

Dec. 3, 1929.

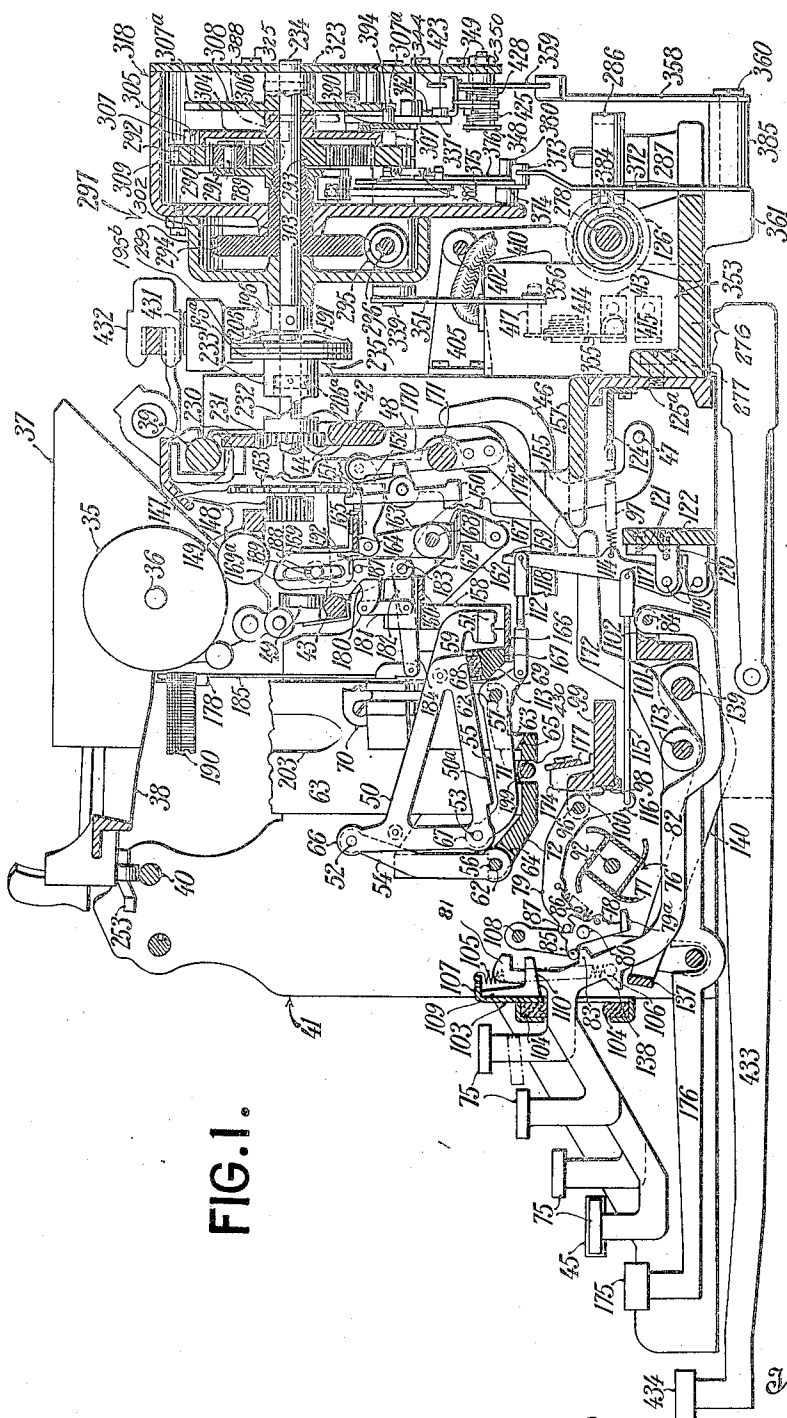
B. C. STICKNEY

1,737,982

TYPEWRITING MACHINE

Filed Dec. 8, 1926

11 Sheets-Sheet 1



Inventor:

Burnham & Stickney

Dec. 3, 1929.

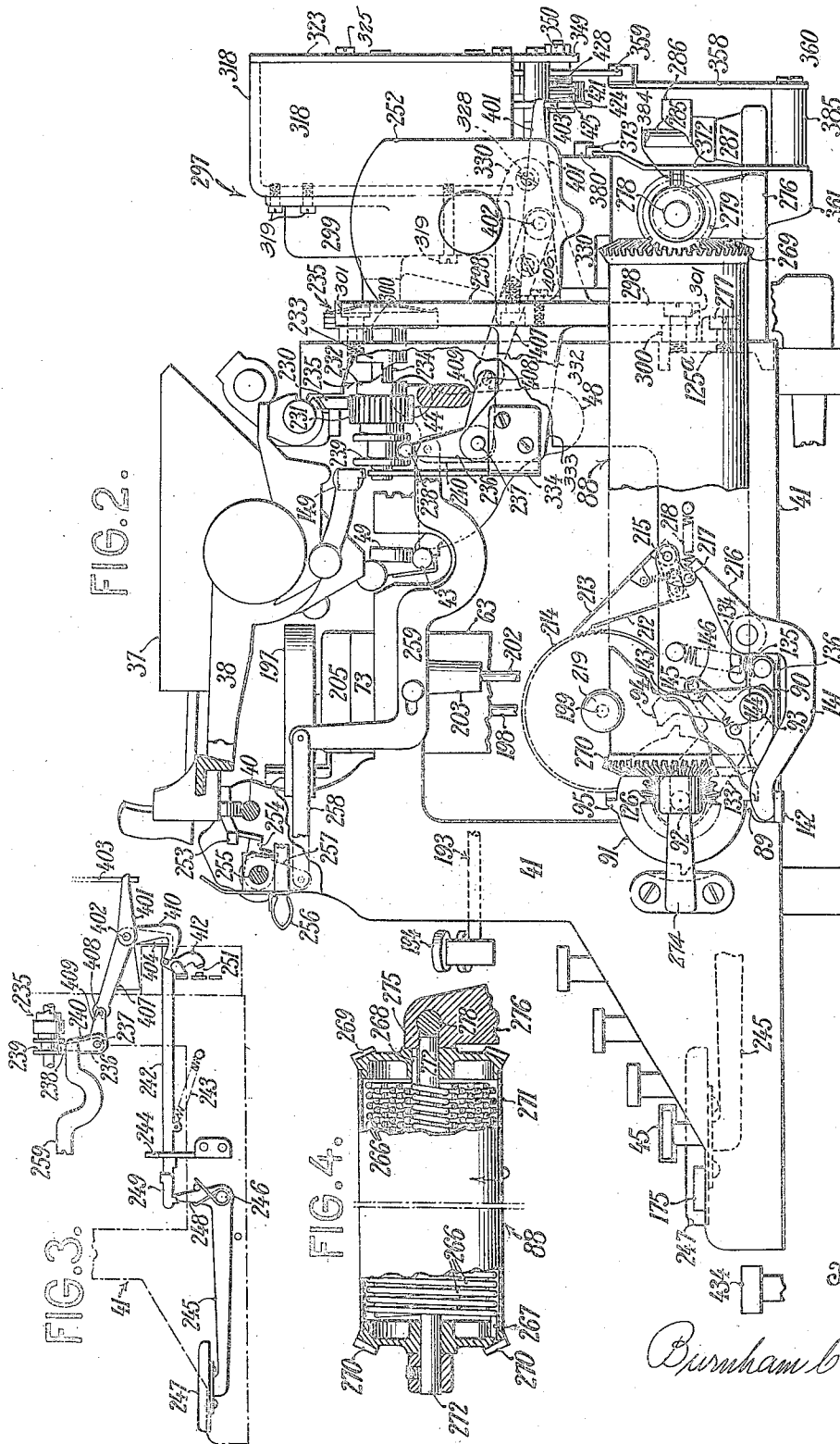
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TYPEWRITING MACHINE

Filed Dec. 8, 1926

11 Sheets-Sheet 2



Inventor:

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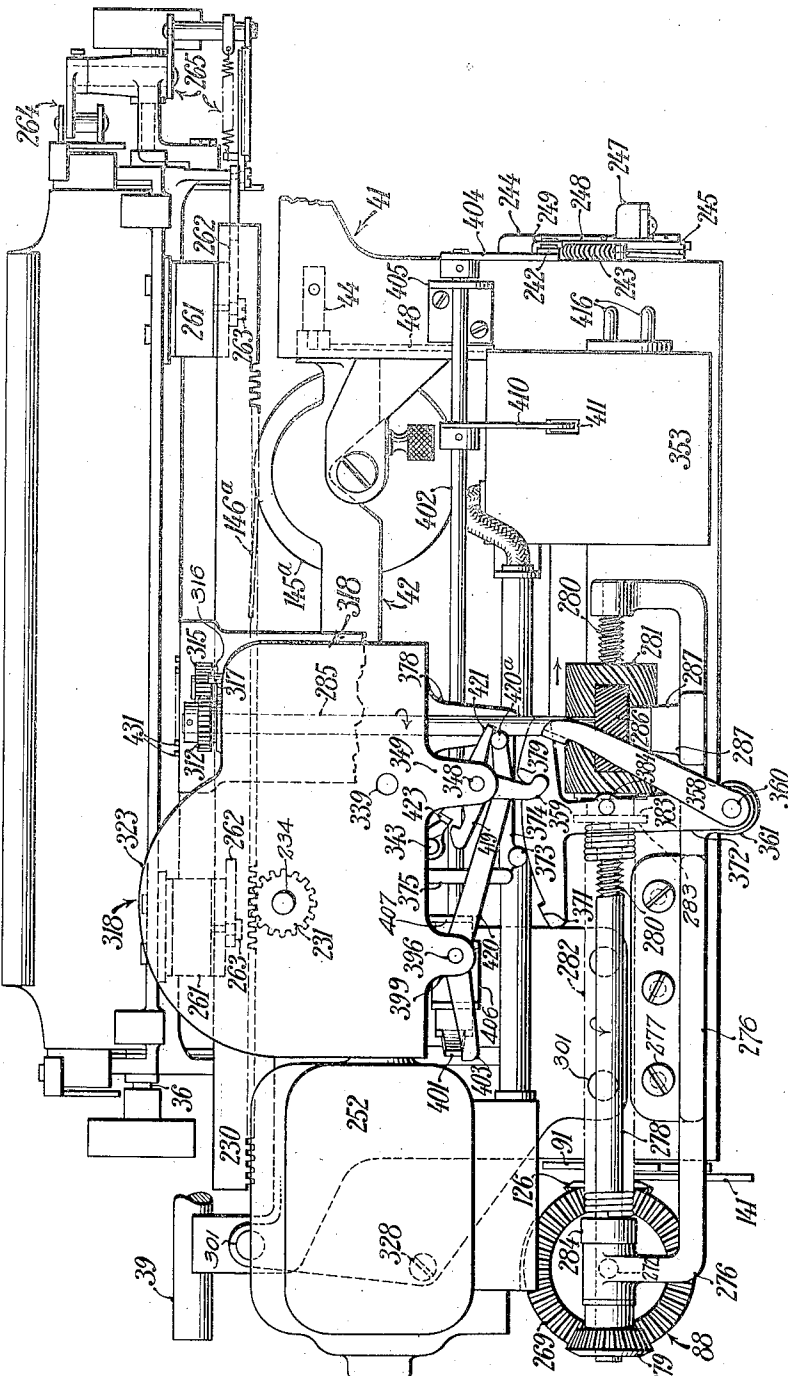
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TYPEWRITING MACHINE

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11 Sheets-Sheet 3

FIG. 5.



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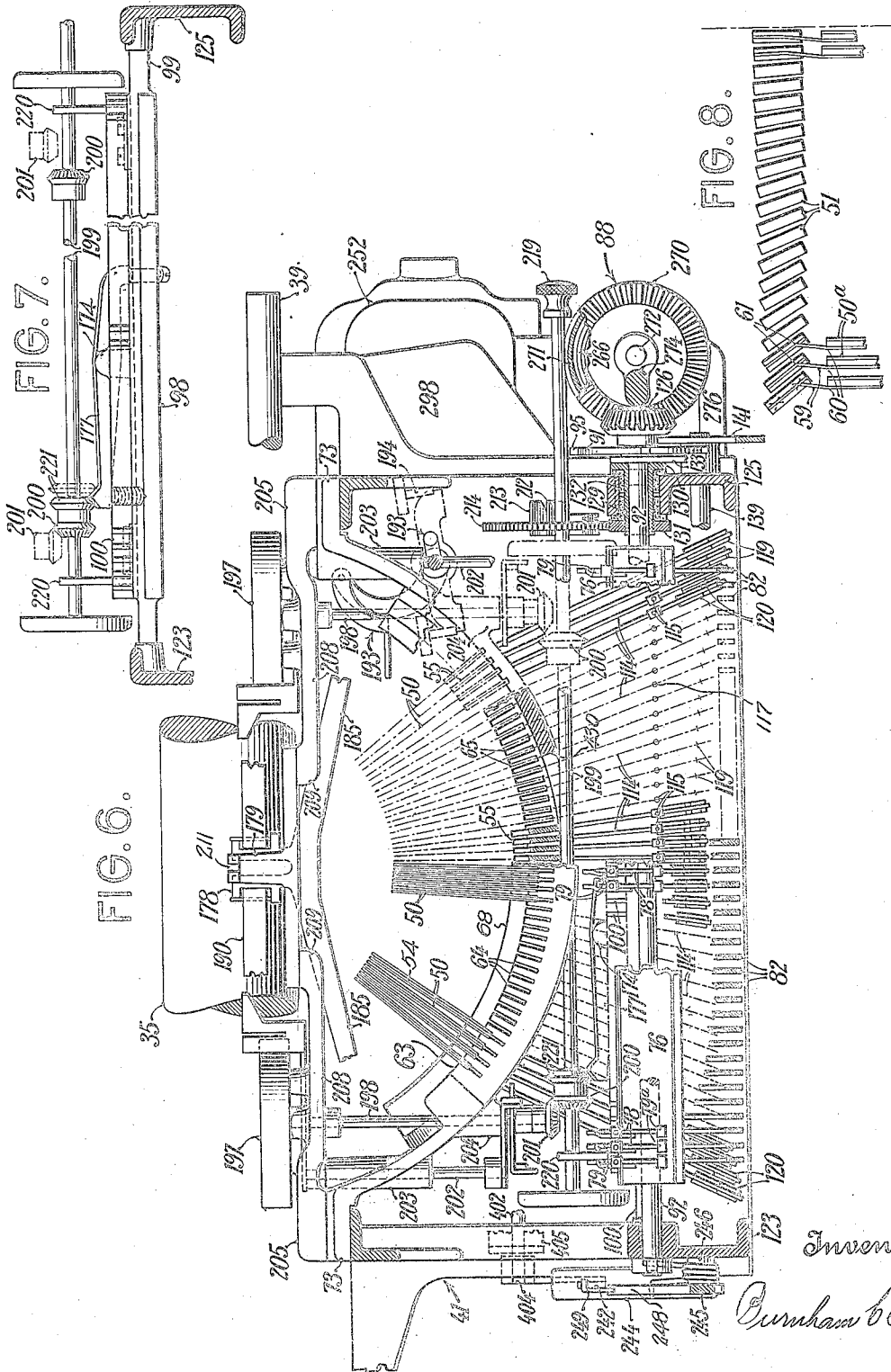
B. C. STICKNEY

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TYPEWRITING MACHINE

Filed Dec. 8, 1926

11 Sheets-Sheet 4



Dec. 3, 1929.

