

April 15, 1958

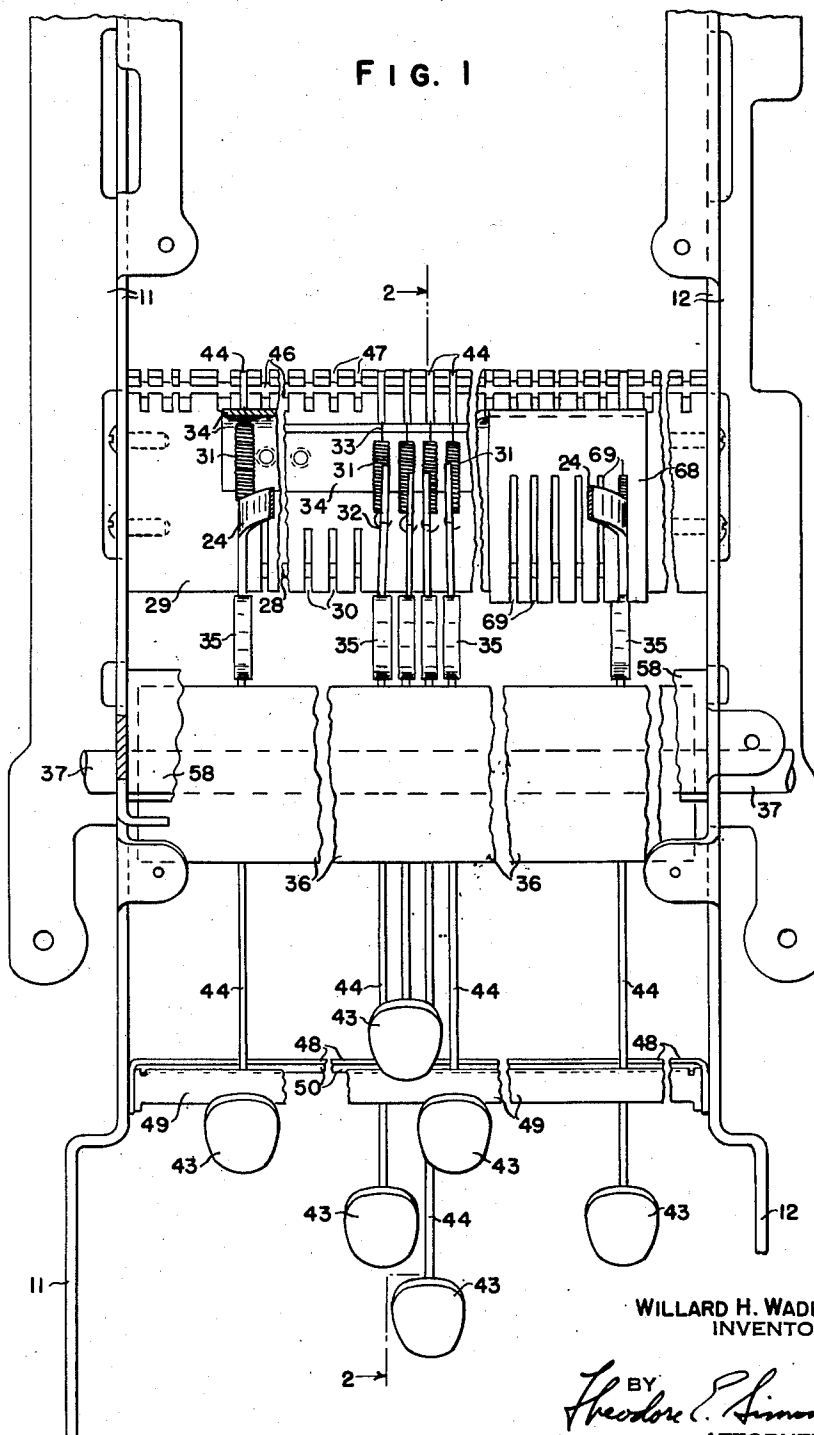
W. H. WADE

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POWER ACTUATED TYPING MECHANISM FOR BUSINESS MACHINES

Filed June 1, 1953

4 Sheets-Sheet 1



