Aug. 12, 1958 F. M. CARROLL 2,847,105

MOVABLE DRUM TYPEWRITER

Filed Jan. 3. 1955 8 Sheets-Sheet 1

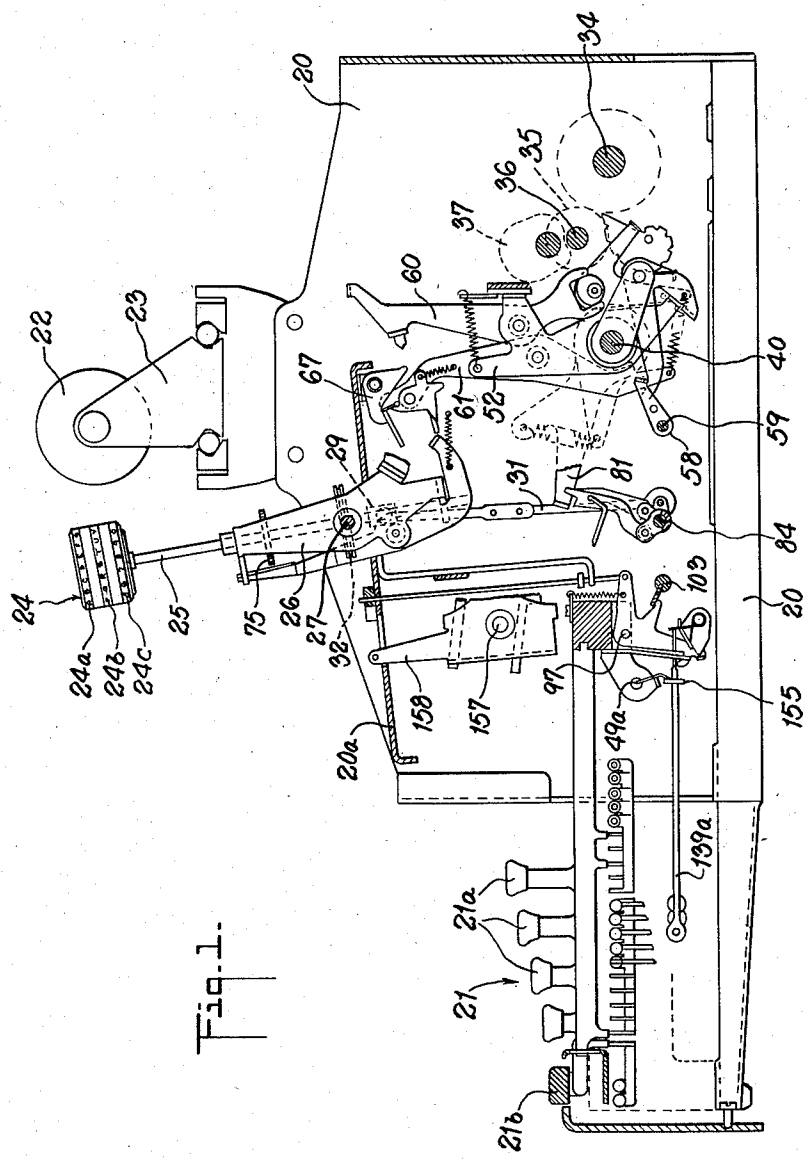


Fig. 1.

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MOVABLE DRUM TYPEWRITER

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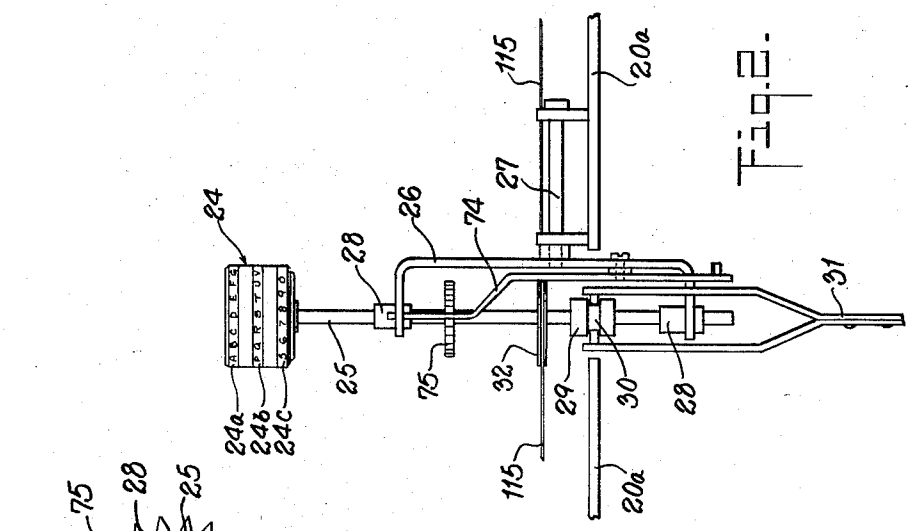


Fig. 2.

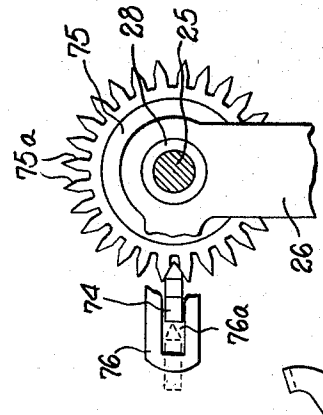


Fig. 7.

Fig. 6.

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MOVABLE DRUM TYPEWRITER

Filed Jan. 3. 1955 8 Sheets-Sheet 3

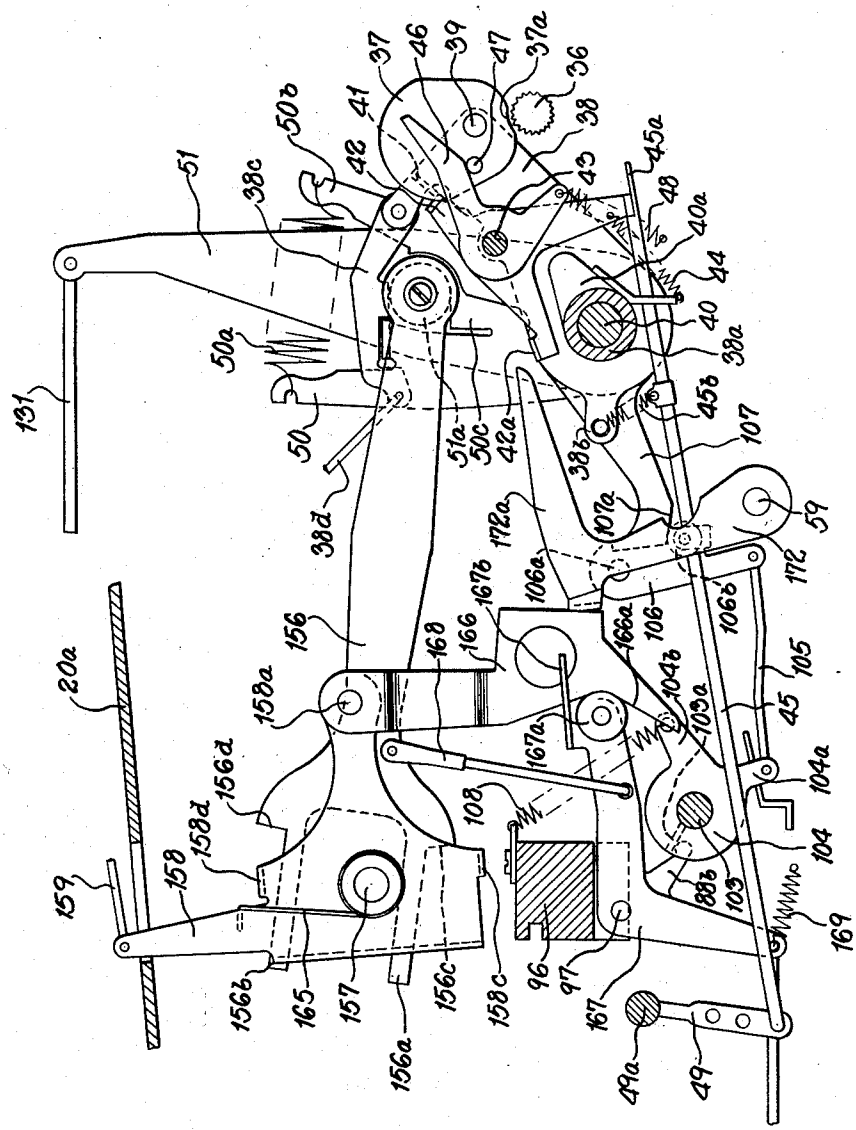


Fig. 11.

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MOVABLE DRUM TYPEWRITER

Filed Jan. 3. 1955 8 Sheets-Sheet 4

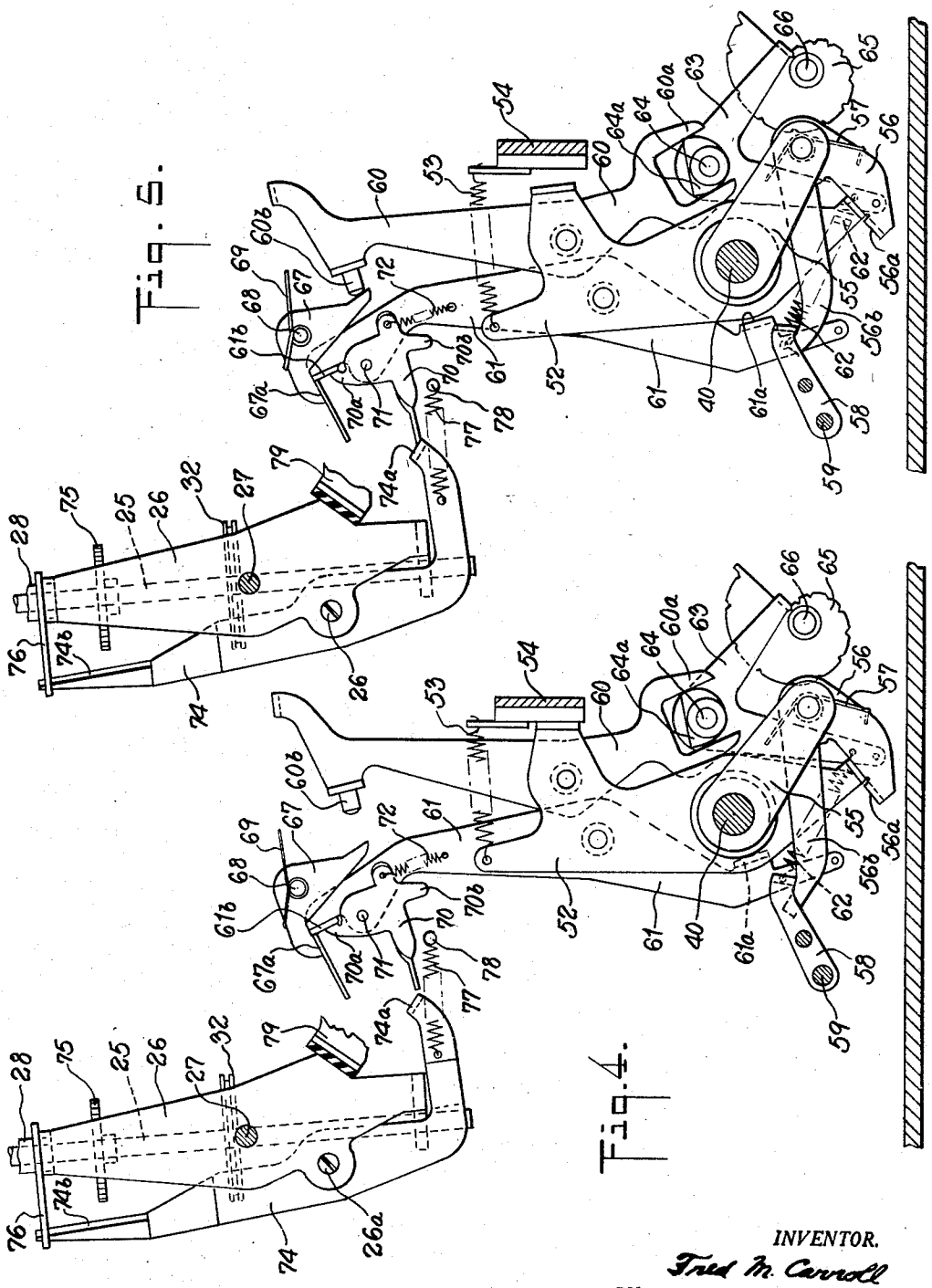


Fig. 5.

