

A. W. SMITH.
 TYPE WRITING MACHINE.
 APPLICATION FILED MAY 15, 1905.

958,778.

Patented May 24, 1910.

4 SHEETS—SHEET 1.

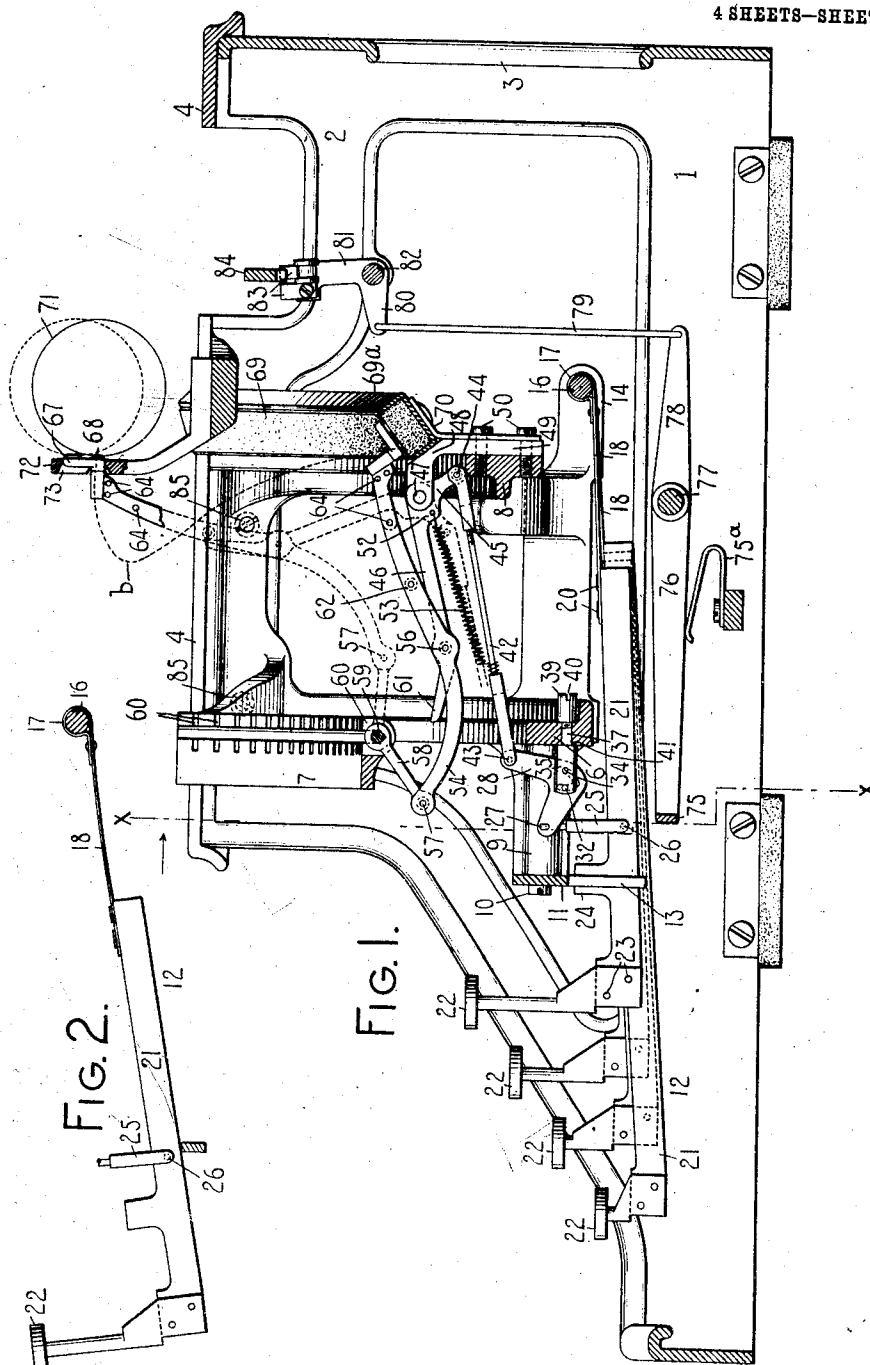


Fig. 1.

Fig. 2.

WITNESSES:

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INVENTOR:

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By Jacob Felber

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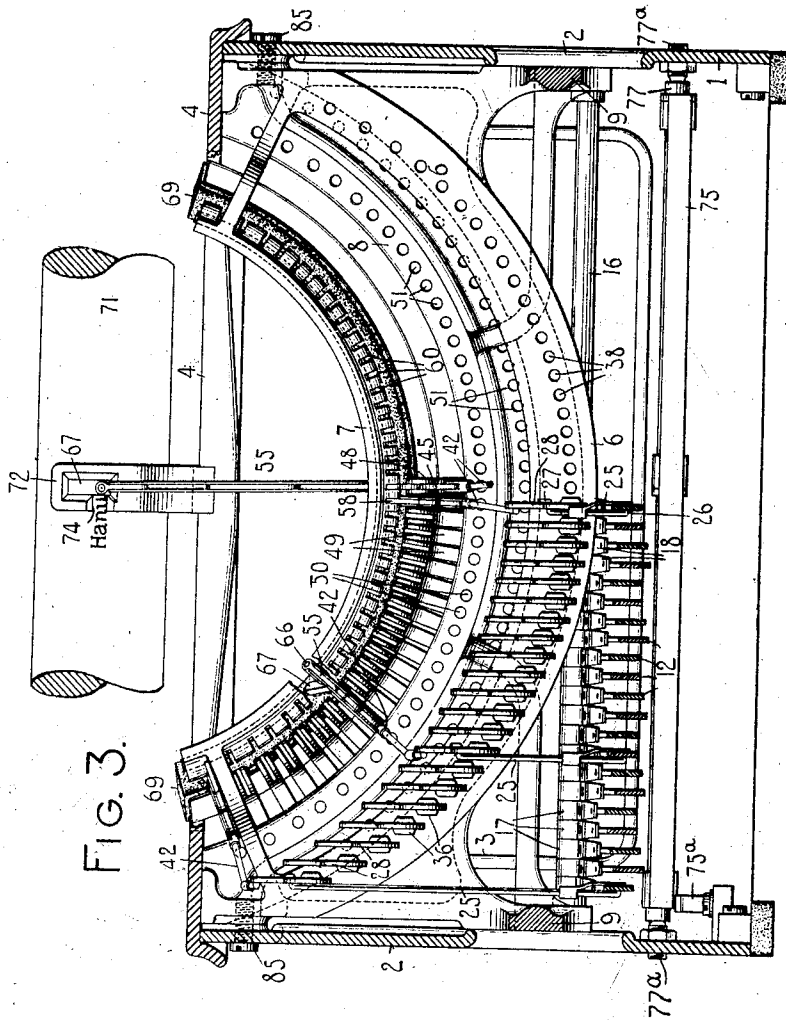


FIG. 3.

