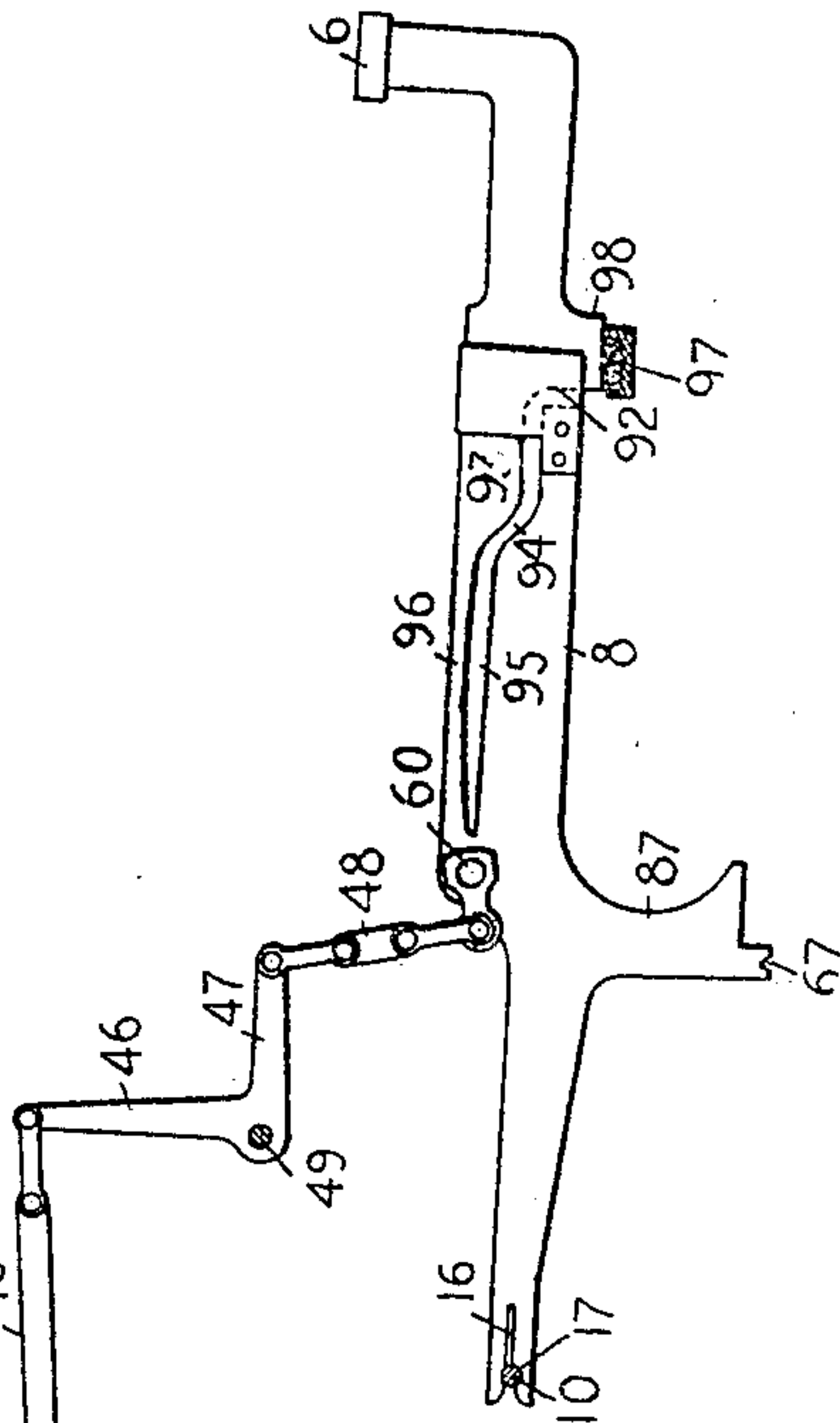
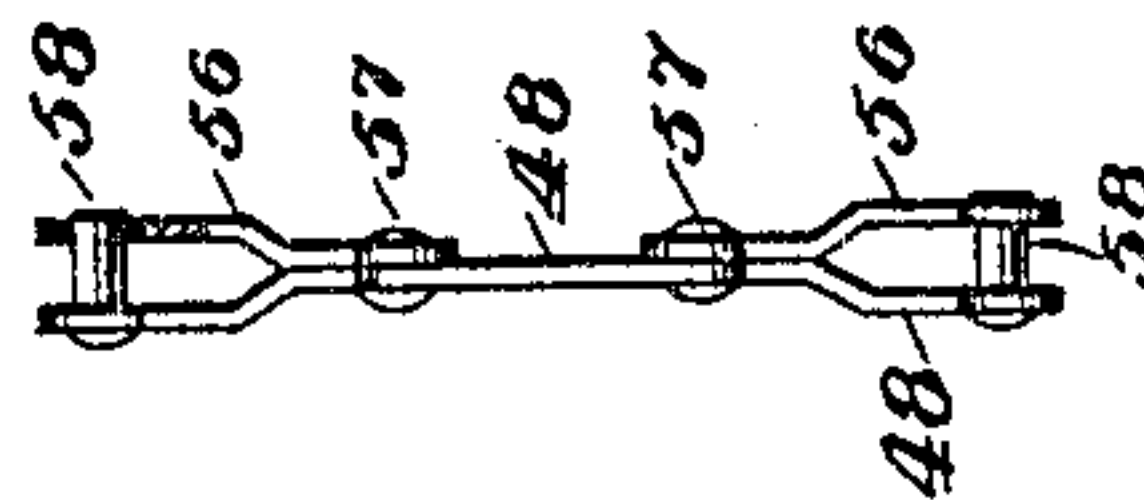


FIG. 4.

Fig. 6.



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UNITED STATES PATENT OFFICE.

GEORGE B. WEBB, OF WESTFIELD, NEW JERSEY, ASSIGNOR TO WYCKOFF, SEAMANS & BENEDICT, OF ILION, NEW YORK, A CORPORATION OF NEW YORK.

TYPE-WRITING MACHINE.

No. 799,121.

Specification of Letters Patent.

Patented Sept. 12, 1905.

Application filed June 28, 1901. Serial No. 66,361.

To all whom it may concern:

Be it known that I, GEORGE B. WEBB, a citizen of the United States, and a resident of Westfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Type-Writing Machines, of which the following is a specification.

This invention relates primarily to the type-actions of front-strike writing-machines; and its main objects are to assemble a large number of rearwardly-striking type-bars compactly below the printing-point with wide bearings or hangers, so that they may be guided accurately to the printing-point; to improve the arrangement and construction of the connections between the keys and the type-bars; to provide improved means for adjusting the key-levers; to improve the mounting of the key-levers; to provide for the convenient detachment of the links employed in the type-actions; to provide improved spring mechanism for returning the key-levers and type-bars, and to render the touch of the keys more agreeable and to insure the prompt rebound of the types from the paper, so as to avoid blurring of the impressions.

Other objects will hereinafter appear.

My invention consists in certain combinations of devices, features of construction, and arrangements of parts, all as will be hereinafter fully set forth, and particularly pointed out in the concluding claims.

In the accompanying drawings, Figure 1 is a central vertical section taken longitudinally of a front-strike writing-machine constructed in accordance with my improvements, the parts being shown in normal position. Fig. 2 is a front sectional elevation of the machine, taken just forwardly of the system of type-bar connections. Fig. 3 is a diagrammatic plan of the key-lever system. Fig. 4 shows the position of a type-action when the key is arrested and just before the impression is made. Fig. 5 is a perspective view of a fragment of a key-lever-returning spring mechanism. Fig. 6 is a detailed edge view of one of the connecting-links.

In the several views portions are omitted or broken away to disclose the invention more clearly, and similar parts are designated by similar numerals of reference.

The framework of the machine comprises a base 1, upon which are erected corner-posts

2, supporting a top plate 3, which is provided with an opening 4 for the passage of the types. The machine is of the full-keyboard type and is provided with four lower banks of keys 5 for lower-case letters and figures and four upper banks 6 for capital letters and other characters. The keys are carried upon the forward ends of rearwardly-extending levers, which are fulcrumed at their rear ends and arranged in two tiers, those in the lower tier bearing the forward keys 5 and being designated as 7 and those in the upper tier bearing the rear keys 6 and being designated as 8. The lower key-levers 7 project rearwardly beyond the ends of the upper key-levers 8 and are fulcrumed upon two transverse rods 9, arranged one above the other, while the key-levers 8 are fulcrumed upon two similarly-arranged rods 10. The several rods are mounted upon an inclined plate or bar 11, which extends across the base and is secured at each end to the side walls thereof by screws 12, said plate being provided with four forwardly and downwardly projecting longitudinal bearings or ridges 13, which are vertically slotted at 14 for receiving the rear ends of the key-levers and are also provided with horizontal grooves 15 for receiving the fulcrum-rods 9 and 10. The latter, it will be seen, are arranged in forwardly-ascending series, the lower and rearmost rod 9 bearing the key-levers for the two forward banks of keys, the next rod serving for the next two banks of keys, and so on. The fulcrum end of each lever is cleft at 16, so as to enable the lever to be sprung upon the rod, a notch 17 being formed in the cleft portion of the lever for engaging the lower side of the rod.