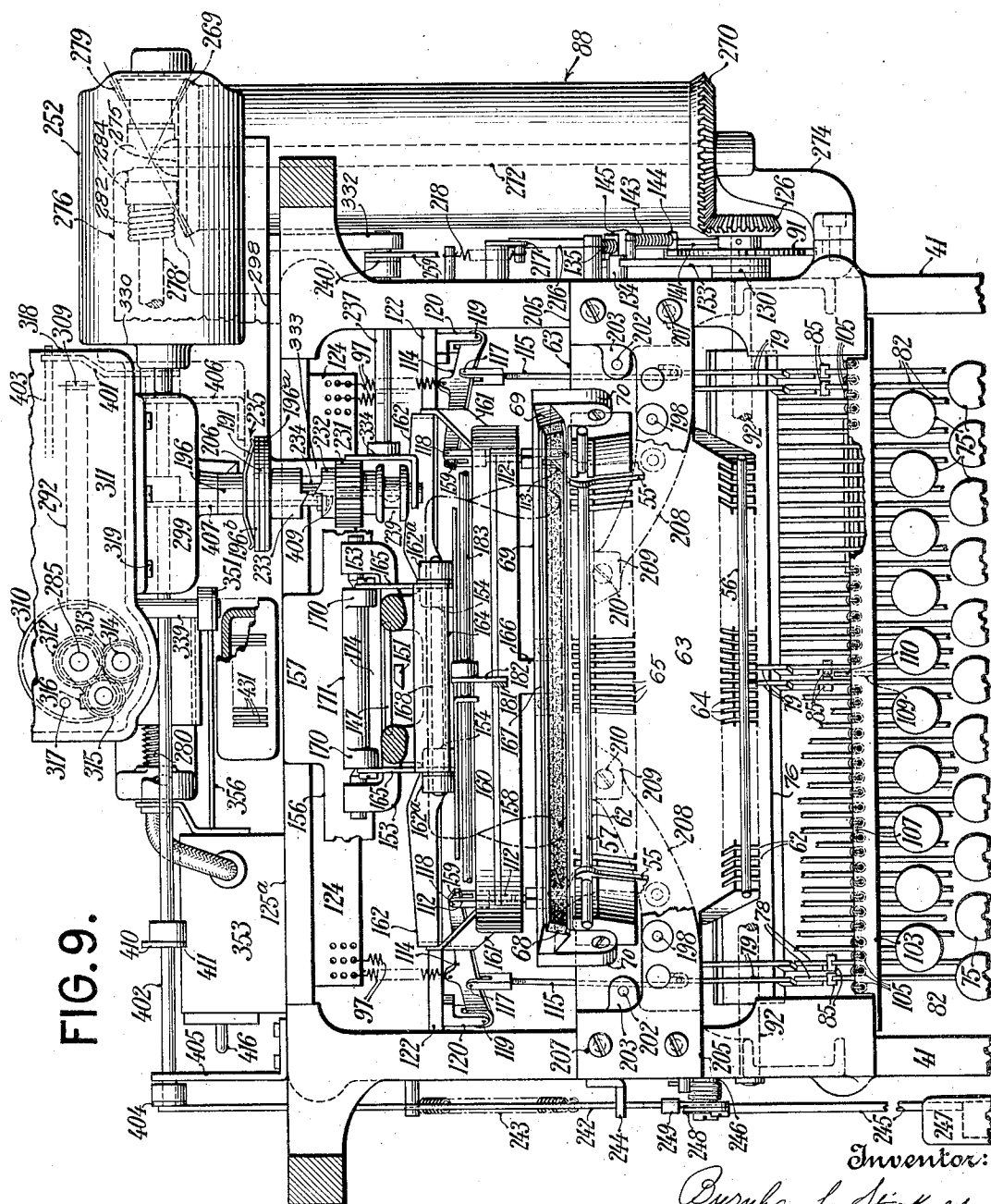
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TYPEWRITING MACHINE

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11 Sheets-Sheet 5



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TYPEWRITING MACHINE

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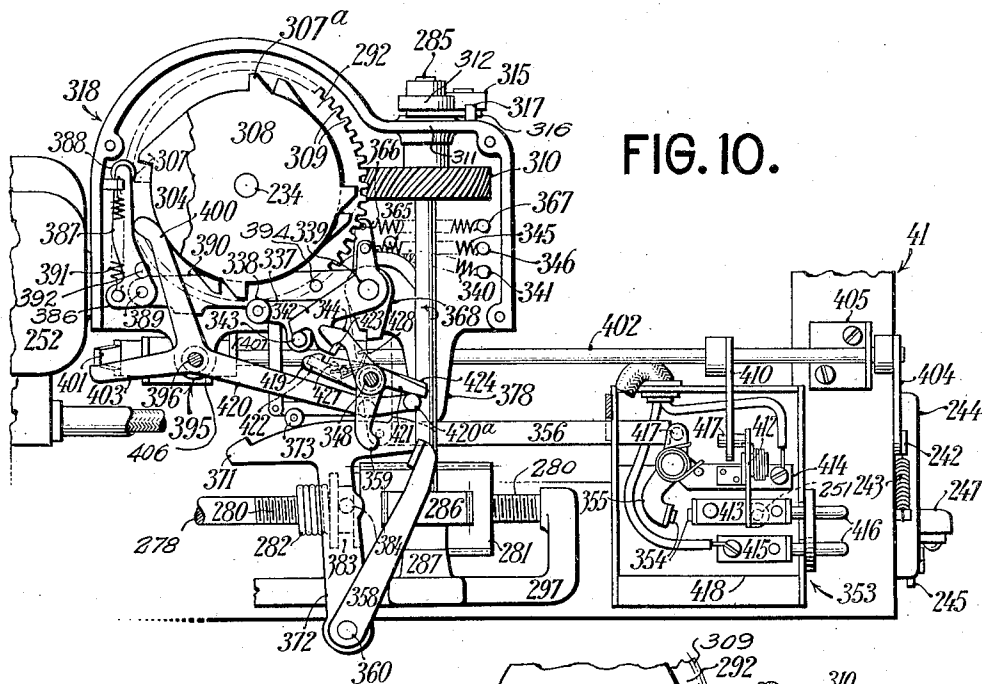


FIG. 10.

FIG. 11.

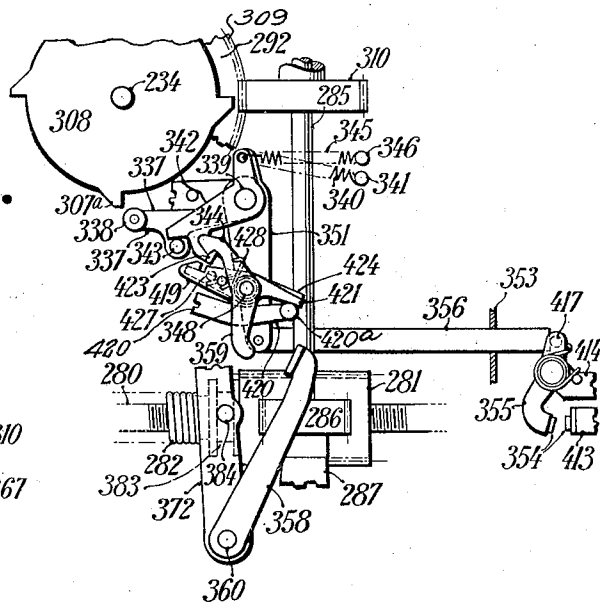
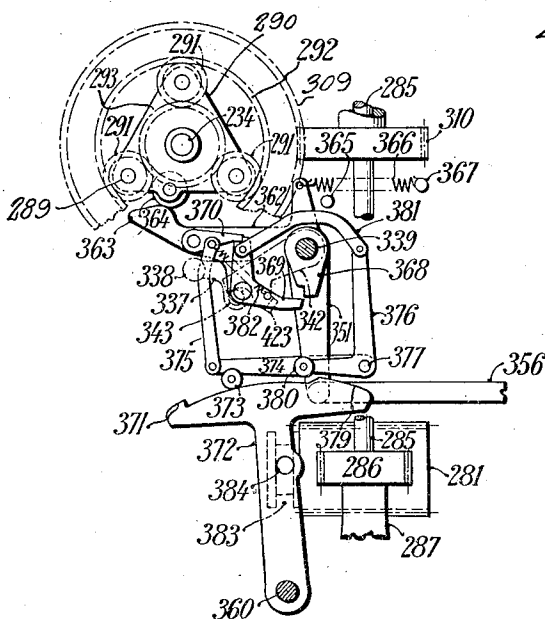


FIG. 12.



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FIG.13.

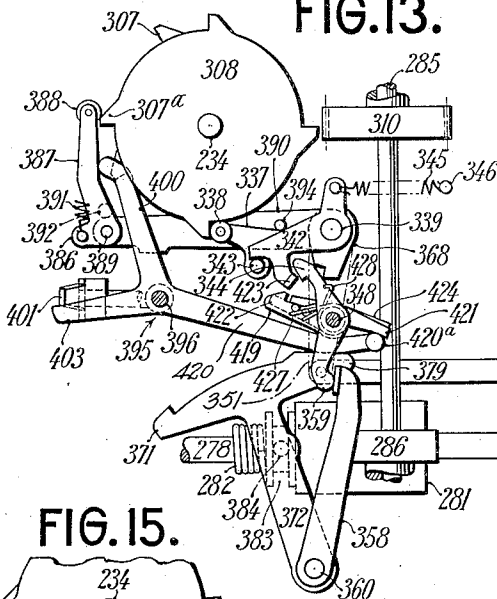


FIG.14.

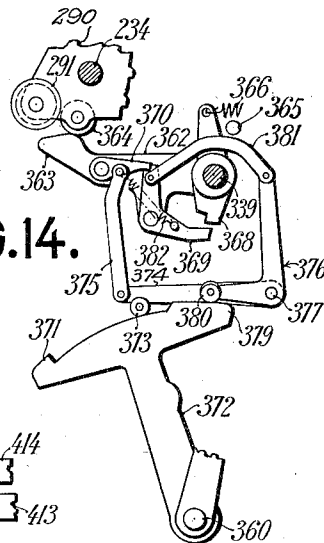


FIG. 15.

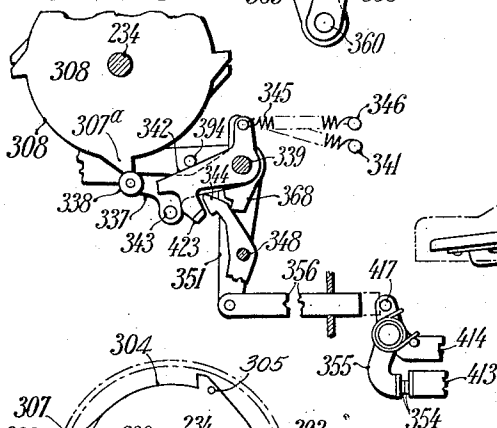


FIG. 16.

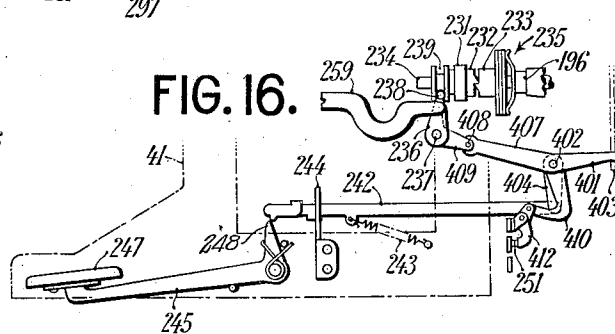


FIG.17.

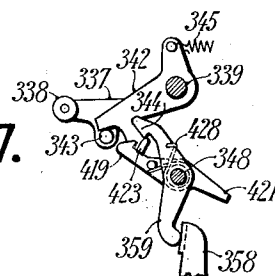
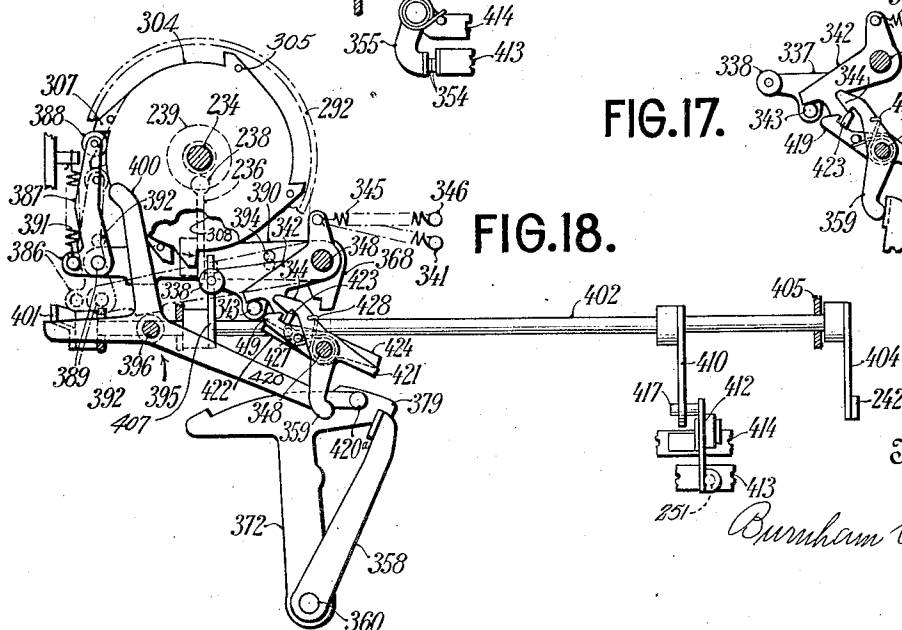


FIG.18.



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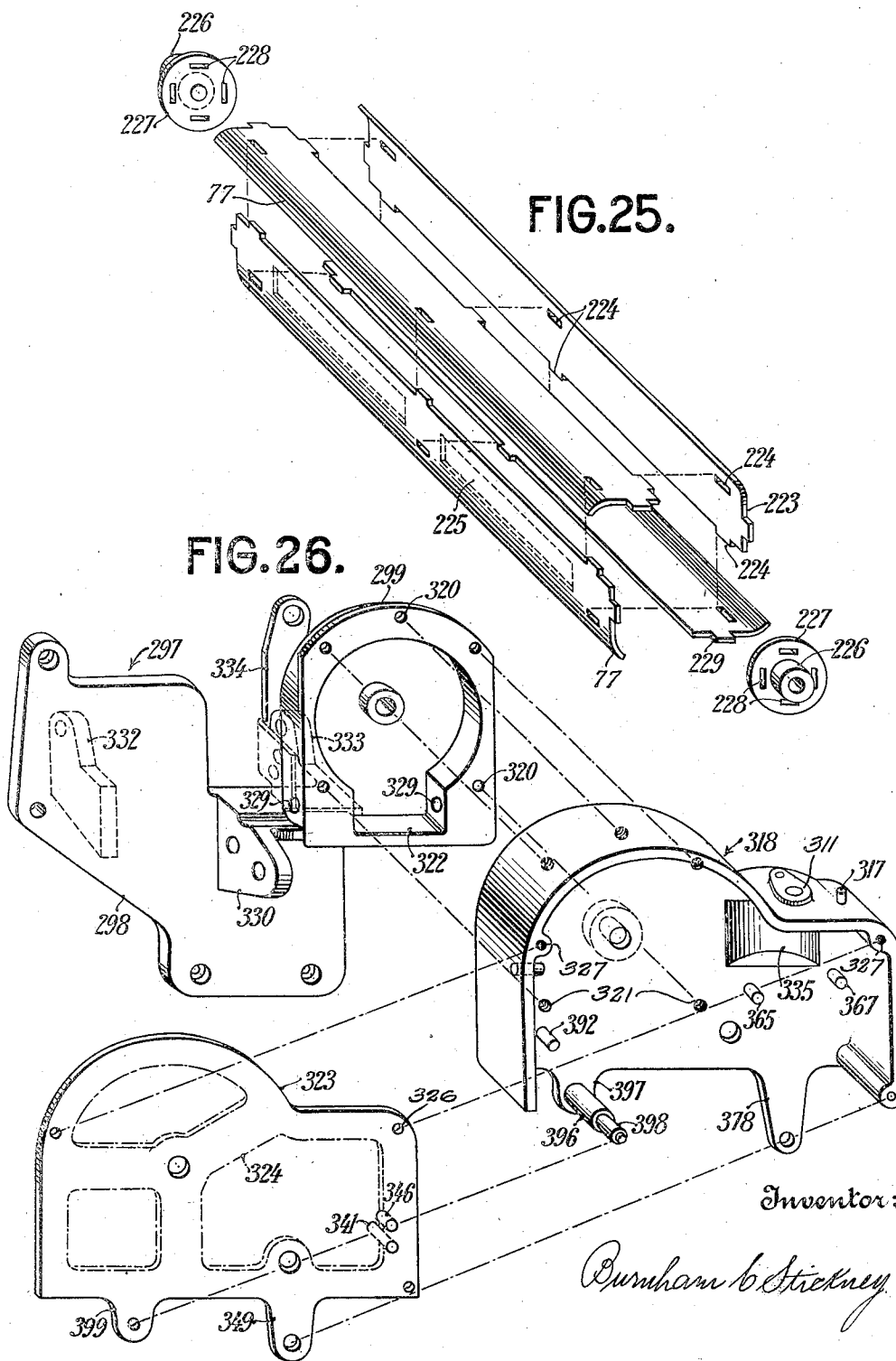
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FIG.27.