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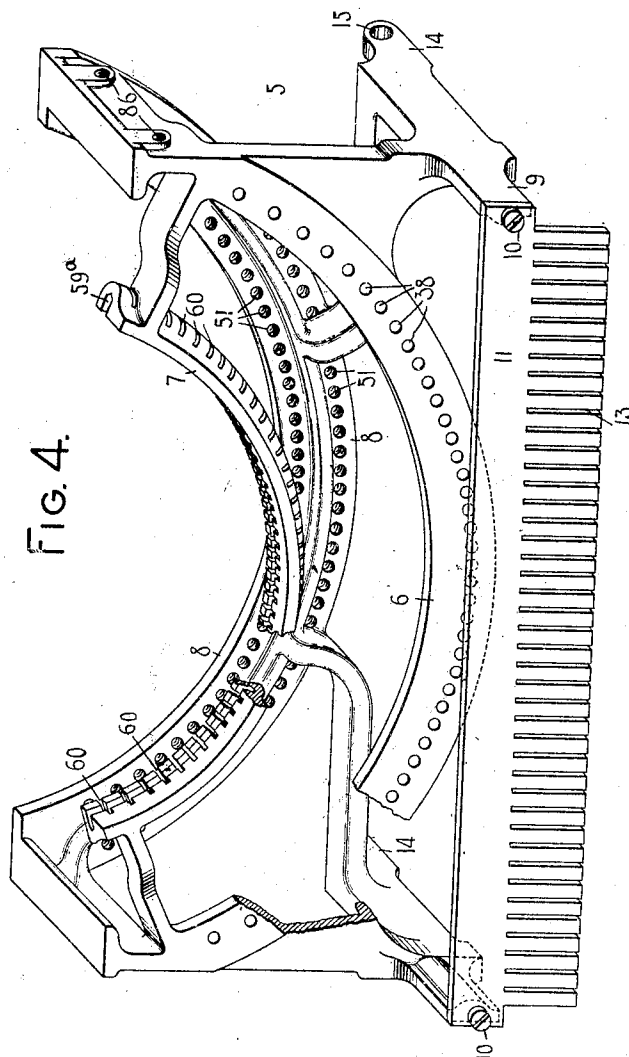


FIG. 4.

WITNESSES:

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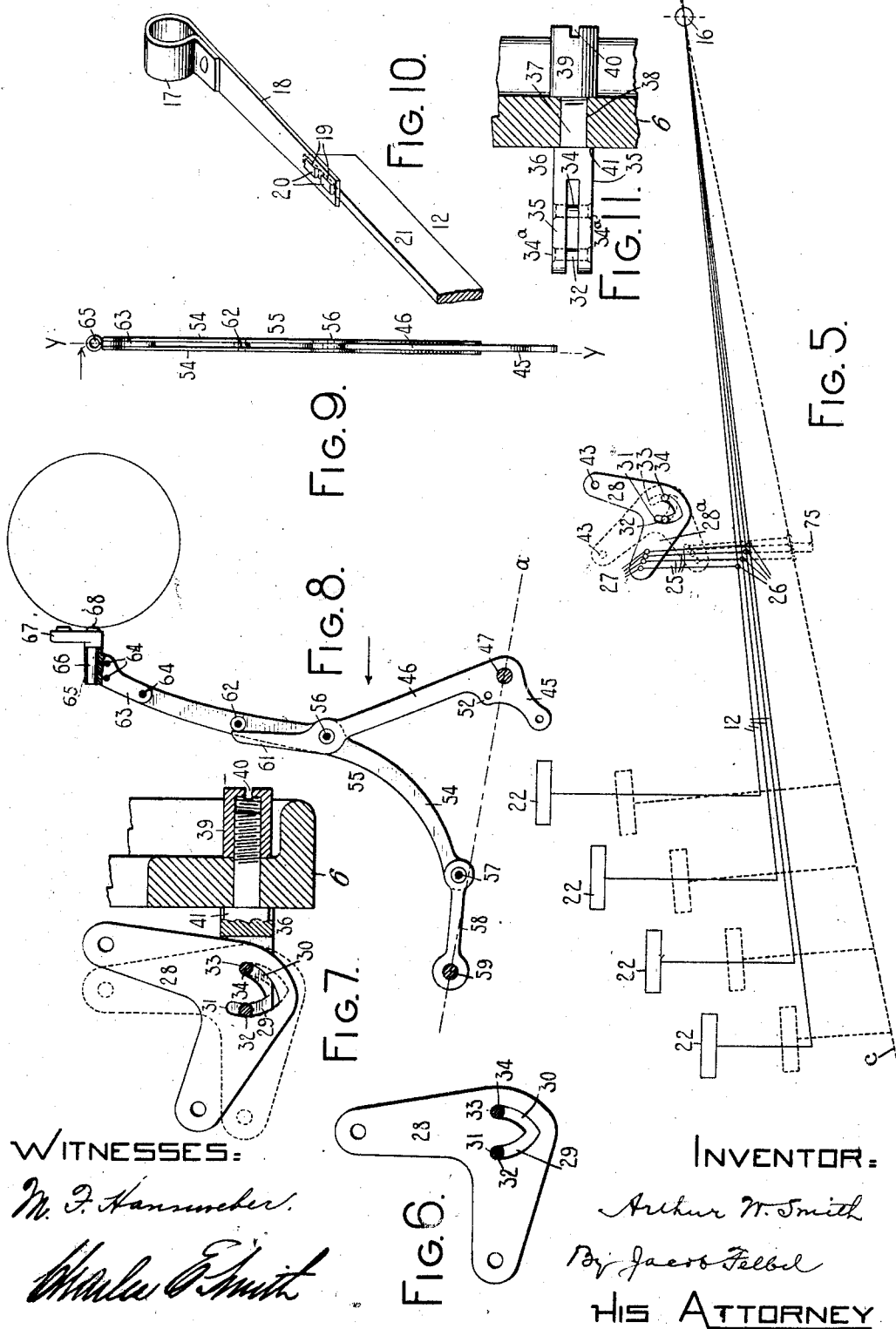
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

ARTHUR W. SMITH, OF NEW YORK, N. Y., ASSIGNOR TO YOST WRITING MACHINE COMPANY, OF ILION, NEW YORK, A CORPORATION OF NEW YORK.

TYPE-WRITING MACHINE.

958,778.

Specification of Letters Patent. Patented May 24, 1910.

Application filed May 15, 1905. Serial No. 260,441.

To all whom it may concern:

Be it known that I, ARTHUR W. SMITH, citizen of the United States, and resident of the borough of Manhattan, city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Type-Writing Machines, of which the following is a specification.

My invention relates to typewriting machines and more particularly to the type actions thereof, and one of the objects of said invention is to provide a light and efficient type action which is speedy in operation and wherein there is a uniform leverage and a uniform extent of dip or depression of the keys throughout the system.

To the above and other ends which will hereinafter appear, my invention consists in the features of construction, arrangements of parts and combinations of devices to be hereinafter described and particularly pointed out in the appended claims.