Fig. 4.

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MOVABLE DRUM TYPEWRITER

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Fig. 10.

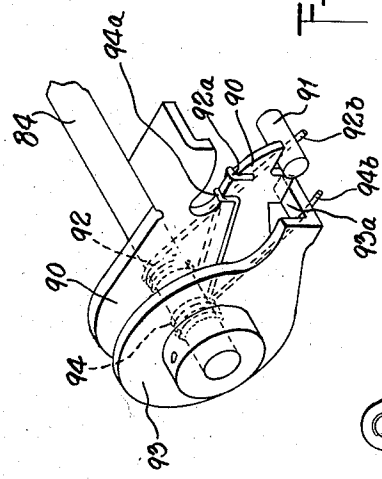


Fig. 9.

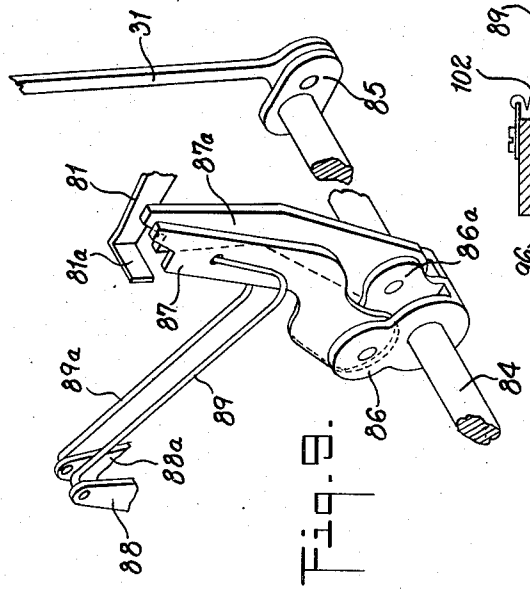
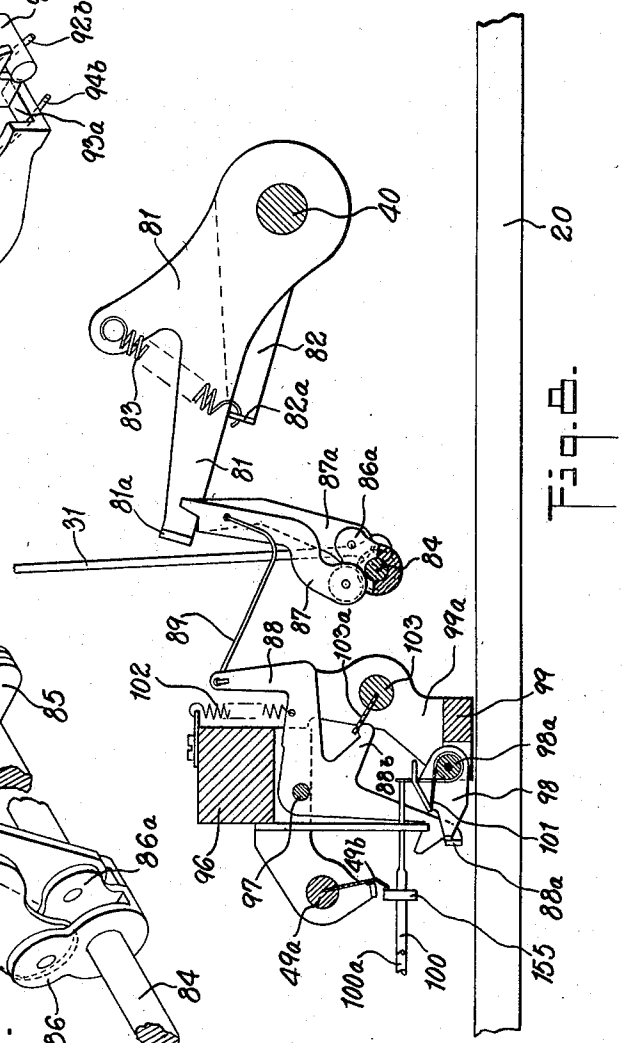


Fig. 11.



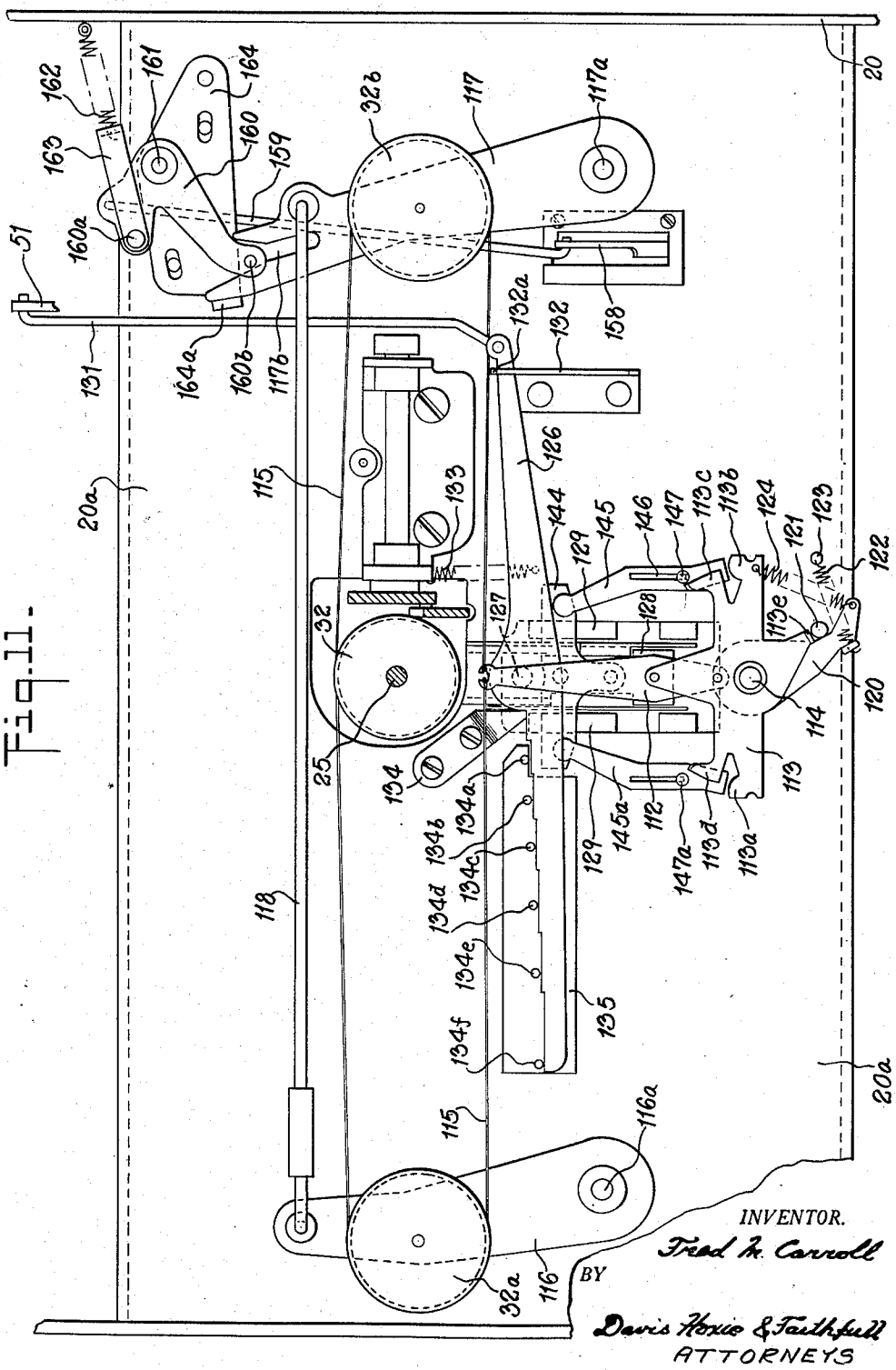
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MOVABLE DRUM TYPEWRITER

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Fig. 11.

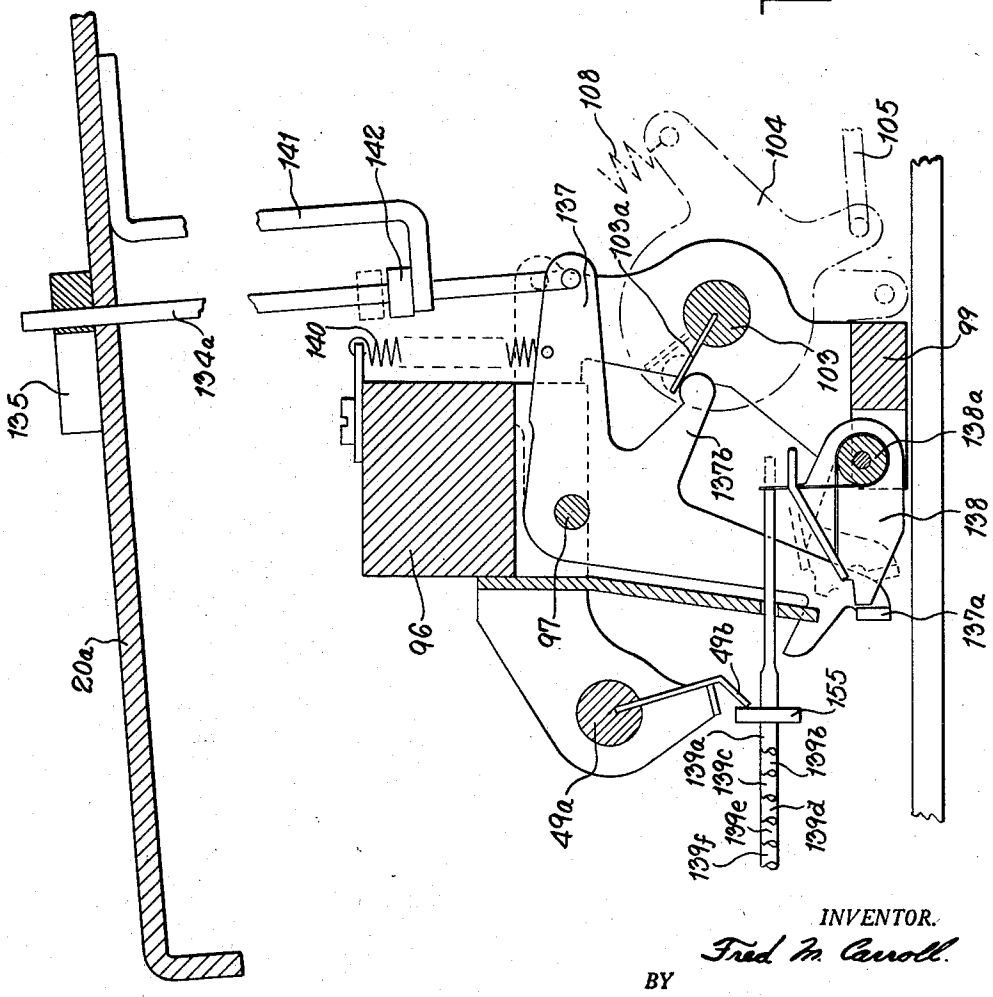


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Fig. 12.



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MOVABLE DRUM TYPEWRITER

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Fig. 13.

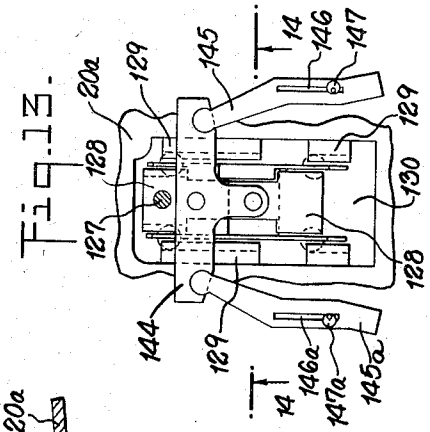


Fig. 14.