The type-bars are pivotally supported below the platen 18 by means of separate hangers fastened upon a downwardly and rearwardly inclined segment 19, the latter being secured at its ends to the under side of the top plate 3. The type-bars strike upon the platen at a point a little below the level of the platen-axis. The purpose of arranging the type-bar pivots in a rearwardly-inclined arc is to enable the type-bars at the sides of the system to drop more freely back to normal positions after actuation than is the case where the type-bars are pivoted in an arc lying in a vertical plane, as usual heretofore. In other words, the fact that the pivots of the type-bars are mounted in a rearwardly-extending inclined

plane results in the pivots extending back of the front face of the platen or in the rear of a vertical plane that extends through the point of impact of the types on the platen, so that the type-bars do not extend vertically over their pivots when they (the type-bars) are in the printing positions and the force of gravity therefore enhances the rapid retrograde movement of each type-bar from the printing position.

The type-bars are disposed side by side in four rows or sets, their types accordingly lying in four curved rows in the type-basket 20. The type-bars in the forward set are designated as 21, those in the next set as 22, those in the next as 23, and those in the rear set as 24. The bars 21 are pivoted on forked hangers 25, which are attached to a beveled face 26, formed upon the front edge of the segment 19. These type-bars are somewhat longer than those in the other sets, and their pivots are more remote from the printing-point. The type-bars 22 are pivoted in hangers 27, attached upon the same segmental face 26, the pivotal points of these hangers being above the pivots of the type-bars 21 or between the latter and the platen, so that the types upon the forward ends of the type-bars 21 and 22 may lie in alternating or staggering arrangement. The type-bars 23 are pivoted upon hangers 28, secured upon the upper curved surface of the segment and are of about the same length as the type-bars 22, but are pivoted in rear thereof, so as to secure clearance at their type ends. The type-bars 24 are mounted upon hangers 29, fastened upon the same upper surface of the segment and are pivoted in rear of the type-bars 23. It will be seen that by pivoting the type-bars in four sets in the described manner a clearance is afforded not only at the type ends of the bars, but also at the hub ends thereof, thus enabling wide hangers or long pivots to be used, so as to permit free vibration of the type-bars to the printing-point without liability of lateral play. It will be understood that by giving the hangers an overlapping arrangement the desired length of pivots may be secured. The forward hangers 25 and 27 may be attached by screws 30, passing through the bases of the hangers and tapped into the segment, while the rear hangers 28 and 29 may be attached by screws 31, passing through the segment from the front and tapped into the bases of the hangers. Thus the heads of all of the screws are at the front of the segment, making it convenient to attach or adjust the hangers. The shanks of the forward set of type-bars 21 are curved downwardly near their hub ends, so as to enable them to clear the upper ends of the hangers 27, while the sets of type-bars 23 and 24 are arched at their rear portions, so as to clear the hangers 25 and 27, as well as the connections which are attached to the type-bars 21 and 22.

One set of connections extends from the forward sets of type-bars 21 and 22 to the lower tier of key-levers 7, and another set of connections extends from the rear sets of type-bars 23 and 24 to the upper tier of key-levers 8. Said connections include a system of converging or radially-arranged bell-cranks mounted in slots 32, cut upon the rear or lower edge of the segment, and pivoted upon a curved rod 33, seated in a groove 34, cut in the upper face of said segment. These bell-cranks are linked to the type-bars and are also connected at their lower ends, by means of forwardly-extending links, to a system of bell-cranks working in vertical planes and linked to the key-levers.

The connections for the forward sets of type-bars 21 and 22 include a set of thrust-links 35, which are attached to the type-bars forwardly of their pivots and extend to the forwardly-projecting arms 36 of a set of radial bell-cranks pivoted upon the rod 33 and having downwardly-extending arms 37, the latter being connected by short forwardly-extending links 38 to the upwardly-directed arms 39 of a set of bell-cranks working in vertical planes and having forwardly-directed arms 40, which are connected by pull-links 41 to the lower set of key-levers 7. The rear sets of type-bars 23 and 24 are connected by pull-links 42 to upwardly-extending arms 43 of a set of radially-disposed bell-cranks pivoted upon the curved rod 33 and having downwardly-directed arms 44, which are connected by long forwardly-extending links 45, overlying the short links 38, to the upwardly-directed arms 46 of another set of vertically-arranged bell-cranks whose forwardly-extending arms 47 are connected by links 48 to the upper key-levers 8. It will be seen that the thrust-links 35 occupy positions in front of the segment 19 and that the pull-links 42 overlie said segment; also, that the type-operating arms 36 of one set of radial bell-cranks extend forwardly from the curved fulcrum-rod 33, while the corresponding arms 43 of the other set extend upwardly from said fulcrum-rod. It will further be understood that the bell-cranks 36 and 43 alternate, thereby giving ample clearance for the links 35, as well as for the links 42, and it will also be seen that the arms 37 are longer than the arms 44, whereby clearance is afforded for the joints at the rear ends of the links 38 and 45. The links 35 and 42 extend in radial directions or lie in planes which are radial to the printing-center, in accordance with the directions of their respective bell-cranks and type-bars.

The forward vertical bell-cranks 46, which are of substantially uniform length, are mounted in groups at different elevations or in ascending series upon horizontal fulcrum-rods 49, the latter being mounted in horizontal ledges or long bearings 50, which are formed upon the front face of a segment 51

and are provided with vertical slots 52 for receiving the hub portions of the bell-cranks, there being one ledge for each group of the latter. The ledge-bearings 50 are arranged
 5 stepwise, beginning at the middle lower portion of the segment with a long ledge, so as to accommodate a large group of bell-cranks, and thence ascending at either side, each ledge being shorter than the one below it and ac-
 10 commodating fewer bell-cranks. By this arrangement the upper ends of all of the bell-cranks are brought substantially to a level with the pivotal ends of their associated radial arms 44, from which the links 45 extend
 15 in substantially horizontal directions. The segment 51 is secured at its ends by screws 52 to arms 53, depending from the under side of the top plate.

The rear set of vertical bell-cranks 39 are
 20 pivoted in groups upon horizontal rods 54, mounted in slotted ledges or bearings 55, formed stepwise upon the rear face of the segment 51. The vertical arms of the bell-cranks 46 are arranged forwardly; and those
 25 of the bell-cranks 39 are arranged in rear of the segment 51, the horizontal arms 40 of the cranks 39 extending forwardly beneath said segment. The segment is given an upward and forward inclination, whereby the
 30 bell-cranks 39 and 46 are given a substantially uniform separation horizontally from their associated radiating type-actuating arms 37 and 44, so that the horizontal links of each set 38 and 45 may be of substantially uniform
 35 length. The key-lever links 41 and 48 may be made of graduated lengths to compensate for the graduated heights at which their attached bell-crank arms 40 and 47 are disposed. The links 48 are shorter than the links 41,
 40 and the latter pass between the key-levers 8.

Each link in the several sets is provided at each of its ends with a yielding keeper 56, as clearly shown in Fig. 6, one end of each keeper being riveted to the body of the link
 45 at 57 and the other end whereof is perforated and fits over a laterally-projecting stud 58, provided upon the tip of the link. The keeper may be sprung away from said stud 58, so as to enable the attachment or detachment of the
 50 link.

The lower end of each of the vertical links 41 and 48 is connected to its key-lever by means of a short arm 59, which is firmly secured to the lever by a single rivet 60 and is
 55 provided with a squared or parallel-sided hub portion 61, which may be caught by a suitable wrench and forced to turn slightly upon the rivet 60, thereby elevating or depressing the arm 59, and hence adjusting the vertical
 60 distance between the key-lever and its associated bell-crank arm 40 or 47. Thus any irregularities in the height of the key-levers may be corrected without disconnecting the parts. The arm 59 lies flat against the side
 65 of the lever and projects rearwardly, the lever

being curved downwardly at 62, so as to clear the lower end of the link, which stands thereover.

A set of flat returning-springs 63 is provided for the upper key-levers and a set 64
 70 for the lower key-levers, all of the springs having at their forward ends pivoted upwardly-extending links 65, which are forked at 66 to engage notches 67, formed in the key-levers. At their rear ends the springs fit in
 75 horizontal grooves or seats 68, formed in transverse bars 69 and 70, the former resting upon the latter and the two being secured together by screws 70". Vertical plates 71 and
 80 72 are secured upon the rear and front edges, respectively, of said bars by screws 73. The front plate 72 is provided with two rows of square bearing-holes or seats 74, which register with the grooves 68, the ends of the
 85 springs being inserted in the said holes and lying within the grooves and curving upwardly at their rear ends, as indicated at Fig. 1, and being prevented from rearward displacement by the plate 71. The tension of the
 90 springs may be adjusted by means of screws 75, which are threaded into lugs 76, projecting inwardly from the opposite walls of the base, and which bear up against lugs 77, projecting forwardly from the opposite ends of
 95 the bar 69, this being swiveled by shoulder-screws 78 between said walls, so that by turning the screws 75 the entire housing for the springs may be tipped so as either to increase or decrease the tension of all of the
 100 springs.

Just forwardly of the springs is arranged a transverse universal bar 79, which underlies the lower key-levers 7 and is hung, by means of links 80, upon forwardly-extending arms 81
 105 of a dog-rocker 82, which is pivoted at 83 and carries both a feeding-dog 84 and a detent-dog 85, said dogs cooperating with the usual rack 86 for effecting the letter-feeding movements of the platen-carriage. Each of the
 110 levers 8 in the upper tier is provided with a foot 87, which passes between the levers 7 and is adapted to bear upon the universal bar 79, as well as to engage its associated spring-link 65.