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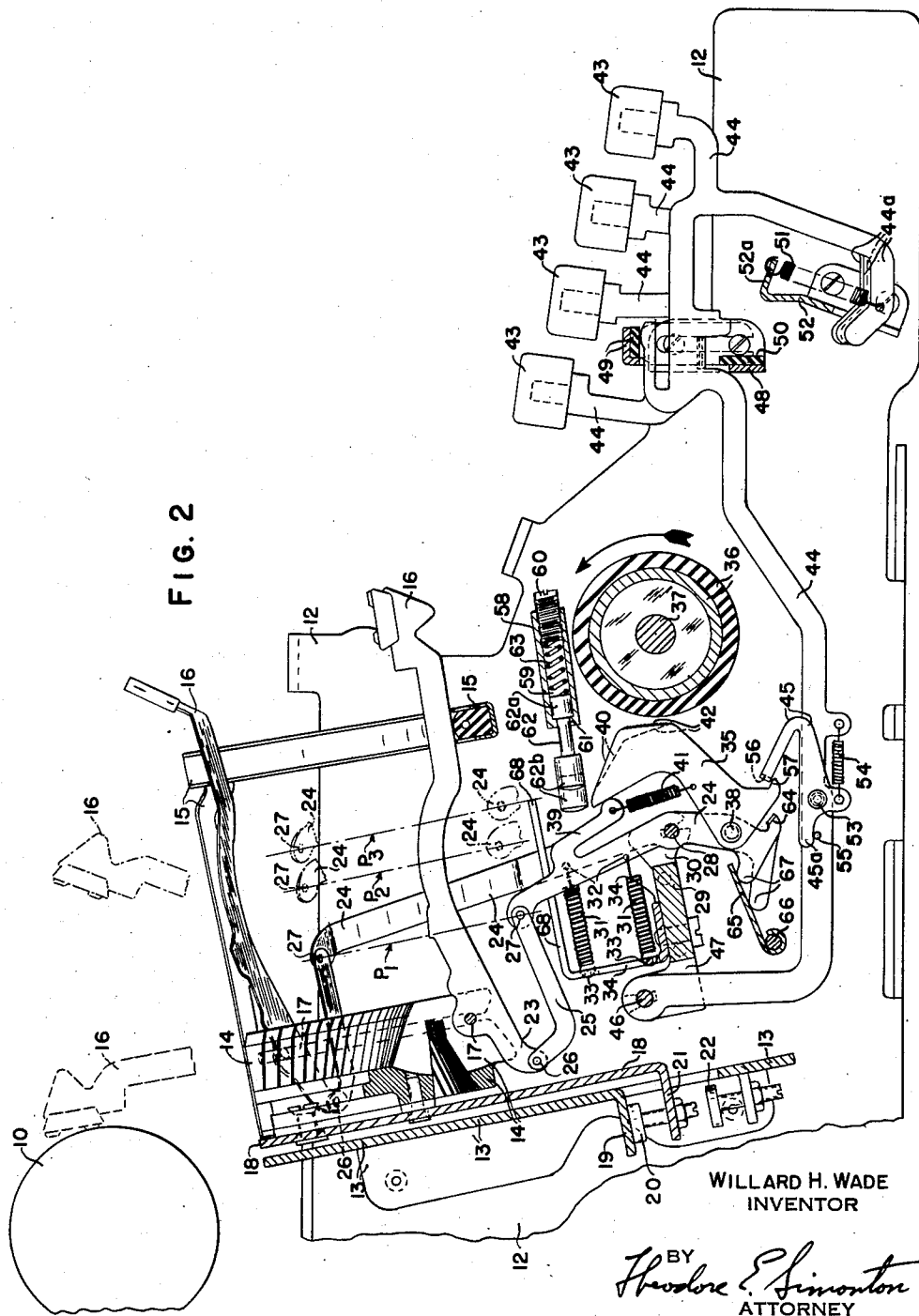
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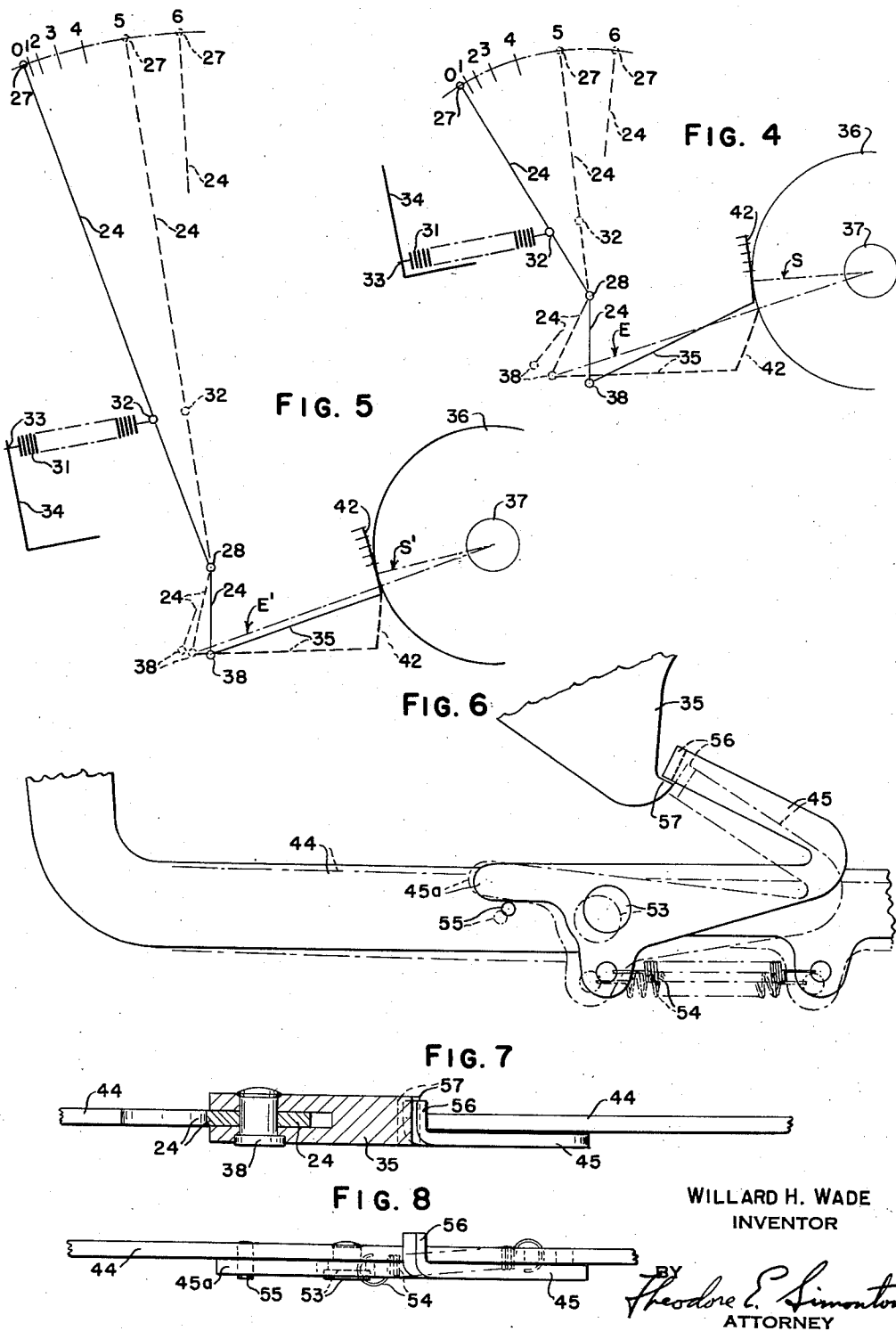
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POWER ACTUATED TYPING MECHANISM FOR BUSINESS MACHINES