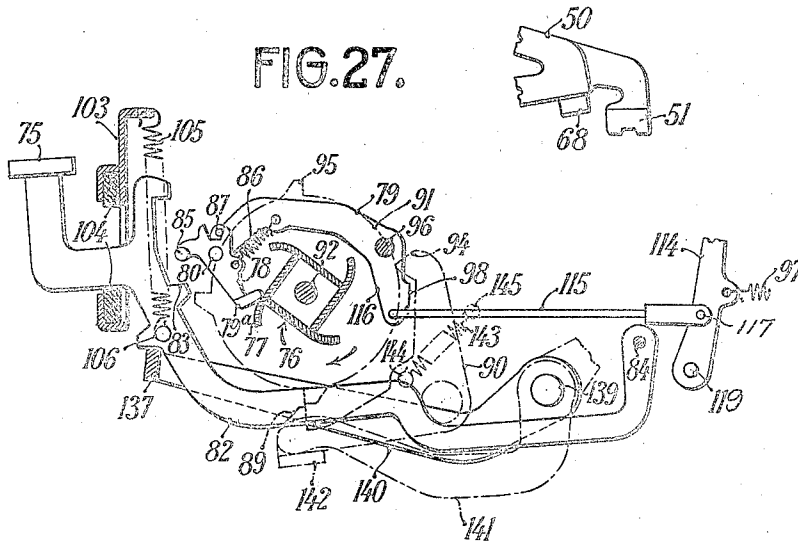
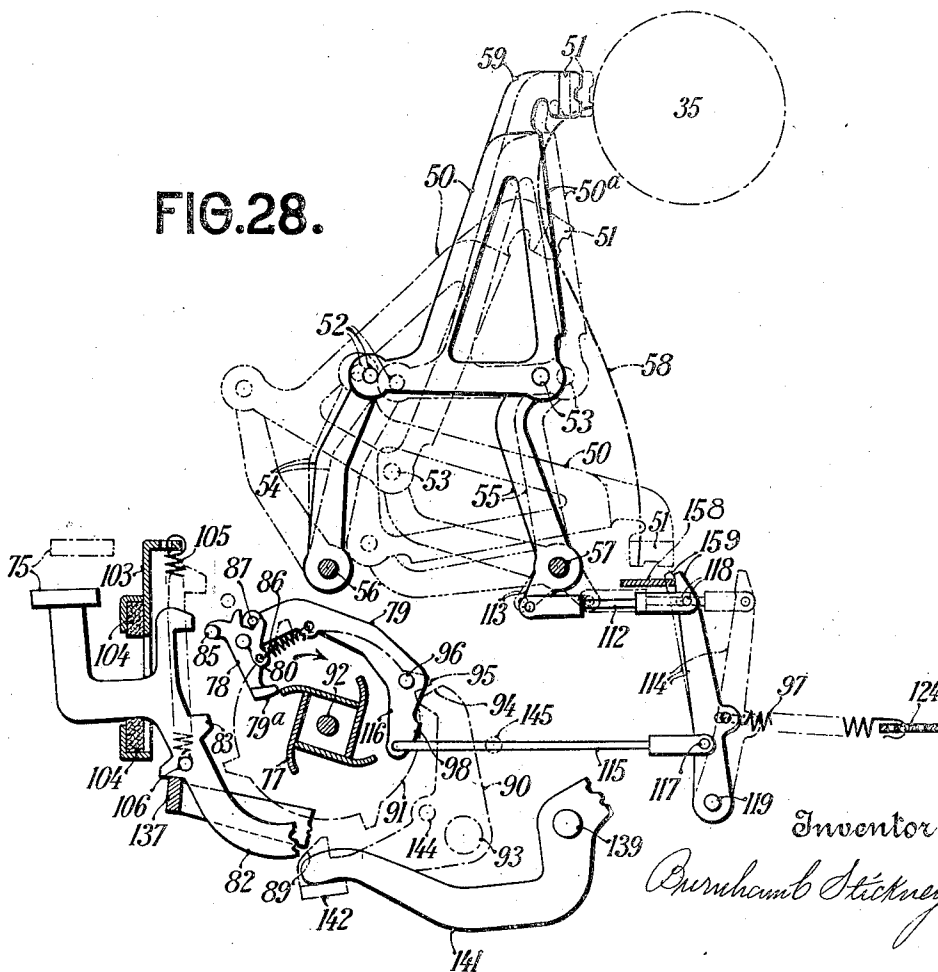


FIG.28.



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TYPEWRITING MACHINE

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FIG. 29.

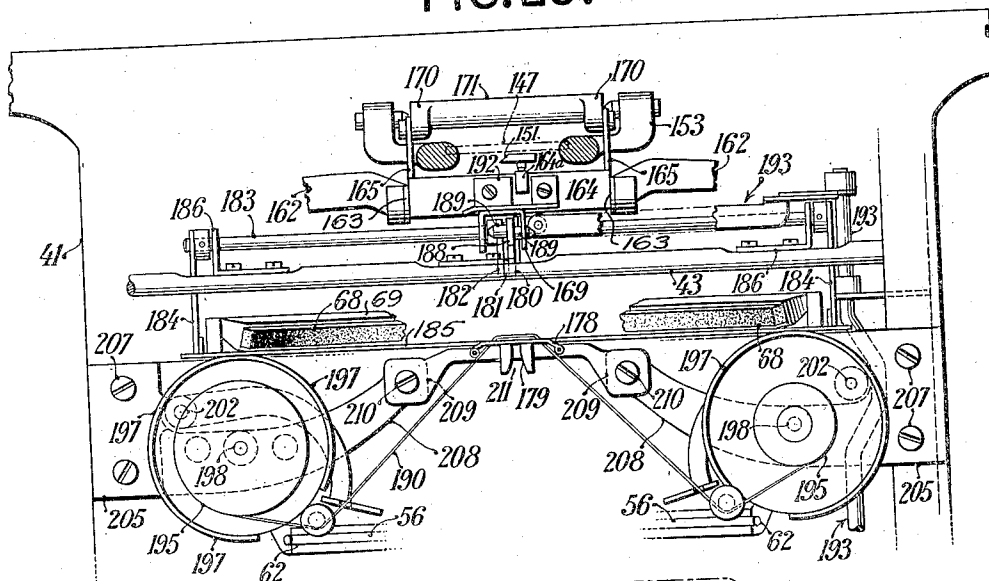
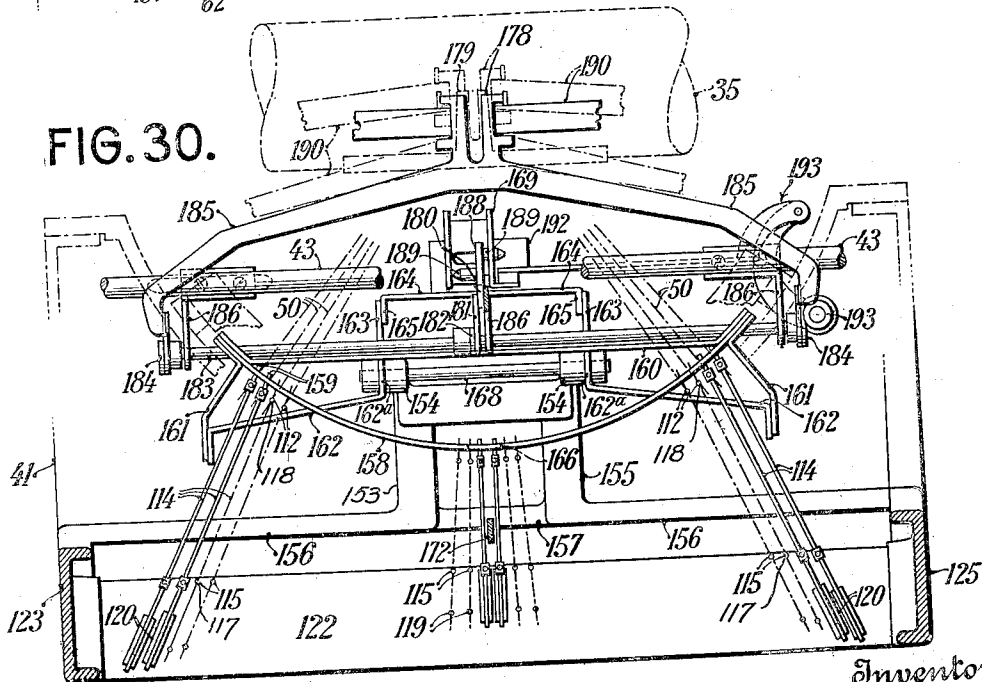


FIG. 30.



Inventor:

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UNITED STATES PATENT OFFICE

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TYPEWRITING MACHINE

Application filed December 8, 1926. Serial No. 153,231.

This invention relates to typewriting machines having automatic type-actions in which the usual keys when depressed, cause their respective type-bars to be operated by power-driven means.

A typewriting machine of this type is disclosed in my co-pending application, No. 36,594, filed June 12, 1925, showing an improved quiet type-action system coupled to power-driven means embodied in a unit placed behind the typewriter and including a revoluble power-drum having longitudinal cam-faces formed thereon. The drum spans a system of power-levers, each of which is linked to a type-action. A spring-motor constantly urges the drum to rotate. The drum is controlled by a pallet-frame actuated by the depression and release of any typewriter-key, so that the drum rotates one step to operate a corresponding type-action. An electric motor rewinds the spring-motor when it is run down, and means similar to those shown in the United States patent to Pitman, No. 1,417,106, dated May 23, 1922, are provided to automatically start and stop the winding of the spring-motor.

An object of the present invention is to apply an improved quiet type-action system of the type just mentioned to an Underwood typewriter with minimum changes in said typewriter.

Another object of the present invention is to use a typewriter having an automatic carriage-return mechanism operated by an electric motor, and to provide means whereby said motor may also rewind the spring-motor that operates the type-action. Thus the motor is made to perform a double function, and means are further provided so that these functions can in no wise interfere with each other.

Another object of the present invention is to provide compact assemblies of the parts forming the power-drive for the type-action, the rewinding mechanism for the spring-motor, and the automatically-selecting mechanism whereby the electric motor drives either the rewinding mechanism or carriage-return mechanism. A preferred form of carriage return mechanism is shown in the pending ap-

plication of Kurowski, No. 41,507, filed July 6, 1925 (now Patent No. 1,679,727, dated August 7, 1928), and is illustrated herein with modifications to be described, said modifications constituting features of the present invention.

In carrying out the present invention there is provided, as disclosed in my aforesaid co-pending application, a system of triangularly-shaped type-bars normally in a cumbent position. Said type-bars are supported upon arms by means of which they may be swung and raised to the printing position. The type-bars and their related arms are arranged as heretofore in planes radiating from the printing point. Below said type-bars and their arms, corresponding key-levers are arranged in parallel array. Each key-lever has arranged above it a power-lever on the end of which is a shiftable member preferably in the form of a swingable dog, which, when said key-lever is depressed, swings toward a power-drum having longitudinal cam-faces thereon, and thereby renders said power-lever operable. Said key levers normally keep the swingable dogs away from the power-drum. Said power-levers are in horizontal array and the power-drum is between said array and the array of key-levers. To an arm of each of said power-levers is attached a link which extends toward and is attached to an intermediate lever of the third order. The points of attachment to said intermediate levers are in a straight line array, parallel to and spaced similarly to the arrayed ends of said power-lever arms. The intermediate levers are extended to enable them to actuate an arcuate universal bar which is concentric with the type-bar-action system, and by means of which letter-feeding carriage-escapement and ribbon-vibrating mechanisms may be operated. At a point close to the universal bar, each intermediate lever has attached to it a link which connects it with one of the type-bar actions. Each intermediate lever therefore has two points of attachment, one for the corresponding type-bar action and one for the corresponding power-lever. The power-lever attachments on said intermediate levers are in a straight

line array, and the type-bar attachments are in arcuate array. Thus the lengths between the two points of attachment on each intermediate lever vary and in order that each intermediate lever may operate its corresponding type-bar in uniformity with the other type-bars, the lengths from the power-lever attachments to the pivots on which said intermediate levers are mounted vary proportionately.

The power-drum, in order to secure lightness and manufacturing economy, is made of stampings fastened together to form a drum of quadrilateral cross-section. Viewed endwise, a portion of each stamping extending lengthwise thereof projects beyond said quadrilateral section, and forms one of the cam-faces of the drum.

A spring-motor of the type disclosed in the aforesaid patent to Pitman is mounted along the side of the typewriter for compactness. Said motor includes layers of helical windings of spring wire, the layers forming a continuous winding or coil having a large energy-storing capacity sufficient for a multiplicity of type-operations. The front end of the coil is connected to an escapement-wheel co-operating with a type-key-controlled pallet-frame. The rear end of the coil is keyed to a shaft which may be driven to rewind the spring-motor.

Means herein provided for rotating the rewinding shaft are also capable of registering the condition of the spring-motor and are disposed along the rear of the typewriter for controlling a novel motor-driven train operable to rewind the spring-motor.

A novel helical gear-connection forming part of the rewinding and registering means improves the sensitivity of said means as registering means.

The carriage-return mechanism, shown in the aforesaid pending application of Kurowski, includes a rack upon the typewriter-carriage and a pinion in mesh therewith. The pinion may be driven by a corresponding clutch-member secured to a shaft along which the pinion may slide. A key and carriage controlled linkage for effecting a clutch engaging and disengaging movement of the pinion is provided. A switch controlled by said linkage starts and stops an electric motor which is geared to the aforesaid shaft on which the clutch-member is mounted. As the motor rotates said clutch-member, the carriage is returned to a position that is predeterminable by means associated with usual shiftable right-hand marginal carriage-stop and which means may operate said linkage to disengage the clutch and open the switch to stop the motor. A suitable key may be operated to actuate said linkage to initiate a carriage-return movement. The motor is fastened to the rear side of the typewriter, and its power is

delivered through the usual speed-reducing worm-wheel or equivalent train.