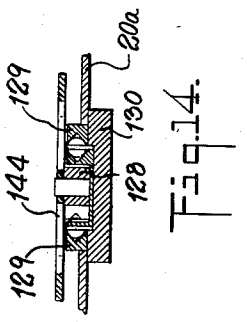
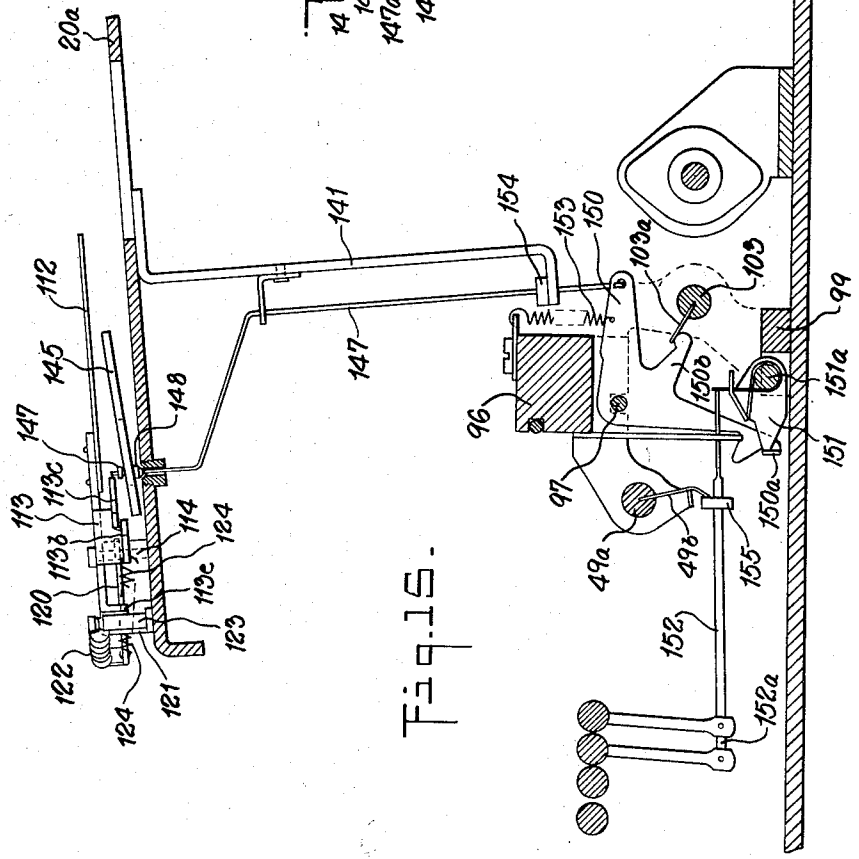


Fig. 15.



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United States Patent Office 2,847,105
Patented Aug. 12, 1958

2,847,105

MOVABLE DRUM TYPEWRITER

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Application January 3, 1955, Serial No. 479,393

16 Claims. (Cl. 197—16)

This invention relates to machines for printing type, such as typewriters. It has particular reference to an improved machine of the class in which the type characters are arranged on a drum or other printing member which is moved under control of selector elements, such as type keys, to position the printing member for printing a selected character.

According to one feature of the invention, the characters on the printing member form two sets of type, which may include small and capital letters, respectively. The printing member is connected to a selector mechanism comprising keys or other selector elements and operable under control of the elements to move the printing member varying extents from a normal position and return the member to this position, thereby selecting characters to be printed in one of the type sets. Means including a key or other control element are provided for shifting the printing member between two normal positions independently of the selector mechanism while maintaining the latter connected to the printing member, whereby either of the two type sets can be placed under printing control of the selector mechanism. Preferably, the selector mechanism, the shifting means, and a striker for impelling the printing member to print each selected character are connected to a main actuator for operating them; and means are provided for rendering the striker inoperative by the actuator in response to operation of the shifting means by its control element.

Another feature of the invention resides in the provision of an improved selector mechanism for positioning the printing member to print a selected character. This mechanism comprises an actuator connected to a main lever for actuating it with an invariable throw, and a plurality of fulcrums spaced different distances from the point at which the actuator is connected to the lever. Any one of these fulcrums is rendered operable as the fulcrum point for the lever by selector means controlled by keys or other selector elements, which may also be connected to the actuator for initiating operation thereof. The printing member has a driving connection from the main lever at a point thereof which is spaced from the fulcrums and the actuator connection, so that the printing member is movable by the actuator through different extents depending upon the fulcrum selected for operation by the selector means.

Preferably, the driving connection between the main lever and the printing member includes a driving lever and a pair of connecting members operable to make connections from the main lever to the driving lever at different points spaced from its pivot point, and the selector means are connected to those connecting members for rendering either of them operative while maintaining the other inoperative. Thus, the number of different positions to which the printing member is movable by the selector means is doubled, since each of the fulcrums will enable movement of the printing member to two different positions through the respective connecting members. By arranging these members to connect to the driving

lever at opposite sides of its pivot point, the printing member will be moved in opposite directions by the respective connecting members, so that the printing member is controlled through the fulcrums as to extent of movement and through the two connecting members for the driving lever as to the direction of movement.

A further feature of the invention is an improved selector mechanism by which the printing member can be made to assume any one of three printing positions to select one of three rows of type characters, the particular character to be printed being selected from this row by the variable fulcrum mechanism previously described. According to this feature, the printing member is movable by a crank shaft connected to a biasing means for opposing rotation of the shaft in either direction from a centered position corresponding to one of the three printing positions. Two crank arms are connected to the shaft for rotating it clockwise and counter-clockwise, respectively, from its centered position and thereby moving the printing member to its second and third positions, respectively, against the action of the biasing means. Selector means are provided for establishing a driving connection from a crank actuating member to the crank shaft through either of the crank arms while maintaining the other arm inoperative. Thus, upon each operating cycle of the actuating member the selector means will control the positioning of the printing member by causing the actuating member to turn the crank shaft through one or the other crank arm or maintaining both crank arms inoperative.

In the preferred construction, the printing member is in the form of a drum on the periphery of which the type characters are arranged in three arcuate or circumferential rows, and the character selection is effected by axial positioning of the drum through the crank shaft and by rotary adjustment of the drum through the variable fulcrum mechanism. In this case, each of the two sets of type preferably occupies 180° of the drum periphery, and the shifting means are adapted to rotate the drum through 180° independently of the selector mechanism so that either set can be placed in position for printing operations under control of the selector mechanism. It will be understood that the selector mechanism includes selector elements, such as the typewriter keys of a conventional key board, which are so connected to the crank shaft, the fulcrums and the two connecting members from the variably fulcrumed lever that each character of the operative set of type on the drum is positioned for printing by actuation of a corresponding key or other selector element.

These and other features of the invention may be better understood by the following detailed description which refers to the accompanying drawings illustrating a preferred form of the invention. As illustrated, the invention is embodied in a typewriter, although it will be apparent that the actuation of the various selector elements for positioning the printing member may be effected otherwise than by conventional manual typewriting operations. In the drawings:

Fig. 1 is a fore-and-aft vertical sectional view of the typewriter;

Fig. 2 is a front view of the type drum or printing member and the mounting means therefor;

Fig. 3 is a fore-and-aft vertical sectional view showing details of the main actuating mechanism and the drum shifting means;

Figs. 4, 5 and 6 are fore-and-aft vertical sectional views of the striker mechanism, showing different positions thereof;

Fig. 7 is a horizontal view of the type drum shaft, showing a toothed wheel thereon and part of the striker coacting with the wheel;

Fig. 8 is a fore-and-aft vertical sectional view showing parts of the selector mechanism including the crank shaft, its actuating member, and the selector means for positioning the crank arms;

Fig. 9 is a perspective view of the crank shaft and its crank arms;

Fig. 10 is a perspective view of the biasing means for centering the crank shaft;

Fig. 11 is a plan view of parts of the typewriter, showing the variably fulcrumed lever, its connections to the type drum, and the drum shifting means;

Fig. 12 is a fore-and-aft vertical sectional view of details of the selector mechanism, showing one of the movable fulcrums and the selector means for actuating it;

Fig. 13 is a plan view of certain details of the connections between the variably fulcrumed lever and the type drum, including the two connecting members controlled by the selector means;

Fig. 14 is a sectional view on the line **14—14** in Fig. 13, and

Fig. 15 is a fore-and-aft vertical sectional view of details of the selector mechanism, showing the selector means for actuating one of the two connecting members.

Referring to the drawings, the typewriter there shown comprises a frame **20** (Fig. 1) provided at the front with a keyboard shown generally at **21**. At the upper part of the frame is a platen **22** rotatably mounted on a carriage **23** adapted to slide crosswise of the frame in the usual manner.

The carriage **23** may be of the form used in the well-known "Electromatic" typewriter, which has also been known as the "International." The platen **22** is adapted to be contacted by a printing member in the form of a type drum **24** on the peripheral surface of which the raised type characters are arranged in three circumferential rows **24***a*, **24***b*, and **24***c*. These rows are spaced from each other in the axial direction of the drum so that the platen can be contacted by only one row at a time, the particular row depending upon the axial positioning of the drum; and the characters in each row are spaced apart circumferentially a sufficient distance so that the platen can be contacted by only one character at a time in that row, the particular character depending upon the rotational positioning of the drum.

The type drum **24** is provided with mounting means including a drum shaft **25** carrying the drum and supported on a tiltable support arm **26**, the latter being mounted intermediate its ends on a horizontal shaft **27** secured in any suitable manner to a platform **20***a* of the frame (Fig. 2). The support arm **26** is provided at its ends with bearings **28** which support the drum shaft **25** for rotation while allowing axial or vertical movement of this shaft in the bearings. A collar **29** is secured to the drum shaft between the bearings **28** and has an external circumferential groove which receives an anti-friction bushing **30**. A spindle **31** has a forked upper end which straddles the lower portion of the drum shaft and is connected to the bushing **30**. Above the collar **29** the drum shaft **25** carries a pulley wheel **32** which, as will be described in detail presently, may be rotated under control of selector elements in the form of keys **21***a* on the board **21** to select a desired character in a selected one of the three rows **24***a*, **24***b*, and **24***c* on the type drum. The axial positioning of the type drum to select the row containing the desired character is also under control of the keys **21***a* and is effected by raising or lowering the drum through the spindle **25**, or allowing the spindle to remain in its normal position wherein the intermediate row **24***b* is adapted to engage the platen, as will be described in greater detail presently.

It will be understood that actuation of each key **21***a* causes the carriage **23** to shift one space from right to left upon completion of each printing operation, so that the paper or other record to be typed is automatically positioned to receive the next imprint from the type drum **24**; and the keyboard is provided with the usual spacer key **21***b* for similarly shifting the carriage independently of the character keys **21***a*. The mechanism for thus shifting the carriage and for rotating the platen and returning the carriage for the next line of type, as well as the means for holding the paper against the platen and accommodating the type-writer ribbon, may be of known or conventional form, as disclosed, for example, in my Patent No. 2,320,810 dated June 1, 1943. Since such mechanism and means form no part of the present invention, they require no illustration or further description.

Having described the general arrangement of the typewriter, the specification will now proceed with a description of the following main parts of the type-writer, in the order stated:

(1) Actuating mechanism. This mechanism produces a rapid oscillation of a main actuating shaft from a continuously rotating prime-mover, such as an electric motor, when any one of the character keys **21***a* is depressed manually.

(2) Striker mechanism for type drum. The purpose of this mechanism is to move the type drum laterally against the platen **22** at the end of the forward movement of the main shaft in its oscillation, after the drum has been positioned rotationally and vertically by actuation of the selected character key **21***a*. The type drum is made to strike the platen and return to its initial position (Fig. 1) by tilting its shaft **25** back and forth about the horizontal shaft **27** as an axis.