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POWER ACTUATED TYPING MECHANISM FOR BUSINESS MACHINES

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5 Claims. (Cl. 197-17)

The invention relates to improvements in power actuated typing mechanism for business machines, and particularly to typing mechanism for typewriters and other business machines of the kind wherein a set of type actions are arranged to print at a common printing point and have appended driving or coupling devices individually actuative to connect the actions individually and transitorily with a single power driven rotor to receive printing impulses.

Acceptance by the public of business machines equipped with typing mechanism of the aforesaid kind has been limited unduly because of the many disadvantages inherent in the various constructions and arrangements of such typing mechanism heretofore provided. These disadvantages include undue complexity and number of parts in the several type actions, undue cost of manufacture, excessive noise and shock in operation, diverse loads imposed on the power driven rotor by the several type actions, improper control of the extent and speed of movement of the types carried by the several type actions, necessity for frequent repair and adjustments, and the difficulty of obtaining and maintaining uniform density and clarity of type impressions made by types of diverse face sizes carried by the set of actions.

The general purposes of the invention are to avoid the aforesaid disadvantages, and to do so particularly, though not exclusively, in a typing mechanism wherein the types are carried by a set of type bars pivoted on an arcuate pivot rod in a substantially semi-circular type bar segment which has radially arranged guide slots for the type bars.

A particular purpose of the invention is to accomplish the foregoing general purposes in a simple and efficient typing mechanism wherein the type bars are pivoted in a case-shiftable segment.

One specific purpose of the invention is to attain a drivable coupling of a type bar action with a power driven rotor which will impel the type bar an invariable distance at an invariable rate of acceleration part way to a printing position and thereupon release the type bar action from the rotor, without shock and without the aid of any auxiliary releasing device, to thereafter print by a momentum force regulative variably by means effective on the type bar action only after such release of the type bar action.

Other specific purposes of the invention are to attain simplification and improvement with respect to the construction and arrangement relatively to a power driven rotor of a type bar action, a coupling device for drivingly coupling the type bar action with the rotor transitorily to receive a printing impulse, and means for actuating the coupling device to effect coupling of the type bar action with the rotor.

