R. W. UHLIG.

PRINTING MECHANISM FOR TYPE WRITERS.

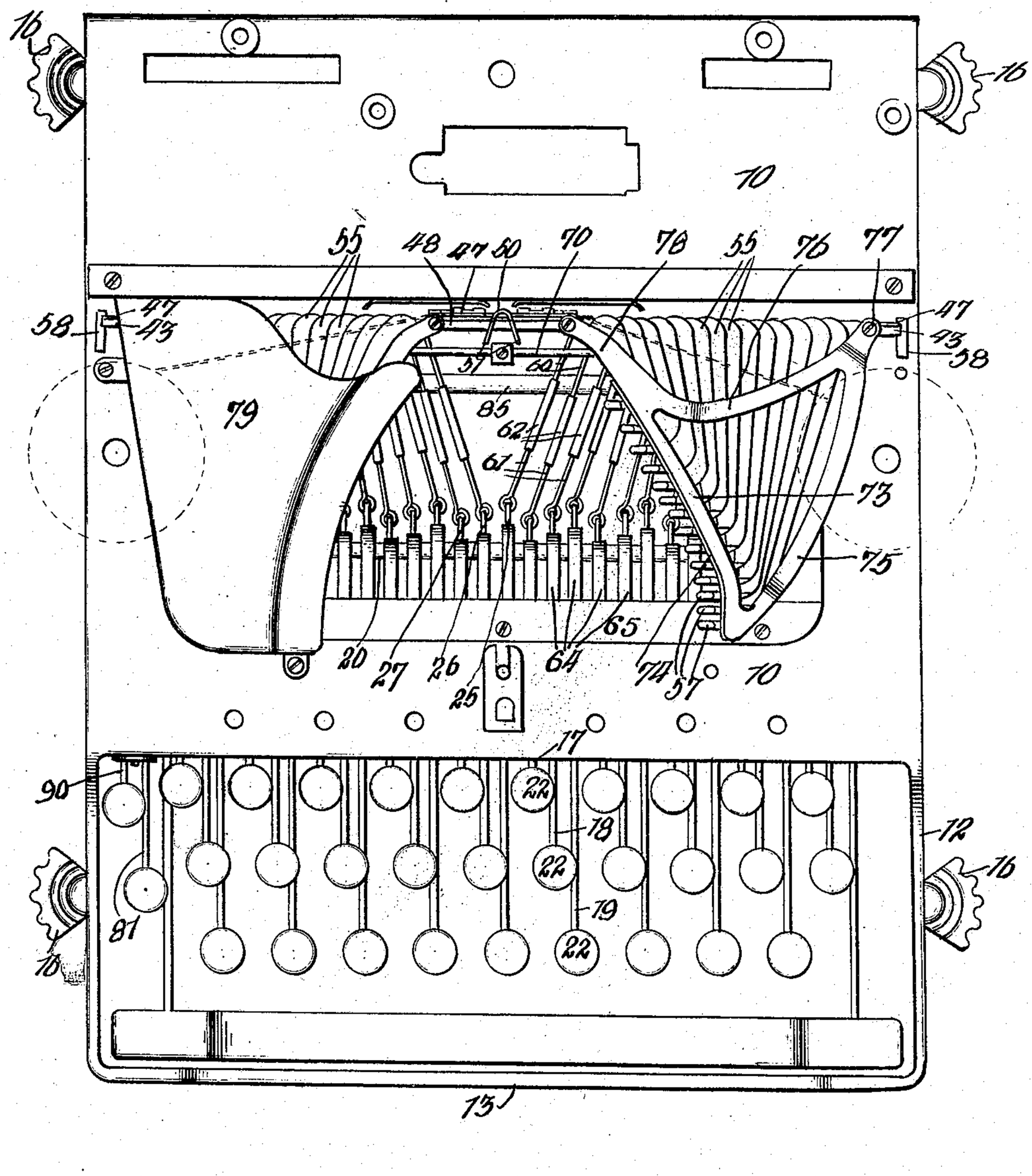
APPLICATION FILED DEC. 18, 1908.

936,833.

Patented Oct. 12, 1909.

5 SHEETS—SHEET 1.

Fig. 1.



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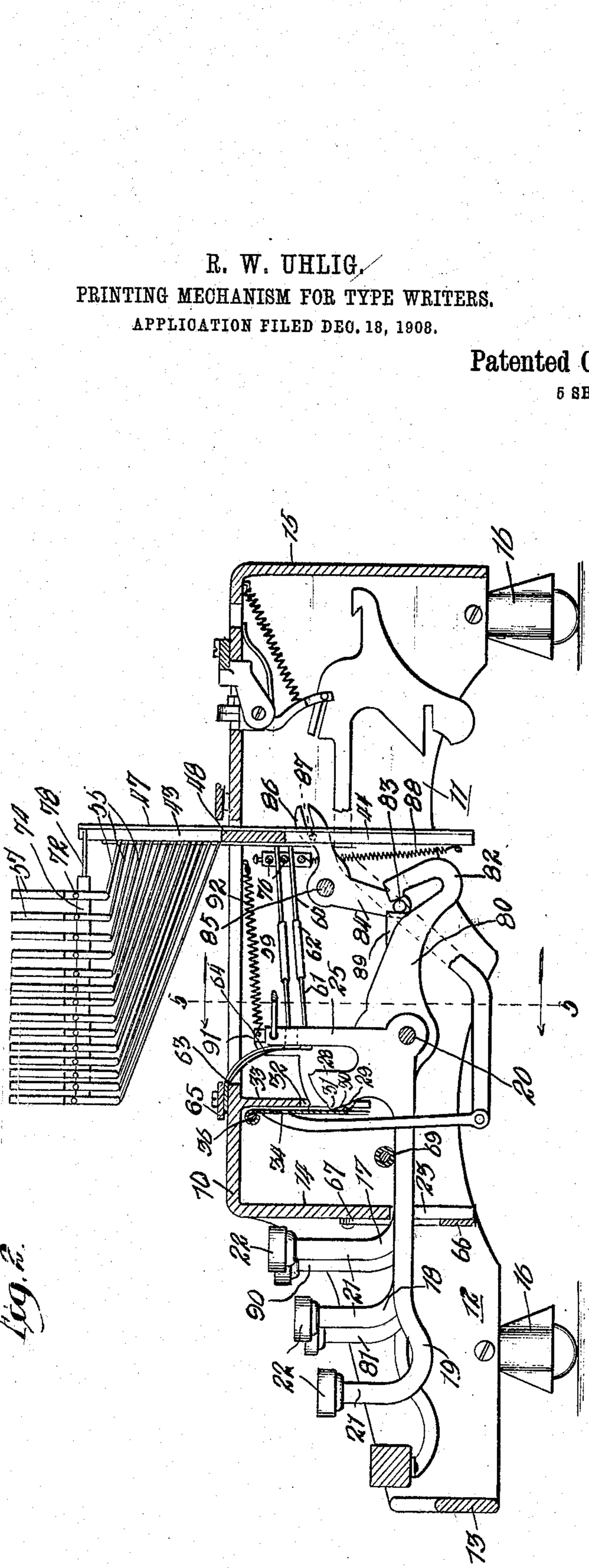

Fig. 2.