To enable the electric motor to drive either the carriage-return mechanism or mechanism for winding the aforesaid spring-motor, there is used a differential gear-mechanism, preferably of the planetary type, which consists of an arm or spider having one or more planetary pinions in mesh with both an inner spur-gear and an outer annular gear. The spider is connected to the electric motor through the speed-reducing train. Preferably, the inner spur-gear is connected to the aforesaid carriage-return clutch-member, and the outer annular gear may be connected to the aforesaid shaft which is rotatable to wind the spring-motor. When the spider with its planetary gears is rotated the outer gear will be rotated to rewind the spring motor if the inner gear is restrained, or the inner gear will be rotated if the outer gear is restrained.

Means are provided for holding the outer gear so that the inner spur-gear will rotate to drive the carriage-return mechanism and may be brought into and out of action by the aforesaid linkage that effects engagement and disengagement of the carriage-return clutch. The electric motor is automatically started and stopped in accordance with the starting and stopping of a carriage-return operation. Means, controlled by the aforesaid means that register the condition of the spring-motor, are employed to automatically restrain the inner gear of the differential train for starting a rewinding operation of the spring-motor. Other means, also controlled by the condition-registering means, operate to withdraw said restraining means to stop the rewinding operation automatically. The electric motor is also automatically started and stopped in accordance with the starting and stopping of the rewinding operation.

The inner spur-gear is preferably restrained for a rewinding operation by means of an interponent normally held by a latch which may be readily operated, to release said interponent, by the aforesaid means that register the condition of the spring-motor. A spring-pressed interponent may serve to restrain the outer annular gear of the differential gear-train to effect a carriage-return operation, and is normally held back by means of a connection to the aforesaid linkage that operates to engage and disengage the aforesaid carriage-return clutch. Said latter interponent may be arranged to receive a secondary movement which may be utilized to withdraw the first-mentioned interponent if it should happen to be in position for a rewinding operation. Thus the rewinding operation may be automatically suspended to permit the differential gear-train to function for a carriage-return operation. In order that the rewinding operation may be auto-

5 matically resumed at the conclusion of a carriage-return operation, means for withdrawing the inner spur-gear-restraining interpo-
 10 nent are arranged to withdraw said interpo-
 15 nent only far enough to release said inner spur-gear from said interponent, but no far enough to be caught by the aforesaid latch. To this end suitable means, preferably a finger, may be presented against said latter interponent to prevent its overflow, and thus assure that it shall not be latched when it is withdrawn to suspend a rewinding operation. A positively-actuated rewinding checking arm is employed to stop the rewinding operation, and may carry a dog rendered effective by releasing a latching means easily operated by the aforesaid spring-motor condition-registering means.

20 The planetary gear-train may be mounted on an extension of the shaft which carries the carriage-return clutch so as to form a compact assembly. Said assembly may also, as will be shown, include the mechanism which restrain the aforesaid gears of the differential gear-train, and may also include the mechanism which controls the restraining means, the entire assembly being enclosed in a compact casing or fixture on which the electric motor may also be mounted. Thus there is formed a compact unit which may readily be attached to the rear side of the typewriter-frame.

25 Another feature of the invention is the provision of a novel yoke-shaped ribbon-carrier which may present a patch or central portion of the usual Underwood ribbon, mounted in the usual way, to the printing point of the typewriter. Said ribbon-carrier co-operates with ribbon-vibrating arms which are connected in a novel way to the usual Underwood ribbon-vibrating means which are behind the type-bar system, and which latter means are modified so as not to interfere with said system. The novel ribbon-carrier being yoked-shaped clears the zone of type-bar movement and does not interfere with said movement.

Other features and advantages will hereinafter appear.

In the accompanying drawings,

50 Figure 1 is a sectional side elevation of an Underwood typewriter, showing how the features of the invention are applied thereto.

Figure 2 is a side elevation of the typewriter, a portion of the right side of the typewriter being broken away to show the clutch whereby the carriage-return mechanism becomes operative. The spring-motor along said right side of the typewriter and the mechanism for controlling said spring-motor at the rear of the typewriter are also shown.

55 Figure 3 is a side elevational view, showing a carriage-return key, and the linkage which said key may operate to cause the carriage-return clutch to become operative. In

this view the clutch is supposed to be disengaged, and said linkage is positioned accordingly.

Figure 4 is a partly-sectioned view of the spring-motor, showing details of its construction.

Figure 5 is a rear view of the typewriter, showing the electric motor and the enclosure for the differential gearing and its controlling parts. This view also shows the means that register the condition of the spring-motor.

Figure 6 is a sectional front elevation of the typewriter, showing particularly the arrangement of the type-actions and some of their operating members. This view also shows how the usual Underwood ribbon-spools and ribbon-reversing mechanism are mounted.

Figure 7 is a front elevation of a cross-bar in which the power levers are mounted, and shows how a detent of the ribbon-reversing mechanism is mounted on said cross-bar.

Figure 8 is a developed view of the type-heads as they rest against their cushion in their fully-retracted positions. This view shows particularly how the centers of the lower-case types on the extreme type-bars may lie within the planes of said type-bars.

Figure 9 is a partly sectioned plan view of the typewriter, showing such features of the invention as may be clearly presented in said view.

Figure 10 is a rear elevation, showing particularly the casing in which is mounted the planetary gearing and the means whereby said gearing is controlled. Said casing is shown with its outer cover removed to present a clear view of said controlling parts.

Figure 11 shows the controlling parts of the planetary gearing that are actuated when the spring-motor requires rewinding.

Figure 12 is a rear elevation, showing the controlling parts of the planetary gearing that are actuated to stop the rewinding of the spring-motor.

Figure 13 shows the relative positions of the parts, whereby the planetary gearing is controlled to rewind the spring-motor, and shows said parts at the moment when the spring-motor condition-registering means have tripped the interponent-withholding latch to thereby cause said rewinding to commence.

Figure 14 is a rear elevation, showing how a rewind checking arm remains ineffective while the spring-motor is being rewound, said arm moving idly up and down as the planetary pinion spider rotates.

Figure 15 is a rear elevation, showing how the switch may be closed to start the electric motor for rewinding the spring-motor notwithstanding that the interponent that is released to effect said rewinding momentarily abuts on an end of one of the projections with

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which it is to co-operate to hold the inner spur-gear of the differential train.

Figure 16 shows the carriage-return key depressed, and also shows the clutch-engaging linkage released thereby.

Figure 17 shows a check that is moved to prevent the full release of the rewinding interponent while the typewriter-carriage is being returned, and shows said interponent just about to escape from its latch which has been moved to the position shown, by means of the spring-motor condition-registering means not shown in this view.

Figure 18 shows how the differential-gear-controlling mechanism is operated to effect the return of the typewriter-carriage.

Figure 19 shows how the carriage-return interponent has moved to cause the withdrawal of the rewinding interponent, and also shows the finger that in this instance is in position for preventing the overthrow of said rewinding interponent.

Figure 20 shows how a dog-holding latch on the vibratory checking arm is tripped to release a dog on said arm when the rewinding is to be halted. This view also shows the rewind checking arm at the end of a positive cam-impressed movement.

Figure 21 shows the rewind-checking arm at the end of a spring-impressed movement, and shows the released dog thereon in such position that the ensuing cam-impressed stroke of said arm is effective to rotate the indicated rock-shaft and thereby terminate the rewinding.

Figure 22 shows how the cam-impressed movement of the rewind checking arm has rotated the rock-shaft.

Figure 23 is a view, showing, in perspective, an assembly of the parts for controlling the differential gear-train.

Figure 24 is a perspective view, showing the finger, check and latch that control the rewinding interponent, and also showing the springs and pivot-stud for said finger, check and latch.

Figure 25 is a perspective view, showing the construction of the novel power-drum having the cam-faces whereby the power-arms of the type-action system are operated.

Figure 26 is a perspective view of the worm-gear housing with its motor-base, and the casing wherein the differential gearing is enclosed and wherein the controlling parts for said gearing are mounted.

Figure 27 is an operated view of one of the type-actions at the moment when the key-lever has been depressed and the dog on the power-lever released, thereby to enable said lever to be moved by the approaching cam-face of the power-drum to operate the type-action to print.

Figure 28 is an operated view of the same type-action at the moment when the power-lever has been moved far enough, so that

the dog thereon is about to escape from a cam-face of the power-drum. At this moment the face of the type has not quite reached the platen, the further movement of the type-action to enable said type to print being effected by the momentum of said type-action.

Figure 29 is a plan view, showing particularly the modified ribbon-carrier and the means for vibrating said ribbon-carrier up and down.

Figure 30 is a front elevation, showing particularly the modified ribbon-carrier and the parts for vibrating it up and down. This view also shows the universal bar, whereby the usual escapement and ribbon-vibrating mechanisms are actuated.

The Underwood typewriter to which the invention is applied has a platen 35 on an axle 36 journaled in a platen-frame 37, which is mounted for case-shifting in a letter-feeding carriage 38. Said carriage runs on rear and front guide-rods 39 and 40 respectively, supported in the typewriter-frame 41.

Means for shifting the platen-frame 37 include the usual swingable case-shift frame 42, extending substantially from side to side of the typewriter-frame 41 and having a front rod 43. The shift-frame 42 may be swung about pivots 44 to elevate the front rod 43 by means of a shift-key 45 attached to a shift-key-lever 46 fulcrumed at 47. Only the rear portion of the shift-key-lever engaging one of the sides 48 of the shift-frame is indicated in Figure 1. The rod 43, as it is elevated, shifts the platen-frame 37 upwardly by means of the usual roller 49 in the middle of the platen-frame. The rod 43 is of such extent that the roller 49 engages said rod throughout the full extent of carriage-travel. The usual spring, not shown, retracts the shift-frame when the shift-key is released, and permits the platen-frame to reassume its normal lower-case position.

The type-action system is similar to that shown in my aforesaid pending application No. 36,594, and the adaptation of an Underwood typewriter to such a type-action system is a feature of the present invention. Modifications of said type-action system to facilitate said adaptation constitute other features of the present invention. The type-action system includes a full complement of type-bars 50, forty-two in number, and each type-bar has upper and lower case types formed on the usual type-heads 51 fastened to said type-bar. Besides the type-head, other essential elements of each type-bar are two pivot-bearings 52 and 53, which, with the type-head 51, are relatively disposed to one another, as shown in Figures 1 and 28, so that swingable arms 54 and 55 connected to each type-bar at said pivot-bearings 52 and 53 serve to move the type-bar from the cum-bent position, indicated in Figures 1 and 28, to the upright printing position, indicated in

Figure 28 alone. The relative positions of the type-head 51, type-bar pivot-bearings 52 and 53 and fulcrum-rods 56 and 57 for the swingable arms 54 and 55 are so chosen that the type-head moves in the characteristic path, indicated by the dot-and-dash line 58 of Figure 28. It will be apparent from Figure 28 that with the type-head moving in said path, the corresponding direction of type-bar movement is such that the larger part of the momentum attained by the type-bar, as it approaches the platen, reacts upon the fulcrum-rods 56 and 57, so that, at the instant of printing, the momentum of the type-bar against the platen is of such character that quiet and yet clear printing results.

Viewed from the front of the typewriter, as in Figure 6, the type-bars 50 and their arms 54 and 55 are arranged in radial array about the lower-case printing point. Each type-bar is preferably formed from a single thin blank into two parallel plates separated at the bearings 52 and 53 by the thickness of arms 54 and 55, and joined along the edge 50^a, which is formed as said single blank is folded to form said plates. One of the plates has a goose-neck portion 59 of proper form to carry the type-head 51.

As shown in Figure 8, the goose-neck portion 59 of each type-bar may be bent side-wise at 60 to bring the center of the lower-case type into the central plane of the type-bar. Another bend in the goose-neck portion at 61 gives the proper inclination to the type-head, to make the upper-case type register with the upper-case printing point. Figure 8 is a developed plan view, showing particularly how the inclination of the type-heads from the type-bar proper varies in the usual manner from a minimum inclination for the middle type-bars to a maximum inclination for the outer type-bars. In order to make the total angle, which includes the entire radial array of type-bars, as small as possible, the angular spacing between adjacent type-bars may decrease as the inclination of the type-bar-heads decrease, this decrease in spacing being in accordance with the usual practice.

As shown in Figure 8, the centers of the lower-case types of all the type-bars may lie in the central planes of their respective type-bars, thereby entirely avoiding the twisting stress heretofore imposed on type-bars which had their lower-case types offset from said planes. By avoiding offsets in the lower-case types, there are effected correspondingly less offsets in the upper-case types, thereby minimizing said twisting stress, particularly at the outer type-bars, when the upper-case types print. It will be noted in Figures 6 and 30 that the total angle, about 80 degrees, which includes the radial array of type-bars, is substantially less than the including angle in the standard Underwood typewriter, said

latter angle being about 110 degrees. The reduction of this angle entails a corresponding reduction in the inclination of the type-heads for the outermost type-bars, and consequently the upper-case types for said outermost type-bars are not offset as much as heretofore.

In order to conform to the radial array of the type-bars 50 and their arms 54 and 55 about the lower-case printing point, the fulcrum-rods 56 and 57 for said arms must obviously be arcuate and concentric with said lower-case printing point. Said rods may be supported and retained in arcuate grooves 62 formed in a type-bar-segment 63, which has slots 64 and 65, cut transversely of said grooves for spacing and retaining the arms 54 and 55 laterally. As shown herein, the forward swingable arm 54 of each type-bar is thinner than the rearward arm 55, the thickness of the forward arm 54 being limited and determined by the minimum spacing between the ends 66 of adjacent type-bars (see Figure 6). It is obvious that the minimum spacing between the corners 67 of adjacent type-bars is greater than the minimum spacing between the ends 66 on account of the radial arrangement of the type-bars. The greater minimum spacing at the corners 67 of the type-bars permits the arms 55 to be of thicker material than the arms 54. As will be shown, it is by rotating arms 55 in a clockwise direction that the type-bars 50 are actuated, and the use of thicker material for said arms 55 is desirable on account of the greater tendency of said arms to wear at their fulcrum-rod 57.

Each type-bar 50 in its cumbent position rests with the rearward portion of its edge 50^a against a cushion 68, which stops the type-bar and limits its retractive movement from the platen. Said cushion is arcuate and may be retained in an arcuate member 69, which may, by means of brackets 70, be secured to the type-bar-segment 63, as shown in Figure 9. Said type-bar-segment 63 includes a suitably formed portion 71, in which the rear slots 65 for the arms 55 are cut, and also include another portion 72, in which the front slots 64 for the arms 54 are cut. Beyond the ends of said portions the type-bar-segment continues to curve outwardly and upwardly toward horizontal extensions 73, Figure 6, by means of which top surfaces of side members of the typewriter-frame 41 may support said segment.

Key-controlled means, whereby the type-bars may be selectively actuated, include a standard typewriter keyboard having keys 75 and also include a power-drum generally indicated by the number 76 and having cam-faces 77. Every time a key 75 is operated the power-drum 76, by suitable means to be described, is caused to rotate to an extent corresponding to the transition of one cam-

face 77 past a dog 78, which is at one end of a power-lever 79. The dog has a surface 79^a which is normally out of the path of the revolving cam-face 77, but which is caused to move into said path simultaneously with the depression of a key, in order that the power-lever may be rotated about its fulcrum by the rotation of the drum 76. To direct the movement of its surface 79^a, each dog 78 is pivoted upon its power-lever at 80. There is a dog and power-lever for every key 75, and key-levers 82 in their normal positions serve, by means of projections 83 on said levers, to hold the dogs disengaged from the power-drum. Conversely, upon the depression of any key, as shown in Figure 27, the key-lever thereof, rotating about a common key-lever fulcrum 84 withdraws its projection 83 from an arm 85 of the dog, to permit said dog, under the pull of a spring 86, to move into position for engagement with the power-drum. The movement of the dog about its pivot may be limited by a stop 87 coacting with suitable projections of the dog.