(3) Selector mechanism for axial positioning of type drum. Through this mechanism, the drum spindle **31** is raised or lowered by the forward movement of the main shaft (**40**) in its oscillation, or is held in an intermediate position, depending upon which of the character keys **21***a* is actuated. In this way, one of the three rows **24***a*, **24***b*, and **24***c* is positioned to contact the platen before the latter is struck by the type drum. During the return movement of the main shaft (**40**) in its oscillation, the vertical positioning mechanism restores the drum spindle to its intermediate position (Fig. 1) if it was previously raised or lowered.

(4) Selector mechanism for rotary positioning of type drum. This mechanism rotates the type drum shaft **25** clockwise or counter-clockwise through different angles, or holds it in a neutral position, depending upon which of the character keys **21***a* is depressed. It is actuated by the forward movement of the main shaft (**40**), so that both the vertical and rotational positioning of the drum are completed by the time the drum **24** strikes the platen. During the return movement of the main actuating shaft (**40**), the rotational positioning mechanism restores the drum shaft **25** to its neutral position (Fig. 1) if it was previously rotated in either direction.

(5) Shift key means. The type drum **24** has two sets of characters, each set occupying approximately 180° of the drum's periphery. The first set *x*, which includes characters for typing small letters of the alphabet, is normally positioned to operate on the platen under control of the character keys **21***a* through the mechanisms previously mentioned. The function of the shift key means is to revolve the type drum approximately 180° so that the second set *y* of characters, which includes characters for typing capital letters of the alphabet, is positioned to operate on the platen in a similar manner. The shift key means is controlled from the keyboard **21** and is operated through the actuating mechanism to disconnect the latter from the striker mechanism and rotate the type drum independently of the character keys **21***a*.

Actuating mechanism

Near the rear of the frame **20** is a shaft **34** extending transversely of the frame and adapted to be driven continuously from an electric motor (not shown). Shaft

34 operates through suitable gearing 35 to drive a parallel shaft 36 (Fig. 1). The shaft 36 has a roughened peripheral surface underlying a cam roller 37 (Fig. 3), which may be made of a resilient material such as rubber. The cam roller 37 is rotatably mounted between the free ends of a pair of opposed arms, one of which is shown at 38, by means of a transverse shaft 39. The arms 38 are held together rigidly as a unit by a sleeve 38*a* on a main actuating shaft 40 extending parallel to the shaft 36 and suitably journalled at its ends, the sleeve 38*a* being rotatable relative to shaft 40. A catch 41 on one end of the cam roller 37 is engageable by a dog 42 pivotally mounted on a shaft 43, which is likewise secured between the arms 38. A spring 44 is connected between one leg of the dog 42 and a projection 40*a* from the main shaft 40. The spring 44 serves to bias the dog 42 clockwise into alignment with the cam roller catch 41 and against a limiting stop (not shown) on the arm 38. The dog 42 is adapted to be turned counter-clockwise on its shaft 43 by a main actuating rod 45, thereby disengaging the catch 41 and releasing the cam roller 37. When the cam is thus released, it is rotated counter-clockwise on its shaft 39 by frictional engagement of its periphery with the rotating shaft 36. Due to the shape of cam 37, its rotation in this manner causes it to move the arms 38 and sleeve 38*a* counter-clockwise through a small angle determined by the eccentricity of the cam, and then allow the parts 38—38*a* to return to their initial position by movement in the opposite direction. When the cam 37 has completed a full revolution, it is stopped and held by re-engagement of its catch 41 with the dog 42, which is returned by spring 44 to its catch-engaging position (Fig. 3) immediately after it has been displaced by rearward movement of the main rod 45. As shown in Fig. 3, the rod 45 has a stepped end 45*a* normally engaging the lower leg of dog 42, so that in its rearward movement (to the right in Fig. 3) the rod first turns the dog counter-clockwise and then disengages the dog so as to allow the latter to return to its initial catch-engaging position under the action of spring 44.

A lever 46 is pivotally mounted on shaft 43 and has one arm normally engaging a pin 47 at the end of the cam 37 opposite the catch 41. The other arm of the lever is connected to a spring 48 which urges the lever 46 clockwise against the pin 47, thereby urging the catch 41 against the dog 42. When cam 37 is released by dog 42, the lever 46 starts the cam in counter-clockwise rotation to move its low point 37*a* beyond the rotating shaft 36 and cause a firm driving engagement between this shaft and the cam. As the cam rotates through one revolution, the pin 47 disengages lever 46 and allows the latter to contact shaft 39 under the action of spring 48, until the cam nears the end of its revolution and causes pin 47 to re-engage the lever 46 at its slanted end portion and restore it to its initial position.

The main rod 45 is supported intermediate its ends by a spring 45*b* connected to a detent 38*b* on the arm 38. At its front end, the rod 45 is supported by the lower end of an actuating lever 49, the latter being suitably connected to the character keys 21*a* so that rod 45 is shifted rearward to release cam 37 and is then returned by spring 45*b* to its normal position (Fig. 3) whenever one of these keys is actuated.

It will be apparent from the foregoing that each actuation of the main rod 45 by one of the character keys 21*a* will cause the dog 42 to release cam 37, whereby the sleeve 38*a* and arms 38 are oscillated rapidly about the axis of main shaft 40, rotating first in a counter-clockwise direction and then in a clockwise direction as viewed in Fig. 3. Upon completion of this oscillation, the cam 37 is again held by dog 42 until the rod 45 is re-actuated by one of the keys 21*a*. In the return movement of main rod 45 (to the left in Fig. 3), the stepped end 45*a* thereof will re-engage the lower leg of dog 42, which has previously been returned to its catch-engaging position by spring 44, so that the catch 41 will be released again upon the next actuation of rod 45.

The mechanism for oscillating the main actuator or sleeve 38*a* upon each actuation of rod 45 can take other forms than that described above. The principle of such mechanisms employing a cam (such as cam 37) is well known in the art and is explained in Patent No. 1,777,055, and another form of this mechanism is disclosed in my Patent No. 2,320,810 dated June 1, 1943.

The main shaft 40 is adapted to be turned with the main actuator or sleeve 38*a* through a connection comprising a catch 38*c* pivoted on the outer portion of arm 38 and normally locking this arm to another arm 50 loosely mounted on shaft 40. The arm 50 is connected through a spring 50*a* with an arm 50*b* likewise mounted loosely on shaft 40. Between the arms 50—50*b* is a lever 51 fixed to shaft 40 and having intermediate its ends a laterally projecting stub shaft 51*a* against which the arm 50 is normally held by arm 38 through catch 38*c*. In this position of the parts (Fig. 3), the other arm 50*b* is held away from stub shaft 51*a* against the action of spring 50*a*, by means of a bent portion 50*c* on arm 50 engaging the arm 50*b*.

As the arm 38 turns counter-clockwise at the beginning of its oscillation by cam 37, the main shaft 40 remains stationary for a short dwell period. However, this initial movement of arm 38 causes it to turn arm 50*b* counter-clockwise through the connection including catch 38*c*, arm 50 and spring 50*a*, until arm 50*b* engages the stub shaft 51*a*. Further counter-clockwise movement of arm 38 will then turn the lever 51 and therefore main shaft 40 counter-clockwise through this same connection. The main shaft 40 is normally biased clockwise against a fixed stop, as will be described in connection with the striker mechanism. Consequently, when arm 38 and shaft 40 have completed their counter-clockwise movement, the shaft 40 will assist the return of arm 38 clockwise toward its initial position (Fig. 3) through engagement of its parts 51*a* and 50*b*. When main shaft 40 returns to its initial stopped position, the arm 38 will continue through the remainder of its return or clockwise movement, thereby drawing arm 50 back into engagement with stub shaft 51*a* and retracting arm 50*b* from the latter shaft, as shown in Fig. 3.

The driving connection between arm 38 and main shaft 40 may be interrupted and restored at will through the raising and lowering of catch 38*c*, by means of a manually operated rod 38*d*. When the driving connection is thus interrupted, the arm 38 can be actuated by its cam 37 without opposition from main shaft 40 and the parts which it actuates, which may be desirable in case the cam 37 should fail to return to its initial position for any reason, as through accidental jamming of any part during an operating cycle.

Striker mechanism

A lever 52 is supported intermediate its ends on the main actuating shaft 40, the lever being rotatable relative to this shaft (Figs. 4–6). A tension spring 53 is connected to the free upper end portion of lever 52 and urges it clockwise against a fixed stop 54. A finger 55 is secured to shaft 40 so as to rotate therewith, and a latch 56 is pivoted on the free end portion of finger 55. The latch 56 is urged clockwise relative to its supporting finger 55 by means of a spring 57, whereby the lower end of lever 52 is normally engaged by a catch 56*a* on the latch. Thus, counter-clockwise rotation of main shaft 40 in the first phase of its oscillation will cause finger 55 to rotate lever 52 counter-clockwise through the latch 56 and against spring 53. An arm 56*b* on the latch is in contact with a dog 58 rotatably mounted on a shaft 59, which is urged counter-clockwise by spring 57 through latch 56. When the dog 58 is turned clockwise on its shaft 59 (as will be described hereinafter in connection with the shift key mechanism), the latch 56 is turned

counter-clockwise so as to disengage its catch 56*a* from lever 52, whereby the lever 52 remains stationary during oscillation of the main shaft 40.

Two levers 60 and 61 are pivotally mounted intermediate their ends on the upper portion of lever 52. A tension spring 62 is connected between the lower end of lever 61 and one arm of a bell-crank lever 63 pivotally mounted on a fixed shaft 64, the other arm of lever 63 being in contact with the notched periphery of a cam 65 rotatable on a fixed shaft 66. The spring 62 urges the lever 61 counter-clockwise on its supporting lever 52, thereby holding an abutment 61*a* of lever 61 against an elastic part (not shown) on the main shaft 40. As will be described in detail presently, the spring 62 provides the force for impelling the striker to strike the type drum 24 against the platen 22. The tension in this spring, and therefore, the striking force, can be adjusted by rotating the cam 65 on its shaft 66. That is, when the cam 65 is rotated counter-clockwise (Fig. 4) it displaces the bell-crank lever 63 counter-clockwise on its supporting shaft 64, so that spring 62 is extended and placed under greater tension. The cam 65 is held in its adjusted position by engagement of the adjacent arm of bell-crank lever 63 in one of the notches in the cam periphery.

A latch 67 is pivotally mounted on a fixed shaft 68 near the upper end of lever 61. This latch has a catch 67*a* normally engaging an upper flange 61*b* of lever 61, whereby the upper end of this lever is held stationary during the counter-clockwise rotation of lever 52. The latch 67 is urged counter-clockwise on its shaft 68 by a spring 69 to hold the latch in its locking position.

The latch 67 is adapted to be actuated to release the upper end of lever 61 by operation of the adjacent lever 60. More particularly, the latter lever has a forked lower end 60*a* which straddles an enlargement 64*a* of the fixed shaft 64. At its upper end, the lever 60 has a pin 60*b* aligned with the lower end of latch 67. As the main lever 52 is rotated counter-clockwise by shaft 40, the lever 60 is rotated counter-clockwise relative to lever 52 due to the fork 60*a* being held by the stationary part 64*a*. Thus, while the axes of the two levers 60—61 will move counter-clockwise on their supporting lever 52, the pin 60*b* at the upper end of lever 60 will move toward the latch 67 and the upper end of lever 61. Near the end of the counter-clockwise rotation of main shaft 40 and lever 52, the pin 60*b* will engage the lower end of latch 67, as shown in Fig. 5, and then swing it clockwise on its shaft 68 so as to release the upper end 61*b* of lever 61 (Fig. 6). In the meantime, the lower end of lever 61 has been moved away from main shaft 40 (Fig. 5) due to the upper end 61*b* of this lever being held stationary during the counter-clockwise rotation of main lever 52, so that spring 62 is extended. Consequently, when latch 67 releases the upper end of lever 61, as previously described, the spring 62 snaps this lever counter-clockwise about its axis on main lever 52, whereby the upper end of lever 61 moves rapidly to the left and the lower abutment 61*a* returns into engagement with shaft 40, as shown in Fig. 6.