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Fig. 3.

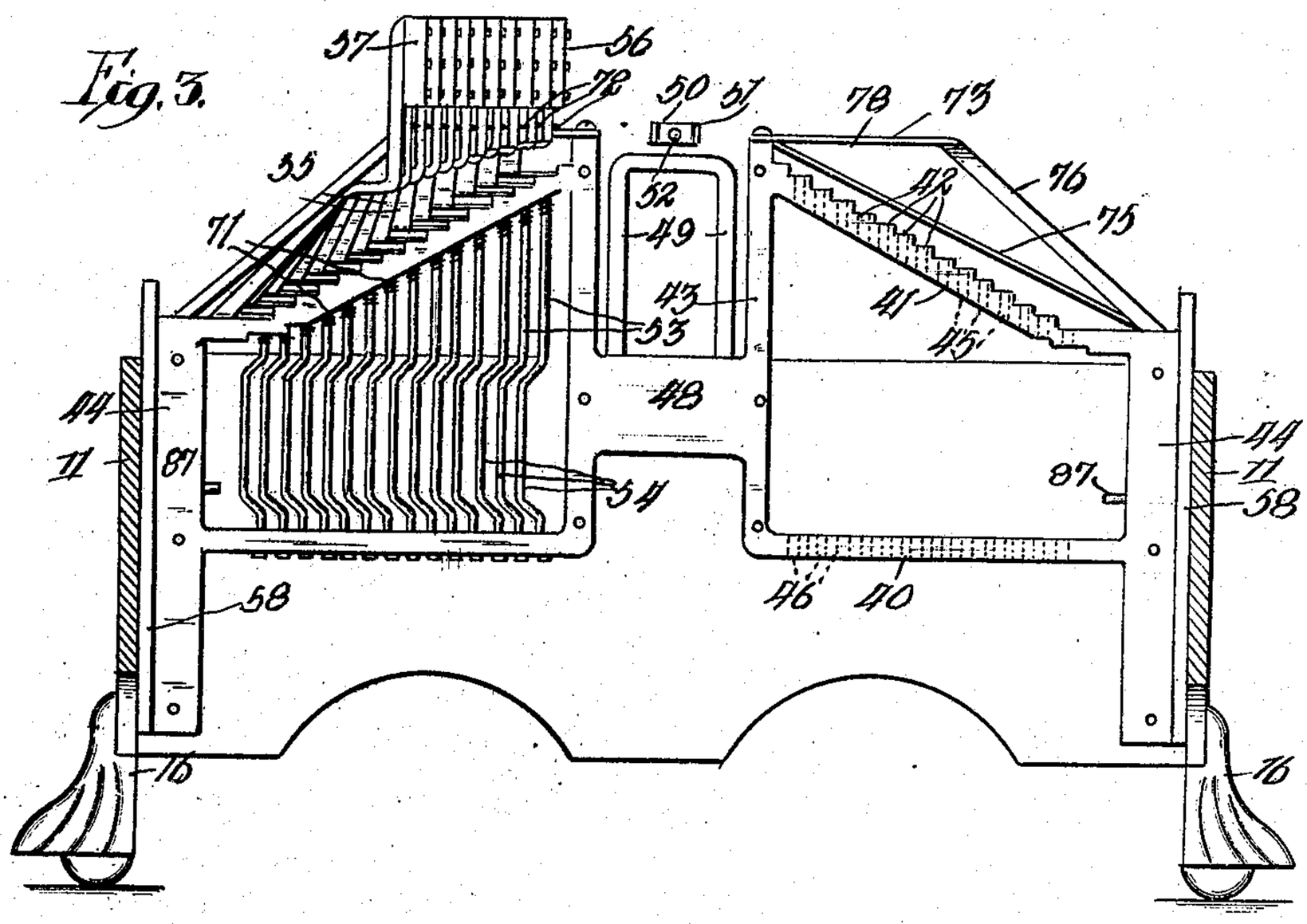

Fig. 4.

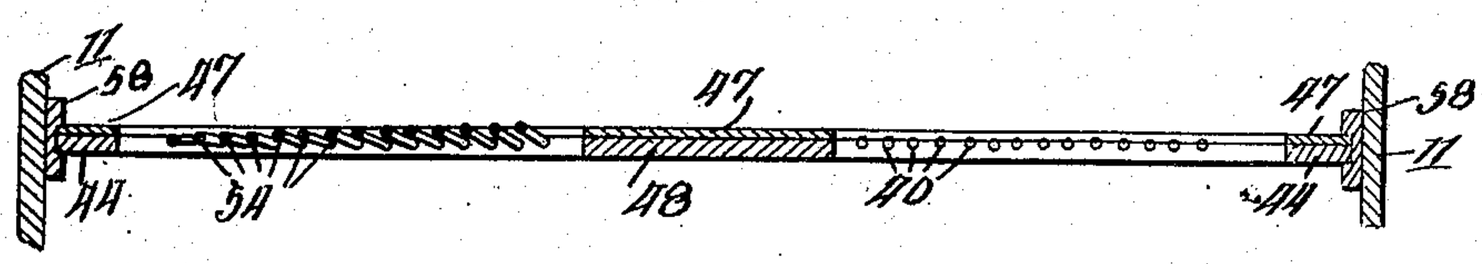

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Fig. 5.