The drum is constantly urged to rotate by a spring-motor, generally indicated by the number 88, which is normally restrained from said rotation by a pallet 89 of a pallet-frame 90, said pallet holding an escapement wheel 91, which, as will be shown, is fastened to a shaft 92 of the power-drum (see Figures 2, 27 and 28). The completion of a key-lever stroke after the corresponding dog has been caused to move into the path of the cam-faces 77, causes, as will be shown, the pallet-frame to be rotated about its pivot 93 to withdraw the pallet 89 from the escapement-wheel 91, and at the same time to interpose another pallet 94 into the path of an approaching tooth 95 of said wheel 91. In the ensuing rotation of the drum, the cam-face 77 will move the dog upwardly, and thereby rock the power-lever 79 about a fulcrum-rod 96, which is common to all the power-levers. Just before the tooth 95 of the escapement-wheel reaches the interposed pallet 94, the power-drum will have rotated far enough so that the surface 79^a of the dog is about to escape from the cam-face 77, which has engaged said surface (see Figure 28), and thereupon the power-lever is suddenly caused to be retracted to its normal position by means of a spring 97 against a stop-surface 98 formed on a bar 99, in which the fulcrum-rod 96 of the power-lever is incorporated. As shown in Figure 28, the type-bar 50 will not have moved far enough to print at the instant the surface 79^a escapes from the cam-face. Completion of the printing movement is dependent upon the momentum of the type-bar and parts connected thereto. As already mentioned, said momentum is of such character that quiet and clear printing results. The type-bar movement is fully discussed in my aforesaid pending application. The

bar 99 is between the side members of the typewriter-frame 41, and has slots 100 for spacing and retaining the power-levers laterally.

The common fulcrum-rod 84 of all the key-levers is incorporated in a bar 101, which has slots 102 for spacing and retaining the rear ends of the key-levers laterally. The forward portion of the key-levers are spaced laterally by means of a slotted plate 103 of the usual form, to which may be secured stop-members 104 extending transversely of all the key-levers and serving to limit the movements thereof (see Figures 1, 27 and 28). Said members may be of somewhat resilient cushioning material. There is a spring 105 for each key-lever to retract the same, one end of said spring being attached to a stud 106 at the side of the key-lever, the other end of the spring being attached to a ledge 107 bent horizontally from the plate 103, which is screwed to the typewriter-frame 41. Each key-lever has a hook-shaped portion 81 to co-operate with the usual Underwood key-lock-rod 108, which is caused, in the usual manner, to be moved under said hook-shaped portions and thereby lock all the key-levers at the end of a writing line. To brace the middle of the key-lock-rod, there may be fastened to the slotted plate 103 a piece 109 having a rearward projection 110 which underlies said key-lock-rod when the rod is in locking position. To afford room for said piece 109 each of the key-levers to the right of said piece has its retracting spring 105 on its right side, and each of the key-levers to the left of said piece has its spring on its left side, thus affording room between the two middle key-levers for the piece 109, as is best illustrated in Figure 9.

Operation of a type-bar to print, is effected by rotating the swingable arm 55 pivoted to the corner 67 of said type-bar, clockwise about its fulcrum-rod 57, as shown in Figure 28. For translating the movement of each power-lever 79 into operation of the corresponding type-bar 50, there is provided a train of connections between said power-lever and said swingable arm 55. Said train of connections includes a link 112 connecting an extension 113 of the arm 55, whereby said arm may be operated, to an intermediate lever 114, and said train also includes a link 115 connecting said intermediate lever 114 to a downwardly-projecting arm 116 of the power-lever. The purpose of the intermediate levers, of which there is one for every power-lever and type-bar, is to receive the power-lever impulses at points 117 that are in horizontal straight-line array opposite the arms 116 of the power-levers, and to deliver said impulses from points 118 that are in arcuate array opposite to and conforming to the arcuate array of the operating extensions 113 of the swingable arms 55, Figures 6 and 30. It is apparent

that the lengths of the intermediate levers between points 117 and 118 vary from a minimum for the inner levers to a maximum for the outer levers. To effect uniform extent of movement of all the points 118 of the levers 114, so that the type-bars are operated uniformly, it is necessary that the lengths of the intermediate levers between points 117 and fulcrums 119 of said levers be such that the ratios of the latter lengths to the corresponding lengths between points 117 and 118 be uniform. To maintain said uniform ratios results in said fulcrums 119 being arrayed with respect to points 117, as indicated in Figures 6 and 30. Each fulcrum 119 may be incorporated in a bracket 120 removably secured by screws 121 to a cross-bar 122 supported between the side members of the typewriter-frame 41. Each of said brackets may be slotted and have the fulcrum 119 inserted transversely of the slot, to receive the intermediate lever. One end of each of the previously-mentioned springs 97 is attached to an intermediate lever. Said springs serve not only to retract the power-lever, as already mentioned, but also serve, as will be apparent, to retract the corresponding type-bar. The other end of the spring 97 is anchored to a plate 124 fastened to a rear member 125^a of the typewriter-frame 41.

The shaft 92 of the power-drum is journaled at its left end in the left side member 123 of the typewriter-frame, and near its right end in a special shock-absorbing bearing inserted in the right side member 125 of the typewriter-frame. Said shaft 92 extends beyond said right side member to receive the escapement-wheel 91, and a pinion 126, which connects said shaft to a gear 270 of the spring-motor 88. The escapement-wheel may be fastened to the hub of the pinion 126, which is fastened to said shaft. The purpose of the shock-absorbing bearing is to deaden the noise and shock attending the operation of the escapement-wheel and pallet-frame in arresting the rotation of the power-drum at each typewriter-key operation. Said bearing (see Figure 6) consists of a sleeve 129 having a flange 130 and a nut 131. A hole in the right side member 125 of the typewriter-frame is substantially larger in diameter than said sleeve, to receive, from opposite sides, shock-absorbing resilient bushings 132, which fit said hole and have holes which closely fit said sleeve 129. Said bushings have outer flanges, which are clamped by the flange 130 and nut 131 of the sleeve against said typewriter-frame right side member 125. There is also a shock-absorbing mounting for the pallet-frame in the form of an arm 133 (see Figure 2) loosely mounted on the power-drum shaft 92, between the flange 130 and the escapement-wheel 91, and yieldably held against a stop 134 projecting from said right side member 125. For pulling and yieldably

holding said arm 133 against said stop 134, there is a spring 135 of suitable dimensions applied to said arm at a horizontal extension 136 thereof, said extension being beyond the pallet-frame pivot 93, which is on said arm. It is apparent that with the arm 133 loosely mounted on the shaft 92, the reactions against the pallets 89 and 94 are finally absorbed by the spring 135, and the shock-absorbing bearing for said shaft 92, as said reactions tend to rotate said arm with said shaft.

For enabling the operation of any key-lever 82 to actuate the pallet-frame 90, and thereby cause a rotation of the power-drum, there is provided a universal bar 137 extending transversely of said key-levers and underlying projections 138 thereof. Said universal bar, when depressed by a key-lever, rocks a shaft 139 by means of arms 140, which are joined to the ends of said bar and keyed to said shaft 139. The shaft 139 is journaled in the side members 123 and 125 to the typewriter-frame and extends beyond the right side member 125 to receive an arm 141, whereby the pallet-frame may be rotated to withdraw the pallet 89 from the escapement-wheel. Said pallet-frame has a projection 142, which is engaged by the suitably formed end of the pallet-frame rotating arm 141. Upon releasing the typewriter-key, there follows a reverse rotation of the pallet-frame back to normal position, said reverse rotation being effected by a spring 143, which has one end attached to the pallet-frame at a stud 144, the other end being attached to a stud 145 projecting from a spur 146 of the arm 133 on which the pallet-frame is pivoted. Said stud 145 also serves as a stop, against which the pallet-frame is normally held by said spring 143. The reverse rotation of the pallet-frame also serves, as will be apparent, to restore the universal bar 137 to its normal position.

The letter-feeding carriage 38 is propelled in letter-feeding steps by the usual spring-motor 145^a (Figure 5), which is connected to said carriage by the usual draw-band 146^a, only partly shown. Much of the standard Underwood escapement-mechanism for letter-feeding the carriage has been retained, and only such changes have been made in said mechanism as were necessary to adapt it for the type-action system herein shown. There is retained the usual Underwood escapement-wheel 147, connected to the one-way pinion 148, which meshes with the letter-feeding rack 149 on the carriage. There is also the usual dog-rocker 150, carrying fixed and loose dogs 151 and 152 respectively co-operating with said escapement-wheel. The usual Underwood escapement-supporting fixture 153 has been modified by the addition of bearings 154, the purpose of which will presently be apparent. For supporting said fixture on the typewriter-frame, there is

a base 155, having lateral extensions 156, which may rest on the typewriter-frame side members 123 and 125 (Figure 30). Said base also has a rearward extension 157, which rests upon a type-writer-frame rear member 125^a.

To cause the escapement-dog-rocker to be actuated every time a type-action is operated, a universal bar 158 cooperates with said type-action, and for this purpose is so disposed that it is displaceable horizontally and forwardly by an end 159 of any intermediate lever 114. The forward displacement of said universal bar is effected in the final portion of the movement of said lever to move the type-bar. Said ends 159 are in arcuate array, to which the shape of the universal bar conforms. For stiffening it, said universal bar has a chord 160. At each outer end of the universal bar and attached to its under surface is a downwardly and rearwardly projecting arm 161, pivotally connected to an arm 162. As shown in Figure 30, the arms 162 are outwardly and downwardly flaring portions of levers 162^a, having upper arms 163, to which is pivotally connected a frame having a cross-member 164 and sides 165 extending rearwardly from said cross-member.

It will be apparent that by means of the arms 161, 162 and 163 a forward displacement of the universal bar effects a rearward displacement of the cross-member 164. To make the cross-member 164 and universal bar 158 move in parallelism, the levers 162^a are fastened to a rock-shaft 168, for which the aforementioned bearings 154 in the escapement-supporting fixture have been provided. Besides being supported by the two pivotal connections to the arms 162, the universal bar 158 has in the middle thereof a forwardly-projecting tongue 166, whereby it may be supported by a slot 167 in the under side of the type-bar cushion-retaining member 69. The cross-member 164 serves the same purpose as the similar cross-member which was part of the usual Underwood universal bar frame, namely, to actuate the dog-rocker 150, which is engaged by a middle portion 164^a of said cross-member (see Figure 29). Said cross-member 164 also carries a member 169, whereby it is enabled to actuate the ribbon-vibrating mechanism to be described. Like similar sides of the usual Underwood universal bar frame, the rearwardly-extending sides 165 of the present cross-member 164 are pivotally connected to and supported by arms 170 of the usual frame 171, pivoted at its ends in the escapement-supporting fixture 153. Said frame 171, in conjunction with the levers 162^a serves to move the cross-bar 164 in parallelism, and has the usual downwardly and forwardly extending arm 174^a, which is en-

gaged by an arm 172 substantially in the middle of the usual space-bar rock-shaft 173. The usual space-bar 175 connected to said rock-shaft by the usual arms 176 is thus enabled to actuate the escapement-mechanism in the usual manner. As shown in Figure 30, the end of said arm 172 projects between the two middle intermediate levers 114.

A ribbon-carrier 178 of a novel form designed to clear the type-bars herein shown, is provided, said carrier serving the purpose of moving the ribbon to and from the printing point by means, which are a combination of some standard Underwood ribbon-vibrating elements and added elements, which, as will presently appear, are necessary. The upper and ribbon-carrying portion of the ribbon-carrier 178 is of the same form as the similar portion of the regular Underwood ribbon-carrier, and is in the space between the type-guide 179 and the front of the platen 35. It is obvious that the ribbon-carrier cannot be extended directly downward for connection with the usual Underwood ribbon-vibrating arm, because in this case both the carrier and said arm would interfere with the type-bar movement. It is for this reason that the usual Underwood ribbon-vibrating arm is shortened and becomes an arm 180 connected by a link 181 to another arm 182 on a ribbon-vibrating rock-shaft 183. Said shaft 183 is of such length that ribbon-vibrating arms 184 at the ends thereof are outside the zone of type-bar movement. The shortened arm 180 and the arm 182 also clear said zone. It is to afford extensions whereby it may be connected to the ribbon-vibrating arms 184 that the ribbon-carrier 178 is of the yoke-like form, shown in Figure 30, having extensions formed to clear the type-bars and being pivotally connected at their ends to the ribbon-vibrating arms 184.

In order that the ribbon-carrier may be shifted up and down in accordance with the case-shifting of the platen, the ribbon-vibrating rock-shaft 183 is journaled in three brackets 186 fastened to the rear of the front rod 43 of the platen-shift frame 42. The middle one of said brackets has a pivot 187 for a lever 188, which has the shortened arm 180. The upper arm of said lever is of the same form as the upper arm of the usual Underwood ribbon-vibrating lever, said arm having the usual two pins 189. For actuating said lever 188, either one of said pins may be selectively engaged by the usual actuating member 169, which moves back and forth with the cross-member 164, on which it is mounted, every time the letter-feeding universal bar 158 is actuated. The backward movement of said actuating member 169 rocks the lever 188 to effect, by the means just described, an upward movement of the ribbon-carrier 178, which carries the ribbon to the printing point.

The extent of upward ribbon-carrier movement, and consequently which field of the usual bichrome ribbon 190 is presented to the printing point, depends upon which one of the pins 189 of the lever 188 is engaged. To enable it to engage either one of said pins 189, the actuating member 169 has the usual slots 169^a, and is shiftable sidewise on the usual bracket 192, which is fastened to the cross-member 164. For shifting the actuating member 169 sidewise for a selection of the ribbon-field to be presented to the printing point, there may be provided the usual bichrome shifting means, generally indicated by the number 193, and including at the front of the typewriter the usual lever 194 for manipulating said means. Said bichrome-shifting means are of the type illustrated in the U. S. Patent No. 926,050, to F. A. Cook, dated June 22, 1909.

Coils 195 of the ribbon 190 are wound upon the usual reels, not shown, which are rotatable within the usual cup-shaped shells 197, which surround the upper end portions of spindles 198. Said spindles have the usual devices, not shown, for being connected with said reels. The usual means, whereby either spindle may be driven, to feed the ribbon past the printing point at each key-operation, include a horizontal shaft 199, Figure 6, having two beveled pinions 200, so located on said shaft 199 that only one of said pinions may be in mesh with a pinion 201 of the corresponding one of spindles 198. The usual means for automatically shifting the ribbon-feeding shaft 199 endwise, to automatically reverse the ribbon-feeding movement as one or the other of the coils 195 becomes fully unwound, are of the type shown in U. S. Patent No. 828,548, to W. F. Helmond, dated August 14, 1906. Said latter means include for each ribbon-spool, a vertical shaft 202 that is automatically caused to be partly turned in the usual manner, to cause a reversal of ribbon-feeding movement when the corresponding spool of ribbon is run down. Each vertical shaft 202 is journaled in one of elongate bearings 203 formed integral with the type-bar-segment 63. The lower portions of the spindles 198 are journaled in bearings 204, also formed integral with said segment 63. The upper portions of spindles 198 are journaled in brackets 205, which rest upon the horizontal extension 73 of the type-bar-segment 63. Screws 207 serve to secure said brackets 205 and the type-bar-segment 63 upon the side members of the type-writer-frame 41. Each bracket 205 has an extension 208 directed inwardly to form abutments 209, to which the type-guide 179, formed as shown in Figures 6 and 29, may be secured by screws 210. For guiding the type-heads 51 of the type-bars to the printing point, said type-guide has a groove 211 with outwardly-flared sides formed to guide the sides of the type-heads as they approach the printing point.