Overlying the forward portions of the upper key-levers 8 is a pad 88, against which
 115 the levers are normally pressed by the springs 63, while the lower key-levers 7 are pressed by the springs 64 against a similar pad 89, arranged just in rear of the fourth bank of keys,
 120 but sufficiently below the key-levers in the fifth bank to clear the latter. Each of the pads is supported by a transverse plate 90, having downwardly-directed guiding-fingers 91 for the key-levers.
 125

In the body of each key-lever is formed an irregular open slot, which begins just in rear of the guide-comb 91 and extends first upwardly at 92, then rearwardly at 93, then diagonally upward at 94, and then horizon-
 130

tally rearwardly at 95 for a considerable distance, thus dividing the lever into two portions, whereof one may be moved independently of the other. The upper portion 95 of the slot is arched, thus forming a thin and easily-sprung connection 96 between the key-bearing portion and the main portion of the lever, so that the key if struck a sharp blow may yield independently of both the main key-lever and connected type-bar. This yielding movement is limited by the width of the slot—that is, the key end of the lever may be sprung until the edges of the portion 93 of the slot touch, whereupon both the key portion and the main portion of the lever travel together for the remainder of the key-stroke. Owing to the resistance of the portion 96 to flexure, there exists during the key-stroke a tendency upon the part of the main portion of the lever to resume its normal condition with reference to the key portion, thereby tending to accelerate the speed of the type-bar or cause the latter to move proportionately faster than the key.

Beneath each of the upper and lower sets of key-levers is arranged a transverse padded stop 97, and the keys are provided with stop-plugs 98 just over said pads. As will be seen at Fig. 4, the key is arrested by its stop 97 before the printing stroke of the type-bar is quite completed, so that the pressure of the finger is taken by said stop, while the momentum of the type-bar and connected parts is sufficient to enable the printing stroke to be completed and the type impressions made. During this final portion of the type-bar stroke the slot or gap in the key-lever opens a trifle wider than normal, the connecting portion 96 being caused to yield slightly downward. The immediate reaction of said portion 96 tends to restore or lift the main portion of the lever to its normal relationship to the key portion, and hence to draw the type-bar away from the platen, although the finger may still be held down on the key. Thus the type is immediately swung away from the platen to the position shown at Fig. 4, and hence cannot make a double or blurred impression upon the paper.

Upon the forward end of the main portion of each lever is secured by rivets 99 a pair of keeper-plates 100, which fork the key-bearing portion of the lever, so as to prevent lateral displacement thereof.

In operation if a key be struck with moderate force the two parts of the key-lever move as if made in one piece, but if struck sharply the effects above described are produced. In case any key in the four front banks is struck its lever pulls down the link 41, thus vibrating the vertical bell-crank 39 40 and through the link 38 swinging the radial bell-crank 37 36, which through the link 35 thrusts its associated type-bar up to the platen. If one of the rear keys be struck, the type-bar movement

is effected through the key-lever 8, link 48, bell-crank 46 47, link 45, bell-crank 44 43, and link 42. In either case the universal bar 79 is forced down and by means of the hooks 80 vibrates the dog-rocker 82, so that upon the relief of the key from pressure and the return of the type-bar to normal position the carriage is fed a letter-space.

By dividing the lever into two portions and making one partially independent of the other it becomes possible for the key to be pressed downward somewhat in advance of the movement of the type-bar and to complete its stroke before the type-bar has reached the printing-point. If the key reaches its stop considerably in advance of the type-bar, the finger is given time to come to rest and begin its upward stroke just before the type strikes. The stop is preferably timed to arrest the key when about two-thirds or more of the printing stroke of the type-bar has been made, so that while the finger is recovering from the stroke the type-bar may continue toward the printing-point aided by the reaction of the elastic portion 96 of the lever, thus effectually avoiding a double stroke or blurred impression, due as usual to a continued pressure upon the key, owing to the difficulty experienced by most operators in striking a staccato blow. Thus it will be seen that I have provided an elastic metal key-lever requiring a minimum amount of lateral space and on account of its light weight offering practically no resistance to the finger-touch. By reason of the elasticity the key-stroke is cushioned at the beginning thereof, the key yielding at first in advance of the movement of its associated type-bar and connections, thus tending to even the force of impact between the finger and key throughout the downward stroke. The key-stroke is also cushioned at its completion by means of the padded stop 97.

The plates 100 may be made in the form of a yoke closing down over the key-bearing portion, thus preventing the latter not only from twisting, but also from becoming accidentally bent upward, so as to cause undue gaping of the irregular slot.

It will be observed that the levers in each tier carry a plurality of banks of keys and are fulcrumed at their rear ends upon a plurality of transverse rods; that one tier is arranged over the other; that one of the rods 10 is arranged rearwardly of and below the other and that the same is true of the rods 9; that the levers 7, which carry keys at the front of the keyboard, project rearwardly beyond the rear ends of the upper levers 8; that the levers which carry forward keys in each tier are fulcrumed in rear of levers in the same tier which carry rear keys and that so long as this arrangement is observed it is not essential in all forms of my invention that the said rods be arranged one below the other; that the levers bearing the front bank of keys

are the longest and are fulcrumed upon the rearmost rod, while the shortest levers bear keys in the rearmost bank of the keyboard and are fulcrumed upon the foremost rod; that the
 5 keyboard comprises eight banks of keys; that the levers 8 in the upper tier comprise two sets, one set carrying the rearmost bank of keys and being fulcrumed upon the uppermost or forward rod 10 and the other set carrying the
 10 next two forward banks of keys and being fulcrumed upon the rear rod 10; that the levers in the lower tier 7 likewise comprise two sets, one set carrying the two lowest banks of keys and being fulcrumed upon the
 15 lowermost or rear rod 9 and the other set carrying the next two banks of keys and being fulcrumed upon the next rod 9; that the rods 9 and 10 taken together form an upwardly and forwardly ascending series having suitable horizontal bearings upon an inclined frame 11, said bearings being slotted vertically at 14 for receiving the rear ends of levers and also being slotted horizontally to receive said fulcrum-rods; that the levers in
 20 each tier diverge upwardly or downwardly according to the positions of their respective fulcrum-rods and are detachably engaged to the latter by means of notched slots extending longitudinally of the levers. It will also
 25 be seen that the pivots of the rearwardly-striking type-bars are arranged in an arc which inclines rearwardly and downwardly; that the printing-center is preferably lower than the level of the platen-axis; that the segment 19 is arranged beneath the platen and is inclined rearwardly and downwardly; that
 30 two sets of type-bar hangers are attached to the forward or lower side of the segment and two sets of hangers are attached to the rear or upper side thereof and that the type ends of said type-bars have accordingly a staggering arrangement or extend in curved rows across the machine; that connections are attached to the several type-bars between the
 35 pivots and types of the latter; that four sets of rearwardly-striking and radially-arranged type-bars lie side by side forwardly of and below the platen, the type-bars in three of the sets 22, 23, and 24 being of substantially
 40 the same length and pivoted in three rows and the type-bars in the fourth set 21 being pivoted at a greater distance from the printing-center and terminating at their type ends forwardly of the other type-bars and the several
 45 sets of type-bars having an alternating or staggering arrangement, so as to secure clearance for both the types and the pivots, as well as for the connections; that key connections are attached to the type-bars 22 forwardly of their pivots and extend downwardly therefrom, and that the type-bars 23 are pivoted in rear of the type-bars 22 and arch forwardly over the latter, so as to clear said
 50 connections when the latter are operated to swing the type-bars 22 to the printing-point.

It will further be seen that pull-links 42 are connected to some of the type-bars and arranged upon one side of the system of type-bar pivots, and thrust-links 35 are connected to the other type-bars and arranged upon the other
 70 side of said system of pivots, said pull-links and thrust-links having an alternating arrangement, one type-bar, for instance, being connected to a pull-link, the next type-bar in the system being connected to a thrust-link, the next to a
 75 pull-link, and so on, and that one set of key connections 35 is arranged upon one side of the segment 19 and the other set of key connections 42 is arranged upon the other side of said segment. It will also be noted that the
 80 type-bars are connected to a system of radially arranged or converging bell-cranks or levers 36 37 and 43 44, the former being directly connected by thrust-links to their type-bars and the latter being directly connected
 85 by pull-links to their type-bars and the bell-cranks or levers in one set alternating with the bell-cranks or levers in the other set; that so long as these levers have a radial or converging arrangement corresponding with the
 90 radial arrangement of the type-bars it is not essential that each lever be made up of arms arranged at an angle to each other; that all of said radial bell-cranks or levers are pivoted upon a common fulcrum-rod 33 and are arranged
 95 below the type-bar pivots; that the levers 43 44 are arranged in rear of the type-bars and the bell-cranks 36 37 are arranged below the type-bars and that the arms 36 extend forwardly and the arms 43 upwardly from the
 100 pivot-rod 33. It will also be perceived that one tier of key-bearing levers overlies the other, the levers in the upper tier 8 being connected to the forward type-bars 21 and 22 and those in the lower tier 7 being connected to the rear
 105 type-bars 23 and 24; that said levers extend rearwardly beneath a system of bell-cranks working in vertical planes and mounted upon the frame 51 and connected to the radial bell-cranks or levers mounted upon the segment
 110 19 by two sets of links 38 and 45; that said vertical bell-cranks are mounted in ascending series in accordance with the elevation of their connected radial bell-cranks or levers, the key-lever links 41 and 48 being accordingly of graduated lengths; that the vertical
 115 bell-cranks 46 47 are mounted forwardly of the vertical bell-cranks 39 40, the latter being also arranged at lower levels than the former and being connected to the lower tier of key-levers and all of said vertical bell-cranks being pivoted upon a downwardly and rearwardly inclined frame 51, arranged forwardly of the segment 19; that the arms 40 of the rear or lower set of vertical bell-cranks extend forwardly beneath the lower edge of said frame 51; that said frame or support has formed upon its front and rear faces bearings
 120 50 and 55, having a stepwise arrangement, and that the vertical bell-cranks are pivoted
 125
 130