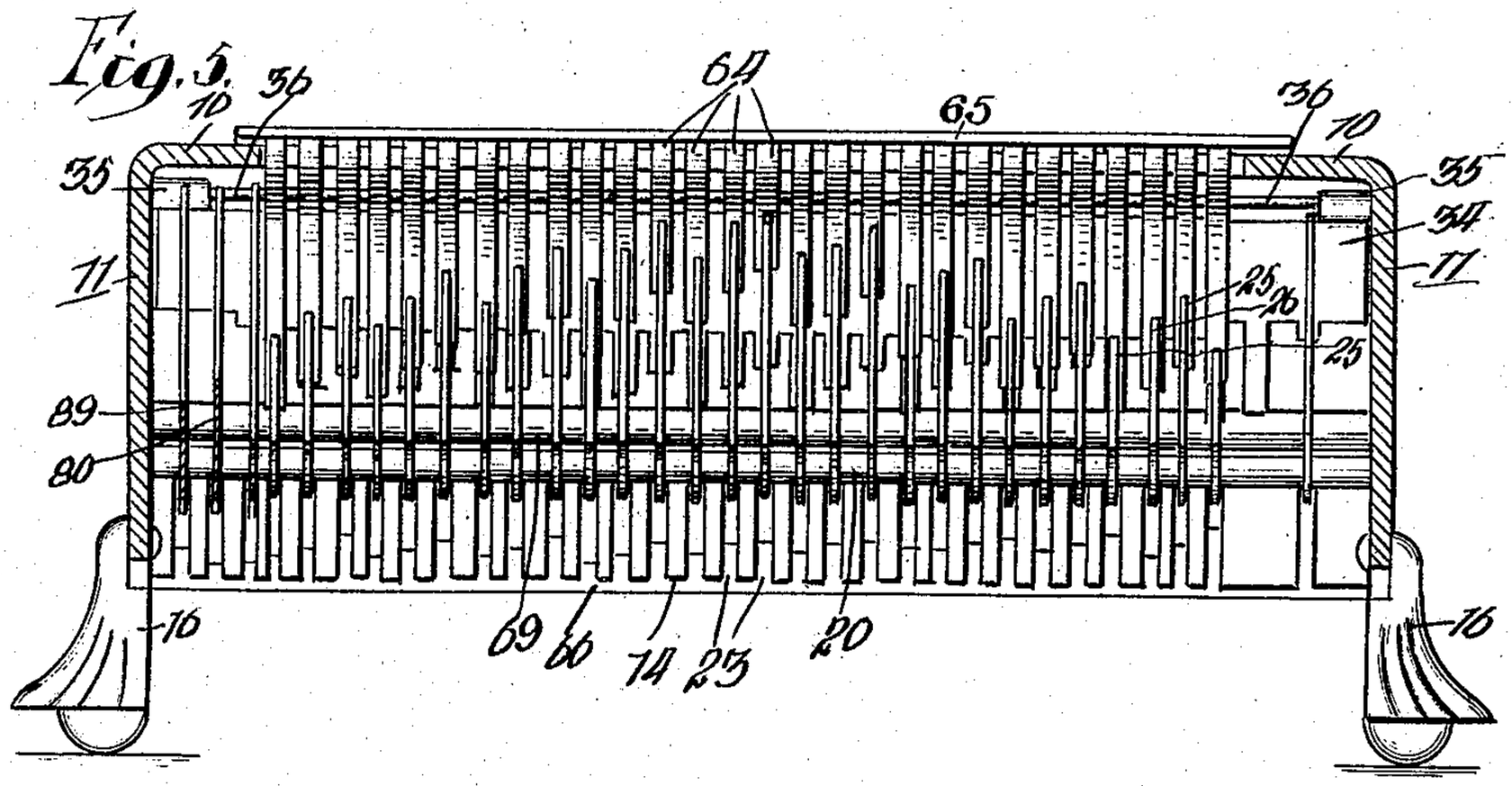


Fig. 6.

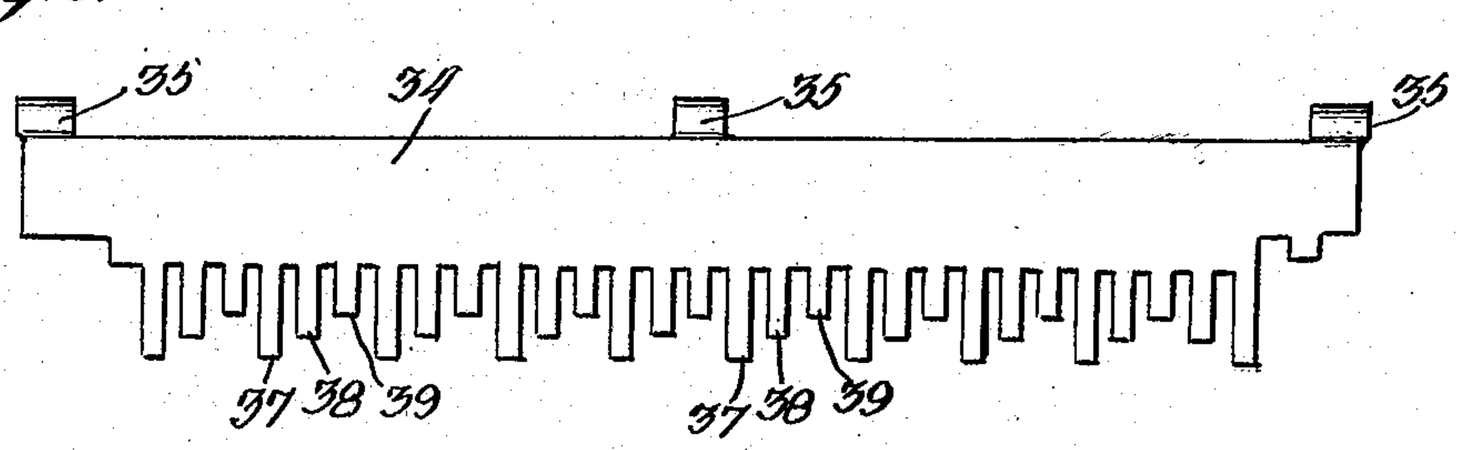
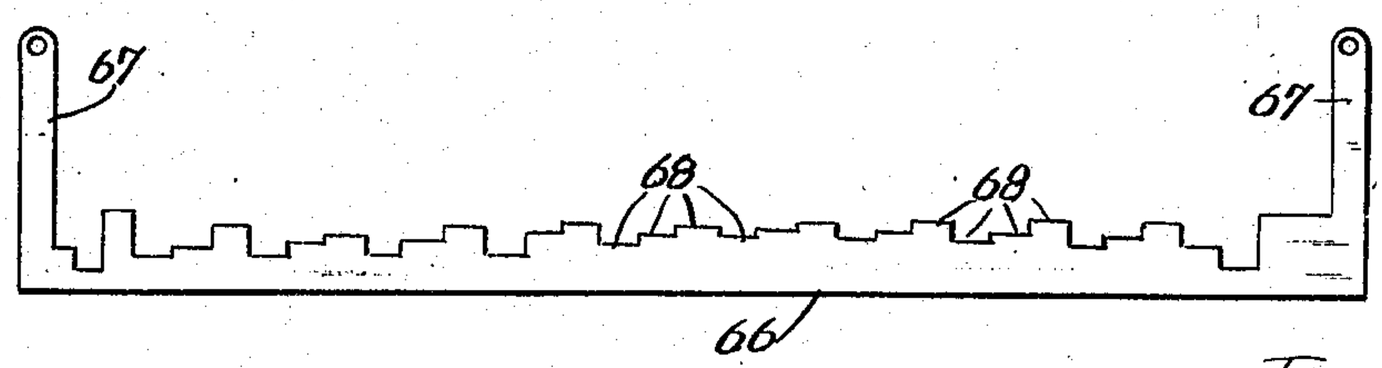


Fig. 7.