In the accompanying drawings, wherein like reference characters indicate corresponding parts in the various views, Figure 1 is a vertical front to rear sectional view of a sufficient number of parts of a typewriting machine to illustrate my invention in its application thereto. Fig. 2 is a detail side view of one of the key levers shown depressed. Fig. 3 is a vertical transverse sectional view taken on the line $x-x$ of Fig. 1 and looking in the direction of the arrow at said line, and with some of the parts broken away to better illustrate other features of the construction. Fig. 4 is a detail perspective view, with parts broken away, of the detachable auxiliary frame carrying the segments on which the type actions are supported. Fig. 5 is a diagrammatic side elevation of a series of key levers and the actuating bell cranks connected thereto. Fig. 6 is an enlarged detail side elevation of one of the type bar actuating bell cranks. Fig. 7 is an enlarged detail side elevation of one of the type bar actuating bell cranks and the hanger therefor, the hanger and the segment to which it is secured being shown in section. Fig. 8 is a detail longitudinal sectional view of one of the jointed type bars, the view being taken on the line $y-y$ of Fig. 9 and looking in the direction of the arrow at said line and illustrating a type bar in printing

position. Fig. 9 is an edge view of a type bar when the parts are in the printing position, the view looking in the direction of the arrow in Fig. 8. Fig. 10 is a fragmentary enlarged detail perspective view of the rear portion of one of the key levers. Fig. 11 is a detail top plan view of one of the hangers for the type bar actuating bell cranks, the segment to which said hanger is secured being shown in section.

The main frame of the machine comprises a base 1 with side portions or plates 2 and a rear end 3; a suitable top plate 4 being secured to the side members and rear end of the frame. An auxiliary detachable frame 5, which is shown in detail in Fig. 4, comprises a front lowermost segment 6, a second segment 7 above the segment 6 and a segment 8 which supports the type bar actuating levers or drivers in place. These segments are united by any suitable means independent of the main frame and are preferably formed as a single casting. The forwardly projecting arms 9 of the auxiliary frame 5 have tapped openings in which headed screws 10 are received. The screws 10 secure in place a comb plate 11 which receives the key levers 12 in the openings 13 in order to properly space the levers at their forward ends and guide them in their movements. Rearwardly projecting arms 14 of the auxiliary frame 5 are provided with bearing openings 15 to receive a shaft or bearing rod 16 which may be supported and fixed in the arms so that the rod may constitute a bearing on which the rear ends of the key levers are pivotally supported. The connection between the key levers and the bearing rods 16 is preferably formed by a loop or bearing 17 at one end of a leaf spring 18, said loop surrounding the bearing rod so as to be free to turn thereon and to form spacing means for maintaining the key levers properly spaced apart at their rear ends. Each of the springs 18 tapers from the rear bearing loop 17 to the front end thereof as shown in Figs. 3 and 10, so that the springs will not interfere with each other when the key levers are actuated. The forward end of each leaf spring 18 is preferably apertured at 19 to receive upwardly projecting rivets 20 that extend from the upper edge of the main body portion 21 of an associated key lever 12. The forward end of the

body portion of each key lever carries an upwardly extending finger key 22 that may be riveted to the body portion as indicated at 23. The body portion of each key lever
5 may have an upwardly extending member 24 that is received in one of the openings 13 in the comb plate. Each key lever has an upwardly extending connecting or draw link 25 pivoted thereto at 26 and the upper end of
10 the link is pivoted at 27 to a bell crank or angular type bar actuating lever 28.

From an inspection of Fig. 3 it will be seen that the draw links 25 are of progressively greater lengths from the center to the sides of the system so as to cooperate with the different bell cranks 28 which are segmentally arranged. Each bell crank has two
15 openings 29 and 30 therein, said openings extending transversely therethrough and constituting in effect a single substantially V-shaped opening that forms pivotal bearings at the upper ends thereof. Thus, the upper
20 end 31 of the slot or opening 29 constitutes a bearing or seat for cooperation with a fixed pivot 32, while the upper end 33 of the slot 30 constitutes a bearing seat for a fixed pivot 34 and each slot 29 or 30 is concentric with the pivot that is received in the other slot.
25 For instance, the slot 29 corresponds to an arc of which 34 is the center, whereas, the slot 30 corresponds to an arc of which the pivot 32 is the center. The pivots 32 and 34 extend through the openings 29 and 30 in the bell crank and are riveted at their ends,
30 as at 34*, to the bifurcated arms 35 of the individual hangers 36 as indicated in Fig. 11. Each hanger 36 is preferably split so as to provide a bifurcated portion, between the arms 35 of which an actuating bell crank
35 may be seated and connected thereto by the pivots 32 and 34 in the manner described. Projecting rearwardly from each hanger is a cylindrical hanger stem 37 which extends through an opening 38 in the segment 6.
40 The rear end of the stem is threaded for cooperation with a nut 39 that has a slot 40 for cooperation with a screw driver in order to secure the hanger in place.

It will be understood that the forward end
50 of the nut bears against the rear face of the segment 6 and draws the shouldered portion 41 of the hanger against the front face of the segment and thus securely holds the hanger in position on the segment. When
55 the nut 39 is loosened it affords an adjustment of the hanger and the associated bell crank around a center defined by the longitudinal axis of the hanger stem, which adjustment I refer to herein as a pivotal adjustment. This method of mounting the
60 hangers 36 facilitates the assemblage of the parts and enables the bell cranks to be adjusted in parallel vertical planes, although they are disposed at progressively greater
65 heights from the center to the sides of the

system, or, in other words, they are vertically and segmentally arranged as illustrated in Fig. 3.

The leaf springs 18 and body portions 21 together constitute key levers 12 which are
70 pivoted on the rod 16 so that all of the key levers are pivoted at their rear ends in a single transverse plane, whereas, the forward ends of the levers extend to different distances toward the front of the machine and
75 the key stems vary in height. The key levers thus provide four different banks of keys 22 arranged fore and aft of the machine in different transverse rows; all of the key levers for the same bank of keys being of the
80 same length, and from an inspection of Fig. 5 it will be understood that the connecting links 25 are connected to the key levers and to the bell cranks at different distances fore and aft of the machine depending on the
85 length of the key levers. Thus, for instance, all of the shortest key levers, that have their keys in the fourth bank counting from the front of the machine, are connected to links at points farthest from the fulcrums of the
90 key levers and are connected to the bell cranks at the farthest points from the fulcrums thereof and nearest the outer ends of the forwardly projecting arms of the bell crank levers, whereas, the key levers of the
95 third bank of keys are longer than the key levers of the fourth bank of keys and the points of connection between the links 25 and the key levers of this row and their respective bell cranks are nearer the fulcrums of
100 the key levers and bell cranks. The key levers of the second row of keys are longer than those of the third and fourth rows of keys and the points of connection between the links 25 and the key levers and bell cranks
105 for the second row are nearer the fulcrums of the key levers and sub-levers, whereas, the key levers for the first row of keys are longest and the links 25 are connected there-
110 to nearer the fulcrums of the key levers and are connected to the bell cranks nearer the fulcrums thereof than any of the key levers of the other rows of keys. The purpose of this construction is to compensate for the
115 difference in length of the various key levers and to equalize the leverage throughout the system of type bars and to provide a uniform extent of dip of the various finger keys, notwithstanding the difference in length of the
120 various key levers. Extending upwardly and rearwardly from the upright arms of the sub-levers or bell cranks are a series of segmentally arranged draw links 42 which are pivoted at their forward ends to the sub-
125 levers as indicated at 43 and are pivotally connected at their rear ends at 44 to crank arms 45 of the type bar actuating levers or drivers 46. These drivers are each pivoted
130 at 47 to a hanger 48 that has its depending stem 49 secured to the rear face of the seg-

ment 8 by two headed screws 50 that pass freely through openings in the stem of the hanger and screw at their forward ends in the tapped openings 51 in the segment.