Further purposes of the invention are to attain in connection with a set of rotor actuated type bar actions of diverse leverage characteristics, and particularly in connection with a set of such type bar actions wherein the

type bars are pivoted in a type bar segment, individual driving connections of the type bar actions with the rotor whereby all type bars are impelled equal distances at equal rates of speed part way to printing position and also to attain separation of the driving connections without wear on the rotor and without shock and noise for final printing impulsion of the impelled actions by kinetic energy accumulated during driving thereof by the rotor; to attain in connection with such a set of type bar actions variable regulation of printing impact with respect to each individual type bar action; and to attain in connection with such a set of type bar actions uniform and smooth acceleration of the printing strokes of all of the type bars through identical parts of such strokes together with equalization of the loads imposed on the rotor in power driving the type bar actions.

Still another, and important, purpose of the invention is to attain the foregoing purposes in typing mechanism of the kind wherein type bar actions carry cams transitorily engageable with a power driven roller to drive the actions to print.

Other purposes and advantages of the invention will appear from the following description of the preferred embodiment of the invention illustrated by the accompanying drawings.

In the drawings:

Fig. 1 is a fragmentary top plan view of a known style of front strike typewriter equipped with a power actuated typing mechanism embodying the invention, certain parts of the typewriter being entirely omitted and others partly broken away for clarity of illustration of certain features of the invention;

Fig. 2 is a fragmentary vertical sectional view taken medially of the set of type bar actions of the typewriter on the line 2-2 of Fig. 1;

Fig. 3 is a detail sectional view on an enlarged scale taken on the same line as Fig. 2 and particularly illustrating certain stages of operation of parts of one of the two medial type bar actions;

Figs. 4 and 5 are diagrammatic views on an enlarged scale illustrating certain stages of operation respectively of a medial type bar action and of a side type bar action;

Fig. 6 is a detail view on an enlarged scale illustrating in side elevation features of one of the cam tripping devices and adjacent portions of its supporting key lever;

Fig. 7 is a detail sectional view taken on the line 7-7 of Fig. 3; and

Fig. 8 is a detail sectional view taken on the line 8-8 of Fig. 3.

The known style of typewriter in which the improvements are shown embodied has a roller platen 10 supported by a carriage (not shown) to travel endwisely transversely of the typewriter above the rear portion of the main frame of the typewriter, said main frame comprising upstanding side plates 11 and 12 and a rearwardly inclined cross plate 13. Said typewriter has the usual radially slotted type bar segment 14 and its attached type bar rest 15 which support the usual set of normally cumbrant type bars 16 (only a center and a side one of which are shown) in an arcuate array with the type bars pivoted in the segment slots on the arcuate pivot wire 17 held in the segment. Each type bar carries an upper case type and a lower case type, the latter being located nearer than the former to the type bar pivot. The segment is rearwardly inclined and is attached to a carrier plate 18 which is case shiftable downwardly and forwardly from a normal position shown in Fig. 2 for lower case printing to a shifted position for upper case printing. The normal position of the segment is determined by engagement of case shift stops

19 and 20, and its shifted position is determined by engagement of case shift stops 21 and 22. The type bars all swing through printing strokes of the same amplitude (approximately 93°) and print at a common printing point at the front of the platen. As usual, the two medial type bars of the set are pivoted equal distances from, and close to, the lowest part of the pivot wire 17. Each type bar has a short actuating arm 23 which normally extends rearward and downward from the type bar pivot.

The improved power mechanism shown for actuating the set of type bars now will be described.

The type bars constitute the type carrying elements of a set of type actions, each action comprising an upstanding sheet metal sub-lever 24 and a fore and aft extending link 25 which is articulated by pivots 26 and 27 respectively to the actuating arm 23 of the type bar and to the upper end of the sub-lever 24. The sub-levers 24 are levers of the first class and are fulcrumed on a common straight fulcrum rod 28 which extends horizontally across the main frame through the forward edge portion of a straight fulcrum bar 29 the ends of which are secured to the main frame side plates. Said forward edge portion of bar 29 is provided with vertical guide slots 30 for the sub-levers. Bar 29 extends across the main frame below the rear portions of the set of type bars, and the set of sub-levers and fulcrum rod 28 extend across the main frame below the medial portions of the set of type bars.

The pivots 26 normally are located in one arc and the pivots 27 in a second arc, both of which arcs are concentric with that of pivot wire 17 and are disposed in planes parallel to the plane containing said pivot wire. Links 25 all are of the same length, the upper arms of the sub-levers 24 being of progressively increasing length from the two medial sub-levers to the two end sub-levers of the set of sub-levers. The purchase or leverage of the upper arms of the sub-levers on the type bars consequently diminishes from the medial to the end sub-levers of the set.