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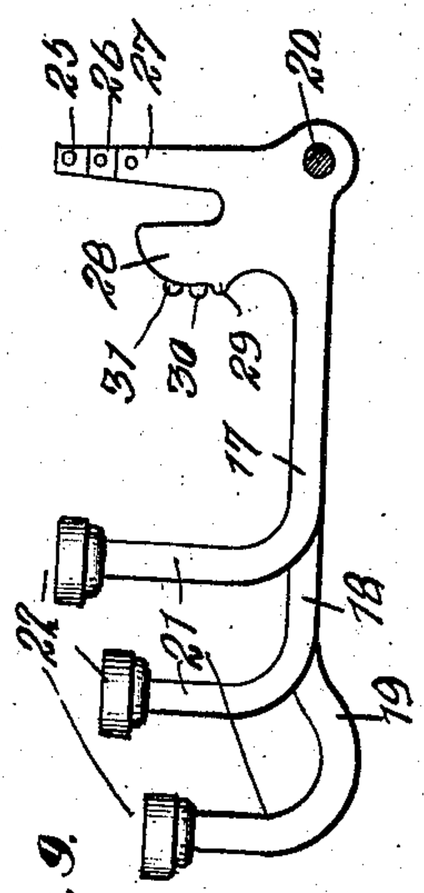

Fig. 9.

Fig. 8.

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UNITED STATES PATENT OFFICE.

RICHARD W. UHLIG, OF RUTHERFORD, NEW JERSEY, ASSIGNOR TO EMERSON TYPE-WRITER COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF MAINE.

PRINTING MECHANISM FOR TYPE-WRITERS.

936,833. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed December 18, 1908. Serial No. 468,135.

To all whom it may concern:

Be it known that I, RICHARD W. UHLIG, a citizen of the United States, residing at Rutherford, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Printing Mechanism for Type-Writers, of which the following is a specification.

The principal object of the present invention is to so construct and combine the various devices comprising the printing mechanism of a visible writing typewriter that the key action of the individual keys will be equalized from end to end of the several banks of keys, and so that the key action of all of the banks will likewise be equalized. In this manner each of the keys will require the same stroke or blow to produce an equal impression on the paper, whereby the resulting action of the type will be uniform, and the impressions registered on the paper will be even throughout. This, of course, results in a much clearer and neater copy than would result from a machine in which some of the type strike the paper with more force than others. Every essential portion of the printing mechanism is devised with respect to this principle of operation, and the key levers, key lever springs, key lever stops, cranked type bars, universal bar, and other portions of the mechanism, are all proportioned and combined together in such manner as to equalize the resulting action of the machine as a whole.

The invention relates to the construction of the individual elements above named, as well as others to be hereinafter referred to, and to their combination and coördination in the manner to be hereinafter described.

The invention further relates to the construction of the type bars themselves and to the method of nesting them together in order to secure equalization of the stroke; as well as lightness of construction, perfection of action, and rigidity in mounting; and also to the guideways provided for centering each of the type heads so as to register its stroke in the exact spot intended on the printing line. The object of the guideways is to prevent any imperfection in the stroke which might result from distortion of the type bar due to lack of sufficient rigidity, or to vibration or original or acquired imperfections in the mounting for the type bar, all of which variations from the normal are prevented by the action of the guideways which hold the type head rigidly at the moment it strikes the paper on the platen, whereby a firm even blow is registered and all vibratory movement avoided.

The invention further relates to the means provided for vertically shifting the type bar frame to bring any one of three styles of type into register with the printing line; and to the machine as a whole and the individual parts thereof.

Further objects will appear from a detailed description of the invention, which consists in the features of construction and combination of parts hereinafter described and claimed.

In the drawings, Figure 1 is a top or plan view of the printing mechanism of a typewriter, showing one of the type shields removed to expose the nested type bars; the platen, and the feeding mechanism being removed from the machine; Fig. 2 a longitudinal sectional view through the center of the machine, from front to rear; Fig. 3 a front elevation of the type frame, showing the type nested therein on the left hand side, and showing in dotted lines the journal sockets on the right hand side; Fig. 4 a longitudinal sectional view through the frame, showing on one side the variations in the position of the cranks of the type bars; Fig. 5 a sectional elevation, taken on line 5—5 of Fig. 2, looking in the direction of the arrow; Fig. 6 a face view of the universal bar; Fig. 7 a face view of the key lever stop bar; Fig. 8 a sectional view, taken through the machine from front to rear near the left edge thereof, and showing the vertical shifting mechanism for the type bar frame; and Fig. 9 a set of three keys, showing the relation of the keys to one another.

The machine as a whole is built into a framework which comprises a flat top wall 10 of rectangular shape, which is cut away in front to provide space for three banks of keys. The framework further comprises a pair of side walls 11, which are carried forward in front of the top wall in the form of extensions 12, which are connected by means of a front rail 13 forming an inclosure, of the usual character, for the keys and key levers. The side walls are connected by means of front and rear cross walls 14 and 15, respectively, and the framework as a whole is mounted upon cushion feet 16 suit-

ably positioned to provide a firm support for the machine.

The keys are arranged in three banks, an upper bank, an intermediate bank, and a lower bank; although the invention is not limited to the employment of three banks, since four banks or any other number might be used. In view of the fact that three banks of keys are employed, it is necessary to employ key levers of three different lengths,—a series of short key levers 17, intermediate key levers 18, and long key levers 19, best shown in Fig. 9. All of the key levers are pivoted, at their inner ends, to a transversely extending key lever rod 20, which extends from side to side of the machine and has its ends rigidly entered and held within the side walls of the framework. Each of the key levers is provided with an upturned forward end 21, which receives a button 22 of the usual character; and the upturned ends of the key levers composing the three banks are of a length to afford a stepped arrangement for the banks of keys, the short key levers terminating in the upper inner bank, the intermediate key levers in the intermediate bank, and the long key levers in the lower outer bank. Each of the levers is entered through an individual guide slot 23 which is cut back from the lower edge of the front cross wall 14, which arrangement maintains the bars in transverse alinement with the rod upon which they are mounted and prevents any interference one with the other. The long, intermediate, and short key levers are of bell crank formation and are provided, at their inner ends, with upwardly projecting arms 25, 26, and 27, respectively, which are of varying length, as best indicated in Fig. 9, the long, intermediate, and short arms being formed on the long, intermediate, and short levers, respectively.