For imparting ribbon-feeding impulses to

the horizontal ribbon-feeding shaft 199, there are provided the usual Underwood ribbon-feeding pawl 212 and check-pawl 213, which cooperate with a ratchet-wheel 214 fastened to said shaft 199. Said pawls are at the inner side of the typewriter-frame right side member 125 and are mounted on a short spindle 215, journaled in said side member (see Figure 2). Said spindle may be rocked, at each type-key-lever stroke, by means of an extension 216 of the arm 141, which is caused to be actuated at each stroke, by the universal bar 137 to work the pallet-frame 90. To enable said extension 216 to rock the ribbon-feeding-pawl spindle, there is fastened at the end of said spindle an arm 217 having a suitably-formed edge engaged by the corresponding edge of said extension. Said edges are kept in contact by a spring 218. In order that the ribbon-feeding shaft 199 may be conveniently shifted manually, it is extended beyond the spring-motor 88, as shown in Figure 6, and has a finger-knob 219. The ribbon-feeding shaft 199 is journaled in brackets 220, which are supported by the cross-bar 99, in which the power-levers 79 are fulcrumed. One of the pinions 200 on said shaft has a portion 221, which is part of the usual detent-device, whereby either one of the pinions 200 is definitely located with respect to the corresponding pinion 201. Co-operating with said portion 221 is the usual lever 177, which, in the present invention is formed as shown in Figures 6 and 7, and is pivotally mounted on an abutment 174 of said cross-bar 99.

A feature of the invention is the novel construction of the power-drum 76, whereby lightness and economy in manufacturing cost are attained. To this end, the power-drum is made of separate stampings 223, as shown in Figure 25. Said stampings have tongue-and-slot formations 224, whereby the stampings, when assembled to form the power-drum, are fastened together. Each stamping 223 includes a portion constituting a cam-face 77, as shown in Figure 25. To further conduce to lightness of the power-drum, each stamping 223 may have openings 225, indicated by the broken lines on one of the stampings (see Figure 25). For supporting the assembled stampings on the power-drum-shaft 92, there is at either end of said assembled stampings a hub 226 having a flange 227. In said flange 227 are slots 228 that interlock with corresponding tongues 229 formed on the ends of the stampings 223, and thus the assembled stampings may be supported by the hubs 226 on the shaft 92. To secure the assembly of the stampings 223 and the hubs 226 all the outer edges of the tongues may be peened into the corresponding slots.

Means for returning the carriage by power include a rack 230 extending longitudinally of the carriage, as shown in Figure 5, and a pinion 231 in mesh with the rack. The pinion

231 has clutch-teeth 232, whereby it may be driven and which may coact for this purpose with similar teeth in a driving clutch-member 233. The clutch-member 233 is mounted on a driving shaft 234 and is frictionally connected thereto by a friction coupling, generally indicated by the number 235. In said friction coupling, as shown in Figure 1, a spring 191 has say, four prongs radiating from a hub 196 keyed to the shaft 234 and to which hub said spring is fastened. Said spring is keyed to a disk 196^b which is frictionally connected to a flange 196^a of the clutch-member 233 by an intermediate disk 206 of friction material. A collar 206^a serves to take up the thrust upon the clutch-member, due to said spring 191. The carriage-return pinion 231 is mounted on a forward portion of the shaft 234, and is slidable along said portion, so that its teeth 232 may move into and out of engagement with the similar teeth of the clutch-member 233. Normally, said carriage-return pinion is in such position that its clutch-teeth are disengaged from the clutch-member 233, and the carriage is free to move in either direction independently of said clutch-member 233. For moving the pinion 231 into and out of engagement with the clutch-member 233, there is the usual arm 236 mounted upon a rock-shaft 237 and having at its end a roll 238 that engages a groove 239 of the pinion 231 for the purpose of enabling said arm 236 to move the pinion 231 back and forth. The rock-shaft 237 connects said arm 236, which is in the interior portion of the typewriter, with an arm 240 at the right side of the typewriter, said arm 240 forming part of the linkage, whereby the pinion is withdrawn from the clutch-member 233 when the carriage has been fully returned.

Means for holding the carriage-return pinion 231 disengaged from the clutch-member 233 and for causing said pinion 231 to move into engagement when the carriage is to be returned, include a latch-bar 242 (see Figure 3) located at the left side of the typewriter and urged rearwardly and endwise by a spring 243. Normally restraining the rearward movement of the latch-bar 242 is a latch-plate 244 fastened to the left side of the typewriter. By raising the forward end of the latch-bar 242, said bar is released from the latch-plate 244, and under the influence of the spring 243 has a rearward movement, which, as will be shown, is effective to cause the engagement of the carriage-return pinion 231 and the clutch-member 233. For thus raising the forward end of the latch-bar 242, there is provided the usual key-lever 245 pivoted to the left side of the typewriter at 246 and having a carriage-return key 247. When the key 247 is depressed the end of an upward-extending arm 248 of said lever raises the end of the latch-bar as the end of said arm 248 overrides the usual bypass member 249

pivoted at the end of the latch-bar 242. Simultaneously with the release of the latch-bar 242 an electric motor circuit is closed through switch-contacts 251 and an electric motor 252 is started to rotate the shaft 234 by means which will presently be described. The carriage continues in the ensuing return movement until the usual tappet 253 thereon (see Figure 2) encounters the cam-face of the usual dog 254. Displacement of the dog 254 by said tappet is effective to rock the splined shaft 255 whereon said dog is mounted. Said dog is movable along said shaft 255 to any predetermined position with the right shiftable carriage-stop 256. The rocking of the shaft 255 by means of the tappet and dog is used to cause the disengagement of the pinion 231 from the clutch-member 233. For this purpose there is at the outer end of the shaft 255, an arm 257, which is connected to the arm 240 by the usual links 258 and 259. By means of the rock-shaft 237 on which the arm 240 is mounted, there is caused a carriage-return pinion-disengaging movement of arm 236 at the other end of said rock-shaft 237 when the dog 254 and rock-shaft 255 are displaced as the carriage reaches the end of its return movement. Simultaneously with the disengagement of the carriage-return pinion 231, the latch-bar 242 is caused to be retracted and is caught and held again by the plate 244. The retraction of the latch-bar 242 also breaks the circuit to the electric motor by opening the switch contacts 251 in the usual manner. The carriage-return means, so far specifically described, are of the type shown in the aforementioned pending application of Alfred G. F. Kurowski, No. 41,507, filed July 6, 1925. As shown in said application the carriage-return rack 230 has an endwise movement relatively of the carriage before said rack picks said carriage up. The rack is supported and guided by means of brackets 261, and lateral projections 262 extending from the inward side of the rack said projections having elongate slots, through which pass screws 263 whereby the rack 230 is supported by said brackets 261. The endwise movement of the rack 230, before said racks picks up the carriage, is for the purpose of line-spacing the platen, and to transmit this movement to the usual platen-spacing member at the side of the typewriter-carriage there are provided the usual means fully described in the aforesaid application of Kurowski, and herein generally indicated by the number 265.

It being the purpose of the invention to provide means whereby the motor 252 is enabled to either operate the carriage-return mechanism or to rewind the spring-motor 88, there will now be discussed in detail some of the features of the invention relating to said spring-motor. As shown in the aforementioned U. S. patent to Pitman, No. 130

1,417,106, dated May 23, 1922, the spring-motor consists of a plurality of helical windings 266 concentrically arranged and forming a continuous coil terminating in an outer end 267 and an inner end 268. On account of the comparatively great length of wire in the coil, a large amount of energy can be stored therein by "winding" it, and a large amount of energy may be withdrawn before the potential power of the coil is decreased to an extent requiring rewinding. As shown in Figure 4, the inner end of the coil is connected to a bevel gear 269 at one end of the coil, and the outer end of the coil is connected to another bevel gear 270 at the other end of the coil. A tube 271 loosely fits shoulders formed on the backs of said gears and encloses the coil. The gears 269 and 270 are loose on a spindle 272, whereby the assembled spring-motor may be supported. In accordance with the preferred disposition of the mechanism whereby the spring-motor may be rewound, said spring-motor is placed along the lower right side of the typewriter, as shown in Figures 2 and 9. In this position the gear 270 at the front end of the spring-motor meshes with the power-drum shaft pinion 126. The gear 269 at the rear end is rotatable to wind the spring-motor. For supporting the spring-motor in position there is fastened to the right column of the typewriter-frame a bracket 274, which receives the forward end of the spring-motor spindle 272. The rear end of the spring-motor is supported by a bearing 275, in which rests the rear end of the spindle 272. Said bearing 275 is a portion of a fixture generally indicated by the number 276 and fastened to the rear member 125^a of the typewriter-frame 41 by screws 277. Said fixture 276 supports a shaft 278 that extends horizontally and parallel to the rear side of the typewriter, and forms part of the means that automatically register the need for rewinding the spring-motor. Said shaft has at its right end a pinion 279 meshing with the spring-motor bevel gear 269, and at the other end there is formed a screw 280. An elongate helical pinion 281 is threaded on said screw, and may rotate the rear shaft 278 to wind the spring-motor through the medium of a helical spring 282, one end of said spring being attached to a shoulder 283 formed on the helical pinion 281, and the other end of said spring being attached to a collar 284, fastened to the shaft 278. Rotation of the shaft 278 turns the gear 269 by means of the pinion 279 at the right end of said shaft. As the spring-motor gear 269 is being rotated to wind the spring-motor coil, rotation of the gear 270 at the front end of the spring-motor is prevented by the aforementioned pallet-frame 90, which holds the escapement-wheel 91 on the power-drum shaft and consequently holds said gear 270, which meshes with the

pinion 126 on said power-drum shaft. As the helical pinion 281 is rotated to wind the spring-motor, there is produced in the helical spring 282 a twist, which is occasioned by the resistance to winding afforded by the coil of the spring-motor. In consequence of the twisting of said helical spring 282, there is a relative rotation between the screw 280 and said pinion 281 thereon, causing the pinion to move longitudinally of the screw as the spring-motor is being wound. As will be shown, the longitudinal movement of the pinion 281, as it reaches a predetermined limit, is used to actuate means for causing the rewinding of the spring-motor to be checked when it has become fully rewound. With the pinion 281 held against counter rotation in a manner to be shown, the unwinding of the spring-motor through use thereof, causes the helical pinion 281 to move longitudinally of its screw in an opposite direction. As this opposite movement reaches a predetermined limit other means to be described are actuated to start the rewinding of the spring-motor. The horizontal spring-motor-rewinding shaft 278 and the pinion 281 thereon are located, as shown, to permit a vertical rewinding shaft 285, extending downwardly from driving mechanism, to be readily connected to said shaft 278 by means of a helical pinion 286, which meshes with the helical pinion 281. It will be noted that by inclining the teeth of the pinion 281, the movement of the pinion 281 along the shaft 278 is facilitated and becomes more sensitively responsive to the condition of the spring-motor. The lower end of said shaft 285 is journaled in a bearing 287, formed in the fixture 276, which supports the horizontal shaft 278.

The horizontal carriage-return shaft 234, on which is the clutch-member 233 for driving the carriage-return pinion 231, is in its usual position. The vertical shaft 285, rotatable to rewind the spring-motor 88, is in such position relatively to the carriage-return shaft 234 that either shaft may be driven by the motor 252 through differential, planetary gearing, the axis of which coincides with the axis of said carriage-return shaft 234. Said gearing consists of a spider 290, on which are mounted three planetary pinions 291, an outer annular gear 292, and an inner spur-gear 293. The planetary pinions rotate on studs 289, and mesh with the outer and inner gears 292 and 293, respectively.

The spider 290, with its planetary pinions, is chosen as the driving member of the planetary gearing, and is therefore connected to the motor 252 by means of a worm-wheel 294 and a worm 295, which meshes with said worm-wheel and which is keyed to a shaft 296 coaxial with and coupled to the motor-shaft, as shown in the aforesaid application of Kurowski. As in said application, the motor 252 is mounted upon a driving-mech-

anism fixture, generally indicated by the number 297, which includes a plate 298 and a housing 299 for the worm and worm-wheel. As shown in Figures 2 and 5, said fixture is attached to the typewriter with the plate 298 close to the rear side of the typewriter, and separated therefrom by spacers 300, which constitute a three-point bearing for said fixture. Screws 301 passing through said plate and spacers and threaded into the rear side of said typewriter secure said fixture.

The worm-wheel 294 is not keyed to the carriage-return shaft 234, but is rotatable thereon. For retaining the usual lubricant, the worm-wheel and worm are enclosed by the housing 299, and one side of another housing 318 that serves to enclose the differential gearing. As shown in Figure 1, a hub 302 of the work-wheel is journaled in said side of the differential gear-housing, and projects through said side and into said housing, so that the planetary pinion spider 290 therein may be threaded upon a shoulder 303 at the end of said hub and be thus connected to the worm-wheel. In order that it may drive the carriage-return shaft 234, the inner spur-gear 293 of the planetary gearing is keyed to said shaft, as indicated in Figure 1. The outer annular gear 292 is mounted concentrically with said pinion by means of a disk 304, to which it is fastened by rivets 305. Said disk has a hub 306, whereby it rotates freely on the shaft 234 which is extended into the differential gear-housing 318. Said disk has projections 307, which are engageable to prevent rotation of said annular gear 292, and thereby cause, when the spider is rotated, rotation of the inner spur-gear 293 to return the typewriter-carriage. A similar disk 308 is keyed to the shaft 234, to which is also keyed the spur-gear 293, and has similar projections 307^a engageable to prevent rotation of the inner spur-gear and thereby cause, when the spider is rotated, rotation of the outer annular-gear to rewind the spring-motor.

For rotating the vertical shaft 285, whereby said spring-motor is rewound, there are formed on the outer periphery of said annular gear helical gear-teeth 309, which mesh with a pinion 310 that is at the upper end portion of said shaft, journaled in an adjacent top wall 311 of the differential gear-housing 318. Said end portion projects upwardly through said top wall, to receive a device that checks reverse rotation of the shaft 285 by the spring-motor when rewinding is not in progress. Said device is of the type shown in the aforesaid patent to Pitman, and includes a gear 312 (Figure 9) fastened to said shaft, a pinion 313 meshing therewith and rotating on a stud 314 in said top wall of the differential gear-housing. Another pinion 315 also meshes with the

gear 312, and, being mounted on an arm 316 rotatable about the shaft 285, may move into and out of mesh with the pinion 313. There is initially just enough reverse rotation of the shaft 285, at the moment rewinding ceases, to cause the pinion 315 to be dragged into mesh with the pinion 313. Said pinions 313 and 315, when in mesh, interlock with the gear 312, to check reverse rotation of the shaft 285. At the start of spring-winding rotation of said shaft, the pinion 315 is caused to be dragged away from the pinion 313, the extent of separation of said pinions being limited by a stop 317, against which the arm 316 abuts when the pinions are sufficiently separated to permit the spring-rewinding rotation of the shaft. The arm 316 may be frictionally connected to either the gear 312 or the shaft 285, to facilitate movement of the pinion 315 into and out of mesh with the pinion 313.

The differential gear-housing 318 is secured to the worm-gear-housing 299 by screws 319, which pass through holes 320 in the worm-gear-housing, and are threaded into holes 321 in the differential gear-housing, said holes being best shown in Figure 26, which include perspective views of both housings, showing details of their construction. The recess 322 in the worm-gear-housing 299 is for the worm 295 the shaft 296 of which is journaled in bearing holes 329. A removable cover 323 forms a rear wall for the planetary gear-housing. The rear end of the extended carriage-return shaft 234 is journaled in said cover, which, as will be shown, also serves to support means for controlling the planetary gearing. To facilitate access to said gearing and its controlling means, said cover may have openings indicated by the broken lines 324 in Figure 26, and may be secured in position by screws 325 passing through holes 326 therein and threaded into holes 327 in the planetary gear-housing.