A striker 70 is pivotally mounted on the upper end portion of lever 61, as shown at 71. This striker is urged counter-clockwise on its pivot 71 by means of a spring 72 secured to lever 61, thereby holding a catch 70*a* on the striker against the flanged upper end 61*b* of lever 61. In this position of the striker, its striking end is aligned with the flanged lower end 74*a* of a striker member or lever 74 which is pivotally mounted intermediate its ends on the support arm 26 of the type drum, as shown at 26*a*. At its upper end portion, the lever 74 has a knife edge 74*b* in front of the drum shaft 25 and facing this shaft. A wheel 75 is secured to shaft 25 opposite the knife edge 74*b*, this wheel being provided around its periphery with teeth 75*a* corresponding in number to the characters in each circumferential row 24*a*, 24*b* and 24*c* on the type drum 24. The recesses between the teeth 75*a* (Fig. 7) are aligned vertically with the respective characters on the type drum, so that the angular spacing of these recesses is the same as the angular spacing of the characters about the drum shaft 25. A guide 76 is secured to the upper end of support arm 26 and has a slot 76*a* (Fig. 7) through which the upper end of lever 74 projects. The lever 74 is urged counter-clockwise on its pivot 26*a* by means of a tension spring 77 secured between the lower end of this lever and a fixed pin 78 which is located in the path of a lower detent 70*b* on the striker 70. By means of the spring 77, the upper end of lever 74 is normally urged against the front end (left end in Figs. 4–7) of the slot 76*a* in the guide 76, and the support arm 26 is urged counter-clockwise against a cushion stop 79 so that type drum 24 is held away from platen 22.

When the upper end of lever 61 is released by latch 67, as previously described, the spring 62 snaps the striker 70 against the lower end of lever 74, whereby this lever is impelled clockwise against spring 77 to strike the knife edge 74*b* against wheel 75 between a pair of adjacent teeth 75*a*. The particular pair of teeth which is thus engaged by the knife edge will depend upon the rotational adjustment which the type drum has undergone on its shaft 25 during the initial part of the forward rotation of main shaft 40, as will be described presently. Whatever the rotational and vertical position of the type drum shaft 25 may be at the time the lever 61 is released, the resulting clockwise movement of lever 74 will cause its knife edge to engage wheel 75 and thereby turn the supporting arm 26 clockwise about its horizontal shaft 27 so as to strike the type drum 24 against the platen 22, and at the same time the engagement of knife edge 74*b* between a pair of adjacent teeth 75*a* will center the selected character on the previously positioned type drum and hold the drum against rotational displacement as it strikes the platen.

Near the end of its striking movement, the striker 70 is moved counter-clockwise on its pivot 71 by engagement of detent 70*b* with the fixed pin 79, whereby the end of the striker is moved out of engagement with the lower end 74*a* of lever 74. Thereupon, the spring 77 snaps the lever 74 counter-clockwise about its pivot 26*a* so that the upper end of this lever re-engages the front end (left end in Figs. 4–7) of the slot in guide 76 and returns the support arm 26 to its initial position against stop 78. In this way, the type drum 24 is snapped away from the platen 22 and made ready for the next typing operation.

In the return movement of the main shaft 40 (clockwise in Figs. 4–6), the main lever 52 is moved clockwise against stop 54 by spring 53, thereby returning the levers 60—61 to their initial positions (Fig. 4). As the upper end of lever 61 moves away from the fixed pin 79, the spring 72 returns the striker 70 against the flanged upper end 61*b* of this lever, so that the striker is again aligned with the lower end 74*a* of lever 74. In the initial return movement of main lever 52, the pin 60*b* at the upper end of the lever 60 moves away from the latch shaft 68. As the return movement of main lever 52 continues, the upper end of lever 61 raises the catch 67*a* and slides under this catch so that the latch 67 again locks the upper end of lever 61 by the time lever 52 has re-engaged its stop 54 (Fig. 4). The striker mechanism is now ready for the next oscillation of main shaft 40.

Selector mechanism for axial positioning of type drum

Referring to Figs. 8 and 9, the main oscillating shaft 40 supports a main actuating member in the form of an arm 81 which is rotatable relative to this shaft. A finger 82 secured to the shaft 40 has a flange 82*a* at its free end, against which the main arm 81 is held by a tension spring 83. Thus, oscillation of the main shaft 40 will cause the finger 82 to depress the free end 81*a* of arm 81 through spring 83 and then raise this free end upon the return movement of shaft 40.

A transverse crank shaft 84 is suitably journalled on the frame 20 and is provided at one end with an arm 85 connecting this shaft to the lower end of spindle 31 which supports the type drum and its shaft 25 (Fig. 1). Intermediate its ends, the shaft 84 has a pair of cranks 86—86*a* (Fig. 9) which are inclined in opposite directions from a vertical plane through the axis of crank shaft 84. At their free ends, the cranks 86—86*a* are pivotally connected to a pair of crank arms 87—87*a*, respectively, extending upward from shaft 84. The crank arms 87—87*a* are adapted to be swung forward and backward on their respective cranks 86—86*a* by selector means including levers 88—88*a* connected to the upper portions of the crank arms through rods 89—89*a*, respectively. The crank arms 87—87*a* are normally held in their rearward positions by the levers 88—88*a* (Figs. 8–9), whereby they are displaced from the path of the downward movement of the flanged end 81*a* of the main actuating arm 81. Consequently, in the normal positions of the crank arms 87—87*a*, they will not be affected by the previously described oscillation of the main arm 81. However, when crank arm 87 is swung forward by its lever 88, subsequent counter-clockwise movement of main arm 81 will engage its flanged end 81*a* with the upper end of arm 87 and depress the latter, thereby turning shaft 84 counter-clockwise and raising spindle 31 so as to align the bottom row of characters 24*c* on the type drum with the platen 22 (Fig. 1). When the other crank arm 87*a* is swung forward by its lever 88*a*, subsequent counter-clockwise movement of main arm 81 will engage its flanged end 81*a* with the upper end of arm 87*a* and depress the latter so as to turn shaft 84 clockwise, thereby lowering the spindle 31 and aligning the top row of type characters 24*a* with the platen 22.

The cam shaft 84 is normally held in a center position (rotationally) so as to maintain the intermediate row 24*b* of type characters in alignment with platen 22. The mechanism for thus centering the cam shaft 84 and the type drum 24 is illustrated in Fig. 10. As there shown, the end of shaft 84 opposite its arm 85 supports a finger 90 which is loosely mounted on this shaft. The free end of finger 90 normally engages a fixed stop 91. Spring 92 is coiled around the shaft 84 and has one end 92*a* pressing down against the free end of finger 90, the other end 92*b* of this spring pressing upward against the fixed stop 91. Accordingly, the spring 92 acts to hold the finger 90 down against the stop 91. A second finger 93 is secured to shaft 84 so as to rotate therewith. A second spring 94 is coiled around the shaft between the fingers 90 and 93 and has one end 94*a* pressing down against the free end of finger 90. The other end 94*b* of this spring presses upward against a detent 93*a* on the free end of finger 93, so as to hold the latter detent against the bottom finger 90 at its free end.

When the shaft 84 is turned counter-clockwise by actuation of crank arm 87, as previously described, the fingers 90 and 93 are raised as a unit from the fixed stop 91 against the opposing force exerted by the end 92*b* of spring 92. Thereafter, as the flanged end 81*a* is raised by the return movement of oscillating shaft 40 and main arm 81, the spring end 92*b* returns shaft 84 clockwise until finger 90 re-engages the stop 91 in the intermediate position of shaft 84. When shaft 84 is turned clockwise by actuation of crank arm 87*a* as previously described, the finger 90 is held stationary by stop 91 but the other finger 93 turns clockwise with the shaft against the opposing force of the spring end 94*b*. Upon the subsequent raising of the flange end 81*a* by return movement of main arm 81, the spring end 94*b* returns shaft 84 counter-clockwise until the detent 93*a* re-engages the finger 90, at which time the shaft 84 is again in its center or neutral position.

The levers 88—88*a* for shifting the crank arms 87—87*a* are pivotally mounted on a transverse support 96 of the frame 20, by means of a fixed shaft 97 (Fig. 8). Since

the respective selector means for actuating the levers 88—88*a* are of similar construction, only the selector means for actuating lever 88 will be described. As shown in Fig. 8, a movable stop 98 is mounted near the lower end of lever 88 and is pivoted on a transverse support 99 of the frame, as shown at 98*a*. An actuating rod 100 is suitably mounted for backward and forward movement in the frame and is engaged at its rear end with a spring 101 on stop 98. In its normal or forward position (Fig. 8), the rod 100 allows the stop 98 to lie opposite the flanged lower end 88*a* of lever 88 but when the rod 100 is moved rearward (to the right in Fig. 8) the stop 98 is raised at its free end so as to allow counter-clockwise movement of lever 88 on its pivot 97 by a spring 102.

The lever 88 is normally held in its Fig. 8 position by a transverse shaft 103 journalled in a part 99*a* on one end of support 99 (and in a similar part, not shown, on the other end of support 99). The shaft 103 has a radial flange 103*a* extending along most of its length and normally engaging a detent 88*b* on lever 88 (and a similar detent, not shown, on the other lever 88*a*). The flange 103*a* forms a holding device, as will be explained presently. Whenever one of the character keys 21*a* is actuated, the shaft 103 is turned first clockwise and then counter-clockwise from the main oscillating arm 38, through a connection illustrated in Fig. 3. As there shown, this connection comprises a plate 104 fixed to the shaft 103 and having an arm 104*a* connected through the link 105 with the lower end of a lever 106. The latter is pivotally mounted at its upper end on a fixed pin 106*a*. Intermediate its ends, the lever 106 carries a roller 106*b* normally engaged by a cam surface 107*a* at the bottom of the free end portion of an arm 107 secured to the main oscillating arm 38. A tension spring 108 is connected between the support 96 and a second arm 104*b* on the plate 104. Thus, the spring 108 urges the shaft 103 counterclockwise to hold the roller 106*b* against the end portion of arm 107.

The rod 100 (Fig. 8) is connected in the conventional manner to a certain group of the character keys 21*a*, namely, the keys corresponding to the characters in the bottom row 24*c* on the type drum (Fig. 1). A similar rod 100*a* is arranged to actuate a stop (not shown) similar to the stop 98 but normally locking the lower end of the other lever 88*a*; and the rod 100*a* is connected in the conventional manner to the keys 21*a* corresponding to the characters in the top row 24*a* on the type drum. The remaining keys 21*a*, corresponding to the characters in the intermediate row 24*b* on the type drum, are not connected to either of the rods 100—100*a*.

Assume that one of the keys 21*a* connected to rod 100 is actuated. The resulting forward shifting of this rod (to the right in Fig. 8) immediately raises the stop 98 to unlock the lower end of lever 88, although the lower end of the adjacent lever 88*a* will continue to be locked by its corresponding stop (not shown) connected to rod 100*a*. At the same time, the main actuating rod 45 (Fig. 3), which is connected in the conventional manner to all of the keys 21*a*, is shifted forward to release the actuating cam 37, as previously described. As the arm 38 starts its oscillation, the cam surface 107*a* on arm 107 moves downward against roller 106*b* and thereby turns shaft 103 clockwise through lever 106, link 105 and plate 104. The resulting clockwise movement of flange 103*a* causes the spring 102 to swing lever 88 counter-clockwise on its pivot 97, since the lower end 88*a* of this lever has previously been unlocked by raising of stop 98. Consequently, the crank arm 87 is swung forward under the flanged end 81*a* of the actuating arm 81. During this positioning of crank arm 87, the other crank arm 87*a* is held in its inoperative position due to the fact that the lower end of its lever 88*a* continues to be locked by its stop (not shown) corresponding to the stop 98, as previously described. When the upper end of crank arm 87 has been

thus positioned under the arm end 81*a*, it is held there during a dwell period due to the roller 106*b* riding off the cam surface 107*a* and along the end of arm 107 (Fig. 3).

At the start of this dwell period (that is, when the roller 106*b* commences to ride along the end of arm 107), the main oscillating shaft 40 commences its counter-clockwise movement due to engagement of the parts 50*b* and 51*a*, as previously described. This causes the flanged end 81*a* of arm 81 (Fig. 8) to descend into engagement with the crank arm 87 and thereby raise spindle 31 and the type drum 24 so as to align its bottom row 24*c* with the platen 22. During this raising of the type drum, and before the drum is actuated by the striker mechanism, it is positioned rotationally to align the selected character in the bottom row 24*c* with the platen 22, as will be described in detail presently. Upon completion of the drum positioning operations, the main oscillating shaft 40 completes its counter-clockwise rotation, so that the striker mechanism strikes the drum 24 against the platen 22, as previously described.