The inner angle of each of the key levers is extended to form a prong 28, and the prongs of the short, intermediate, and long levers are provided with lower, intermediate, and upper bosses 29, 30, and 31, respectively, as best shown in Fig. 9. The prongs of the key levers operate within slots 32 in a cross guide flange 33 which depends from the top wall of the framework and extends in parallel relation with and slightly to the rear of the front cross wall 14, as best shown in Fig. 2. Immediately in front of the guide flange 33 is located a universal bar 34, the peculiar shape of which is shown in Fig. 6. The universal bar 34 is provided, on its upper edge, with three eyes 35 embracing a rod 36 which serves to hinge the universal bar at its upper edge and permit the bar to be swung back under the pressure imparted by the key levers. The lower edge of the universal bar is cut away to provide long, intermediate, and short prongs 37, 38, and 39, respectively; and the key levers are mounted on their rod in suitable position to bring the lower bosses 29 on the short levers into engagement with the long prongs 37; the intermediate bosses 30 on the intermediate levers into engagement with the intermediate prongs 38; and the upper prongs 31 on the long levers into engagement with the short prongs 39 of the universal bar. The arrangement is such that by depressing one of the upper keys with its short lever a given distance, as, for instance, half an inch, a greater angular degree of movement will be imparted to the lower boss 29 than will be imparted to the upper boss 31 by an equal depression of one of the long key levers. Inequality of movement, however, is compensated for partly by the fact that the lower bosses 29 on the short levers are closer to the pivotal point than the upper bosses 31 on the long levers; and the resulting action is further equalized in view of the fact that the lower bosses contact the long prongs 37 which are farthest from the axis of movement of the universal bar, while the upper bosses 31 contact the short prongs which are closest to the axis of movement. By the arrangement above described, inequalities of movement in the universal bar, which otherwise would result from differences in the lengths of the key levers, are equalized, and likewise the stroke or blow required to actuate the individual keys of different banks will be made uniform.

At a point to the rear of the key levers, and in substantially the vertical plane of the printing line, is located a vertically movable type bar frame, as best shown in Fig. 3. The type bar frame is formed in two sections or halves, each of which comprises a lower horizontal rail 40 and an upper diagonally extending rail 41 having in its upper edge steps 42. The upper and lower rails are connected by means of vertical inner and outer rails 43 and 44, respectively; and, in order to provide for ease in assembling, the upper and lower rails are provided with journal recesses 45 and 46, respectively, which recesses, when the parts are assembled, are covered and inclosed by means of a frame plate or housing 47, of the same shape as the frame section, which is screwed or otherwise secured to the face thereof. The inner rails of the two frame sections are connected by means of a cross head 48 which has secured thereto an upwardly extending yoke 49 which carries on its cross head a type bar guide 50 which is of forwardly opening V formation comprising rearwardly converging side arms 51 which converge together in the center, at which point is a pin hole 52, the function of which will hereinafter appear. The frame sections serve as a mounting for two groups or sets of type bars which are adapted to nest together.

Each of the type bars comprises a vertical rock shaft portion 53, the upper and lower ends of which are journaled within the journal sockets 45 and 46, respectively, and the intermediate portions of which are provided with cranks 54. The rock shaft portions of the type bars will decrease uniformly from the center toward the end of each group of type bars, as shown in Fig. 3. Each of the type bars further comprises a flattened intermediate portion 55, which intermediate portions carry, at their outer ends, vertical type carrier heads 56 very nearly equal in length from end to end of the group, which type carrier heads serve as a mounting for type blocks 57 which carry the usual large and small letters and figures, punctuating marks and other characters required in typewriting. The intermediate sections 55 are of gradually increasing length from the inner to the outer end of the group and extend at differing angles with respect to the several pivotal points as best shown in Fig. 1. In that figure it will be noted that the inner type bars have their intermediate sections extended back and away from the printing point, and that the outer intermediate type bar sections extend forwardly toward the printing point, as compared with the axes of movement in the two cases, and that the remaining intermediate type bar sections extend at uniformly varying angles between the extremes presented by the inner and outer type bar sections. This arrangement brings the vertical type carrying heads into the alinement shown, and tends to equalize, in so far as possible, the distance traveled by each of the type carrying heads in its swing from normal position to printing position. With the parts in the position shown, the inner heads will swing through an arc having a shorter radius but much greater angle than the outer heads, although the distance traveled will, of necessity, be somewhat less. All of the type bars are arranged so that the type blocks will swing in a horizontal plane; and, in view of the fact that the type carrying heads are all of substantially equal length, and, in view of the fact that the upper ends of the rock shaft portions are of varying lengths and are arranged in stepped formation, it follows that the intermediate portions of the type bars must extend diagonally upward from the type bar frame to the point of connection of the type carrying heads. Furthermore, the fact that the sections of the type bars are flat enables them to nest closely together in overlapping position, which results in a very light and compact structure. Furthermore, the flattening of the intermediate sections brings their greatest dimension in transverse relation with respect to the plane of their type surfaces, so that the bars are heavily reinforced against bending, twisting or vibration when the blow is struck by the type. In a certain prior construction, type bars were employed, the intermediate sections of which extended horizontally, and the type carrying heads of which were of varying length and arranged in stepped formation, but the present arrangement is much superior, in that it results in a much stiffer and lighter bar, and at the same time tends to more nearly equalize the weight between the inner and outer bars than was previously possible.

The type bar frame is slidably mounted within vertical guideways 58 on the inner faces of the side walls of the framework, which permits vertical adjustment of the frame, carrying the entire number of type bars by means of shifting levers to be hereinafter described.