5 Each of the drivers has an ear 52 that is perforated to receive one end of a restoring spring 53, the forward end of said spring being secured to the associated draw link 42 so that the tendency of said contractile restoring spring is to draw the forward end of the associated actuator or driver 46 down and to elevate the key lever by effecting a rearward pull on the upwardly directed arm of the associated sub-lever 28.

10 Each actuator 46 is received between two plate-like members 54 that are maintained spaced apart by shouldered rivets to form a type bar proper 55; and the actuator is pivoted at 56 to said type bar proper intermediate the ends thereof as indicated in Figs. 1 and 8. The front end of each type bar is pivoted at 57 to a guide link 58, which in turn, is pivoted at its upper end on a pivot wire 59 seated in a longitudinal groove 59^a in the segment 7, each guide link working in a transverse guiding slot 60 in said segment. A finger or abutment 61 projects from each actuator or driver 46 beyond the pivotal connection 56 and this abutment co-operates with an abutment 62 which is formed by a shouldered rivet between the side members 54 of the type bar. The co-operation between the two abutments 61 and 62 takes place just before the type bar reaches the printing position so that after the abutments are brought into coöperation the type bar proper 55 and its associated actuator or driver 46 will move together as one around the pivot 47 of the driver, the finger or abutment 61 being received between the side plates or members 54, thus preventing any relative lateral play or movement between the actuator and type bar and tending to further stiffen the type bar at the last portion of the printing stroke.

15 From an inspection of the dotted line showing of a type action in Fig. 1, it will be understood that the construction and arrangement of the parts of each action are such that a bending of the finger 61 is effective to lengthen or shorten the distance between the type and the pivot 47 and thus adjust the type up or down when the parts of the type action are in the printing position. It will likewise be observed that by filing away a part of the finger 61 the distance in question is shortened and a corresponding adjustment of the type effected.

20 A block 63 is received between the side plates or members 54 of each type bar at the free end thereof, the side plates and block being riveted together at 64. The block extends beyond the free end of the type bar proper where it is provided with an opening 65 (Fig. 9) which is shaped to receive

a conoidal stem 66 that extends from the rear face of the type block 67, the stem being disposed opposite one of the types, preferably the lower case type 68.

From an inspection of Fig. 8 it will be observed that the construction and disposition of the parts is such that when the type bar is in printing position the pivotal connection 57 between the guide link 58 and an end of the type bar proper 55 is slightly above a line drawn through the pivots 47 and 59 of the associated guide link and actuator respectively as indicated by the dotted line *a* in Fig. 8. It is important that substantially this disposition of the parts be maintained in order that the type bar may strike with full force during the printing stroke and in order that the type bar proper 55 and its driver 46 may swing together as one part around the pivot 47 as a center at the last portion of the printing stroke.

A segmental inking pad 69 is supported with its inking face inclined in a metallic trough or support 69^a that rests on bracket arms 70 which may be secured in place by certain of the screws 50 which secure the hangers 48 to the segment 8, so that the inking pad is supported above said segment in part by the brackets 70 and in part by the hangers 48 and thus the type rest or inking pad is supported by the segment 8. The type bars normally rest with the printing faces of the types against the inking pad and in the movement of a type action to the printing position the lowercase type describes a path of movement indicated by the dotted line *b* in Fig. 1; that is to say, it moves first upwardly and forwardly and then rearwardly in a substantially horizontal direction to impact with the platen 71 which is diagrammatically shown in Figs. 1 and 8. The platen may be shifted for upper and lower case printing by any suitable means. In moving to the printing position the type block is received in a fixed type guide 72 that is supported at its lower end on the top plate of the machine. The inner walls of the central opening in the type guide are beveled as at 73 for coöperation with the side walls of the type block to guide it in its movement to the printing position, and the left hand side of the type guide is cut away at 74 in order that the last written letter or character may be presented to the view of the operator when the carriage is fed to the left a letter space distance. There is therefore no appreciable obstruction of the operator's view of the printed matter by the type guide, notwithstanding the fact that it surrounds the type block on all sides to properly direct it to the printing position.

It is desirable not only to connect the key levers of different lengths at different points in the sub-levers 28 as shown in the diagram

in Fig. 5, but it is also desirable to arrange the key levers of different lengths initially at a different height, that is to say, all of the key levers of the first row of keys (counting from the front of the machine) are at one height in normal position thereof, whereas the key levers of the second row of keys are at a slightly greater elevation in the normal position thereof, and the key levers of the third row of keys are slightly higher than those of the second row and the key levers of the fourth row of keys are at the greatest height. In other words the key levers have their keys arranged in four banks and adjacent key levers have their keys in different banks and are of different lengths and arranged at different heights (see Figs. 1 and 3). Nevertheless, the keys 22 of all the key levers have the same extent of depression or "dip" as is indicated by the full and dotted line showing of the keys in Fig. 5.

A universal bar 75 extends transversely beneath the various key levers at about the center of the points of connection of the links 25 to the key levers as indicated in Fig. 5. The upper edge of the universal bar is spaced apart from the lowermost key levers for, say, about one sixteenth of an inch so that there is a free movement of all of the key levers before the universal bar is taken up and movement transmitted therethrough to the escapement mechanism. The key levers are arranged in sets of four from side to side of the machine and the levers of each set are at progressively greater distances from the universal bar from one side of the set to the other. The key levers being at different distances from the universal bar, of course, have different extents of free movement before the universal bar is taken up, the extent of free movement depending upon the distance of the key levers from the universal bar in the initial positions of the key levers; but the universal bar is, nevertheless, depressed to the same extent by all of the key levers, inasmuch as they all are depressed to the same plane as indicated by the dotted line *c* in Fig. 5.

The actuation of the escapement mechanism is always the same irrespective of the key lever depressed and irrespective of the different initial positions of the key levers, inasmuch as the universal bar is taken up and depressed to the same extent by the different key levers and the escapement mechanism, actuated through the universal bar, is always actuated in the same manner irrespective of the key lever depressed. The escapement is always operated to afford a feed movement of the carriage at the same relative portion of the printing stroke whether one of the shortest key levers, that is normally at the greatest height, is actuated or one of the longest key levers, that

is normally in the lowest position when at rest be actuated. The universal bar 75 is connected at its ends to side arms 76 which in turn are rigidly connected to a rock shaft 77 that turns on bearing screws 77^a received in the base of the machine and a restoring spring 75^a coöperates with one of said arms to normally maintain the universal bar in the elevated position. A rearwardly extending arm 78 projects from the shaft 77 and the end of this arm is connected to an upwardly extending link 79 that in turn is connected to a forwardly extending crank arm 80 of a dog rocker 81 pivoted at 82 and carrying the usual feed dog 83 which coöperates with a feed rack 84 carried by the carriage (not shown). I have merely shown a conventional form of escapement and it should be understood that any suitable escapement mechanism may be employed. By actuating the universal bar in the manner described, I am enabled to effect an almost complete printing movement of the type action before the universal bar is taken up so that the escapement mechanism will not retard the type action, the weight of the escapement mechanism not being added to the type action until the momentum necessary for the printing stroke has been acquired.