in groups upon said bearings 50 and 55, a large number of bell-cranks being grouped in a transverse line at the middle lower portion of each of the back and front sides of the frame and the remainder of the bell-cranks being grouped in a succession of shorter transverse lines at successively higher elevations at the sides of the system. It will further be seen that I have combined a series of type-operating arms, a series of levers, and a series of links connecting said arms to said levers, each of said links having upon each of its ends a yielding keeper 56, one end whereof is perforated and fits over a laterally-projecting stud 58, provided upon the tip of the link, whereby the latter is detachably pivoted at each end to its associated arm and lever; that the levers 7 and 8 are provided with short arms 59, whereby said levers are connected to a series of type-operating arms, each of said arms 59 being firmly secured by a single rivet upon the body of its lever and being also provided with a parallel-sided portion 61, which is adapted to be engaged by a suitable tool, whereby said short arm may be forced to turn upon its rivet, thereby causing a relative adjustment between its associated lever and type-operating arm, and that the links 41 and 48 are directly attached to said short arms 59. It will also be observed that the set of springs 64 is arranged above the set 63 and that the springs in both sets extend longitudinally of the key-levers 7 and 8 and are fixed upon a single supporting device which extends transversely of the machine and are also detachably connected by forked thrust-links 65 to the key-levers; that each of the transverse bars 69 and 70 is provided with seats for the springs; that the plate 71 prevents rearward displacement of the springs, the latter abutting against said plate at their rear ends, and that by means of the screw 75 the spring-support may be rocked upon its bearings, so as to adjust the tension of the springs. It will further be observed that the key-carrying portion of each lever 7 and 8 is capable of bodily movement independently of the remaining portion, said portions being joined by an integral yielding or flexible neck 96; that one portion of the lever bears the key and that the other portion is connected to the type-bar; that the elastic construction 96 is located between the ends of the key-lever, whereby the forward or key portion is enabled to yield relatively to the rear or type-bar-operating portion; that the relatively yielding movement of said portions is limited to the width of the slot or gap in the lever; that upon said gap being closed at the depression of the key the two portions of the lever move together as one piece, so as to cause the type-bar to swing to the printing-point; that the stop 97 is provided for the key-bearing portion of the lever; that upon the arrest of the key by said stop the movement of the type-

bar is aided by the resiliency of the yielding connection 96 between the two lever portions; that the keys are arrested during the printing strokes of the type-bars and before the latter strike the platen; that the universal-bar and carriage-escapement devices are operated by the portions of the levers 7 and 8 which are connected to the type-bars; that the adjacent ends of the lever-sections overlap and lie edge to edge and are connected by a yoke 100, fixed upon the lower section and embracing the upper section; that the finger-key portion of the lever may move independently of the other portion when the key is struck sharply, so as to relieve the force of the blow upon the finger, while at the same time the lever as a whole may vibrate upon its rear fulcrum to cause the type-bar to swing toward the platen, and that the irregular slot in the forward portion of the key-lever is in the direction of the length of the lever. It will also be seen that I have provided a "visible" writing-machine wherein the various hangers to which the type-bars or levers are pivoted are applied alternately to opposite faces of the segment or segmental support and are so arranged that they have an overlapping and staggered arrangement fore and aft of the machine.

My improvements may also be applied to under-strike and top-strike machines, and many variations may be made within the scope of the invention. Portions of the improvements may be used without others.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a type-writing machine, the combination with a platen and a system of type-bars, of a system of key-levers arranged in two tiers, one arranged over the other, and the levers in each tier carrying a plurality of banks of keys, a plurality of transverse fulcrum-rods for the upper tier, and a plurality of transverse fulcrum-rods for the lower tier, the several levers being fulcrumed at their rear ends upon said rods.

2. In a type-writing machine, the combination with a platen and a system of type-bars, of a system of key-levers arranged in two tiers, one arranged over the other, and the levers in each tier carrying a plurality of banks of keys, a set of transverse fulcrum-rods for the upper tier of levers, one of said rods being arranged rearwardly of the other and the levers whose keys are in the rear bank or banks being fulcrumed upon the forward rod and the levers whose keys are in the next forward bank or banks being fulcrumed upon the rear rod, and a second set of transverse fulcrum-rods for the lower tiers of levers, one of the rods in said second set being arranged rearwardly of the other and the levers whose keys are in the front bank or banks of the keyboard being fulcrumed upon the rear rod and the levers whose keys

are in the next rear bank or banks being fulcrumed upon the forward rod of said second set.

3. In a type-writing machine, the combination with a platen and a system of type-bars, of a system of key-levers arranged in two tiers, one above the other, the levers in each tier carrying a plurality of banks of keys at their forward ends, the levers in the upper tier carrying keys at the rear of the keyboard and the levers in the lower tier carrying keys at the front of the keyboard and also projecting rearwardly beyond the rear ends of upper levers, a set of transverse fulcrum-rods for the upper levers, and a set of transverse fulcrum-rods for the lower levers, said rods taken together being arranged in forwardly and upwardly ascending series, and the levers of each tier which carry the forward keys being fulcrumed in rear of the levers in the same tier which carry the rear keys.

4. In a type-writing machine, the combination with a platen and a system of type-bars, of a plurality of sets of levers carrying banks of keys and fulcrumed at their rear ends upon a forwardly and upwardly ascending series of transverse fulcrum-rods, the levers bearing the front bank of keys being the longest and being fulcrumed upon the rearmost rod, and the shortest set of levers bearing keys in the rearmost bank and being fulcrumed upon the foremost rod.

5. In a type-writing machine, the combination with a platen and a system of type-bars, of eight banks of keys, a system of levers carrying said keys, four transverse fulcrum-rods upon which the levers bear at their rear ends, said levers being arranged in two tiers one over the other, the levers in the upper tier comprising two sets, one set carrying the two rearmost banks of keys and being fulcrumed upon the uppermost rod, and the other set carrying the next two forward banks of keys and being fulcrumed upon the next rod, and the levers in the lower tier likewise comprising two sets, one set carrying the two lowest banks of keys and being fulcrumed upon the lowermost rod, and the other set carrying the next two banks of keys and being fulcrumed upon the next rod, said rods being arranged in forwardly and upwardly ascending series, and the several sets of levers being of corresponding lengths.

6. In a type-writing machine, the combination with a platen and a system of type-bars, of a system of key-bearing levers, an upwardly and forwardly ascending series of fulcrum-rods for the rear ends of said levers, and an inclined frame having bearings for said fulcrum-rods, said bearings being slotted vertically for receiving the rear ends of the levers.

7. In a type-writing machine, the combination with a platen and a system of type-bars, of a system of key-bearing levers, an upwardly and forwardly ascending series of fulcrum-

rods for the rear ends of said levers, and an inclined frame having bearings for said fulcrum-rods, said bearings being slotted vertically for receiving the rear ends of the levers, and also having horizontal slots in which said fulcrum-rods are seated.

8. In a type-writing machine, the combination with a platen and a system of type-bars, of a system of key-levers arranged in two tiers, the levers in each tier carrying a plurality of banks of keys, a set of transverse fulcrum-rods for the upper tier of levers, one of said rods being arranged rearwardly of the other and the levers in said tier which have keys in the rear bank or banks being fulcrumed upon the forward rod, and the levers in said tier which have keys in the forward bank or banks being fulcrumed upon the rear rod, and a second set of transverse fulcrum-rods for the lower tier of levers, one of the last-mentioned rods being arranged rearwardly of the other, and the levers in the lower tier which have keys in the front bank or banks at the keyboard being fulcrumed upon the rearmost rod, and the levers in said lower tier which have keys in the next rear bank or banks of keys being fulcrumed upon the other rod of the second set, an inclined frame having bearings for the several fulcrum-rods, said bearings being slotted vertically for receiving the rear ends of the key-levers, and the latter being detachably mounted upon the rods.

9. In a type-writing machine, the combination with a platen and a system of type-bars, of a series of key-levers, as 7, carrying at their forward ends a plurality of banks of keys, and a plurality of transverse fulcrum-rods, as 9, upon which the rear ends of said key-levers are fulcrumed, said rods being arranged one lower than and rearwardly of the other, and the levers diverging accordingly at their rear ends and being detachably engaged to said rods by means of notched slots 16 extending longitudinally of the levers.

10. In a type-writing machine, the combination with a platen and a system of type-bars, of two tiers of key-levers bearing keys at their forward ends, and a plurality of transverse fulcrum-rods for the rear ends of the levers in each tier, the several rods being arranged in a forwardly and upwardly ascending series, and the levers diverging accordingly at their rear ends and detachably engaging said rods by means of notched slots extending longitudinally of the levers.

11. In a front-strike writing-machine, the combination with a cylindrical platen, of a series of rearwardly-striking type-bars whose pivots are arranged in an arc which inclines rearwardly and downwardly.

12. In a front-strike writing-machine, the combination with a cylindrical platen, of a series of rearwardly-striking type-bars whose pivots are arranged in an arc which inclines rearwardly and downwardly, the printing-

center being lower than the level of the platen-axis.

13. In a front-strike writing-machine, the combination with a cylindrical platen, of a downwardly and rearwardly inclined segment supported beneath said platen, and type-bars pivotally supported upon said segment and striking rearwardly against the platen at a point below the level of the platen-axis.

14. In a front-strike writing-machine, the combination with a cylindrical platen, of a downwardly and rearwardly inclined segment supported beneath said platen, a system of radially-arranged hangers attached to said segment, and type-bars pivoted in said hangers and striking rearwardly against the platen at a point below the level of the platen-axis.