The inner arms of the key levers are connected with respective type bars by means of links 59, which links consist of hooked inner and outer sections 60 and 61, respectively, connected by means of right-and-left-threaded turnbuckles 62, whereby the tension of the bars can be regulated. The inner sections of the links are loosely hooked around the respective cranks, and the outer sections are hooked through holes in the ends of the type lever arms. The links are arranged to progressively and forwardly converge toward the center of the machine and are arranged in groups of three in accordance with the arrangement of the keys in three banks. Furthermore, the inner arms of the key levers, although arranged in groups of three, of varying lengths, gradually increase in length from the sides of the machine toward the center, so that the inner arm of the long center key lever will be longer than any of the others, and will engage its link at the greatest distance from the pivotal point of the lever. The cranks, instead of lying in the same plane, when in normal position lie in uniformly varying planes, as best shown in Fig. 4. The outermost crank of each group of type bars lies in parallelism with the transverse plane of the machine, while the centermost crank, when in normal position, lies at an angle about 45° behind such plane, the intermediate cranks being arranged at varying angles between these two extremes. The result of this arrangement is that, when one of the outermost keys is depressed and its link drawn forward, the initial pull of the link will be at substantially right angles to the crank; and the outer and heavier type bar, which has the greatest length of travel, will receive an initial pull or impulse with the crank at right angles to the pull and in the best position to overcome the initial inertia of the heavier type bar. Toward the end of the stroke, after the bar has acquired its initial momentum, it is desirable to relieve the pull on the crank and thereby diminish the acquired momentum of the type bar when the

impression is struck. The arrangement is one which accomplishes this result in view of the fact that toward the end of the stroke the crank will be swung almost to its dead center position, so that toward the end of the stroke the pull of the link will be practically eliminated. In the case of the innermost type bars, which are the lightest and which have the least movement, it is desirable to start more gradually and end up with the momentum acquired in order to compensate for the difference in weight in the bars; and the arrangement is one which accomplishes these results, in view of the fact that, at the beginning of the stroke, the crank will lie behind its position of greatest efficiency, which will be reached when the crank is drawn to right angle relation with the link, and the stroke will end with the crank in a position at a substantial angle to the link, so that none of the momentum acquired in the earliest stages of the stroke will be lost at the time the blow is struck.

The crank arrangement, together with the variable angles at which the intermediate sections of the type bars are set, serve in part to equalize the action of the key mechanism. Further equalization is secured by the arrangement of the key lever spring plate 63, which is in the form of a flat plate, screwed or otherwise secured to the top wall of the framework at a point where the latter is cut away to expose the material mechanism of the machine. The spring plate is provided with a plurality of depending springs 64, which are arranged in groups of three of varying lengths, as best shown in Fig. 5. The prongs of these groups increase in length from the center toward the ends while retaining their group arrangement as regards the length of the prongs composing each individual group. The prongs are struck down at an angle with respect to the body of the plate, which is held in position by means of a clamping bar 65, and each of the prongs engages the front edge of the inner arm of the adjacent key lever. The arrangement is one which brings the longest inner arm of each group of three levers into engagement with the shortest prong of a group of three prongs on the spring plate. This arrangement is maintained from side to side, the lengths of the individual prongs composing each group being increased from the center to the sides co-incident with the decrease in the lengths of the type lever arms from the center toward the sides of the machine. This spring arrangement further serves to aid in equalizing the action of the keys in that the longest arms, which control the movements of the inner, lighter type bars, will engage the shortest and most rigid spring prongs, and the shortest arms, which control the movements of the outer, heavier type bars, will engage the longest and most resilient spring prongs. This puts a greater spring resistance on the inner type bars, thereby retarding their swing to compensate for their lesser weight and distance of travel. By arranging the prongs in sets of three, the variant action which, unless otherwise counteracted, would result from the difference in length of the three key levers composing a group, is in a measure counteracted, and likewise a heavier spring tension is maintained against the center groups of key levers than against the outer groups of key levers, so that the variation from side to side of the machine will be equalized. As a further means of equalizing the action of all the keys, a stop bar 66 is provided, the formation of which is shown in Fig. 7, which bar is provided, at its ends, with hangers 67, which are screwed to the front wall of the framework and serve to hold the body of the bar in transverse relation with respect to the entire series of key levers. The acting edge 68 of the stop bar is notched to provide a step formation in groups of three, and the general arrangement is one which raises the stop surfaces of the stops composing the center groups to a higher level than the surfaces of the stops composing the outer groups, whereby the throw of the center keys will be shorter than the throw of the outer keys. Furthermore, the group arrangement is desirable in order to permit the short key levers, which are struck from a point relatively close to their axes, to have a movement through a greater angle than the long or lower key levers which are struck from a position at a greater distance from the pivotal point. This arrangement equalizes the length of stroke required to depress any one of a group of three levers.

The return movement of the key levers is regulated by means of a rubber covered stop bar 69 which extends across the machine immediately above the entire set of key bars and holds them in normal position.

The inner ends of the link sections 60, immediately in front of their point of connection with the cranks, are entered between steadying rods 70, which extend from side to side of the machine and serve to prevent vertical displacement and consequent interference of the bars while allowing free longitudinal movement.

In addition to the key lever springs which have been previously described, each of the rock shaft sections of the type bars is provided, at its upper end, with a small coil spring 71, as shown in Fig. 3. The function of these springs is to hold the type bars in normal position. If desired, the tension of these springs could be graduated, although such graduation is not necessary where the other means herein described for equalizing the action have been provided.

Each of the vertical type bar heads is provided with an inwardly projecting pointed pin 72, which, when the bar is thrown to printing position, is adapted to enter the hole 52 between the arms of the V shaped guide 50, so that the moment the impression is struck the type bar head will be held rigidly against vibration or side play, being guided to position between the side arms and held in position by the register of the pin with the guide hole.

The type bar heads are maintained in their normal or retracted position by means of type head rests 73 provided with leather buffers 74 which cushion the type bar heads as they are thrown back to normal position. The type head rests are held elevated and rigidly supported by outwardly converging braces 75, and 76, which terminate in a head 77 connected with the upper stepped rail of the type bar frame near its outer end, the inner end 78 of the type head rest 73 being directly connected to the upper end of the inner vertical rail 43 of the type bar frame.

The type bars are screened and protected by means of shields 79 of suitable configuration to overlie the entire group of type bars when in their retracted position.

The type bar frame is adapted to be thrown either above or below its normal center position, in order to bring either capitals or punctuation marks into register with the printing line, by means of suitable lever mechanism of the following character. In view of the generally increased printing surface of capital type, as compared with type formed to imprint punctuation marks or similar characters, it is desirable to have the capitals formed on the type blocks in the lowermost position with the small letters occupying the center normal position and the punctuation marks occupying the upper position. This brings the capitals closest to the angle at the lower end of the type bar head and closest to the guide pin. This is the point of greatest rigidity, so that the hardest stroke will be registered at this point, which is desirable in view of the increased surface area of the capitals as compared with the small letters or punctuation marks. The machine is, therefore, arranged to elevate the type bar frame when it is desired to make a shift for capitals, and this elevation is accomplished by means of an elevating shift lever 80 which is pivoted to the key bar rod 20, and terminates, at its forward end, in an upturned button key 81 similar in general appearance and arrangement to the remaining keys. The inner end 82 of the lever is hooked, as shown in Fig. 2, and overlies a pin 83 inwardly extending from the end of a bell crank lever 84, which is rigidly mounted on a rock shaft 85. The upper arm 86 of the bell crank lever is slotted at its end and engages a pin 87 which inwardly projects from the side rail 44 of the vertical movable type bar frame, as shown in Fig. 3. When the key 81 is depressed the hooked end 82 of the lever will be elevated, thereby causing the hooked end to ride over the pin 83 and causing the latter to swing toward the rear. This movement elevates the slotted upper arm 86 of the lever and lifts the type bar frame, which lifting movement is assisted by the action of a pair of coil springs 88, the lower ends of which are secured to the sides of the type bar frame, and the upper ends of which are hooked around the lowermost bar 70. In order to equalize the movement on opposite sides of the type bar frame, the rock shaft 85 is provided, on its opposite end, with a lever arm, not shown, which is exactly like the slotted arm 86 previously described.