By employing the leaf springs 18, each connected at one end to a body portion 21 of the key lever 12 and each pivoted at its rear end, I am enabled to obtain a soft, easy and resilient touch that automatically accommodates itself to the stroke of the operator whether the operator's stroke be a quick, sharp blow or a long following stroke. Thus, if the operator should have a quick, sharp blow or touch, the power applied to the finger key may cause the leaf spring 18 to be bent slightly before the different parts of the type action have been set in motion. At the initial portion of the stroke, a quick, sharp blow transmitted with a finger key will cause the body of the key lever to turn on a pivot 26 and slightly flex the associated spring 18 so that the full weight or resistance of setting the different parts of the type action in motion is not given back to the finger of the operator. If, on the other hand, the operator should have a long, following stroke which tends to press the key after the type bar has reached the printing position, then the body portion 21 of the key lever will turn on the pivot 26 after the type bar has reached the printing position and will cause a flexion of the associated spring 18 and the sudden shock or jar incident to the arrest of the type bar by the platen will not be transmitted to the finger of the operator. Thus it will be seen that each type action accommodates itself to the touch of different operators and affords an easy and soft action which is devoid of shock or jar either at the initial portion of

the stroke, when the parts are being set in motion, or at the end of the stroke, when the type bar has reached the printing position. The flection of the spring 18 at the terminal portion of the stroke is illustrated in Fig. 2 from which it will be seen that the point 26, being arrested by the type bar contacting with the platen, a further depression of the key will turn the body portion of the lever on the pivot 26 and will flex the spring against its tension. As soon as the undue pressure is relieved the spring will tend to straighten itself and the parts of the key lever assume their normal relations.

By providing two pivots 32 and 34 for each sub-lever or bell crank 28 to turn on I am enabled to accelerate the type bar during its movement from the normal to the printing position and to afford an easy action at the initial portion of the stroke. Thus, when the parts are in the normal position the sub-lever 28 will be in the full line position represented in Figs. 5 and 7, with the longest extent of leverage on the arm 28^a, the leverage being from the pivot 34 to the point of connection 27 between said lever and its associated link 25. As the key lever is depressed, the sub-lever will turn on the pivot 34 until the type bar has acquired its momentum and will shift from the bearing 33—34 to the pivot 32 when the upper bearing wall or portion 31 of the slot 29 is brought into contact with said pivot 32, so that during the last portion of the stroke the bell crank will vibrate around the pivot 32, and the leverage is from the pivot 32 to the point of connection 27, thereby shortening the leverage on the arm 28^a of the bell crank and accelerating the movement of the type bar at the last portion of the printing stroke. Fig. 6 illustrates the position of the sub-lever when it is just about to change from the pivot 34 to the pivot 32, and this is at approximately one-half of the length of movement of the sub-lever.

By my construction it will be seen that every member or part of each type action is carried by the frame 5, that the different segments constitute parts thereof, and that this frame may be readily secured to or removed from the main frame of the machine by four headed screws 85 that extend through the main frame at each side thereof and take at their inner ends into threaded openings 86 in the supporting frame 5. By this construction I am enabled to mount and adjust the several portions of the various type actions of the system in the supporting frame 5 therefor outside of the main frame of the machine, thereby greatly facilitating the assemblage of the parts, and after they are all assembled in place on the frame 5, said frame may be secured in the main frame of the machine by the four screws

85. This construction greatly facilitates the manufacture of the machine and enables repairs to be readily effected without dismounting various individual parts of the construction in order to gain access to the part or parts to be replaced or repaired.

From the foregoing description it will be understood that the pivotal connection between the guide link and type bar of each action, the fixed pivot of the guide link and the fixed pivot of the driver are substantially in the same plane when the type is in the printing position; or as it might be otherwise expressed, the pivotal end of each type bar, the fixed pivot of the associated guide link and the fixed pivot of the associated driver are substantially in a straight line extending fore and aft of the machine when the type bar is in the printing position. It will also be observed that the operative points of connections of the type bar actuating devices with the key levers are in different transverse planes; that the operative connections to the key levers from said actuating devices are also in different transverse planes, and that all of the points of operative connection to the key levers of the same length from said type bar actuating devices are in the same transverse plane.

While I have described my invention with considerable detail it should be understood that various features thereof may be employed without other features of the invention, and that various changes may be made without departing from the spirit of my invention.

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

1. In a typewriting machine, the combination of a type carrier, a finger key, and an intermediate sub-lever that turns on a plurality of pivotal centers at each printing operation to afford a change in the leverage during the operation of said sub-lever.

2. In a typewriting machine, the combination of a type carrier, a finger key, and an intermediate bell crank that turns on a plurality of pivotal centers to afford a change in the leverage during the movement of said bell crank.

3. In a typewriting machine, the combination of a key lever, a type carrier, and an intermediate bell crank operatively connected to said key lever and type carrier and turning on a plurality of fixed pivotal centers during the movement of said bell crank to afford a change of leverage during the depression of the key lever.

4. In a typewriting machine, the combination of a key lever, a type carrier, a sub-lever that turns on a plurality of fixed pivots at each printing operation, and links that connect the sub-lever to the type carrier and key lever.

5. In a typewriting machine, the combination of a key lever, a type carrier, a bell crank that turns on a plurality of fixed pivots and affords an automatic change of leverage during the operation thereof, and links that connect the bell crank to the type carrier and key lever.

6. In a front strike typewriting machine, the combination of a series of segmentally arranged type bars, a series of finger keys therefor, and a series of intermediate bell cranks operatively connected to said type bars and finger keys and each turning on a plurality of fixed pivots and affording a change of leverage during the operation of the bell cranks.

7. In a front strike typewriting machine, the combination of a series of segmentally arranged type bars, a series of key levers therefor, a series of intermediate bell cranks each turning on a plurality of fixed pivots and affording a change of leverage during the operation of the bell cranks, a series of links connecting the key levers to the bell cranks, and a series of links intermediate the bell cranks and type bars.

8. In a front strike typewriting machine, the combination of a series of segmentally arranged type bars, a series of key levers therefor, a series of segmentally arranged intermediate bell cranks, a series of hangers for said bell cranks, each bell crank turning on a plurality of fixed pivots on its associated hanger and affording a change of leverage during the printing operation.

9. In a typewriting machine, the combination of a type carrier, a key lever therefor, an intermediate actuating device between the key lever and type carrier, and an individual hanger for said actuating device, the pivotal connection between said actuating device and hanger being effected by a plurality of pivots that afford a change of leverage during each operation of the actuating device.