15. In a front-strike writing-machine, the combination with a cylindrical platen, of a segment arranged beneath the platen and inclining downwardly and rearwardly, two sets of hangers attached to the forward or lower side of said segment, two sets of hangers attached to the rear or upper side of said segment, forwardly-extending type-bars pivoted in the said hangers and striking at a common printing-center a little below the level of the platen-axis, the type ends of said type-bars having a staggering arrangement, and keys connected to said type-bars.

16. In a front-strike writing-machine, the combination with a cylindrical platen, of a segment arranged beneath the platen and inclining downwardly and rearwardly, two sets of hangers attached to the forward or lower side of said segment, two sets of hangers attached to the rear or upper side of said segment, forwardly-extending type-bars pivoted in the said hangers and striking at a common printing-center a little below the level of the platen-axis, the type ends of said type-bars having a staggering arrangement, and key connections attached to the several type-bars between their pivots and types.

17. In a front-strike writing-machine, the combination with a platen, of four sets of rearwardly-striking radially-arranged type-bars lying side by side forwardly of and below the platen, the type-bars in three of the sets of substantially the same length and pivoted in three rows, the type-bars in the fourth set being pivoted at a greater distance from the printing-center and terminating at their type ends forwardly of the other type-bars, and the several sets of type-bars having an alternating or staggering arrangement.

18. In a front-strike writing-machine, the combination with a platen, of a set of rearwardly-striking type-bars, as 22, pivoted at their rear ends, key connections attached to said type-bars forwardly of their pivots and extending downwardly therefrom, and a set of key-operated rearwardly-striking type-bars, as 23, pivoted in rear of the type-bars 22 and arching forwardly over the latter, the

types upon the forward ends of the several type-bars lying in curved rows and having an alternating or staggering arrangement.

19. In a type-writing machine, the combination of a system of type-bars, a set of pull-links connected to some of the type-bars and arranged upon one side of the system of type-bar pivots, a set of thrust-links connected to the other type-bars and arranged upon the other side of said system of pivots, said pull-links and thrust-links having an alternating arrangement, and key-levers connected to the several links.

20. In a front-strike writing-machine, the combination with a platen, of a segment, a forwardly-extending series of type-bars mounted thereon, a rear series of type-bars also mounted thereon, a set of key connections attached to the forward type-bars and arranged upon one side of said segment, and a set of key connections attached to the rear type-bars and arranged on the other side of said segment.

21. In a front-strike writing-machine, the combination with a platen, of a segment, a forward series of type-bars mounted thereon, a set of thrust-links 35 connected to said type-bars between their pivots and types, a rear series of type-bars also mounted upon said segment, a series of pull-links 42 connected to said rear type-bars between their pivots and types, and key-operated levers connected to the several links.

22. In a front-strike writing-machine, the combination with a platen, of a segment, a forward series of type-bars mounted thereon, a set of thrust-links 35 connected to said type-bars between their pivots and types, a rear series of type-bars also mounted upon said segment, a series of pull-links 42 connected to said rear type-bars between their pivots and types, said links 35 being arranged upon one side of said segment and said links 42 being arranged upon the other side of said segment, and key-operated levers connected to the several links.

23. In a front-strike writing-machine, the combination with a platen, of a system of rearwardly-striking radial type-bars, and a system of radially-arranged key-operated bell-cranks or levers, some of said bell-cranks or levers being directly connected by thrust-links to their type-bars, and others of said bell-cranks or levers being directly connected by pull-links to their type-bars, and the bell-cranks or levers in one set alternating with the bell-cranks or levers in the other set.

24. In a front-strike writing-machine, the combination with a platen, of a system of rearwardly-striking radial type-bars and two sets of radially-arranged key-operated bell-cranks or levers pivoted upon a common curved fulcrum-rod and arranged below the type-bar pivots, the bell-cranks or levers in one set having arms which are connected by thrust-links to their type-bars, and the bell-cranks

or levers in the other set alternating with the bell-cranks or levers in the first set and having differently-directed arms which are connected by pull-links to their type-bars.

25. In a front-strike writing-machine, the combination with a platen, of a segment, a system of rearwardly-striking type-bars mounted upon said segment, and two sets of alternating key-operated bell-cranks or levers working in radial slots formed in said segment and pivoted upon a common curved fulcrum-rod mounted in said segment, thrust-links connecting one set of bell-cranks or levers with their type-bars, and pull-links connecting the other set of bell-cranks or levers with their type-bars.

26. In a front-strike writing-machine, the combination with a platen, of a segment, sets of hangers mounted upon one edge or side thereof, forwardly-extending type-bars pivoted in said hangers, the type ends of the bars having a staggering arrangement, two sets of alternating key-operated pivoted bell-cranks or levers working in radial slots formed in the opposite edge or side of said segment, thrust-links extending from one set of bell-cranks or levers and attached to their type-bars between the pivots and types of the latter, and pull-links extending from the other set of bell-cranks or levers and similarly attached to their type-bars.

27. In a front-strike writing-machine, the combination with a platen, of a plurality of sets of type-bars, a support upon which said type-bars are pivotally mounted, a set of links attached to one set of said type-bars and arranged upon one side of said support, a set of key-operated bell-cranks or levers connected to said links, a set of links attached to another set of said type-bars and arranged upon the other side of said support, and a set of key-operated bell-cranks or levers connected to the last-mentioned links, the several bell-cranks or levers working in radial or converging planes, and the bell-cranks or levers in one set alternating with those in the other set.

28. In a front-strike writing-machine, the combination with a platen, of a plurality of sets of rearwardly-striking type-bars, a set of bell-cranks or levers arranged in rear of said type-bars and connected to one of the sets of the latter by pull-links, a set of bell-cranks or levers arranged below said type-bars and connected to the other set of bars by thrust-links, all of said bell-cranks or levers working in converging planes, and all of said links being attached to the type-bars between the pivots and types of the latter.

29. In a front-strike writing-machine, the combination with a platen, of a series of rearwardly-striking type-bars, and a series of key-operated bell-cranks or levers working in radial or converging planes and arranged in rear of said type-bars, and connected to the latter by pull-links which are attached to the type-

bars between the pivots and types of the latter, each link working in the plane of its associated key-operated lever and type-bar.

30. In a front-strike writing-machine, the combination with a platen that is adapted to travel from end to end of the machine and a series of upwardly and rearwardly striking type-bars, of a series of bell-cranks or levers working in radial or converging planes and arranged below said type-bar pivots and connected to the type-bars by thrust-links which are attached to the type-bars between the pivots and types of the latter, and a series of key-levers which extend fore and aft of the machine below the platen and are operatively connected to said bell-cranks.

31. In a front-strike writing-machine, the combination with a platen, of a downwardly and rearwardly inclined segment arranged therebelow, a plurality of sets of type-bars mounted upon hangers attached to said segment at the forward side or edge thereof, a plurality of sets of bell-cranks or levers working in radial slots cut in the rear side or edge of the segment, said bell-cranks or levers being mounted upon a curved fulcrum-rod seated in a groove formed in said segment, thrust-links extending downwardly in front of said segment from one set of type-bars to forwardly-extending arms formed upon one set of bell-cranks or levers, pull-links extending rearwardly over said segment from another set of type-bars to upwardly-extending arms formed upon the other set of bell-cranks or levers, and keys connected to the several bell-cranks or levers.

32. In a front-strike writing-machine, the combination with a platen, of a plurality of sets of rearwardly-striking type-bars lying side by side, the type-bars in one set extending forwardly of the type-bars in another set, a system of key-bearing levers arranged in tiers, corresponding to the sets of type-bars, one tier overlying another, levers that are situated and vibrate in radial planes, and operative connections between said radial levers and type-bars and between the radial levers and the key-levers.

33. In a front-strike writing-machine, the combination with a platen, of a plurality of sets of rearwardly-striking type-bars lying side by side, the type-bars in one set extending forwardly of the type-bars in another set, a system of key-bearing levers arranged in tiers, one tier overlying another, the levers in the lower tier bearing keys arranged in forward banks and the levers in the upper tier bearing keys arranged in rear banks, connections extending from the forward type-bars to the lower tier of key-levers, and connections extending from the rear type-bars to the upper tier of key-levers.

34. In a front-strike writing-machine, the combination with a platen adapted to travel from end to end of the machine, of a series of

upwardly and rearwardly striking type-bars, a series of bell-cranks or levers connected to said type-bars and working in converging or radial planes, a series of pivoted bell-cranks
 5 situated in planes that extend fore and aft of the machine and connected to said radial bell-cranks or levers and working in vertical planes, and a series of key-levers connected to said vertical bell-cranks.

10 35. In a front-strike writing-machine, the combination with a traveling platen, of a series of upwardly and rearwardly striking type-bars, a series of bell-cranks or levers working in converging or radial planes, links
 15 connecting said type-bars to said radial bell-cranks or levers, a series of bell-cranks working in vertical planes, links connecting said vertical bell-cranks to said radial bell-cranks or levers, and a series of key-levers that extend
 20 fore and aft of the machine beneath the vertical bell-crank levers and are connected to said vertical bell-cranks.

36. In a front-strike writing-machine, the combination with a platen, of a series of rear-
 25 wardly-striking type-bars, a series of bell-cranks or levers working in converging or radial planes and connected to the type-bars, a series of links extending from said bell-cranks or levers and connected to a series of bell-
 30 cranks working in vertical planes, and a series of key-levers extending beneath said vertical bell-cranks and connected to the latter by links.