The lowering of the type bar frame is accomplished by means of a lowering shift lever 89, which terminates, at its forward end, in a key 90, and the rear inward end of which slightly overlies the pin 83 on the bell crank lever 84. As the key 90 is depressed, the inner end of the lever 89 will be elevated away from the pin 83, which will allow gravity to act and permit the type bar frame to descend against the tension of the springs 88 and will permit the pin 83 on the end of the lower arm of the bell crank lever 84 to swing outwardly and upwardly under the lever 89. Each of the shifting levers is provided with an upwardly extending finger 91, and each of the fingers is engaged by a forwardly extending coil spring 92 which is secured to a suitable portion of the framework. When the depressing lever is released, the spring 92, acting on the finger 91 of the lever, will throw down the inner end of the lever 89 against the underlying pin 83, which will be moved back to the normal position shown in Fig. 2, which movement will raise the type bar frame, assisted by the springs 88, until it has assumed its normal or intermediate position. Fig. 8 diagrammatically shows the elevating shift lever in full lines, and the depressing shift lever in dotted lines, the key on each of the levers being depressed to its lowermost position.

In use, when any one of the keys is depressed, the link arm on the key lever will be drawn forward, which moves the link and exerts a pull on the cranked portion of the intended type bar. The nature and extent of the pull will be determined in each case by the initial position of the crank, by the length and position of the key lever, by the tension of the spring prong with which it coacts, by its action against the universal bar, by the position of the stop which limits the movement of the bar, and by the shape and position of the type bar itself. Each of these factors is to be determined with special

reference to the bank in which the key is located and the position of the key in such bank. By proportioning and arranging the various elements which combine to regulate the stroke of the bar, it is possible to equalize the action of all the type bars and impart to each one the desired stroke action. Further equalization can be effected, if desired, by weighting the innermost bar or bars in such a manner as to give the bars a more nearly equal weight, although it is desirable, for obvious reasons, to keep the weight of all the bars at a minimum and secure the equalization by the regulation of other factors which determine the character of the stroke. The small coil springs which encircle each of the rock shaft sections of the type bars are intended to hold the bars in normal or retracted position regardless of the action of the spring prongs. In order to shift the type bar frame vertically, it is desirable that the hooked inner ends of the links encircle the cranks of the type bars, when in normal position, without actually pressing against them in a manner which would impede the shifting movement of the crank sections up and down through the hooked link ends as the frame is raised and lowered. If the spring prongs were relied on entirely to hold the bars in position to permit shifting, it would be necessary to adjust the tension of each spring prong with such extreme nicety as to be impracticable in the assembling of the machine. It is desirable, therefore, that the return movement of the key levers be limited at such a point as to hold the links out of actual contact with the cranks and rely upon the coil springs for imparting the slight additional tension necessary to finally return the bars to normal position after the cranks have been relieved from engagement with the link hooks. It is not the intention, however, to limit the invention to the employment of coil springs, since the adjustment of the spring prongs might be regulated with sufficient nicety to effect the complete return movement without the provision of additional springs. The provision of turnbuckles enables the length of each of the links to be perfectly adjusted to act in the manner specified, and after the initial adjustment of the links at the factory the turnbuckles can be soldered or otherwise rigidly secured to the link sections to prevent mal-adjustment thereafter. The spring tension of all of the key levers is regulated with regard to the amount of power required to throw the type bar controlled, so that the type bar which requires the most power to actuate it will feel a light tension, and one which requires less power will feel a correspondingly heavier tension. The springs which are secured to the type bar frame counteract in part the action of gravity and assist in raising the frame, although the weight of the latter, carrying with it the type bars, will always be sufficient to over-balance the tension of the springs, allowing gravity to act when it is desired to lower the frame. If the springs were removed, however, the weight of this mechanism would be so great as to render the shifting movements difficult and unsatisfactory.

In a certain prior construction, the cranked sections of the type bars were located entirely below their journal mountings, but the present arrangement is much superior, in that the rock shaft sections of the type bars will be journaled and supported on each side of the crank, so that the action of the latter will be more certain, by reason of the fact that the rock shaft section on the bar will not be subjected to any movement which, in the older construction, tended to cramp the bar and interfere with its freedom of action. The method of shifting the type bar frame in either direction is one which causes the frame to move steadily and easily to the desired position; and the arrangement of the type block is one which results in the striking of each set of characters with just sufficient force to equalize the impressions registered by type of any selected character.

The printing mechanism, as a whole is extremely compact in character, and the horizontal movement of the type bars not only eliminates the action of gravity in the forward and return movements, but also reduces the vertical height of the machine, with the result that the complete machine is firm and strong and very pleasing in appearance.

What I regard as new and desire to secure by Letters Patent is:

1. In typewriter printing mechanism, the combination of a plurality of nested type bars, each of the type bars comprising a type carrying section, a rock shaft section, and an intermediate connecting section, journal mountings for the rock shaft sections, cranks formed intermediate said journal mountings, the cranks normally lying in variant angular positions with respect to a transverse vertical plane, and key levers and connections for actuating said cranks, substantially as described.

2. In typewriter printing mechanism, the combination of a plurality of nested type bars, each of the type bars comprising a type carrying section, a rock shaft section, and an intermediate connecting section, journal mountings for the rock shaft sections, cranks formed intermediate said journal mountings, the cranks normally lying in variant angular positions with respect to a transverse vertical plane, the inner cranks being normally turned more to the rear of such plane than the outer cranks, and key

levers and connections for actuating said cranks, substantially as described.

3. In typewriter printing mechanism, a plurality of type bars pivoted to swing on vertical axes, a plurality of key levers all pivoted in the same straight horizontal line and having their forward ends in the form of keys and having their rear inner ends in form to impart actuating movements to the type bars, and connections between the type bars and the rear ends of the respective key levers, engaging the latter at different vertical distances from the pivotal centers of the key levers for equalizing the action of the keys, substantially as described.