As the main oscillating shaft 40 commences its return or clockwise movement, the arm end 81*a* (Fig. 8) is raised to allow shaft 84 to lower the type drum 24 to its intermediate or neutral position, and at the same time the type drum (if it has been displaced rotationally) is returned to its normal or neutral angular position through a mechanism which will presently be described. When the main oscillating shaft 40 returns to its normal stop position, the final return movement of arm 38 causes the roller 106*b* (Fig. 3) to ride back on the cam surface 107*a*, whereupon the final raising of this cam surface 107*a* to its normal position will allow spring 108 to turn shaft 103 and its holding device 103*a* counter-clockwise, thereby returning lever 88 and its crank arm 87 to their normal positions shown in Fig. 8. In the meantime, the assumed key 21*a* has been released to retract the rod 100, so that stop 98 is restored by gravity to its normal locking position opposite the lower end 88*a* of lever 88, when the latter is returned to its normal position by shaft 103.

When the other rod 100*a* is actuated by one of the keys 21*a* connected to it, the operation is similar to that previously described except that the stop 98 is retained in its locking position while the corresponding stop (not shown) for the lever 88*a* is raised by the forward movement of rod 100*a*, whereby the top of crank arm 87*a* is positioned under the end of actuating arm 81. Consequently, in this case the type drum 24 is lowered to align the top row 24*a* with the platen 22. Upon actuation of a key 21*a* corresponding to a character in the middle row 24*b* of the type drum, the crank arms 87—87*a* will remain in their inoperative positions (Fig. 8) during the ensuing cycle, since neither of the rods 100—100*a* is actuated. Consequently, the actuating arm 81 will go through its cycle without affecting the vertical positioning of the type drum, so that the middle row of characters 24*b* will remain in alignment with the platen 22.

It will be apparent that the parts 103—107 form a connection between the actuator 38*a* and the selector means 88—102 for operating the latter prior to operation of the crank actuating member 81 by actuator 38*a*, since shaft 40 which moves the member 81 has a short dwell period at the start of the rotation of actuator 38*a*, as previously described.

Selector mechanism for rotational positioning of type drum

As previously mentioned, the shaft 25 of the type drum 24 carries a pulley wheel 32 for rotating this shaft. The rotation of wheel 32 is effected through a main arm 112 of the rotational positioning mechanism, the details of which are illustrated in Figs. 11–14. Referring to Fig. 11, the arm 112 is secured to a driving lever 113 pivotally mounted intermediate its ends on a vertical pin 114 fixed to the frame platform 20*a*. At its rear end, the arm 112 is forked and connected to the two ends of a tension member in the form of a wire 115. From one of the tines at the forked end of arm 112, the wire 115 extends partly around another pulley wheel 32*a*, thence to the pulley wheel 32 where it makes at least one complete turn around this wheel, then to and partly around a third pulley wheel 32*b*, and finally back to the other tine on the arm 112. The pulley wheels 32*a* and 32*b* are rotatably mounted on arms 116 and 117 which are adapted to swing on pivot pins 116*a* and 117*a*, respectively, on opposite sides of the frame platform 20*a*. The free ends of arms 116 and 117 are interconnected by a link 118. The arm 117 is normally held in the Fig. 11 position by the shift key mechanism (to be described presently), whereby the other arm 116 is also held in its Fig. 11 position through the link 118.

It will be apparent that when the lever 113 is turned clockwise on its pivot 114, the free end of arm 112 moves to the right and thereby turns wheel 32 and drum shaft 25 counter-clockwise (as viewed in Fig. 11) through the wire 115. Conversely, counter-clockwise movement of lever 113 will cause the drum shaft 25 to turn clockwise.

The drum shaft 25 is normally held in a certain angular position by a centering or biasing means comprising a finger 120 loosely mounted on the pivot pin 114 directly below the lever 113. The free end portion of finger 120 is normally held against a fixed stop 121 by means of a tension spring 122 connected at one end to the finger 120 and at the other end to a pin 123 fixed to the frame platform 20*a*. Another tension spring 124 is connected between one end 113*b* of lever 113 and the free end of finger 120, and this spring holds the finger 120 against a detent 113*e* on the lever 113. Upon clockwise rotation of lever 113, its detent 113*e* causes the finger 120 to rotate clockwise with the lever against the tension in spring 122, so that when the lever 113 is released it is immediately returned to its centered position by spring 122 acting through finger 120 and detent 113*e*. Upon counter-clockwise rotation of lever 113, the finger 120 remains stationary against stop 121, and the lever 113 turns relative to this finger so as to disengage detent 113*e* from the finger and extend the other spring 124. Thus, when the counter-clockwise turning force is released, the spring 124 returns the lever 113 to its centered position with its detent 113*e* engaging finger 120 and the latter held against pin 121 by spring 122.

When the type drum 24 is in its normal angular position, where it is held by the rotational centering means described above, the type characters at the mid-point of the respective horizontal rows 24*a*, 24*b*, and 24*c* (in the first set *x*) will form a column of three characters which is centered vertically opposite the platen 22. By means which will now be described, the lever 113 can be turned through different angles in either direction under control of the keys 21*a* so as to align with the platen 22 any other column of three characters including a selected character in the set *x*, whereby the previously described vertical positioning of the drum under control of the selected key will cause the selected character to strike the platen upon release of the striker mechanism. Thereafter, the vertical and rotational centering mechanisms automatically return the drum 24 to its neutral position wherein the intermediate row 24*b* and the normally centered vertical column of characters are aligned with the drum.

The force for turning the lever 113 in either direction is applied through a main lever 126 which, by means of a pin 127, is pivoted intermediate its ends on an anti-friction slide 128. This slide forms part of a driving connection from main lever 126 to the type drum 24, and as best shown in Figs. 12 and 13 the slide is mounted between opposed tracks 129 extending fore and aft of the frame 20. The tracks 129 are secured to a plate 130

suitably fastened to the lower surface of the frame platform 20*a* under an opening which receives the tracks.

The lever 126 is actuated with an invariable throw through a link 131 connecting the right hand end of this lever to the lever 51 on the main oscillating shaft 40 (Fig. 3). Thus, upon actuation of a key 21*a* on the keyboard, the resulting oscillation of main shaft 40 and lever 51 causes the right hand end of lever 126 to move first forward and then backward through a certain distance which is uniform regardless of which key is actuated. A vertical guide plate 132 is secured to the frame platform 20*a* and has a rear stop 132*a* against which the right-hand end of lever 126 is normally held by link 131. A tension spring 133 is connected to lever 126 between its pivot 127 and the link 131, and this spring urges the lever 126 rearward against a fixed fulcrum 134 secured to the frame platform 20*a*. The fulcrum 134 engages lever 126 near its pivot 127 but at the side of the latter which is remote from the link 131. The left hand portion of lever 126 is stepped along its rear edge, each step being located slightly forward of the next step toward the fixed fulcrum 134. A series of vertical rods 134*a*—134*f* is located just to the rear of lever 126, each of these rods being positioned opposite one of the steps of the lever. These rods form a series of retractable fulcrum members for the lever 126, the rods being slidable vertically in holes (not shown) in the frame platform 20*a* and in aligned holes in a plate 135 secured to the top of this platform. The fulcrums 134*a*—134*f* are normally retracted (in their lower positions) so that the lever 126 is free to turn about the fixed fulcrum 134 upon actuation of this lever through the link 131. However, upon raising of any one of the retractable fulcrums 134*a*—134*f*, the subsequent actuation of lever 126 through link 131 will cause the lever to swing about the raised fulcrum instead of the fixed fulcrum 134.

Each oscillation of the main shaft 40 will cause the link 131 to swing lever 126 first clockwise and then counterclockwise about one of the fulcrums 134—134*f*, thereby moving the slide 128 forward and then backward through its pivotal connection 127 with the lever 126 (Fig. 11). The extent of this movement of slide 128 will depend upon which one of the fulcrums 134—134*f* is acting upon the lever 126. That is, the slide movement will be smallest when none of the retractable fulcrums 134*a*—134*f* is raised, so that the fixed fulcrum 134 near the pivot 127 serves as the fulcrum point; and it will be greatest when the fulcrum 134*f* (which is farthest from the pivot 127) has been raised so as to act as the fulcrum point. Thus, the seven fulcrums 134—134*f* enable the slide 128 to be moved forward through any one of seven different distances from its normal rearward position upon actuation of lever 126, depending upon which one of these fulcrums is acting upon the lever. The increment in the movement of slide 128 due to the spacing between any two adjacent fulcrums 134—134*f* corresponds to the distance between adjacent type characters in each row, 24*a*, 24*b* and 24*c* on the type drum.

The retractable fulcrums 134*a*—134*f* are adapted to be raised under control of selector means including the keys 21*a*. Since the respective selector means for these retractable fulcrums are similar in construction, only the selector means for the fulcrum 134*a* will be described. Such means, as shown in Fig. 12, comprise a lever 137 pivoted on the stationary transverse shaft 97 and having one arm connected to the lower end of the fulcrum rod 134*a*. A movable stop 130*a* (similar to the stop 98) is pivoted on the transverse support 99, as shown at 138*a*, near the flanged lower end 137*a* of lever 137. The stop 138 is normally positioned opposite the flanged end 137*a* so as to lock the lever 137 against counterclockwise movement about its axis 97. A rod 139 (similar to the rods 100—100*a*) is movable rearward in the frame (to the right in Fig. 12) to turn the stop 138 clockwise on its pivot 138*a* and thereby raise the free end of the stop so as to unlock the lever 137. A tension spring 140 urges the lever 137 counter-clockwise so as to engage a finger 137*b* of this lever against the flange or holding device 103*a* on shaft 103. The fulcrum rod 134*a* is slidable in a supporting bracket 141 depending from the frame platform 20*a* and has a collar 142 normally resting on a part of this bracket to determine the lowermost or retracted position of the fulcrum rod.

The rod 139 is connected to six of the character keys 21*a*, namely, the keys corresponding to the drum characters in the two vertical columns which are second (in both lateral directions) from the normally centered column in the set *x* on the drum 24. The three keys 21*a* corresponding to the drum characters in the normally centered vertical column, and the six keys corresponding to the drum characters in the two columns immediately adjacent this normally centered column, are not associated with any of the retractable fulcrums 134*a*—134*f*. The six keys 21*a* corresponding to the type characters at the extreme ends of the three rows in the first set *x* are connected to a rod 139*f* adapted to actuate a stop (not shown) similar to the stop 138 but controlling the last fulcrum rod 134*f*. It will be understood that the remaining keys 21*a* are connected in groups of 6 to the intermediate rods 139*b*—139*c*, according to the spacing of their corresponding type characters at either side of the normally centered vertical column on the type drum 24; and the rods 139*b*—139*c* are associated with the fulcrum rods 134*b*—134*c*, respectively, in the same manner that the rods 139*a* and 139*b* are associated with their respective fulcrum rods 134*a* and 134*b*.

Upon actuation of rod 139*a* from any one of its six keys 21*a*, the stop 138 is immediately raised to unlock the lower end of lever 137. The shaft 103 then starts the clockwise movement of its oscillation (as previously described in connection with the vertical positioning of the drum), which allows the lever 137 to turn counter-clockwise under the action of its spring 140 (Fig. 12). In this way, the fulcrum rod 134*a* is raised so as to act as the fulcrum point for lever 126 when the latter is actuated through link 131 and arm 51 (Fig. 11) by the forward movement of main shaft 40 in its oscillation. In the meantime, the other fulcrum rods 134*b*—134*f* are held in their inoperative or retracted positions because the lower ends of their levers corresponding to the lever 137 continue to be locked by their respective stops (not shown) corresponding to the stop 138. The return or counter-clockwise movement of shaft 103 restores lever 137 to its normal position so as to retract fulcrum rod 134*a*, whereupon the stop 138 returns by gravity to its locking position (the rod 139*a* having been withdrawn by release of the actuated key 21*a*). Upon actuation of any of the other rods 139*b*—139*f* from one of its keys 21*a*, the corresponding one of the fulcrum rods 134*b*—134*f* will be operated in a manner similar to that previously described in connection with the rod 134*a*, the other fulcrum rods being held in their retracted positions by their respective stops controlled by the rods 139*a*—139*f*.