37. In a front-strike writing-machine, the
 35 combination with a platen, of a series of rearwardly-striking type-bars, a series of bell-cranks or levers working in converging or radial planes and connected to the type-bars, a series of links extending from said bell-cranks
 40 or levers and connected to a series of bell-cranks working in vertical planes, and a series of key-levers extending beneath said vertical bell-cranks and connected to the latter by links, said vertical bell-cranks being mounted
 45 in ascending series, in accordance with the elevation of their connected radial bell-cranks or levers, and said key-lever links being accordingly of graduated lengths.

38. In a front-strike writing-machine, the
 50 combination with a platen, of a series of type-bars as 21, 22, a set of radial bell-cranks or levers having forwardly-extending arms 36 connected by thrust-links 35 to said type-bars, a set of vertical bell-cranks 39, 40 connected
 55 by links 38 to arms 37 formed upon said radial bell-cranks or levers, a series of key-levers 7 fulcrumed at their rear ends and connected by links 41 to said vertical bell-cranks 39, 40, a series of type-bars, as 23, 24, alternating
 60 with the type-bars 21, 22, a series of radial bell-cranks or levers having upwardly-extending arms 43, pull-links 42 connecting the latter to said type-bars 23, 24, a series of vertical bell-cranks 46, 47 connected by links
 65 45 to arms 44 formed upon the said radial

bell-cranks or levers 43, and a series of key-levers 8 fulcrumed at their rear ends and connected by links 48 to said vertical bell-cranks 46, 47.

39. In a front-strike writing-machine, the
 70 combination with a platen, of a series of type-bars, as 22, a series of radial or converging bell-cranks or levers having forwardly-extending arms 36, thrust-links 35 connecting
 75 said type-bars to said forwardly-extending arms, a series of vertical bell-cranks 39, 40 connected by links 38 to arms 37 formed upon said radial bell-cranks or levers, and a series of key-levers 7 fulcrumed at their rear ends
 80 and connected by links 41 to said vertical bell-cranks.

40. In a front-strike writing-machine, the combination with a platen, of a series of type-
 bars, as 23, a series of radial or converging bell-cranks or levers having upwardly-ex-
 85 tending arms 43, pull-links 42 connecting said type-bars to said upwardly-extending arms, a series of vertical bell-cranks 46, 47 connected by links 45 to arms 44 formed upon said radial bell-cranks or levers, and a series of key-le-
 90 vers 8 fulcrumed at their rear ends and connected by links 48 to said vertical bell-cranks.

41. In a front-strike writing-machine, the combination with a platen, of a series of type-
 bars, as 21, 22, a set of radial or converging
 95 bell-cranks or levers having forwardly-extending arms 26 connected by thrust-links 35 to said type-bars, a set of vertical bell-cranks 39, 40, connected by links 38 to arms 37 formed upon said radial bell-cranks or levers, a series
 100 of key-levers 7 fulcrumed at their rear ends and connected by links 41 to said vertical bell-cranks 39, 40, a series of type-bars, as 23, 24, alternating with the type-bars 21, 22, a series of radial bell-cranks or levers having up-
 105 wardly-extending arms 43, and alternating with the said radial bell-cranks or levers 26, pull-links 42 connecting the arms 43 to said type-bars 23, 24, a series of vertical bell-cranks 46, 47 fulcrumed forwardly of the said bell-
 110 cranks 39, 40, and connected by links 45 to arms 44 formed upon the said radial bell-cranks or levers 43, said links 45 being arranged above the links 38 and the arms 44 being shorter than the arms 37, and a series of
 115 key-levers 8 fulcrumed at their rear ends and arranged above the key-levers 7 and connected by links 48 to said vertical bell-cranks 46, 47, said links 48 being arranged forwardly of the links 41 and the latter passing up from the
 120 lower key-levers and between the upper key-levers.

42. In a front-strike writing-machine, the combination with a platen and a system of
 radial type-bars, of a system of radial bell-
 125 cranks or levers connected thereto, a system of rearwardly-extending key-levers, and a system of vertical bell-cranks connecting the key-levers to the radial bell-cranks or levers.

43. In a front-strike writing-machine, the 130

combination with a platen and a system of radial type-bars, of a system of radial bell-cranks or levers connected thereto, a system of key-levers, and a plurality of sets of bell-cranks, as 39, 40, and 46, 47, working in vertical planes and connecting said radial bell-cranks or levers to the key-levers.

44. In a front-strike writing-machine, the combination with a platen, of a series of rearwardly-striking type-bars, a series of bell-cranks or levers connected to said type-bars and working in radial planes, a plurality of sets of bell-cranks connected to said radial bell-cranks or levers and working in vertical planes, one set of vertical bell-cranks being mounted forwardly of the other set of vertical bell-cranks, and keys connected to the several vertical bell-cranks.

45. In a front-strike writing-machine, the combination with a platen, of a series of rearwardly-striking type-bars, a series of bell-cranks or levers working in radial planes, links connecting said type-bars to said radial bell-cranks or levers, a plurality of sets of bell-cranks working in vertical planes, the vertical bell-cranks in one set being pivoted forwardly of the vertical bell-cranks in the other set, links connecting said vertical bell-cranks to said radial bell-cranks or levers, and keys connected to the several vertical bell-cranks.

46. In a front-strike writing-machine, the combination with a platen, of a series of rearwardly-striking type-bars, a series of bell-cranks or levers working in radial planes and connected to the type-bars, two sets of bell-cranks working in vertical planes and connected by links to said radial bell-cranks or levers, two tiers of key-levers extending beneath said vertical bell-cranks, one tier being arranged over the other, a set of links connecting one tier of levers to one set of vertical bell-cranks, and a set of links connecting the other tier of levers to the other set of vertical bell-cranks.

47. In a front-strike writing-machine, the combination with a platen, of a series of rearwardly-striking type-bars, a series of bell-cranks or levers working in radial planes and connected to the type-bars, two sets of bell-cranks arranged forwardly of said radial bell-cranks or levers and working in vertical planes, links connecting said sets of vertical bell-cranks with said radial bell-cranks or levers, a series of key-levers extending beneath said vertical bell-cranks and connected to the latter by links, said vertical bell-cranks being mounted in ascending series in accordance with the elevation of their connected radial bell-cranks or levers, and said key-lever links being accordingly of graduated lengths.

48. In a front-strike writing-machine, the combination with a platen, of a series of rearwardly-striking type-bars, a set of bell-cranks or levers working in vertical planes and con-

nected to their type-bars by thrust-links, a set of bell-cranks or levers working in radial planes and connected to their type-bars by pull-links and alternating with the bell-cranks or levers in the other set, two sets of bell-cranks working in vertical planes, one set of vertical bell-cranks being pivoted forwardly of the other set of vertical bell-cranks, two sets of links connecting said sets of vertical bell-cranks to said radial sets of bell-cranks or levers, and two tiers of key-levers extending beneath said vertical bell-cranks and connected thereto by two sets of links, said vertical bell-cranks being mounted in ascending series in accordance with the elevation of their connected radial bell-cranks or levers, and the key-lever links in each of said sets being accordingly of graduated lengths.

49. In a front-strike writing-machine, the combination with a platen and a system of rearwardly-striking type-bars, of a system of key-levers arranged in a plurality of tiers one above another, and a system of bell-cranks working in vertical planes and connected to the type-bars, said bell-cranks being divided into sets and each set thereof being connected to a corresponding tier of key-levers.

50. In a front-strike writing-machine, the combination with a platen and a system of rearwardly-striking type-bars, of a system of key-levers arranged in a plurality of tiers one above another, and a system of intermediate bell-cranks working in vertical planes and connected to the type-bars, said bell-cranks being divided into sets and each set thereof being connected to a corresponding tier of key-levers by links, the links for the lower tier of key-levers passing up between the levers in the upper tier.

51. In a front-strike writing-machine, the combination with a platen and a system of rearwardly-striking type-bars, of a system of radial bell-cranks or levers divided into two sets, one set connected by thrust-links and the other set by pull-links to the type-bars, a system of key-levers arranged in two tiers, one above another, and a system of vertical bell-cranks arranged between the key-levers and said radial bell-cranks or levers, said system of vertical bell-cranks being divided into two sets, one set being connected to one of said sets of radial bell-cranks or levers and also to one of said tiers of key-levers, and the other set of vertical bell-cranks being connected to the other set of radial bell-cranks or levers and also to the other tier of key-levers.

52. In a front-strike writing-machine, the combination with a platen and a system of rearwardly-striking type-bars, of a system of radial bell-cranks or levers divided into two sets, one set thereof being connected by thrust-links and the other set by pull-links to the type-bars, a system of key-levers arranged in two tiers one above the other, and a system of vertical bell-cranks arranged between the key-

levers and said radial bell-cranks or levers, said system of vertical bell-cranks being divided into two sets, one set being connected by links to one of said sets of radial bell-cranks or levers and being also connected by links to one of said tiers of key-levers, and the other set of vertical bell-cranks being connected by links to the other radial cranks and the other key-levers, said vertical bell-cranks being pivoted in sets one behind the other.

53. In a front-strike writing-machine, the combination with a cylindrical platen, of a downwardly and rearwardly inclined segment arranged therebeneath, type-bars mounted upon said segment and striking rearwardly at a common center below the level of the platen-axis, a downwardly and rearwardly inclined frame 51 arranged forwardly of said segment, bell-cranks mounted in ascending series upon the frame 51 and connected to said type-bars, and keys connected to said bell-cranks.

54. In a front-strike writing-machine, the combination with a cylindrical platen, of a downwardly and rearwardly inclined segment arranged therebeneath, type-bars mounted upon said segment and striking rearwardly at a common center below the level of the platen-axis, a downwardly and rearwardly inclined frame 51, bell-cranks mounted in ascending series upon both the front and rear sides of said frame 51 and connected to said type-bars, and key-levers connected to said bell-cranks.