4. In typewriter printing mechanism, a plurality of pivoted key levers of different lengths, having their ends in the form of keys arranged in banks, and having at their inner ends upwardly extending arms, type bars, and links actuating said type bars, the links engaging the long lever arms being connected therewith at the greater distances from the pivotal centers, the link connections at the center of the machine for each bank of key levers being connected at greater distances from the pivotal centers than the links toward the sides of the machine, for equalizing the action of the keys, substantially as described.

5. In typewriter printing mechanism, a plurality of pivoted key levers of different lengths, having their ends in the form of keys arranged in banks, and having at their inner ends upwardly extending arms, type bars, and links actuating said type bars, the links engaging the long lever arms being connected therewith at the greater distances from the pivotal centers, the link connections at the center of the machine for each bank of key levers being connected at greater distances from the pivotal centers than the links toward the sides of the machine, for equalizing the action of the keys, and springs engaging the arms on said levers, the tension of the springs acting upon the key levers of each bank being graduated from the center toward the sides of the machine, for aiding in equalizing the action, substantially as described.

6. In typewriter printing mechanism, a plurality of pivoted key levers of different lengths, having their ends in the form of keys arranged in banks, and having at their inner ends upwardly extending arms, type bars, and links actuating said type bars, the links engaging the long lever arms being connected therewith at the greater distances from the pivotal centers, the link connections at the center of the machine for each bank of key levers being connected at greater distances from the pivotal centers than the links toward the sides of the machine, for equalizing the action of the keys, and flat springs engaging the arms of the key levers, the springs engaging the center arms of each bank of key levers being of less length and greater tension than the flat springs engaging the arms of the outer key levers, for aiding in equalizing the action, substantially as described.

7. In typewriter printing mechanism, a plurality of pivoted key levers of different lengths, having their ends in the form of keys arranged in banks, and having at their inner ends upwardly extending arms, type bars, and links actuating said type bars, the links engaging the long lever arms being connected therewith at the greater distances from the pivotal centers, the link connections at the center of the machine for each bank of key levers being connected at greater distances from the pivotal centers than the links toward the sides of the machine, for equalizing the action of the keys, and a spring plate provided with spring prongs of varying lengths, the prongs engaging the arms of the center key levers of each bank of keys being of less length and greater tension than the prongs engaging the arms of the side key levers of each bank of keys, for aiding in equalizing the action, substantially as described.

8. In typewriter printing mechanism, a plurality of type bars pivoted to swing on vertical axes, a plurality of key levers all pivoted in the same straight horizontal line and having their forward ends in the form of keys and having their rear inner ends in form to impart actuating movements to the type bars, and connections between the type bars and the rear ends of the respective key levers, engaging the latter at different distances from the pivotal centers of the key levers for equalizing the action of the keys, the connections for the center key levers engaging the rear ends thereof at greater distances from the pivotal centers for the levers than the connections for the key levers toward the sides of the machine, substantially as described.

9. In typewriter printing mechanism, the combination of a plurality of key levers, a type bar for each key lever, connections between each of the key levers and its type bar, the connections engaging the key levers at suitable points to equalize the action of the key levers and the throw of the type bars, and springs acting upon the key levers and having variant tension for equalizing the action, substantially as described.

10. In typewriter printing mechanism, the combination of a plurality of key levers of different lengths arranged in banks, and a universal bar hung adjacent to the key levers and adapted to be engaged by the key levers of different banks at different distances from the axis of movement of the universal bar, for aiding in equalizing the movements of the universal bar, substantially as described.

11. In typewriter printing mechanism, the combination of a plurality of key levers all pivoted in alinement with one another, the levers having different degrees of angular movement, a universal bar hinged adjacent to the levers and adapted to be engaged by the levers having the greatest degree of angular movement at points near its free edge, and adapted to be engaged by the levers having lesser degrees of angular movement at points closer to its axis of movement for tending to equalize the movements of the universal bar, substantially as described.

12. In typewriter printing mechanism, the combination of a plurality of key levers all pivoted in alinement with one another, the levers being of different lengths to form banks of keys, a universal bar hinged adjacent to the levers and adapted to be engaged by the short levers at points near its free edge, and adapted to be engaged by the long levers at points closer to its axis of movement, the levers being provided with upwardly extending arms, links engaging the lever arms, the links for the long lever arms being connected at greater distances from the lever pivotal point than the links engaging the short lever arms, substantially as described.

13. In typewriter printing mechanism, the combination of a plurality of key levers of three different lengths and having their forward ends upturned to provide three banks of keys, means for pivoting all of the key levers in alinement with one another, two groups of type bars, a connection between each key lever and its corresponding type bar, the key levers being formed and the connections being made in a manner to equalize the key action to compensate for the differences in the weight and swing of the type bars, substantially as described.

14. In typewriter printing mechanism, the combination of a plurality of key levers of three different lengths and having their forward ends upturned to provide three banks of keys, means for pivoting all of the key levers in alinement with one another, two groups of type bars, a connection between each key lever and its corresponding type bar, the key levers being formed and the connections being made in a manner to equalize the key action to compensate for the differences in the weight and swing of the type bars, and variant spring mechanism acting on the key levers for further equalizing the key action, substantially as described.

15. In typewriter printing mechanism, a plurality of type bars pivoted to swing on vertical axes, a plurality of key levers all pivoted in the same straight horizontal line and having their forward ends of different lengths and upturned to furnish front and rear banks of keys, the rear inner ends of the key levers being in form to impart actuating movements to the type bars, and connections between the type bars and the rear ends of the respective key levers, the connections for the long levers of the front bank of keys engaging the rear inner ends of such levers at greater distances from the pivotal points for the key levers than the connections for the shorter levers furnishing the rear bank of keys, substantially as described.

16. In typewriter printing mechanism, a plurality of type bars pivoted to swing on vertical axes, a plurality of key levers all pivoted in the same straight horizontal line and having their forward ends of different lengths and upturned to furnish front and rear banks of keys, the rear inner ends of the key levers being in form to impart actuating movements to the type bars, and connections between the type bars and the rear ends of the respective key levers, the connections for the long levers of the front bank of keys engaging the rear inner ends of such levers at greater distances from the pivotal points for the key levers than the connections for the shorter levers furnishing the rear bank of keys, the connections for the center key levers engaging the rear ends thereof at greater distances from the pivotal centers than the connections for the key levers toward the sides of the machine, substantially as described.

RICHARD W. UHLIG.

Witnesses:
MARTIN PETERSEN,
JOHN DAVIS.