The type actions are biased to rest position by a set of returning springs 31 of identical size and strength which are arranged to act with like effectiveness to return the type bars from printing position and to yieldingly resist printing strokes of the bars with like effectiveness. To these ends the springs 31 have anchorages 32 at their forward ends to the upper arms of sub-levers 24 at uniform leverage ratio points located in a plane parallel to the plane P¹ in which link pivots 27 normally lie, and said springs normally extend perpendicularly to said plane P¹ and have anchorages 33 at their rear ends in a second and parallel plane, these anchorages 33 being to a spring anchor bar 34. Anchor bar 34 is located over, and is fixed to, the fulcrum bar 29.

For imparting printing strokes to the type actions in an improved manner there are provided a set of coupling devices or drivers 35, each appended to a different one of the type actions, and a power driven rotor or rotary actuator 36 for all of said drivers, which rotor is driven constantly in the direction of the arrow (Fig. 2) by a suitable power source while the machine is in use. As more fully hereinafter explained, the drivers are engageable individually with the rotor, and said drivers and rotor are constructed and arranged for driving engagements which actuate the type actions with identical working loads on the rotor to impel the respective type bars through identical initial parts of their printing strokes at identical accelerating speed rates up to identical maximum speeds in identical time intervals during angles of rotation of the rotor of identical amplitude. The drivers and rotor further are constructed and arranged for automatic disengagement of each driver from the rotor under the sole influence of the rotor and the driver-carrying type action and without shock, noise and wear to uncouple the type actions from the rotor for completion of identical

terminal portions of the printing strokes of the respective type bars solely by momentum.

The rotor 36 is a roller having a cylindrical outer sheath of suitable resilient frictional material, such as natural or synthetic rubber. It is fixed to a shaft 37 which is journaled in side plate 11 and 12 of the machine frame with said shaft parallel to the sub-lever fulcrum rod 28 and, preferably, at approximately the same horizontal level as said rod. The rotor extends across the machine frame in front of the set of sub-levers 24 and under the forward ends of the cumbrant array of type bars.

The driving or coupling devices 35 are cams which, except as hereinafter described, are of identical size and shape. Said cams are formed of nylon, but may be formed of other suitable rigid material, such as steel. Each cam is pivoted to the pendent arm of a different sub-lever 24 by a horizontal pivot 38 extending transversely of the machine, all of said pivots being equidistant from the sub-lever fulcrum rod 28 and being located directly thereunder in axial alignment in the normal rest positions of the respective type actions. Normally each cam extends upwardly and forwardly from its pivot between the row of sub-levers 24 and the roller 36. Each sub-lever 24 has depending from its upper arm and forward of said arm a lug 39, against the lower end of which an outer end or stop portion 40 of the cam pivoted to said sub-lever normally is held rearwardly pressed by one of a set of cam returning springs 41. Springs 41 connect the cams forward of their pivots with the lower ends of lugs 39 of the sub-levers and bias the cams to roller-clearing rest relations to the respective sub-levers determined by lugs 39 and stop portions 40. The lugs 39 normally stand in register transversely of the machine so that the cams, except for their tread surfaces, about to be described, also normally stand in register transversely of the machine.

Each cam 35 has a tread surface 42 which is drivably engageable with roller 36 and extends only part way around the pivotal axis 38 of the cam, this surface being relatively short, preferably about $\frac{3}{4}$ inch long. The tread surfaces of all of the cams are of the same length and same contour, preferably being segments of a right cylinder having a radius of three inches, and they normally face the roller. Each tread surface is located between the pivoted and free ends of the cam and is increasingly eccentric to the cam pivot 38 from that end of the tread surface which normally is lowest and nearest the roller to that end of the tread surface which normally is highest and farthest from the roller and from which stop portion 40 of the cam extends. The distance from the cam pivot to the end of the cam tread surface closest to the pivot is identical for all of the cams.

The pitch of the tread surfaces of the cams progressively decreases from that of the tread surfaces of the two identical cams pivoted to the two medial type actions to that of the two identical cams pivoted to the two end type actions. This rate of decrease in cam pitch is in direct proportion to the rate of increase in the lengths of the upper arms of the sub-levers from the medial to the end sub-levers heretofore described. When the type actions are in rest position the end edges of the cam tread surfaces which are nearest the cam pivots all normally stand on a common straight horizontal line which is parallel to the axis of the power driven roller and is spaced slightly from the periphery of said roller at the rear of the roller at a level which is not substantially higher than the level of the roller axis and, preferably, is slightly lower than the level of said axis, as shown. In effect, the cams thus have eccentric tread surfaces of identical length and contour which, in the normal positions of the cams are tilted progressively rearward about said horizontal line from the two medial cams to the two end cams. The tread surfaces of the

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cams preferably are provided with minute transverse ribs, or otherwise roughened.