10. In a typewriting machine, the combination of a type carrier, a finger key therefor, an intermediate bell crank between the finger key and type carrier and operatively connected thereto, and an individual hanger for said bell crank, said bell crank and said hanger being connected by a plurality of pivots that afford a change of leverage during the operation of the bell crank.

11. In a typewriting machine, the combination of a type carrier, a finger key therefor, an intermediate actuating device, and a hanger therefor, one of said actuating device and hanger elements being bifurcated to receive the other and one of said elements having a plurality of pivots with which the other element coöperates to afford a change of leverage and an acceleration of the type bar as it approaches the printing position.

12. In a typewriting machine, the combination of a type carrier, a finger key therefor, an intermediate bell crank operatively connected to the finger key and type carrier, and a hanger for said bell crank, one of said bell crank and hanger elements being bifurcated to receive the other and one of said elements having a plurality of pivots with which the other element coöperates to afford a change of leverage, and means for affording an axial adjustment of said hanger.

13. In a typewriting machine, the combination of a type carrier, a finger key therefor, an intermediate bell crank operatively connected to the finger key and type carrier, a hanger for said bell crank, one of said bell crank and hanger elements being bifurcated to receive the other and one of said elements having a plurality of pivots with which the other element coöperates to afford a change of leverage.

14. In a typewriting machine, the combination of a type bar, a separate type bar actuating device operative to move the type bar to the printing position, and a bifurcated hanger that receives said device and which has a plurality of pivots with which the device coöperates to afford an automatic change of leverage during the operation thereof and an acceleration of the type bar as it approaches the printing position.

15. In a typewriting machine, the combination of a type bar, a separate type bar actuating bell crank operative to move the type bar to the printing position, and a bifurcated hanger which receives said bell crank and which has a plurality of pivots that connect the bell crank to the hanger and with which the bell crank coöperates to afford an automatic change of leverage during the operation thereof and an acceleration of the type bar as it approaches the printing position.

16. In a typewriting machine, the combination of a type bar, a type bar actuating device, a fixed support therefor having a plurality of stationary pivots; said actuating device being mounted to fulcrum first on one stationary pivot and then on another, the said actuating device being slotted concentrically with said stationary pivots.

17. In a typewriting machine, the combination of a type bar actuating bell crank, and a hanger therefor, one of said elements having a plurality of slots and the other having a plurality of pivots contained in said slots, so that the bell crank rides first on one pivot and then on another to effect an automatic change of leverage.

18. In a typewriting machine, the combination of a type bar, a separate type bar actuating bell crank having a plurality of slots therein and operative to move the type bar to the printing position, a bifurcated hanger that receives said bell crank in the bifurcated portion thereof, and a plurality

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of pivots that extend from side to side of the bifurcated portion of the hanger and through the slots in the bell crank and afford a change of leverage of the bell crank during the operation thereof and an accelerated movement of the type bar as it approaches the printing position.

19. In a typewriting machine, the combination of a type bar actuating bell crank having a plurality of slots therein, a bifurcated hanger that receives said bell crank in the bifurcated portion thereof, and a plurality of pivots that extend from side to side of the bifurcated portion of the hanger and through the slots in the bell crank and unite said bell crank and hanger, each of the slots in the bell crank being concentric with a pivot other than the one contained therein, whereby the bell crank is adapted to turn first on one pivot and then on another to effect an automatic change of leverage during the movement of the bell crank.

20. In a typewriting machine, the combination of a type bar actuating device having a substantially V-shaped pivot-receiving opening therein, and a fixed support having two pivots that are received in said opening.

21. In a typewriting machine, the combination of a type bar actuating lever having a substantially V-shaped pivot-receiving opening therein, and a fixed hanger having two pivots that are received in said opening.

22. In a typewriting machine, the combination of a type bar actuating bell crank lever having a substantially V-shaped pivot-receiving opening therein, and a bifurcated hanger that receives said bell crank and has two pivots that extend through said substantially V-shaped opening.

23. In a typewriting machine, the combination of a type bar actuating bell crank having a substantially V-shaped pivot-receiving opening therein, a bifurcated hanger that receives said bell crank and has two pivots that extend through said substantially V-shaped opening, a key lever operatively connected to said bell crank, and a type bar also operatively connected to said bell crank.

24. In a front strike typewriting machine, the combination of a series of segmentally arranged type bars, a series of key levers therefor, and a series of segmentally arranged bell cranks operatively connected to the type bars and key levers and each having two pivots on which it turns during the depression of its key lever to afford an automatic change of leverage and to afford the easiest action at the initial portion of the key depression.

25. In a typewriting machine, the combination of a type bar, a key lever therefor, and a spring having one end connected to and supporting the lever and the other end pivoted, said spring forming the connection between said key lever and its pivot.

26. In a typewriting machine, the combination of a type bar, a rigid key lever therefor, and a leaf spring connected at one end to the key lever and having a pivotal bearing at the other end around which the key lever turns.

27. In a typewriting machine, the combination of a type bar, a rigid key lever therefor, and a leaf spring riveted at one end to the key lever and having a pivotal bearing formed from the spring at the other end thereof and on which the key lever turns.

28. In a typewriting machine, the combination of a pivot rod, a series of springs having pivotal bearings cooperating with said pivot rod, a series of key bearing bars rigidly connected to said springs so that the pivotal bearings for the springs constitute pivotal centers on which the key bearing bars vibrate, and type bars operatively connected to said key bearing bars.

29. In a typewriting machine, the combination of a pivot rod, a series of springs having pivotal bearings formed therefrom and which surround and cooperate with said pivot rod, a series of key bearing bars rigidly connected to said springs so that the pivotal bearings for the springs constitute pivotal centers on which the key bearing bars vibrate, and type bars operatively connected to said key bearing bars.

30. In a typewriting machine, the combination of a pivot rod, a series of leaf springs having pivotal bearing loops formed therefrom and which surround and cooperate with said pivot rod, a series of key bearing bars rigidly connected to said springs so that the pivotal bearing loops of the springs maintain the key bars spaced apart and constitute pivotal connections on which the key bearing bars vibrate, and type bars operatively connected to said key bearing bars.

31. In a typewriting machine, the combination of a pivot rod, a series of leaf springs having their rear ends bent to form pivotal loops or bearings that surround the pivot rod and turn thereon, the said bearing loops being wider than the body portions of the springs and constituting means for maintaining the springs in their proper relative positions along the pivot rod, keys connected to said springs, type bars, and means connected to said keys for actuating said type bars.

32. In a typewriting machine, the combination of a pivot rod, a series of tapering leaf springs having their rear ends bent to form pivotal loops or bearings that surround the pivot rod and turn thereon, the said bearing loops being wider than the body portions of the springs, key bearing bars connected to the forward end of said springs, the bearing loops of the springs constituting means for maintaining the key bearing bars properly spaced apart, type

bars, and means connected to said key bearing bars for actuating said type bars.