55. In a front-strike writing-machine, the combination with a cylindrical platen, of a downwardly and rearwardly inclined segment arranged therebeneath, type-bars mounted upon said segment and striking rearwardly at a common center below the level of the platen-axis, a series of bell-cranks or levers working in radial or converging planes and connected to said type-bars, a downwardly and rearwardly inclined frame 51, bell-cranks mounted in ascending series upon the frame 51 and working in vertical planes, links connecting said vertical bell-cranks to said radial bell-cranks or levers, a series of key-levers, and a series of links connecting said key-levers to said vertical bell-cranks.

56. In a front-strike writing-machine, the combination with a cylindrical platen, of a downwardly and rearwardly inclined segment arranged therebeneath, type-bars mounted upon said segment and striking rearwardly to a common center below the level of the platen-axis, a series of radial or converging bell-cranks or levers connected by links to said type-bars, a downwardly and rearwardly inclined frame 51, bell-cranks mounted upon the front and rear faces of said frame 51 and working in vertical planes, one set of said vertical bell-cranks having arms extending beneath the lower edge of said frame 51, two sets of links connecting said vertical bell-cranks to said radial bell-cranks or levers, a series of key-levers extending beneath the

said bell-cranks, and two sets of links connecting the latter to said key-levers.

57. In a front-strike writing-machine, the combination with a cylindrical platen and a system of type-bars, of a support for the type-bars, a segmental frame arranged forwardly of said support and having formed upon its front and rear faces bearings having a stepwise arrangement, bell-cranks mounted in said bearings and connected to said type-bars, and key-levers connected to said bell-cranks.

58. In a front-strike writing-machine, the combination with a platen and a system of type-bars, of a support for the type-bars, a system of radial or converging bell-cranks or levers connected to said type-bars, a frame having formed upon its front and rear faces bearings having a stepwise arrangement, two sets of bell-cranks mounted upon said frame and connected by links to said radial bell-cranks or levers, the bell-cranks mounted upon the rear face of said frame being arranged upon lower levels than those mounted upon the forward face thereof, two sets of links connecting said radial bell-cranks or levers to said vertical bell-cranks, and two sets of links connecting the latter to a system of key-levers.

59. In a front-strike writing-machine, the combination with a platen, of a segment arranged therebelow, a plurality of sets of rearwardly-striking type-bars mounted upon said segment, two sets of alternating radial or converging bell-cranks or levers connected by thrust-links and pull-links to said type-bars, a frame having upon each of its front and rear faces a set of bell-cranks working in vertical planes, two sets of links connecting said vertical bell-cranks with the said radial bell-cranks or levers, a system of key-levers arranged in two tiers one over the other, a set of links connecting one tier of key-levers to one tier of vertical bell-cranks, and a set of links connecting the other tier of key-levers to the other set of vertical bell-cranks.

60. In a front-strike writing-machine, the combination with a system of type-bars, of a system of vertical bell-cranks connected to the type-bars and pivoted in groups upon a series of bearings arranged stepwise upon a frame, a large number of bell-cranks being grouped in transverse lines at the middle lower portion of the frame, and the bell-cranks being grouped in a succession of shorter transverse lines and at higher elevations at the sides of the system, and key-levers connected to said bell-cranks.

61. In a front-strike writing-machine, the combination with a system of type-bars, of a system of vertical bell-cranks connected to the type-bars and pivoted in groups upon a series of horizontal rods mounted in transverse bearings formed stepwise upon the front and rear sides of a frame, a large number of

bell-cranks being grouped in line at the middle lower portion of each of said sides of the frame, and the bell-cranks being grouped in a succession of shorter lines at higher elevations at the sides of the system, key-levers extending beneath said frame, and two sets of links of graduated lengths connecting the key-levers to the bell-cranks.

62. In a type-writing machine, the combination with a series of type-operating arms and a series of levers, of a series of links connecting said arms to said levers, each of said links having upon each end a yielding keeper 56, one end of each keeper being riveted to the body of the link, and the other end thereof being perforated and fitting over a laterally-projecting stud 58 provided upon the tip of the link, whereby the link is detachably connected at each end.

63. In a type-writing machine, the combination with a series of type-operating arms and a series of levers, of a series of short arms 59 whereby said levers are operatively connected to said type-operating arms, each of said arms 59 being firmly secured by a single rivet upon one of said levers or type-operating arms, and being also provided with a portion adapted to be engaged by a suitable tool, whereby said short arm may be forced to turn upon its rivet, thereby causing a relative adjustment between its associated lever and type-operating arm.

64. In a type-writing machine, the combination with a series of type-bars and a series of levers, of a series of short arms 59 whereby said levers are operatively connected to said type-bars, each of said arms 59 being firmly secured by a single rivet upon a lever and being provided with a portion adapted to be engaged by a suitable tool, whereby said short arm may be forced to turn upon its rivet, and means, including a series of links attached to said short arms 59, for connecting said levers to said type-bars.

65. In a type-writing machine, the combination with a series of type-operating arms and a series of levers, of a series of short arms 59 whereby said levers are operatively connected to said type-operating arms, said arms 59 being firmly secured each by a single rivet upon one of said levers or said type-operating arms, and each of said short arms being provided with a parallel-sided portion, as 61, whereby said short arm may be forced to turn upon its rivet.

66. In a type-writing machine, the combination with a series of type-operating arms, and a series of key-bearing levers, of a series of short arms 59 mounted upon said key-bearing levers and extending longitudinally thereof and connected by links to said type-operating arms, each of said short arms 59 being firmly secured by a single rivet upon the side of its key-lever, and being also provided with a portion adapted to be engaged by a suitable

tool, whereby said short arm may be forced to turn, thereby causing a relative adjustment between the key-lever and the connected type-operating arm.

67. In a front-strike writing-machine, the combination with a series of rearwardly-striking type-bars, of a series of bell-cranks connected thereto, a series of key-levers extending rearwardly beneath the bell-cranks and having bends 62, and a series of short arms 59 mounted upon said key-levers above said bends and connected by links to said bell-cranks, each of said short arms being firmly attached by a single rivet to its key-lever and being provided with a portion adapted to be engaged by a suitable tool, whereby said short arm may be forced to turn upon said rivet, thereby causing a relative adjustment between its key-lever and bell-crank.

68. In a type-writing machine, the combination with a type-bar, of a key-operated lever upon the body of which is fixed an adjustable pivoted arm, said arm being connected to said type-bar, whereby an adjustment may be effected without disconnecting the parts.

69. In a type-writing machine, the combination with a type-operating arm and a key-operated lever, of an adjustable pivoted arm fixed upon the body of one of said devices and connected to the other of said devices, whereby an adjustment may be effected without disconnecting the parts.

70. In a type-writing machine, the combination with a series of type-bars, of a series of key-levers fulcrumed at their rear ends and connected to the type-bars, and two sets of springs extending longitudinally of the levers and connected thereto, one set being arranged above the other set and the springs in one set being connected to the key-levers alternately with the springs in the other set.

71. In a type-writing machine, the combination with a series of type-bars and a series of levers connected to the type-bars, of two sets of springs fixed one set above the other upon a single support which extends transversely of the machine, and links connecting said springs to said key-levers.

72. In a type-writing machine, the combination with a series of type-bars and a series of key-levers extending rearwardly beneath the type-bars, of two sets of forwardly-extending springs arranged one set above the other beneath the key-levers and detachably linked to the latter.

73. In a type-writing machine, the combination with a series of type-bars and a series of levers connected thereto, of two sets of springs extending longitudinally of the levers and connected to the latter, a transverse bar provided with seats for one set of springs, and a transverse bar provided with seats for the other set of springs.

74. In a type-writing machine, the combination with a series of type-bars and a series of

levers connected thereto, of two sets of springs extending longitudinally of the levers and connected to the latter, a transverse bar provided upon its under side with seats for one set of
5 said springs, and a transverse bar arranged beneath said bar and provided upon its under side with seats for the other set of said springs.

75. In a type-writing machine, the combination with a series of type-bars and a series of
10 levers connected thereto, of two sets of springs extending longitudinally of said levers, transverse bars 69 and 70 having seats for said springs, and plate 72 attached to said bars and having perforations registering with said
15 seats.

76. In a type-writing machine, the combination with a series of type-bars and a series of
20 levers connected thereto, of two sets of springs extending longitudinally of said levers, transverse bars 69 and 70 having seats for said springs, plate 72 attached to said bars and having perforations registering with said seats, and plate 71 attached to the rear sides
25 of said bars for preventing rearward displacement of the springs.

77. In a type-writing machine, the combination with a series of type-bars, and a series of
30 levers connected thereto, of two sets of flat springs extending longitudinally of said levers, transverse bars 69 and 70 having in their under sides square grooves, plate 72 attached to said bars and having square perforations
35 registering with said grooves, said springs curving at their rear ends, and upwardly-extending forked connections carried by the free ends of said springs and engaging said levers.

78. In a type-writing machine, the combination with a series of type-bars and a series of
40 levers connected thereto, of a series of springs extending longitudinally of said levers, means for supporting the springs, and thrust-links pivoted to the springs and forked at their free ends to engage notches formed in said levers.

79. In a type-writing machine, the combination with a series of type-bars of two tiers
45 of key-levers connected thereto, one tier arranged over the other, and two sets of springs mounted below the key-levers and detachably connected to the latter by means of forked
50 links, one set of said springs being connected to one tier of levers and the other set of springs being connected to the other tier of levers.