The movements of slide 128 are transmitted to the lever 113 through a driving connection including a T-shaped plate 144 which is pinned or otherwise secured to the slide, as shown in Figs. 11, 13 and 14. At its two end portions, the plate 144 is provided with sockets which receive the rounded ends of connecting members in the form of levers 145 and 145*a*, respectively, whereby these levers are adapted to be raised and lowered at their free front ends relative to the slide. Intermediate their ends, the levers 145—145*a* are formed with longitudinal slots 146—146*a*, respectively, which receive the upper end portions of vertical rods 147—147*a*, respectively. The latter rods extend upward through openings in the frame platform 20*a* and are provided with enlargements 148 engaging the bottoms of the levers 145—145*a*. By

means of the rods 147—147*a*, the respective levers 145—145*a* can be raised and lowered about their socketed ends in the plate 144, whereby the free ends of these levers are moved into and out of alignment with the corresponding ends 113*b* and 113*a* of the lever 113. The levers 145—145*a* are limited in their upward movement by detents 113*c* and 113*d*, respectively, on the lever 113, so that when either of the levers 145—145*a* is raised against the stop 113*c* or 113*d*, it is in position to engage the end 113*b* or 113*a* of lever 113 upon forward movement of slide 128 and thereby turn the lever 113 about its axis 114.

Since the respective selector means for raising and lowering the rods 147 and 147*a* are similar in construction, only the selector means raising and lowering the rod 147 will be described. Such means comprise a lever 150 (similar to the lever 137) pivotally mounted on the fixed shaft 97 (Fig. 15) and connected to the lower end of rod 147. Adjacent the flanged lower end 150*a* of this lever is a movable stop 151 pivotally mounted on the transverse support 99, as shown at 151*a*. A rod 152 is movable rearward of the frame (to the right in Fig. 15) to raise the free end of stop 151 and thereby unlock the lower end of lever 150. By means of a tension spring 153, the lever 150 is normally urged counter-clockwise on its pivot 97 so as to engage a finger 150*b* on this lever with the flange 103*a* on shaft 103. A collar 154 on the rod 147 normally rests on the flanged bottom of bracket 141, which supports the rod 147 for vertical movement.

The rod 152 is connected in the conventional manner to a certain group of keys 21*a*, namely, the keys representing the characters to the left of the normally centered vertical column of characters on the drum 24 (as viewed from the platen 22 in Fig. 1). A similar rod 152*a* controls the stop (not shown but corresponding to the stop 151) associated with the other vertical rod 147*a*; and this rod 152*a* is connected in the conventional manner to the keys 21*a* representing the characters located to the right (as viewed from the platen 22 in Fig. 1) of the normally centered vertical column of characters on the drum 24. The keys 21*a* corresponding to the three characters in the normally centered vertical column on drum 24 are not connected to either of the rods 152—152*a*.

Assume that the rod 152 is actuated from one of its keys. The resulting rearward movement of this rod raises the stop 151 so as to unlock the lower end of lever 150. The subsequent clockwise movement of shaft 103 will then allow spring 153 to turn lever 150 counter-clockwise so as to raise the rod 147, which causes the free end of lever 145 to be raised against the detent 113*c*. In the meantime, the other rod 147*a* will be retained in its lower position due to the fact that the stop (not shown) controlled by rod 152*a* will remain in position to lock the lower end of the lever (not shown but corresponding to lever 150) connected to vertical rod 147*a*. Consequently, the subsequent forward movement of slide 128 by lever 126 will cause the lever 145 to engage the lever end 113*b* and turn lever 113 clockwise about its pivot 114 (Fig. 11), whereby the type drum 24 and its shaft 25 are turned counter-clockwise, the extent of this rotational movement depending upon which of the fulcrums 134—134*f* is acting upon lever 126. Upon the return or counter-clockwise movement of shaft 103 (Fig. 15), the lever 150 is returned clockwise to its initial position, thereby lowering rod 147 and allowing the lever 145 to drop to its normal inoperative position. The return of lever 150 to its normal position allows the stop 151 to drop back to its normal locking position, due to release of the key 21*a* which actuated the rod 152.

Upon actuation of the other rod 152*a* from one of its keys 21*a*, the action will be similar to that previously described except that the other vertical rod 147*a* will be raised to lift the free end of lever 145*a*, while the rod 147 and its lever 145 will be held in their lower positions by the stop 151 which locks the lower end of lever 150. Consequently, the subsequent forward movement of slide 128 by lever 126 will cause lever 145*a* to rotate lever 113 counter-clockwise and thereby turn the type drum and its shaft 25 clockwise (Fig. 11), the extent of this rotational movement again being dependent upon which one of fulcrums 134—134*f* is acting upon lever 126.

The rods 147—147*a* and connecting members 145—145*a* form means for selectively connecting the main lever 126 to the driving lever 113 at different points spaced from its pivot 114, so that the movement of the printing member 24 is controlled by the selector means 138—140 and 150—153 through this connecting means as well as the fulcrums 134—134*f*. The parts 103—107 form a connection between the actuator 38*a* and the selector means 138—140 and 150—153 for operating these selector means prior to actuation of main lever 126, since the shaft 40 which moves this lever through the parts 51 and 131 has a short dwell period at the start of the rotation of actuator 38*a*, as previously described.

It will be apparent from the foregoing that when the type drum 24 contacts platen 22 through actuation of the striker mechanism, the drum will be in one of fifteen different rotational positions depending upon which of the character keys 21*a* started the operating cycle. That is, the fulcrums 134—134*f* in conjunction with lever 145 provide seven rotational positions in one direction (counter-clockwise) from the normally centered vertical column on the drum, and these seven fulcrums in conjunction with the other lever 145*a* provide seven rotational positions in the other direction from the normally centered column, the fifteenth position being the normally centered one in which the type drum remains when neither of the levers 145—145*a* is raised during the operating cycle. Since the vertical positioning mechanism is adapted to align any one of the three horizontal rows 24*a*, 24*b* and 24*c* with the platen 22, under control of the character keys 21*a*, this means that any one of forty-five different characters in the set *x* on the drum can be positioned for the typing operation through actuation of a corresponding key 21*a*.

The key 21*a* representing the central character in the middle row 24*b* of the set *x* is not, of course, connected to any of the rods 100—100*a* (Fig. 8), 139*a*—139*f* (Fig. 12) and 152—152*a* (Fig. 15); and the keys representing the central characters in the top and bottom rows 24*a* and 24*c* are connected only to the rods 100*a* and 100, respectively, of these ten rods. The remaining keys are each connected to one or more of these ten rods, in a pattern which will be apparent from the foregoing.

As previously mentioned, each of the character keys 21*a* is connected in any conventional manner to the main actuating rod 45, as by means of a transverse shaft 49*a* carrying the lever 49 (Fig. 3) and having a flange 49*b* engaged by collars 155 on rods connected to the various keys (Figs. 1, 8, 12 and 15).

Shift key means

A lever 156 is pivoted at its rear end on the stub shaft 51*a* of lever 51 (Fig. 3). At its front end, the lever 156 is forked to form tines 156*a* and 156*b*, one above the other. Between these tines is a transverse shaft 157 suitably mounted in the frame 20 and carrying an arm 158. This arm projects upwardly through an opening in the frame platform 20*a* and is connected at its upper end to the front end of a rod 159 overlying the platform. At its rear end, the rod 159 is connected to a toggle lever 160 mounted on a vertical pivot 161 secured to the frame platform 20*a* (Fig. 11). A tension spring 162 is secured at one end to frame 20 and at the other end to a link 163 connected to a pivot pin 160*a* on toggle lever 160. A pin 160*b* on the toggle lever extends downward into a slot 117*b* in the free end portion of pulley lever 117. A plate 164 is secured to the frame platform below the toggle lever 160 and forms a stop 164*a* against which the free end of the pulley arm 117 is engaged in one position of the toggle. In this position of the toggle

(Fig. 11), the type drum 24 is shifted 180° from its normal position shown in Fig. 1.

As the upper end of arm 158 is moved forward from its position shown in Fig. 11, the toggle lever 160 is moved counter-clockwise about its pivot 161 against the tension in spring 162, by means of the connecting rod 159. When the link 163 passes over the pivot 161, spring 162 acts to snap the toggle lever 160 counter-clockwise. Since the ends of wire 115 are held by arm 112, the pulley arms 116 and 117 will thus be turned clockwise from their positions shown in Fig. 11, thereby turning the drum shaft 25 clockwise through 180° so that the type drum is restored to its normal position in which it is held by the parts as shown in Fig. 3. In this normal position of drum 24 (Fig. 1), the typing operations previously described are performed with the characters of the first set *x*, which is opposite the platen 22. For typing with the characters of the second set *y*, the drum 24 is rotated 180° relative to the vertical and rotational positioning mechanisms by movement of arm 158 from its normal position against the front end of its slot in platform 20*a* (Fig. 3) to its opposite position in which the parts are as shown in Fig. 11. The movements of arm 158 are controlled by drum shifting means which will now be described.

A lever 166 depends from a pivot 158*a* on the arm 158 (Fig. 3). Another lever 167 is pivotally mounted at 97 and is provided at its rear end with a roller 167*a* engaging a cam surface 166*a* at the free lower end portion of lever 166. Above the roller 167*a*, the lever 167 has a forked guide 167*b* which straddles the lever 166 so as to hold the roller and the cam surface 166*a* in alignment. A rod 168 connects the free end portion of lever 156 with the lever 167 adjacent its roller. The lever 167 is biased counter-clockwise by a tension spring 169 so as to urge the tine 156*a* against the overlying shaft 157 and hold the roller 167*a* at the low portion of cam surface 166*a*. A rod 170 is connected at one end to the lower end of lever 157 and at the other end to a shift key (not shown) on the keyboard 21, so that rod 170 is shifted forward (Fig. 3) by operation of this key and thereby turns lever 157 against the tension in spring 169. This clockwise turning of lever 157 lowers the free end of lever 156, whereby its shoulder 156*c* is moved into alignment with a detent 158*c* at the bottom of arm 158, and its shoulder 156*d* is moved out of alignment with a detent 158*d* on the upper portion of arm 158. Upon return movement of rod 170, the resulting counter-clockwise movement of lever 167 by its spring 169 will restore lever 156 to its Fig. 3 position, wherein the shoulder 156*c* is out of alignment with detent 158*c*, and shoulder 156*d* is in alignment with detent 158*d*.

An arm 172 is secured at its lower end on the transverse shaft 59, which is urged counter-clockwise by spring 57 through latch 56 and dog 58 (Fig. 4). The upper end of arm 172 is engaged by the lower part of lever 166 opposite the roller 167*a*. A finger 172*a* extends rearward from the upper end of arm 172 and is engageable with a detent 42*a* on the dog 42 so as to trip the dog and release the cam roller 37 for an operating cycle.

Assume that the parts are in the positions shown in Fig. 3, wherein the type drum 24 is in its normal position shown in Fig. 1. To operate the drum shifting means, the rod 170 is shifted forward by its key, whereupon the resulting movement of levers 167 and 156 lowers the shoulder 156*c* into alignment with detent 158*c*, as previously described. At the same time, the roller 167*a* is moved downward along the lower raised part of cam 166*a* so that lever 166 moves arm 172 clockwise on its shaft 59. This causes the finger 172*a* to engage detent 42*a* and trip the dog 42, so as to start an operating cycle of the main actuating mechanism independently of the main rod 45 and the character keys 21*a* connected thereto. The resulting counter-clockwise movement of actuating lever 51 will move lever 156 forward and turn arm 158 clockwise due to engagement of shoulder 156*c* with detent 158*c*. Consequently, the toggle lever 160 and the pulley levers 117—116 will be shifted to the position shown in Fig. 11, thereby turning the drum shaft 25 counter-clockwise through 180° for typing with the second character set *y* under control of the character keys 21*a*. The clockwise turning of arm 158 also lowers lever 166 so that roller 167*a* rides back to the low part of cam 166*a*, permitting finger 172*a* to return to its Fig. 3 position. Thus, the cam roller 37 will be held again by dog 42 at the end of the actuating cycle, and control of the dog 42 will be restored to the character keys 21*a* through main actuating rod 45.