A set of key operated mechanisms, now to be described, are provided for initiating power operations of the individual type actions, one of these mechanisms being provided for controlling each type action. Each such mechanism comprises a key 43, a key lever 44, and a cam actuating dog 45. The key levers extend fore and aft of the machine in parallelism and have upturned forward ends supporting the keys in four stepped banks or rows. At their rear ends the key levers are fulcrumed on a common straight horizontal fulcrum rod 46 which extends through the rear edge portion of the fulcrum bar 29 parallel to fulcrum rod 28, said portion of bar 29 being provided with vertical guide slots 47 for the key levers.

Between their fulcrum rod and the keyboard the key levers extend under the set of sub-levers, the set of driving cams and the power driven roller. The key levers are guided adjacent the keyboard in a vertically slotted guide comb 48 which is secured at its ends to the main frame side plates 11 and 12. The comb carries a horizontal return stop 49 for the key levers and carries also a horizontal stop 50 to limit the down strokes of the key levers.

For uniform maximum depression of the keys, the lower edges of the key levers are graded upward above stop 50 from those of the first or forward bank to those of the fourth or rear bank as indicated in Fig. 2. For uniform key touch the key levers have returning springs 51 all of the same size and inherent strength and all anchored at their upper ends to a horizontal flange 52^a formed on a supplemental key lever guide comb 52 which is secured at its ends to the main frame side plates. The springs are anchored at their lower ends to the lower ends of pendent portions 44^a of the key levers, which key lever portions are guided in comb 52 and have their lower ends stepped progressively downward from the rear bank key levers to the front bank key levers, as shown in Fig. 2, so that the normal extent of stretch of the springs in the returned positions of the key levers increases from that of the springs attached to rear bank key levers to that of the springs attached to the front bank key levers.

The dogs 45 are of identical size and shape and are pivotally mounted on the key levers equidistant from the key lever fulcrum rod by normally axially aligned horizontal pivots 53 which are parallel to, and equidistant from, the cam pivots 38 and are located below the set of cams. Each dog is connected with its supporting key lever by a returning spring 54 which is weaker than cam returning spring 41 and normally holds a rearwardly extending stop portion 45^a of the dog rocked downwardly against a laterally projecting stop pin 55 on the key lever. Each dog is formed of sheet metal and extends first forwardly and then upwardly and rearwardly from its pivot to provide an up and down bendably adjustable arm which is formed at its upper end with a nose or laterally extending lug 56. Nose 56 of each dog normally overhangs a normally forwardly extending lip or projection 57 which is formed on the adjacent cam and normally is located forwardly and below the cam pivot. Depression of the key of the lever which carries the dog will rock the associated cam forwardly and downwardly relatively to the type action sub-lever to which the cam is appended and will press the tread surface of the cam into drivable engagement with the resilient peripheral surface of the roller, as shown, for example, in Fig. 3, to cause an ensuing power driven printing stroke of the type action.

The following provisions are made for such individual regulation of the ultimate impact forces of the several type bars as may be required to attain uniform density of type impressions by all of the type actions, which density otherwise might vary by reason of such factors as variations in size of the type faces on different type bars,

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and variations in frictional resistance to actuation of different type bar actions. The set of individual printing impact regulating devices for the set of type bar actions are so constructed and arranged that they can be conditioned variably and individually to interpose progressively increasing spring resistance to printing strokes of the type bar actions during varying final extents of the momentum imparted portions of such strokes, or to interpose no spring resistance to such strokes, but cannot be conditioned for coaction with the type bar actions while the cams are engaged with the roller. Such a blow regulating means affords more perfect regulation of the type impacts and does not interfere with the disengagement of the cams from the roller, increase the driving load on any cam, or cause extra wear on the roller or on any cam.