33. In a typewriting machine, the combination of a key bearing bar, a separate spring connected at one end to the bar and pivoted at its opposite end so as to constitute a pivotal connection on which the key bearing bar and spring turn, a type bar, and connection from the key bearing bar to the type bar.

34. In a typewriting machine, the combination with a jointed type bar comprising a type-carrying portion, a guide link and a pivoted driver to which said type-carrying portion is pivoted, and means arranged to come into play at the final portion of the printing stroke to form a rigid connection between the type-carrying portion and said driver, whereby the type-carrying portion ceases to turn about its pivotal connection with the driver and swings about the pivot of the driver.

35. In a typewriting machine, the combination with a jointed type bar comprising a type-carrying portion and a pivoted driver to which said type-carrying portion is pivoted, and means on said driver normally removed from said type-carrying portion but adapted to move into contact therewith during the last portion only of the printing stroke of the type bar.

36. In a typewriting machine, the combination with a jointed type bar, of a driver, an abutment on the driver, and a cooperating abutment on the type bar proper, said abutments cooperating during the printing movement to rigidly connect the parts to move together as one part.

37. In a typewriting machine, the combination with a jointed type bar, of a driver, an abutment on the driver, and a cooperating abutment on the type bar proper, which abutments are brought into cooperative relation during the last portion of the printing stroke.

38. In a typewriting machine, the combination of a type bar proper, a guide link therefor, an actuator, an abutment carried by the actuator, and a cooperating abutment carried by the type bar proper.

39. In a typewriting machine, the combination of a type bar proper, a guide link therefor, an actuator, an abutment carried by the actuator, and a cooperating abutment carried by the type bar proper, said abutments being brought into cooperative relation during the last portion of the printing stroke so as to form in effect a rigid bar of the actuator and type bar proper at the last portion of the printing movement.

40. In a typewriting machine, the combination of a link pivoted at one end to a fixed portion of the machine, a type bar pivoted at one end to the free end of said

link, an actuator pivoted to the type bar intermediate the ends thereof, an abutment on the actuator, and a cooperating abutment on the type bar.

41. In a typewriting machine, the combination of a link pivoted at one end to a fixed portion of the machine, a type bar pivoted at one end to the free end of said link, an actuator pivoted to the type bar intermediate the ends thereof, an abutment on the actuator, and a cooperating abutment on the type bar, said abutments being brought into cooperative relation during the last portion of the printing stroke so as to form in effect a rigid bar of the actuator and type bar proper at the last portion of the printing movement.

42. In a typewriting machine, the combination of a link pivoted at one end to a fixed portion of the machine, a type bar pivoted at one end to the free end of said link, an actuator pivoted to the type bar intermediate of the ends thereof, an abutment on the actuator that extends beyond the pivotal connections between the type bar and actuator, and a cooperating abutment on the type bar.

43. In a typewriting machine, the combination of a link pivoted at one end to a fixed portion of the machine, a type bar pivoted at one end to the free end of said link and having type fixed against movement thereon, an actuator in the form of a bell crank pivoted to the type bar intermediate the ends thereof, an abutment on the actuator that extends beyond the pivotal connections between the type bar and actuator, and a cooperating abutment on the type bar.

44. In a typewriting machine, the combination of a type bar having two parallel sides spaced apart and an abutment secured to and extending between said sides, a key operated driver or actuator pivoted to the type bar intermediate of the ends thereof and between the sides of the type bar and having an abutment that cooperates with the abutment on the type bar, and a guide link pivoted at one end to a fixed portion of the machine and at its opposite end to one end of the type bar.

45. In a typewriting machine, the combination of a type bar having two parallel sides spaced apart and an abutment secured to and extending between said sides, a key operated driver or actuator pivoted to the type bar intermediate of the ends thereof and between the sides of the type bar and having an extension or finger that cooperates with the abutment on the type bar at the last portion of the printing stroke, a guide link pivoted at one end to a fixed portion of the machine and at its opposite end to one end of the type bar, whereby during the last por-

tion of the printing stroke the driver and type bar form in effect a rigid bar that turns on the pivot of the driver as a center.

46. In a typewriting machine, the combination of a type bar having two parallel sides spaced apart and an abutment secured to and extending between said sides, a type fixed against movement on said type bar, a driver or actuator pivoted to the type bar intermediate of the ends thereof and between the sides of the type bar and having an extension or finger that coöperates with the abutment on the type bar at the last portion of the printing stroke, a guide link pivoted at one end to a fixed portion of the machine and at its opposite end to one end of the type bar, whereby during the last portion of the printing stroke the driver and type bar form in effect a rigid bar that turns on the pivot of the driver as a center, a key lever, and intermediate connections between said driver and key lever.

47. In a typewriting machine, the combination of a type bar, a guide link therefor, one end of the guide link being pivoted to a fixed point, and the other end to the type bar, and a driver which turns on a fixed pivot and which is pivoted to the type bar, the pivotal connection between the guide link and type bar, the fixed pivot of the guide link and the fixed pivot of the driver being substantially in the same plane when the type bar is in the printing position.

48. In a typewriting machine, the combination of a type bar, a guide link therefor, one end of the guide link being pivoted to a fixed point and the other end to the type bar, and a driver which turns on a fixed pivot and which is pivoted to the type bar intermediate of the ends thereof, the pivoted end of the type bar, the fixed pivot of the guide link and the fixed pivot of the driver being substantially in a straight line when the type bar is in the printing position.

49. In a front strike typewriting machine, the combination of a type bar, a guide link pivoted at one end to one end of the type bar and at the other end to a fixed portion of the machine, and a driver that is pivoted to a fixed portion of the machine and to said type bar intermediate of the ends thereof, the pivotal end of the type bar, the fixed pivot of the link and the fixed pivot of the driver being substantially in a straight line extending fore and aft of the machine when the type bar is in the printing position.

50. In a typewriting machine, the combination of a universal bar and a series of key levers of different lengths arranged at different elevations from the universal bar; the lower edges of the longest levers being nearest the universal bar, the lower edges of the shortest levers being farthest from the

universal bar and the lower edges of the remaining levers being at intermediate distances from the universal bar.

51. In a typewriting machine, the combination of a universal bar, a series of sets of key levers all out of contact with the universal bar when in the normal position and with keys therefor arranged in different banks fore and aft of the machine, adjacent key levers having their keys in different banks and being of different lengths and the adjacent key levers of each set being at progressively greater elevations and at progressively greater distances from the universal bar from one side of the set to the other.

52. In a typewriting machine, the combination of a universal bar, and a series of sets of key levers normally out of contact with the universal bar and adapted to contact therewith at the last portion of the printing strokes, each set comprising four key levers with their keys arranged in four different banks fore and aft of the machine, all of said key levers being fulcrumed in a single transverse plane, adjacent key levers of each set being at progressively greater elevations and at progressively greater distances from one side of the set to the other with the shortest key lever of each set farthest from the universal bar.

53. In a typewriting machine, the combination of a series of key levers of different lengths, a universal bar, said key levers being arranged in their normal positions at different distances from the universal bar according to the lengths of the key levers, type bars, and connections from said key levers to the type bars, the connections joining at different distances from the fulcrums of the key levers, depending on the lengths of said key levers.