80. In a type-writing machine, the combination with a series of type-bars and a system
55 of levers connected thereto and arranged in two tiers or rows, of two sets of springs, one for each tier or row of levers, said springs projecting from a single transverse support
60 and extending longitudinally of said levers and connected at their free ends to the latter.

81. In a type-writing machine, the combination with a series of type-bars, of two tiers of
65 key-levers, a series of springs extending longitudinally of the levers and arranged beneath

the latter, and connections from said springs to said key-levers, the upper tier of key-levers having feet which pass down between the levers in the lower tier and are connected to
70 said springs.

82. In a type-writing machine, the combination with a series of type-bars and a series of
75 key-levers connected thereto, of a series of springs extending longitudinally of said levers and mounted in seats provided upon a rocking bar which extends transversely of the machine, an ear 77 provided upon said bar, and a screw 75 bearing upon said ear so as to
80 rock said bar and adjust the tension of said springs.

83. In a type-writing machine, the combination with a series of type-bars, of a series of
85 key-levers mounted in the base of the machine and fulcrumed at their rear ends and connected to the type-bars, a bar extending across the machine beneath the key-levers and pivoted at its ends in the opposite walls of the base, a forwardly-projecting ear upon said bar, screw 75 bearing against said ear, and springs
90 extending forwardly from said bar beneath the key-levers and connected to the latter.

84. In a type-writing machine, the combination with a series of type-bars and two tiers
95 of key-levers connected thereto, one tier arranged above the other, of a bar extending transversely of said key-levers, two sets of springs mounted upon said bar, one set connected to each tier of key-levers, and means for rocking said bar so as to adjust the tension of said springs.
100

85. In a type-writing machine, the combination with a series of type-bars and two tiers
105 of key-levers connected thereto, of a bar 69 extending across the machine below said key-levers and having seats in its under side for a set of springs, forked links connecting the free ends of said springs with feet 87 projecting downwardly from the upper tier of levers, bar 70 secured to the under side of the bar 69 and having at its under side seats for another
110 set of springs connected by forked links to the lower tier of key-levers, plate 71 secured to the rear side of said bars, perforated plate 72 secured to the front side of said bars, pivots 78, ear 77, lug 76, and screw 75.
115

86. In a type-writing machine, the combination with a series of type-bars, of a series of
120 key-levers arranged in two tiers one above the other and connected to said type-bars, carriage-escapement devices, a universal bar arranged beneath the lower tier of levers and connected to said carriage-escapement devices, and feet projecting downwardly from the upper tier of levers and passing between the levers in the lower tier and adapted to
125 bear upon said universal bar.

87. In a type-writing machine, the combination with a series of type-bars and a double
130 set or tier of levers, of carriage-feeding devices, a universal bar connected to the latter

and extending across one of said tiers of levers and adapted to be actuated thereby, and devices extending from the other tier of levers into position to actuate said universal bar, said extending devices passing between the levers in the first set or tier.

88. In a type-writing machine, the combination with a type-bar, of a lever connected thereto, and a key carried by a portion of the lever which is capable of limited bodily movement independently of the remaining portion, said portions being joined by an integral flexible neck 96.

89. In a type-writing machine, the combination with a type-bar, of a key-lever connected thereto, the key portion of said lever having a limited movement relatively to the portion thereof that is connected to said type-bar, said portions being joined by an integral yielding portion 96.

90. In a type-writing machine, the combination with a type-bar, of a key-lever of the second order connected thereto and having an elastic construction between its ends, whereby the forward or key portion of said lever is enabled to yield relatively to the rear or type-bar-operating portion thereof when a key is struck sharply by the finger, said portions of the lever being integral.

91. In a type-writing machine, the combination with a type-bar, of a key-lever having a single fulcrum and composed of two portions, to one of which said type-bar is connected, and one of which portions is joined to the other by a yielding neck, as 96, said two portions being integral and means being provided for limiting the relative yielding movement of said portions.

92. In a type-writing machine, the combination with a type-bar, of a one-piece key-operated lever composed of overlapping sections joined by a yielding neck 96, said lever being so constructed that the key-operated portion may yield to a limited extent and then move together with the remaining portion to move the type-bar to the printing-point.

93. In a type-writing machine, the combination with a platen, of a type-bar, a lever connected thereto and comprising two integral portions that are integral one with the other and that yield relatively one to the other, a key, and a stop.

94. In a type-writing machine, the combination with a platen, of a type-bar, a key-lever comprising two portions that are integral one with the other and that yield relatively one to the other so that the key-bearing portion of the lever may move independently of the remainder thereof, a stop for said key-bearing portion of the lever, and means for connecting the other portion of the lever to the type-bar.

95. In a type-writing machine, the combination with a type-bar, of a lever comprising two portions having yielding connection to each other that is integral therewith, a key,

and a stop for arresting said key before the type impression is made, the construction and arrangement being such that upon the arrest of said key the movement of the type-bar may be aided by the resiliency of said yielding connection between the two lever portions.

96. In a type-writing machine, the combination with a series of type-bars, of a series of key-levers each comprising two portions connected by a yielding portion that is integral therewith, and a transverse pad-stop 97 for arresting the keys during the printing strokes of the type-bars and before the types strike the platen.

97. In a type-writing machine, the combination of a key-lever formed of two portions that are integral one with the other and one of which portions yields relatively to the other, a key carried by one of said portions, a type-bar connected to the other of said portions, a universal bar operated by the portion of said lever that is connected to said type-bar, and carriage-escapement devices connected to said universal bar,

98. A key-lever for type-writing machines composed of sections which are formed integral with one another and whereof one of said integral sections may yield relatively to another, the adjacent ends of the sections overlapping and being connected by a yoke fixed upon one of said sections and embracing the other.

99. In a type-writing machine, the combination of a platen, a type-bar, and a key-lever fulcrumed at its rear end and comprising two gaping sections formed integral with each other, one arranged edgewise over the other, one of said sections being connected to the type-bar and the other bearing a finger-key, and said sections being yieldingly joined by an integral connection, whereby the finger-key portion may move independently of the other portion when the key is struck sharply, so as to relieve the force of the blow upon the finger, while at the same time the lever as a whole may vibrate upon its rear fulcrum to cause the type-bar to swing toward the platen.

100. In a type-writing machine, the combination of a platen, a series of type-bars and a series of key-levers fulcrumed at their rear ends and each comprising two gaping integral sections, one arranged edgewise over the other, one of said sections being connected to a type-bar and the other bearing a finger-key, and said sections being yieldingly connected by a connection that is formed integral therewith, whereby the finger-key portion may move independently of the other portion when the key is struck sharply, so as to relieve the force of the blow upon the finger, while at the same time the lever as a whole may vibrate upon its rear fulcrum to cause the type-bar to swing toward the platen, and a stop for arresting the key-bearing sections of said levers.

101. In a type-writing machine, a key-lever

having a gap or slot in the direction of its length and between its ends, said gap or slot dividing the lever into two sections or parts that are formed integral with each other, one section or part being arranged above the other, and a yoke or support for preventing sidewise movement of one section or part relatively to the other.

102. In a type-writing machine, the combination of a segment, type-carriers supported upon opposite sides of said segment, and key-actuated means which connect with said type-carriers and which are situated upon opposite sides of said segment.

103. In a type-writing machine, the combination of a segment, type-carriers supported upon opposite sides of said segment, actuating-links which connect with said type-carriers and which are situated upon opposite sides of the segment, and key-actuated means which connect with said links and which extend to opposite sides of said segment.

104. In a type-writing machine, the combination of a segment, type-carriers supported upon opposite sides of said segment and which extend in one direction, actuating-links which connect with said type-carriers and which are situated upon opposite sides of the segment, and key-actuated levers which connect with said links and project to opposite sides of said segment.

105. In a type-writing machine, the combination of a segment, segmentally-arranged type-carriers supported upon opposite sides of said segment, segmentally-arranged actuating-links which connect with said type-carriers and which are situated upon opposite sides of said segment, and key-operated segmentally-arranged actuating-levers which are connected to said links and project to opposite sides of the segment.

106. In a type-writing machine, the combination of a segment, segmentally-arranged type-carriers supported upon opposite sides of said segment, two sets of segmentally-arranged actuating-links which connect with

said type-carriers upon opposite sides of said segment, one of said sets of links being draw-links whereas the other set are thrust-links, and key-operated segmentally-arranged actuating-levers which are connected to said links upon opposite sides of the segment.

107. In a type-writing machine, the combination of a segment, hangers supported on opposite sides of said segment, the hangers on one side thereof being staggered with relation to the hangers on the other side of the segment, type-bars pivoted to said hangers, actuating-links which are situated on opposite sides of the segment and which connect with said type-bars, finger-keys, and operative connections between the finger-keys and links.

108. A key and type-bar mechanism for type-writing machines comprising a key and a type-bar, a connecting-link, a stationary rod to act as a pivot for one of said first and third elements, the said element being slotted to removably engage said pivot and split to give a spring effect.

109. In a front-strike type-writing machine, the combination of a key-actuated bell-crank lever, a radially-disposed lever, an upwardly and rearwardly striking type-bar, a link from said radially-disposed lever to the type-bar, and a draw-link from the bell-crank to said radially-disposed lever.

110. In a front-strike type-writing machine, the combination of a series of segmentally-arranged upwardly and rearwardly striking type-bars, a series of segmentally-arranged radially-disposed substantially upright levers, links between said upright levers and said type-bars, a series of key-actuated bell-cranks, and a series of draw-links between said bell-cranks and upright levers.

Signed at New York, in the county of New York and State of New York, this 25th day of June, A. D. 1901.

GEORGE B. WEBB.

Witnesses:

K. V. DONOVAN,
E. M. WELLS.