A straight metal bar 58 extends across the machine above the roller 36 and is secured at its ends to the frame side plates. This bar is formed with a series of parallel fore-and-aft extending bores 59 having internally screw threaded forward ends into which threaded adjusting plugs or screws 60 are variably screwable. Bores 59 extend to the forward ends of a series of smaller coaxial bores 61 which extend through the rear edge portion of bar 58, each opposite the pendent lug 39 of a different one of the sub-levers 24. A set of printing impact varying metal plungers 62 are slidable in bores 61, said plungers having forward heads 62^a slidable in bores 59 and having rear heads 62^b which are formed of nylon or other suitable material possessing good noise reducing and wear resisting qualities. Confined in each bore 59 between plunger head 62^a and screw plug 60 is a different one of a set of helical and axially compressible springs 63 for regulating printing impacts. Opposite ends of the springs 63 are opposed to plunger heads 62^a and screw plugs 60, respectively. Rearward projection of the plungers toward the sublevers 24 is limited positively by plunger heads 62^a so that in the normal positions of the respective type actions the lugs 39 are retracted from plunger heads 62^b to such an extent that said lugs will make initial contact with plunger heads 62^b only, and shortly, after the cams break contact with the power driven roller. Because the sub-levers from the medial to the end sub-levers move through progressively decreasing total angles of throw, the lengths of the plungers are so correspondingly progressively increased from the medial to the end plungers that lugs 39 will make initial contact with plunger heads 62^b when the type bars are equidistant from the platen, i. e., so that the sub-levers will drive the plungers forward during like angles of terminal movement of the type bars on their printing strokes. Any screw plug 60 can be screwed forwardly of the machine far enough to prevent any compression of the associated spring 63 on printing strokes of the associated type bar action. Any screw plug may be variably screwed rearwardly of the machine to such extents that the associated plunger will start to compress the associated spring as soon as the type action begins to drive the plunger forwardly, or at any desired later point in the printing stroke of the associated type bar action. Further, any screw plug can be screwed rearwardly of the machine far enough to maintain the associated spring 63 under more or less normal compression.

Collective or universal regulation of the type impacts for all of the type bars can be attained in a known manner by varying the rate of revolution of the power driven roller and will not affect the functioning of the aforesaid individual blow regulating means.

Preferably, each type bar action is provided with overthrow limiting stop means for its appended driving cam, each such stop means comprising a stop lug 64 projecting laterally from the pendent arm of the sub-lever 24 of the type bar action for abutment by the cam only in the event the cam is abnormally rocked about its pivot from its rest relation to the sub-lever. In normal typing opera-

tions the cam never strikes its overthrow limiting stop lug 64. If, however, the type bars of two or more type bar actions should become jammed together while the driving cams of those type bar actions are in driving engagement with the power driven roller, the cams will be rocked against their stops by a slightly greater than normal rocking of the cams about their pivots 38 relatively to the sub-levers thereby to prevent the roller from swinging the cams farther to such an extent as to drag the cams under the roller and to damage the cam returning springs by abnormally stretching the springs.

Preferably, the machine is provided with a flat and straight universal bar 65 which extends across the machine and is fixed to a horizontal rock shaft 66 journaled in the frame side plates. For equal rocking of this universal bar by the respective type bar actions, the sub-levers 24 are formed at their lower ends with rearwardly extending projections 67 which engage under the universal bar and rock it upwardly on the printing strokes of the type bar actions, said projections being stepped, from the medial to the side type bar actions, progressively closer to the rock shaft 66.

Preferably, guide means are provided to resist lateral deflection of the longer ones of the sub-levers 24, as by providing a forward extension 68 from each end of the spring anchor bar 33 at the upper edge of the bar, and forming each of these extensions with fore and aft guide slots 69 for the adjacent six end sub-levers.

The mode of operation of the foregoing power mechanism now will be summarized briefly. Depression of the controlling key 43 for any type action will pull down the actuating dog 45 for the driving cam 35 of that type action and thereby rock the cam about its pivot 38 until it is pressed into an initial full drivable engagement with the power roller 36 wherein the ribbed tread surface of the cam is pressed very slightly into the yielding peripheral surface of the roller as indicated in Fig. 3. Such initial full drivable engagement with the roller by all cams is made always by the same short lower or leading end portion of the cam tread surface irrespective of the cam pitch, and the engagement is broken when the trailing end of the tread surface reaches a straight line connecting the roller axis and the cam pivot 38, all as will appear from Figs. 4 and 5 wherein, respectively, the cams of a medial and of an end type action are shown in full lines in initial full driving engagement with the roller and are shown in dotted lines at engagement-breaking position. The mean point of such initial full drivable engagement of the tread surfaces of the two medial cams is on the line S (Fig. 4) and that of the tread surfaces of the two end cams is on the line S' (Fig. 5), said lines being radial to the roller axis. From the medial to the end cams the starting engagement points are located progressively downward around the roller periphery while the respective cams disengage from the roller periphery at substantially the same level, the disengagement points of the two medial cams being on line E (Fig. 4) and those of the two end cams being on line E' (Fig. 5), which lines also are radial to the roller axis.