The motor 252 is secured to the driving mechanism fixture 297, one side of said motor being against the rear surface of the plate 298 of said fixture, and another side of the motor bearing against the surface 330 formed at right angles to the plate. The motor is secured by screws 328. For supporting the rock-shaft 237, which connects the carriage-return pinion-shifting arm 236 with the carriage-return pinion-releasing arm 240, there are formed upon the plate 298 forwardly-extending projections 332 and 333. The projection 332 is, as shown in Figures 2 and 9, at the right, outside of the typewriter-frame. The projection 333 extends into the interior of the typewriter, and, viewed from the top of the typewriter, as in Figure 9, is a little to the right of and below the carriage-return shaft 234. Said projection 333 has fastened thereto a bracket 334, which supports the

inner end of the carriage-return shaft. The planetary gear-housing 318 has formed in its inner wall a depression 335 to clear the pinion 310 that meshes with the outer annular gear 292.

When the spring-motor requires rewinding, the inner spur-gear 293 is to be held to enable the motor 252, through the differential gearing of which said spur-gear is a member, to effect said rewinding. For engaging the projections 307^a of the disk 308, and thereby holding said disk and said spur-gear 293, to which said disk is connected, there is provided (see Figures 10 and 11) an arm 337, having a projection-engaging roll 338 on the end thereof. Said arm 337 may move said roll into and out of the path of the projections 307^a, and is, for this purpose, loosely fulcrumed on a rod 339 journaled in the inner wall of the planetary gear-housing 318, and the cover 323 of said housing. The arm 337 is constantly urged into engagement with the disk 308 by a spring 340, one end of which is attached to said arm, the other end of said spring being attached to a stud 341, projecting from the inner surface of the planetary gear-housing-cover 323. The rod 339 is also rotatable to withdraw the arm 337 from the disk 308, and has fastened thereon for this purpose an arm-holding member 342 that normally holds the arm 337 disengaged from its disk 308. As best shown in Figure 23, the member 342 is adjacent the arm 337, which it engages by means of a pin 343 projecting from said arm 337. The arm-holding member 342 is in turn normally held by a latch 344, against the pull of a spring 345, one end of which is attached to said member, the other end being attached to a stud 346, also projecting from the inner surface of the planetary gear-housing-cover 323. Thus, by means of the latch 344 and the arm-holding member 342, the arm 337 is normally withheld from engagement with the disk 308. The latch 344, with other members to be described, is pivoted upon a stud 348, which is secured to the inner surface of a downwardly-projecting spur 349 of the planetary gear-housing-cover 323, by a nut 350. The reason for not fastening the arm 337 directly to the rod 339, and thus having the latch 344 coact directly with said arm 337 is because it may happen that when the latch is released the roll 338 might abut the outer edge of one of the projections 307^a, as in Figure 15. In this case, the movement of the arm 337 would be checked, and could not be used to effect the closing of a circuit, to start the electric motor simultaneously with the tripping of the latch 344. The arm 337 is therefore loosely mounted upon the rod 339, which may rotate freely as soon as the latch 344 is withdrawn from the member 342, keyed to said rod and pulled by the spring 345.

To enable the rotation of the rod 339 when

the latch 344 is withdrawn to close a circuit for starting the motor, said rod is extended inwardly toward the typewriter and beyond the planetary gear-housing 318, and has fastened at the end of the extension an arm 351. A switch-box 353, located at the back of the typewriter, has a motor-circuit-closing device including contacts 354, which, upon permitting movement of a spring-pressed arm 355, on which one of the contacts is mounted, are brought together and close a circuit to start the motor. The spring-pressed arm 355 is normally held by a bar 356, so that the contacts 354 are separated, one end of said bar engaging said spring-pressed contact-arm 355, the other end being pivotally connected to the arm 351 that is on the rod 339. Said arm 351 and bar 356 are so proportioned and adjusted that the contacts 354 are open when the arm 337 is disengaged from the disk 308. When the latch 344 is withdrawn, rotation of the rod 339 under the influence of the spring 345 occurs, and is effective, by the means just described, to close the contacts 354 to start the motor. Simultaneously, the arm 337 moves into engagement, so that the roll 338 on said arm intercepts one of the projections 307^a of the disk 308, and thereby prevents rotation of the inner spur-gear 293 of the planetary gearing. The spider 290, driven by the motor, rotates and drives the annular gear 292 as the inner spur-gear is thus held. Rotation of said annular gear 292 is, as already explained, effective to rewind the spring-motor 88, and is started, in the manner just described, when the spring-motor has become run down.

As already explained, the helical pinion 281 moves along the screw 280 of the shaft on which it is mounted as the spring-motor becomes unwound through use. Said helical pinion 281 also moves along said screw in an opposite direction as the spring-motor becomes wound. The direction of the thread of the screw 280, of the helix of the spring 282, and the direction of rotation of the pinion 281, when winding the spring-motor, are so chosen that as the spring-motor becomes unwound the pinion 281, substantially held against counter-rotation, moves, as viewed in Figure 10 and other figures showing similar views, from right to left. The limit of said movement is reached when the spring-motor is in such a state as to require rewinding, and, as the pinion reaches said limit, it will have moved far enough to cause an arm 358 constrained, as will be shown, to move with the pinion, to withdraw the latch 344 from the arm-holding member 342. For engagement with the end of said arm 358, which trips it, the latch 344 has a downwardly-projecting portion 359. The latch-tripping arm 358 connected to another member, to be described, swings about a stud 360, which may project

from a downwardly-extending lug 361 of the fixture 276 that supports the helical pinion 281 and the shaft 278 on which it is threaded.

For rotating the rod 339 and arm 342, and thereby withdrawing the arm 337 and causing the contacts 354 to be opened when the rewinding is to be terminated, there are provided means, which becomes effective when the spring-motor 88 has become fully rewound. The previously-described means that are caused to be actuated when the spring-motor requires rewinding, are best shown in Figure 11. In Figure 12 are shown the means, now to be described, that become effective and are actuated when the rewinding is to be terminated. The need for termination of the rewinding of the spring-motor is automatically registered by the helical pinion 281 as said pinion, moving along the screw 280, reaches a predetermined position, the movement of said pinion along the screw occurring during the rewinding of the spring-motor. The power behind the movement of said pinion 281 along the screw is not positive enough to withdraw the arm 337 from the disk 308, and thereby terminate the rewinding of the spring-motor. It is provided therefore that the movement of the pinion 281 need only present an interponent against which suitable mechanism, whereby the arm 337 may be positively withdrawn, may react for becoming conditioned so as to be effective. For positively withdrawing the arm, there is provided what may be called a rewinding checking arm 362, which is loosely mounted on the rod 339, and has at its end a cam-portion 363, so positioned that said arm may be displaced by a cam-roll 364, which, for the purpose of being positively driven, and thus positively actuating the arm 362, is mounted on the planetary pinion spider 290. The roll 364 overrides the cam-shaped portion 363 of the arm 362 once in every revolution of the planetary pinion spider 290. When not engaged by said roll 364 as in Figure 21, the arm 362 is pulled against a stop 365, which projects from the inner wall of the planetary gear-housing 318. Holding said arm 362 against said stop 365 is a spring 366, one end of which is attached to said arm, the other end being attached to a stud 367, also projecting from the inner wall of the planetary gear-housing. Thus, under the influence of the spring 366 and the cam-roll 364, the arm 362 vibrates up and down about the rod 339 whenever the planetary pinion spider 290 is rotated. The downward movement of the rewind checking arm 362, being positively driven by means of the cam-roll 364, is effective to positively rotate the rod 339 to effect the withdrawal of the arm 337 from the disk 308. To enable the rewind checking arm 362 to positively rotate the rod 339, there is fastened to said rod an arm 368, which may be engaged by a dog 369, when said dog is released from a latch

370, which normally holds it in the position shown in Figure 12, the dog 369 and latch 370 formed, being pivotally mounted upon the rewind checking arm 362.

The latch 370 is caused to be moved to release the dog 369 when the spring-motor has become fully rewound, this condition of the spring-motor being automatically registered, as already explained, by the pinion 281, as it reaches a predetermined position in its endwise movement which accompanies the rewinding of the spring-motor. As it reaches said position, it will have caused an interponent in the form of a projection 371 on a sector 372 to have moved under a roll 373, which vibrates up and down with the arm 362. The purpose of the roll 373 is to afford means, connected to the latch 370, which react against the projection 371 as the rewind checking arm 362 moves downwardly, and thus translate the downward movement of said arm 362 into a displacement of the latch 370, for the purpose of releasing the dog 369. For supporting the roll 373 and connecting it to the latch 370, it is mounted upon an arm 374, which is connected to the latch 370 by a link 375. Said arm 374 and a bell-crank 376, to be described, are pivotally mounted on a stud 377, which may project from the inner surface of a downwardly-extending spur 378 of the planetary gear-housing 318. With the rod 339 and the arm 368 thereon rotated into a position corresponding to the engagement of the arm 337 with the disk 308, the first effect of the release of the dog 369, as the latch 370 is displaced by a downward stroke of the arm 362, is as shown in Figure 20, from which said arm 337 and disk 308 are omitted. In the succeeding upward stroke of the arm 362 under the influence of the spring 366, the dog 369 snaps into position, as shown in Figure 21. In said position the dog and the rewind checking arm 362 are effective in the next downward stroke of said arm to push against the arm 368 of the rod 339, and thereby rotate said rod to withdraw the arm 337, also on said rod, from the disk 308. In this case the member 342 will be caught and held again by the latch 344, as indicated in Figure 22, and, as also indicated in said latter figure, the contacts 354 will also have been opened to open the motor-circuit, and the motor will thereby have been stopped.

The dog 369 is withdrawn from the arm 368, which it has pushed to rotate the rod 339 and relatched before the spring-motor becomes fully run down again, so that the rod 339 and its attachments may be rotated the other way again when the spring-motor requires rewinding. For this purpose, the endwise movement of the pinion 281 accompanying the unwinding of the spring-motor, is used, and, as the pinion in said endwise movement reaches a predetermined position,

it will have caused another interponent, in the form of a ridge 379 on the sector 372, to have moved under a roll 380, which is on the bell-crank 376. As the ridge 379 moves under said roll, it displaces said roll upwardly, and thereby rotates the bell-crank about its pivot 377 to an extent sufficient to cause the withdrawal of the dog 369 from the arm 368 and permit the latch 370 to fall into position again to hold said dog. To enable it to withdraw the dog 369, the bell-crank 376 is connected thereto by a link 381. The dog 369 and its latch 370 are spring-pressed by a common spring 382. The point of attachment of the link 381 to the dog 369 is in such position relatively to the point of attachment of said link to the bell-crank 376 that there is very little movement of said bell-crank as the rewind checking arm 362 moves up and down. In order that the helical pinion 281 on the screw 280 may move the interponent sector 372 and the latch-tripping arm 358, as said pinion moves back and forth along said screw, there is formed on said pinion, a circumferential groove 383, which engages a pin 384 projecting from the sector 372. In order that said arm 358, as well as said sector may be moved, they are joined, as shown in Figure 1, by a hub 385. The arm 358 and sector 372, joined by said hub, swing about the previously-mentioned stud 360.

For holding the outer annular gear 292, so that the inner spur-gear 293 may rotate and return the typewriter-carriage, there are provided means controlled by the carriage-return key 247. The annular gear 292 is held by interposing the end of an arm 387 into the path of projections 307 of the disk 304, which is fastened to said annular-gear 292. The end of said arm 387, like the end of the arm 337, has a roll 388, the rolls on the ends of said arms being for the purpose of reducing the friction attending the withdrawal of said arms from the projections of their respective disks. For guiding the arm 387 in its movement toward and away from the disk 304, it is pivoted at 389 upon a beam 390, which is loosely mounted upon the rod 339, upon which, as already explained, the arm 337, arm-holding member 342, etc. are mounted. A spring 391, attached to a spur 386 of the arm, serves to urge the arm 387 toward its disk 304 and to hold the beam 390 against a stop 392, which projects from the inner wall of the planetary gear-housing 318.

The beam 390 is rotatable about the rod 339 for the purpose of withdrawing the arm 337 should said arm be engaged in holding the inner spur-gear when the typewriter-carriage is to be returned. In such case the beam 390 has a movement imparted to it by the arm 387 pivoted at the end of said beam, as said arm is moved endwise by the initial rotation of the disk 304, as said arm en-

gages said disk to hold the annular gear 292 when the carriage is to be returned. To enable the movement of the beam 390 to withdraw the arm 337 and the arm-holding member 342, which holds said arm 337, there projects from the side of the beam 390 a pin 394, which engages the upper edges of said arm 337 and arm-holding member 342.

For normally withholding the arm 387 from the disk 304, and also for withdrawing said arm from said disk when the carriage-return movement is terminated, there is provided a three-armed lever 395, which may be pivoted upon a stud 396, projecting from a downwardly-extending spur 397 of the inner wall of the planetary gear-housing 318. (See Figure 26.) Said stud 396 has a reduced portion 398, which receives the lever 395, and the other end of the stud is supported by a downwardly-extending spur 399 of the planetary gear-housing-cover 323. For withholding or withdrawing the arm 387 from the disk 304, the lever 395 has an arm 400 formed to engage an edge of said arm 387, as shown, for example, in Figure 13. By means, which will now be described, the lever 395 is positively moved to withdraw the arm 387 from the disk 304 as the typewriter-carriage reaches the end of its return movement. As already explained, the termination of the carriage-return movement causes, by means of the tappet 253 on the carriage, actuation of linkage including the rock-shaft 237 for withdrawing the carriage-return pinion 231 from the clutch-member 233. Said rock-shaft 237 is also caused to be rocked when the carriage-return key 247 is depressed, as already explained. As shown in Figure 16, the depression of said key 247 causes the engagement of the carriage-return pinion 231 with the clutch-member 233, said engagement being effected by the rearward movement of the latch-bar 242 as said latch-bar is released from the holding plate 244. In order that the rearward and endwise movement of the latch-bar 242, as the carriage-return key 247 is depressed, may cause the arm 387 to engage the disk 304 to hold the outer annular gear 292, there are provided connecting means between said latch-bar 242 and said arm 387. Besides the lever 395, said connecting means include an arm 401 mounted on a rock-shaft 402, which extends horizontally and parallel to the rear side of the typewriter, so that one end of said rock-shaft is above the rear end of the latch-bar 242, and the other end is opposite an arm 403 of the lever 395. A downwardly-extending arm 404 has pivotally connected to its end the end of the latch-bar 242 and is fastened to said rock-shaft 402. At the latch-bar end said rock-shaft is journaled in a bracket 405 fastened to the rear of the typewriter. Near the other end, said rock-shaft is journaled

in a bracket 406 fastened to the outer surface of the plate 298 that forms part of the driving-mechanism fixture 297. For connecting the rock-shaft 402 with the rock-shaft 237, on which the carriage-return pinion-shifting arm 236 is mounted, there is fastened to the rock-shaft 402 an inwardly-extending arm 407, having a bifurcated end which engages a pin 408 in the end of an arm 409 extending from the carriage-return pinion-shifting arm 236. By means of the arms 407 and 409, movement of the rock-shaft 402, as the latch-bar 242 is released, is transmitted to the rock-shaft 237 to cause the engagement of the carriage-return pinion 231 with the clutch-member 233. Conversely, by means of said arms 407 and 409, the positive movement of the rock-shaft 237, which said rock-shaft receives as the carriage-return movement is terminated, is imparted to the rock-shaft 402, and, by means of the arm 401 mounted on said rock-shaft 402 which engages the arm 403 of the lever 395, said lever 395 is positively actuated to positively withdraw the arm 387 from its disk 304 which is connected to the annular gear 292.