As long as the rod 170 is held in its actuated (forward) position, the reciprocating movement of lever 156 by lever 51 will have no effect upon arm 158, since shoulder 156*d* will lie below detent 158*d*. Consequently, the toggle lever 160 will continue to hold the type drum 24 in position for typing with the character set *y*. The rod 170 may be locked in its forward position by means of a locking key (not shown) on the keyboard, to facilitate repeated typing with the second character set *y*.

Upon release of the shift key rod 170, the spring 169 turns lever 167 counter-clockwise so as to raise the free end portion of lever 156 and move roller 167*a* along the upper raised portion of cam 166*a*. This swings the lower end of lever 166 so as to re-engage finger 172*a* with detent 42*a*, thereby releasing dog 42 for another cycle of the actuating mechanism. The resulting forward movement of lever 156 returns arm 158 counter-clockwise to its normal position shown in Fig. 3, since shoulder 156*d* has now been raised into alignment with detent 158*d*. This actuates toggle lever 160 so as to swing the pulley arms 117—116 clockwise (Fig. 11) and return the type drum 24 to its normal position for typing with the first character set *x*. The counter-clockwise turning of arm 158 raises lever 156, thereby restoring roller 167*a* to the low part of cam 166*a* and allowing finger 172*a* to retract from dog 42. The actuating mechanism is now under control of main rod 45, for typing with characters of the first set *x* as selected by the keys 21*a*.

Each time the arm 172 is swung rearward to trip the dog 42, by forward actuation or rearward return of rod 170, the shaft 59 and dog 58 are turned clockwise against spring 57 (Fig. 4) so as to disengage the latch 56 from lever 52. Thus, the latch 56 forms a means responsive to operation of the drum shifting means for rendering the striker mechanism inoperable by the actuator during the 180° shifting of the type drum 24 in either direction. However, this immobilizing of the striker mechanism is only temporary, because as the arm 158 completes its toggled movement in either direction, its lever 166 allows arm 172 to return to its forward position under the action of spring 57, so that lever 52 is re-engaged by latch 56.

I claim:

1. A machine of the class described comprising a type drum having peripheral rows of printing characters forming two sets of type, means mounting said drum for axial and rotary movement, mechanisms for selectively rotating the drum and moving it axially to select a character to be printed in one of said sets, means for shifting the drum to place the other set under printing control of said mechanisms, whereby said mechanisms are operable to select a character to be printed in said other set, a striker for moving the drum to print a character selected by said mechanisms, a main actuator connected to said mechanisms and striker for operating the same, and means responsive to operation of said drum shifting means for rendering the striker inoperable by said actuator.

2. A machine of the character described comprising a type drum having printing characters forming two sets of type on the drum periphery, each set occupying a different segment of said periphery, means mounting the drum for

rotary movement, mechanism for selectively rotating the drum to select a character to be printed in one of said sets, said mechanism including a movable member having a normal position and movable different extents therefrom depending upon the character to be selected, and a driving connection between said member and the drum, and drum shifting means for rotating the drum independently of said member while maintaining said connection, whereby said mechanism is operable to select a character to be printed in the other of said sets, said connection comprising a pulley coaxial with the drum and rotatable therewith, a pair of pulleys spaced from the drum pulley, and a tension member forming a loop connected to said movable member and extending at least partly around said pulleys, said drum shifting means being operable to move one pulley of said pair away from the drum pulley while moving the other pulley of said pair toward the drum pulley.

3. In a machine of the character described including a printing member having a plurality of type characters, and means mounting the printing member for movement to select a character to be printed, the combination of a main lever, a main actuator connected to the lever for actuating it with an invariable throw, a plurality of fulcrums spaced different distances from the point at which the actuator is connected to the lever, selector means for rendering any one of said fulcrums operable as the fulcrum point for the lever, and a driving connection to the printing member from the lever at a point thereof which is spaced from the fulcrums and said first point, whereby the printing member is movable by the actuator through different extents depending upon the fulcrum selected for operation by said selector means, the fulcrums including a plurality of movable members biased toward operative positions in which they act as fulcrum points of the lever, the selector means including a releasable stop for each of said fulcrum members and normally locking the corresponding fulcrum member in an inoperative position, a holding device normally retaining the fulcrum members in their inoperative positions independently of said stops, and a connection between said actuator and holding device for rendering the holding device inoperative prior to actuation of said main lever, whereby the fulcrum member corresponding to a released stop is positioned to act as the fulcrum point of said main lever.

4. The combination according to claim 3, in which the selector means also include a plurality of levers each of which is connected to a corresponding fulcrum member and is normally held by the corresponding stop and said holding device to lock the corresponding fulcrum member in its inoperative position.

5. In a machine of the character described including a printing member having a plurality of type characters, and means mounting the printing member for movement to select a character to be printed, the combination of a main lever, a main actuator connected to the lever for actuating it with an invariable throw, a plurality of fulcrums spaced different distances from the point at which the actuator is connected to the lever, selector means for rendering any one of said fulcrums operable as the fulcrum point for the lever, and a driving connection to the printing member from the lever at a point thereof which is spaced from the fulcrums and said first point, whereby the printing member is movable by the actuator through different extents depending upon the fulcrum selected for operation by said selector means, said driving connection including a driving lever connected to the printing member and having a pivot point, and means for selectively connecting the main lever to said driving lever at different points spaced from said pivot point, whereby the movement of the printing member by the main lever is variable under control of said selective connecting means as well as said fulcrums.

6. In a machine of the character described including a printing member having a plurality of type characters, and means mounting the printing member for movement to select a character to be printed, the combination of a main lever, a main actuator connected to the lever for actuating it with an invariable throw, a plurality of fulcrums spaced different distances from the point at which the actuator is connected to the lever, selector means for rendering any one of said fulcrums operable as the fulcrum point for the lever, and a driving connection to the printing member from the lever at a point thereof which is spaced from the fulcrums and said first point, whereby the printing member is movable by the actuator through different extents depending upon the fulcrum selected for operation by said selector means, said driving connection including a driving lever connected to the printing member and having a pivot point, said selector means including means for selectively connecting the main lever to said driving lever at different points spaced from said pivot point, whereby the movement of the printing member is controlled by the selector means through said selective connecting means as well as said fulcrums.

7. In a machine of the character described including a printing member having a plurality of type characters, and means mounting the printing member for movement to select a character to be printed, the combination of a main lever, a main actuator connected to the lever for actuating it with an invariable throw, a plurality of fulcrums spaced different distances from the point at which the actuator is connected to the lever, selector means for rendering any one of said fulcrums operable as the fulcrum point for the lever, and a driving connection to the printing member from the lever at a point thereof which is spaced from the fulcrums and said first point, whereby the printing member is movable by the actuator through different extents depending upon the fulcrum selected for operation by said selector means, said driving connection including a driving lever connected to the printing member and having a pivot point, and means for selectively connecting the main lever to said driving lever at either side of said pivot point, whereby the printing member is movable by the main lever in either of two opposite directions under control of said selective connecting means.

8. In a machine of the character described including a printing member having a plurality of type characters, and means mounting the printing member for movement to select a character to be printed, the combination of a main lever, a main actuator connected to the lever for actuating it with an invariable throw, a plurality of fulcrums spaced different distances from the point at which the actuator is connected to the lever, selector means for rendering any one of said fulcrums operable as the fulcrum point for the lever, and a driving connection to the printing member from the lever at a point thereof which is spaced from the fulcrums and said first point, whereby the printing member is movable by the actuator through different extents depending upon the fulcrum selected for operation by said selector means, said driving connection including a driving lever connected to the printing member and having a pivot point, said selector means including means for selectively connecting the main lever to said driving lever at either side of said pivot point, whereby the movement of the printing member is controlled by the selector means through said fulcrums as to extent of movement and through said selective connecting means as to direction of movement.

9. In a machine of the character described including a printing member having a plurality of type characters, and means mounting the printing member for movement to select a character to be printed, the combination of a main lever, a main actuator connected to the lever for actuating it with an invariable throw, a plurality of fulcrums spaced different distances from the point at which the actuator is connected to the lever, selector means for rendering any one of said fulcrums operable as the fulcrum point for the lever, and a driving connection to the printing member from the lever at a point thereof which is spaced from the fulcrums and said first point,

whereby the printing member is movable by the actuator through different extents depending upon the fulcrum selected for operation by said selector means, said driving connection including a driving lever connected to the printing member and having a pivot point, biasing means normally holding the driving lever in a centered position, and a pair of connecting members operable to make connections from the main lever to said driving lever at opposite sides of its pivot point, respectively, the selector means including means for rendering either of said connecting members operative while maintaining the other inoperative, whereby the movement of the printing member is controlled by the selector means through said fulcrums as to the extent of movement and through said connecting members as to direction of movement.

10. In a machine of the character described including a printing member having a plurality of type characters, and means mounting the printing member for movements in opposite directions through variable extents to select a character to be printed, the combination of a main lever, a main actuator connected to the lever for moving the same, a driving connection to the printing member from the lever and including a driving lever having a pivot point and a pair of connecting members operable to make connections from the main lever to said driving lever at opposite sides of its pivot point, respectively, and selector means coacting with the main lever for varying the extent of movement thereof by the actuator and thereby controlling the extent of movement of the printing member, the selector means including means for rendering either of said connecting members operative while maintaining the other inoperative and thereby controlling the direction of movement of the printing member.

11. The combination according to claim 10, comprising also a connection between the actuator and the selector means for operating said last means prior to movement of the main lever by the actuator.

12. In a machine of the character described including a printing member having a plurality of type characters, and means mounting the printing member for movement to any one of three printing positions to select a character to be printed, the combination of a crank shaft connected to said member for moving the same, biasing means connected to the crank shaft and opposing rotation of the shaft in either direction from a centered position corresponding to one of said printing positions, a pair of crank arms connected to the shaft and operable to rotate the same clockwise and counterclockwise, respectively, from its centered position and thereby move the printing member to its second and third printing positions, respectively, against the action of said biasing means, a crank actuating member for operating the crank arms, and selector means for establishing a driving connection from said actuating member to the crank shaft through either of said arms while maintaining the other arm inoperative.

13. The combination according to claim 12, in which each crank arm is movable into and out of an operating position wherein it is adapted to be operated by the actuating member, the selector means being connected to the arms for moving them selectively to their operating positions.

14. The combination according to claim 12, comprising also actuating mechanism for operating the crank actuating member, and a connection between the actuating mechanism and the selector means for operating said last means prior to operation of said actuating member.

15. The combination according to claim 12, in which each crank arm is movable into and out of an operating position wherein it is adapted to be operated by the actuating member, the selector means including means biasing the crank arms toward their operating positions, a releasable stop for each of said crank arms and normally locking the corresponding arm in an inoperative position, a holding device normally retaining the crank arms in their inoperative positions independently of said stops, actuating mechanism for operating the crank actuating member, and a connection between said actuating mechanism and holding device for rendering said device inoperative prior to operation of said actuating member, whereby the crank arm corresponding to a released stop is moved to its operating position by said biasing means.

16. A machine of the class described comprising a printing member having printing characters forming two sets of type, means movably mounting said member, selector mechanism connected to the printing member and including selector elements each corresponding to a character in each of said sets, the selector mechanism being operable under control of said elements to move said member varying extents from a normal position and return the member to said position, thereby selecting characters to be printed in one of said sets, means including a control element for shifting the printing member between two normal positions independently of the selector mechanism while maintaining said mechanism connected to the printing member, whereby either of said sets can be placed under printing control of the selector elements, a striker for impelling the printing member to print a selected character, a main actuator connected to the selector mechanism, the shifting means and the striker for operating the same under control of said elements, and means responsive to operation of said shifting control element for rendering the striker inoperable by said actuator.

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