The angle between lines E and S for the steepest cams, that between lines E' and S' for the least steep cams, and those between intermediate lines for the remaining cams, thus decrease in direct proportion to the decrease in cam pitch from the two medial cams to the two end cams. While power is applied to all of the sub-levers equidistant from their common straight fulcrum axis, the applied force is varied in inverse proportion to the power transmission ratios of the respective sub-levers, and the angles of throw imparted to the respective sub-levers during cam engagement with the roller is varied in direct proportion to the variations in leverages of the sub-levers on the type bars.

The cams all break contact with the roller without noise, shock and wear, and they maintain contact with the roller during an angle of rotation of the roller the ampli-

tude of which is the same for all cams. The cams all actuate their respective type actions to drive all the type bars through the same angle (approximately 65°), and they accelerate the type bars at the same rate from zero to the same maximum speed while the cams are in contact with the roller and then free the type actions for completion of the printing strokes of the type bars through identical angles by momentum. The rate of acceleration of the type action printing strokes during five equal increments of their driving connection with the roller is indicated in Figs. 4 and 5 by the numerals "0," "1," "2," "3," "4" and "5" adjacent the upper ends of sub-levers 24 of the medial and end type actions, the positions of the upper ends of these sub-levers at the printing position of the type bars being indicated in these views by the numeral "6."

During the momentum period of the printing stroke of any type bar action its appended cam is restored by its returning spring 41 to rest relation to the type bar action so as to clear the roller when the action is restored, after printing, to its rest position by the returning spring 31 of the action. If the controlling key of the action is held depressed until the action is returned, the cam lip 57 on the return stroke of the action will strike the nose 56 of the cam actuating dog 45 and rock the dog as indicated in dotted lines in Fig. 6 to permit the type action and appended cam to return to normal position without re-engaging the cam with the roller. When pressure on the key is released, the key lever and dog will return to normal position as indicated in full lines in Fig. 6.

Link pivots 27 move from plane P¹ to plane P² during engagement of the cams with the roller and move to plane P³ in the printing positions of the type bars. Shortly after the momentum period of the printing stroke of any type bar action has begun, the arm or lug 39 on the sub-lever of said type bar action will engage head 62^b of the blow regulating plunger 62 for that type bar action and then will drive the plunger forwardly throughout the remainder of the printing stroke, as shown in dotted lines in Fig. 3. By variably screwing the plugs 60 in or out the associated springs 63 can be conditioned to variably cushion the printing strokes of the respective type bars or to be wholly ineffective.

I claim:

1. Power actuated typing mechanism comprising a horizontally disposed cylindrical power roller, pivoted type bars mounted to swing through printing strokes the angular amplitude of which is identical for all of the type bars, levers which are opposed to the roller along a common straight fulcrum axis parallel to the roller and each of which actuates a different type bar through a complete printing stroke by swinging of the lever from a rest relation to the roller through an angle the amplitude of which varies with the type bar which the lever actuates, and cams each carried by a different one of the levers for rotation about an axis parallel to the roller and from a roller-clearing rest relation to its carrying lever into a roll-free engagement of the cam with the roller which swings that lever from its rest relation to the roller, the cams having each a roller engageable eccentric tread the length of which is the same on each cam and the eccentricity of which to the cam axis is identical on each cam at one end of the tread and progressively increases to the other end of the tread, the cams being so carried by the levers that roll-free engagements of the cams initiate at the cam tread ends of identical eccentricity and terminate at said other cam tread ends, and the eccentricity of each of said other cam treads ends to the cam axis being such that roll-free engagements of the cams with the power roller terminate at identical points in the printing strokes of the type bars.

2. Power actuated typing mechanism, as claimed in claim 1, in which the cams are one-piece cams whose treads have congruous contours curved from end to end on a constant radius.

3. Power actuated typing mechanism, as claimed in claim 1, having yieldable buffering devices for the respective type bar actuating levers arranged to be impacted by the levers at identical points in the printing strokes of the type bars and only after termination of the rolling engagements of the cams with the power roller, and means individual to each buffering device for varying the yielding resistance of each buffering device to lever impact.

4. Power actuated typing mechanism, as claimed in claim 1, in which the cams are arranged to rotate downwardly into and out of roll-free engagements with the power roller and to initiate roll-free engagements with the roller below the horizontal level of the roller axis.

5. Power actuated typing mechanism, as claimed in claim 1, wherein the cam axes are in register parallel with

the roller when the levers are all in rest relation to the roller, the cams swing downwardly into and out of roll-free engagements with the roller, and the ends of identical eccentricity of the cam treads all lie along a common straight horizontal line parallel to the roller when all of the levers are in rest relation to the roller and all of the cams are in rest relation to the levers, which horizontal line is below the level of the axis of the roller.

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