54. In a typewriting machine, the combination of a universal bar, and a series of key levers of different lengths, and all of which dip to a single transverse plane and which are located normally at different distances from said universal bar, the distance depending on the lengths of said key levers relatively one to another, type bars, and connections from said key levers to the type bars, the connections joining the key levers at different distances from the fulcrums of the key levers, depending on the lengths of said key levers.

55. In a typewriting machine, the combination of a universal bar, and a series of key levers fulcrumed in a single transverse plane and having keys arranged in different banks fore and aft of the machine, the key levers for each bank of keys being of the same length and the different key levers of the system being arranged in their normal positions at different distances from the universal bar, the distance each key lever is situ-

ated from the universal bar being determined by the relative length of the lever, type bars, and connections from said key levers to the type bars, the connections co-
 5 operating with the key levers at different distances from the fulcrums thereof depending on the lengths of said key levers.

56. In a typewriting machine, the combination of a universal bar, a series of sets of
 10 key levers with keys therefor arranged in different banks fore and aft of the machine, adjacent key levers having their keys in different banks and being of different lengths and the adjacent key levers of each set being
 15 at progressively greater distances from the universal bar from one side of the set to the other, type bars, and connections from said key levers to the type bars, the connections coöperating with the key levers at different
 20 distances from the fulcrums of the latter depending on the lengths of said key levers.

57. In a typewriting machine, the combination of a universal bar, and a series of sets of key levers each set comprising four key
 25 levers with their keys arranged in four different banks fore and aft of the machine, all of said key levers being fulcrumed in a single transverse plane, adjacent key levers of each set being at progressively greater
 30 distances from one side of the set to the other with the shortest key lever of each set farthest from the universal bar, type bars, and connections from said key levers to the type bars, the connections coöperating
 35 with the key levers at different distances from the fulcrums of the latter depending on the lengths of said key levers.

58. In a typewriting machine, the combination with the main frame of the machine, of a series of key levers of different
 40 lengths, a series of type bars, and a series of type bar actuating devices between the type bars and key levers, the points of operative connection to the intermediate actuating devices from the key levers being in
 45 different planes transverse of the machine and all key levers of the same length having their points of operative connection to the actuating devices in the same transverse plane.

59. In a typewriting machine, the combination with the main frame of the machine, of an auxiliary frame separate from said main frame and detachably fixed therein, a series of jointed type bars, a series of key
 55 actuated devices therefor, a series of separate key levers for said key actuated devices, said type bars and key actuated devices and key levers being carried by the auxiliary frame so that the jointed type bars, the key
 60 actuated devices and key levers may be mounted in or removed from the main frame with said auxiliary frame.

60. In a front strike typewriting machine, the combination with the main frame of the
 65 machine, of an auxiliary frame separate

from the main frame and detachable therefrom, a series of type bars, a series of guide links for said type bars, a series of drivers, and a series of keys for actuating said
 70 drivers, said type bars, guide links, drivers and keys being carried by and adapted to be mounted in and removed from the main frame with said auxiliary frame.

61. In a typewriting machine, the combination with the frame of the machine, of
 75 a type bar segment separate from the frame of the machine, a series of separate hangers secured to said segment, a series of type bars pivoted to said hangers, a second segment separate from the frame of the machine, a
 80 second series of separate hangers secured to said second segment, a series of sublevers pivoted to said second series of hangers and operatively connected to said type bars, means independent of the machine frame
 85 for connecting said segments, and means for detachably fixing the segments to the machine frame.

62. In a typewriting machine, the combination with the main frame of the machine, of
 90 a detachable segment, a series of guide links carried by said segment, a series of type bars pivoted to said links, a series of drivers for said type bars, a second detachable segment for said drivers, and means
 95 independent of the main frame of the machine for connecting said segments, whereby the type bars, guide links and drivers may be mounted in or removed from the main frame with said segments.

63. In a typewriting machine, the combination with the main frame of the machine, of a detachable segment, a series of guide
 100 links carried by said segment, a series of type bars pivoted to said links, a series of drivers for said type bars, a second detachable segment for said drivers, a series of key operated type bar actuating devices, a third detachable segment on which said
 105 type bar actuating devices are mounted, and means independent of the main frame of the machine for uniting said segments, whereby the type bar, guide links, drivers and type bar actuating devices may be
 110 mounted in or removed from the main frame of the machine with said segments.

64. In a typewriting machine, the combination with the main frame of the machine, of an auxiliary frame that is detachable
 120 from said main frame, a series of type bars, a series of guide links therefor, a series of drivers for the type bars, and a series of type bar actuating devices operatively connected to said drivers, said type bars, guide links,
 125 drivers and type bar actuating devices being carried by and removable with said auxiliary frame.

65. In a typewriting machine, the combination with the main frame of the machine, of an auxiliary frame that is detachable
 130

from said main frame, a series of type bars, a series of guide links therefor, a series of drivers for the type bars, and a series of key levers operatively connected to said drivers, said type bars, guide links, drivers and key levers being carried by and removable with said auxiliary frame.

66. In a typewriting machine, the combination with the main frame of the machine, of an auxiliary frame that is detachable from said main frame, a series of type bars, a series of guide links therefor, a series of drivers for the type bars, a series of type bar actuating bell cranks, and a series of key levers operatively connected to said bell cranks, said type bars, guide links, drivers, bell cranks and key levers being carried by and removable with said auxiliary frame.

67. In a typewriting machine, the combination with the main frame of the machine, of an auxiliary frame that is detachable from said main frame, a series of type bars, a series of guide links therefor, a series of drivers for the type bars, a series of bell cranks, a series of connecting links between said bell cranks and drivers, a series of key levers, and a series of connecting links between said key levers and bell cranks, the type bars, guide links, drivers, bell cranks, key levers and connecting links being carried by and detachable from the main frame of the machine with said auxiliary frame.

68. In a typewriting machine, the combination with the main frame of the machine, of an auxiliary frame fixed in and detachable from the main frame, a system of

type actions carried by said auxiliary frame, and an inking pad against which the types normally bear and which is also carried by the auxiliary frame and may be placed in or removed from the main frame with said auxiliary frame and type actions.

69. In a typewriting machine, the combination with the main frame of the machine, of an auxiliary frame detachable from the main frame, a system of type bars, a system of key operated type bar actuating devices, and an inking pad against which the types normally rest, said type bars, actuating devices and inking pad being carried by said detachable auxiliary frame and adapted to be placed in and removed from the main frame with said auxiliary frame.

70. In a typewriting machine, the combination of a type bar, a driver pivoted thereto, the driver contacting with the type bar at the last portion of the printing stroke and the two parts moving together as one part, the construction and arrangement of the parts being such that one of the contacting portions on the driver and type bar is adapted to be filed away and thereby effect an adjustment of the type relatively to the printing point when the parts are in printing position.

Signed at the borough of Manhattan, city of New York, in the county of New York, and State of New York, this 12th day, of May, A. D. 1905.

ARTHUR W. SMITH.

Witnesses:

E. M. WELLS,

J. B. DEEVES.