In order that the endwise movement of the latch-bar 242, controlled by the carriage-return key, may open and close the switch-contacts 251 to start the electric motor 252, there is fastened to the rock-shaft 402 at the rear of the typewriter an arm 410. Said arm 410 is so formed that it reaches into an opening 411 of the switch-box 353 to control a spring-pressed arm 412, on which one of the contacts 251 is mounted, said arm being pivotally mounted to permit the engagement with, or the disengagement of, said one contact from the other contact, which is mounted on a bar 413 in the switch-box. Said bar 413 also carries the fixed contact of the pair of contacts 354. The other one of said contacts 354, as already mentioned, is mounted on the spring-pressed arm 355 controlled by the spring-motor-winding mechanism. The latter spring-pressed arm 355 is also pivotally mounted, both spring-pressed arms 355 and 412 being pivotally mounted on a bar 414 in the switch-box 353. One of the motor-terminals is connected, as shown in Figure 10, to the bar 414. The other motor-terminal is connected to a bar 415, also in said switch-box. Each bar 413 and 415 has a terminal 416, by means of which connection to the power-line may be made in the usual manner. On each spring-pressed contact-arm 355 and 412 there is a current insulated stud 417, whereby said arms are engaged. The bars 413, 414 and 415 are mounted upon an insulating block 418 in the switch-box.

For preventing engagement of the arm 337 with its annular gear-holding disk 308, when the carriage-return mechanism is engaged, there is provided a check 419, which

is caused to hold the member 342 as soon as the carriage-return mechanism is engaged. Said check 419 is conveniently mounted on the same stud 348 that holds the latch 344. The lever 395, controlled by the engagement and disengagement of the carriage-return mechanism, in turn controls the check 419, and has for this purpose, an arm 420 formed to engage an extension 421 of the check 419. Normally, when the lever 395 withholds the arm 387 from its annular gear-housing disk 304, said lever also holds the check 419 from the member 342, as shown, for example, in Figures 10 and 11. Engagement of the carriage-return mechanism causes the arm 401 to be withdrawn from the arm 403 of the lever 395, and thereby permits the arm 387 to engage its holding disk 304, the movement of said arm 387 toward its disk being effected by the pull of the spring 391. The withdrawal of said arm 401, as the carriage-return mechanism is engaged, also permits the check 419 to engage the member 342, as shown in Figure 18, said figure also showing the arm 387 engaged to hold the disk 304. One reason for providing the check 419 to hold the member 342 when the carriage-return mechanism is engaged, is that the latch 344 may be in such position, as shown, for example, in Figure 17, that said member 342 is about to be released from said latch 344. It is obvious that a slight jar might in this case cause the release of the member 342 when the carriage-return mechanism is being operated.

Should rewinding of the spring-motor be in progress when the carriage-return mechanism is engaged, or in other words, should the arm 337 be in position to hold its disk 308, the beam 390 becomes effective to withdraw the arm 337, so that the carriage may be returned. In this manner, the carriage-return function of the planetary gearing dominates and takes precedence over the spring-motor-rewinding function of said gearing, so that the use of the typewriter may proceed at all times without interruption. As shown in Figure 19, the beam 390 has been caused to move to withdraw the arm 337 and member 342 by the initial rotation of the disk 304, which in turn has caused an endwise movement of the arm 387. The endwise movement of said arm 387 is limited by said beam striking against the stud 396, on which the lever 395 is mounted. It is obvious that the beam 390, as it moves to withdraw the arm 337 and member 342, may overthrow said arm and member and cause the member 342 to be caught and held by its latch 344. If said arm 337 and member 342 are thus overthrown and caught, resumption of the spring-motor-rewinding operation, when the carriage-return operation is terminated, is prevented. To prevent overthrow of the arm 337 and member 342, there is provided a finger 422, which is caused to be presented under the latching extension 423 of the

member 342 when the carriage-return mechanism is engaged. Said finger is caused to be withdrawn from said member 342 when the carriage-return mechanism is disengaged.

Control of the finger 422 may be thus effected by means of the same arm 420 of the lever 395 which controls the check 419. The finger 422 has an extension 424, which is engaged by the end of said arm 420. Said arm 420 has its end 420^a made wide enough to control both the check 419 and the finger 422. When the arm 420 is withdrawn, the finger 422 is pressed toward the member 342 by a spring 425, shown in Figure 24. One end of said spring is retained in a slot 426 formed in the head of the stud 348, on which said finger 422 is mounted, and the other end of the spring engages a stud 427, projecting from the side of said finger. The latch 344 and the check 419 are pressed toward the member 342 by a common spring 428, which serves both the check and the latch, as indicated in Figure 24. Another reason for providing the check 419 to prevent engagement of the arm 337 with its disk 308, is that the spring-motor may afford enough reaction to hold the annular gear 292 while the typewriter-carriage is being returned. In this case, it is obvious that there would be no movement of the beam 390, and consequently said beam would be ineffective to prevent engagement of the arm 337. It will be understood that the beam, however, would move in this case should the arm 337 become engaged, and would thereupon operate to withdraw said arm, and it will be further understood that the check 419 is provided to prevent undue engagement of the arm 337 without having undesirable recourse to the movement of the beam 390.

Assuming that the spring-motor-rewinding function of the planetary gearing is not in progress, the operation of the mechanism, when the carriage-return key 247 is depressed, is as follows. Depression of the key causes the lever 245, on which it is mounted, to release the latch-bar 242, as shown in Figure 16. Said latch-bar is pulled endwise and rearwardly by the spring 243. This rearward and endwise movement of the latch-bar is used to shift the carriage-return pinion 231 into engagement with the driving clutch-member 233, to close a circuit through the contacts 251 to start the motor 252, and to cause the outer annular gear 292 of the differential gearing to be held by the arm 387, so that the inner spur-gear 293 may rotate as the planetary pinion spider 290 is driven by the motor. All these functions, resulting from the depression of the carriage-return key 247, are effected by means of the rotation of the rock-shaft 402, extending along the rear of the typewriter, and the various arms mounted on said rock-shaft, the rotation of said rock-shaft being derived from the rearward and endwise movement of the latch-bar 242. A reverse rotation

of the rock-shaft 402 takes place when the typewriter-carriage reaches the end of its return movement, and is effected as the tappet 253 on said carriage positively actuates the linkage including the rock-shaft 237, which is connected to the rock-shaft 402 in the manner already described. Said reverse rotation causes the restoration of the latch-bar 242, separation of the contacts 251, and withdrawal of the arm 387 from the disk 304. Should the spring-motor-rewinding function of the planetary gearing be in progress when the carriage-return key 247 is depressed, the endwise movement of the arm 387, and consequent rotation of the beam 390 cause the spring-motor-rewinding function to be suspended, in the manner stated, until the typewriter-carriage has returned, after which the rewinding function is automatically resumed.

The type-bar-supporting segment 63 has in its bottom portion a slot 430, which forms a clearance for the horizontal ribbon-feeding shaft 199, which would otherwise interfere with said segment. Said slot is best indicated in Figures 1 and 6. The planetary gearing and its related parts are arranged to clear the usual column of tabulating stops at the rear of the typewriter, said column of stops being generally indicated by the number 431. Said stops coact in the usual manner with stops 432 settable on the typewriter-carriage 38. The column of tabulating stops 431 is controlled by means of the usual levers 433, extending forwardly therefrom, and carrying the usual tabulating keys 434 at the front of the typewriter.

Variations may be resorted to within the scope of the invention, and portions of the improvements may be used without others.

Having thus described my invention, I claim:

1. The combination with typewriting mechanism, including types and a carriage, of a single motor for returning said carriage, a single key-controlled revolvable spring-motor for operating all of said types, and means whereby said single motor is automatically caused to rewind said spring-motor for a multiplicity of type-operations when said spring-motor has become unwound from having successively operated a multiplicity of types.

2. In a typewriting machine having types and a carriage, the combination with carriage-returning mechanism, and key-controlled type-actuating mechanism including a revolvable spring-motor for actuating said latter mechanism, of a driving motor normally at rest, means for connecting and disconnecting said driving motor to and from the carriage-returning mechanism for starting and stopping a carriage-return operation, means controlled by the condition of the spring-motor for connecting and disconnecting said driving motor to and from the spring-motor for

starting and stopping a rewinding operation, said connecting means enabling said driving motor to operate said carriage-returning mechanism and to also rewind the spring-motor when it is in run-down condition, and means whereby said driving motor is automatically started and stopped in accordance with the starting and stopping of the carriage-returning and spring-motor rewinding operations.

3. In a typewriting machine having types and a carriage, the combination with carriage-returning mechanism, and key-controlled type-actuating mechanism including a revoluble spring-motor for actuating said latter mechanism, of an electric motor normally at rest, means for connecting and disconnecting said electric motor to and from the carriage-returning mechanism for starting and stopping a carriage-return operation, means controlled by the condition of the spring-motor for connecting and disconnecting said electric motor to and from the spring-motor to start and stop a rewinding operation, said connecting means enabling said electric motor to operate said carriage-returning mechanism and to also rewind said spring-motor when it is in run-down condition, a switch-device, and means controlling said switch-device, whereby said electric motor is started and stopped in accordance with the starting and stopping of the carriage-returning and spring-motor rewinding operations.

4. In a typewriting machine having types and a movable carriage, the combination with means including a single motor for returning said carriage, of key-controlled means including a revoluble spring-motor for operating all of said types, said spring-motor having a revoluble rewinding member, and means whereby the first motor may operate said revoluble rewinding member to rewind said spring-motor for a multiplicity of type-operations.

5. In a typewriting machine having types and a movable carriage, the combination with means operable by power for returning said carriage, of key-controlled means including a revoluble spring-motor and a revoluble power-drum operated by said spring-motor for operating all of said types, a driving motor, and means whereby said driving motor is enabled to operate the carriage-return means and is also enabled to rewind said spring-motor for a multiplicity of type-operations when said spring-motor has become run down.

6. In a typewriting machine having types, a carriage and carriage-return means operable by power, the combination with key-controlled means including a revoluble spring-motor for operating all of said types, of a driving motor, a train of differential gearing driven by said driving motor and connected to said carriage-return means and to said

spring-motor, and means, effective upon said differential gear-train, whereby said second motor is enabled through said train either to rewind said spring-motor for a multiplicity of type-operations or to operate the carriage-return means.

7. In a typewriting machine having types, a carriage and carriage-return means operable by power, the combination with key-controlled means including a revoluble spring-motor for operating all of said types, of a driving motor, a train of differential gearing driven by said driving motor and connected to said carriage-return means and to said spring-motor, means effective upon the differential gear-train whereby said driving motor is enabled to actuate said carriage-return means, and means also effective upon said train whereby said driving motor is automatically caused to rewind the spring-motor for a multiplicity of type-operations and to automatically terminate said rewinding.

8. In a typewriting machine having types, a carriage, and carriage-return means operable by power, the combination with key-controlled means including a spring-motor for operating said types, of a driving motor, a train of differential gearing driven by said motor and connected to said carriage-return means and to said spring-motor, a carriage-return key, means becoming effective upon the differential gear-train through the operation of said latter key, whereby said second motor is enabled to actuate said carriage-return means, and means also effective upon said train and controlled by the tension of said spring-motor, whereby said driving motor is automatically caused to rewind the spring-motor for a multiplicity of type-operations and to automatically terminate said rewinding.

9. In a typewriting machine having types, a movable carriage and means operable by power for returning said carriage, the combination with means including a spring-motor for operating said types, of a motor, means including differential gearing whereby said second motor is enabled to either actuate said carriage-returning means or to rewind said spring-motor, and means whereby the rewinding, if in progress, is automatically suspended when the carriage is to be returned by said motor, and whereby the rewinding is thereafter automatically resumed.

10. In a typewriting machine having types and a carriage, the combination with a key-controlled revoluble spring-motor for operating said types and a carriage-return mechanism operable by power, of differential gearing including a rotatable planetary pinion-member and two gears co-operating with said member so that when either of said gears is restrained, the other gear will rotate if said member is rotated, means whereby said carriage-return mechanism may be operated by

the rotation of one of said gears, means whereby said spring-motor may be rewound for a multiplicity of type-operations by the rotation of the other gear, a motor connected to said member for rotating the latter, said motor being normally inactive, and means whereby said motor may be started and either one of said gears may be held, whichever gear is held depending upon whether the carriage-return mechanism is to be operated or the spring-motor is to be rewound.

11. In a typewriting machine having types, a movable carriage and means including a spring-motor for operating said types, the combination with differential gearing including two gears either one of which may be caused to rotate by holding the other gear, of means whereby the rotation of one of said gears moves the carriage, means whereby the rotation of the other gear rewinds the spring-motor, a motor for driving said differential gearing, means for holding the proper gear for and during a carriage movement, means for holding the other proper gear for and during the rewinding of the spring-motor, and means whereby the motor is automatically started and stopped in accordance with the operation of the last two mentioned means.

12. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, a movable carriage, carriage-returning means controlled by a key, and means for rewinding said spring-motor, of a driving motor, differential gearing driven by said driving motor and operatively connected to said carriage-returning means and to said rewinding means, means controlled by said key whereby said driving motor is started and said gearing is conditioned to operate said carriage-returning means, and means whereby said motor is automatically started and said gearing is conditioned to operate said rewinding means, said latter means automatically becoming effective when the spring-motor requires rewinding.

13. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, a carriage, carriage-returning means controlled by a key, and means for rewinding said spring-motor, of a driving motor, differential gearing driven by said driving motor and operatively connected to said carriage-returning means and said spring-winding means, a member controlled by said key and movable into position to condition said differential gearing for operating said carriage-returning means, said member being capable of a secondary movement as it conditions said gearing, a second member movable into position to condition said differential gearing for operating said rewinding means, and means whereby the secondary movement of

the key-controlled member causes the second member to be moved out of conditioning relation to said differential gearing if said second member is in said relation when the key-controlled member is moved.

14. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, a movable carriage, carriage-returning means, and means for rewinding said spring-motor, of a driving motor, differential gearing driven by said driving motor and operatively connected to said carriage-returning means and to said rewinding means, a member movable into position to condition said differential gearing for operating said carriage-returning means, a second member movable into position to condition said differential gearing for operating said rewinding means, and means whereby the movement of the second member into position to condition said differential gearing is checked and prevented when the first-mentioned member is in position to condition said gearing, said latter means being ineffective when the first-mentioned member is not in position to condition said gearing.

15. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, a movable carriage, carriage-returning means, and means for rewinding said spring-motor, of a driving motor, differential gearing whereby said driving motor may drive either said carriage-returning means or said spring-winding means, a member movable into position to condition said differential gearing for operating said carriage-returning means, said member being capable of a secondary movement as it conditions said gearing, a latch, a second member normally held by said latch and movable into position to condition said differential gearing for operating said rewinding means when released by said latch, means whereby the secondary movement of the first member causes the second member to be moved out of conditioning relation to said differential gearing if said second member is in said relation when the first member is moved, and means whereby the movement of said second member by said first member is limited to prevent said second member being caught and held by said latch.

16. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, a movable carriage, carriage-returning means, and means for rewinding said spring-motor, of a driving motor, differential gearing whereby said driving motor may drive either said carriage-returning means or said spring-winding means, a member movable into position to condition said differential gearing for operating said carriage-return-

ing means, said member being capable of a secondary movement as it conditions said gearing, a latch, a second member normally held by said latch and movable into position to condition said differential gearing for operating said rewinding means when released by said latch, means whereby the secondary movement of the first member causes the second member to be moved out of conditioning relation to said differential gearing if said second member is in said relation when the first member is moved, and means whereby the movement of said second member by said first member is limited to prevent said second member being caught and held by said latch, said last mentioned means being effective only when the first member is engaged in conditioning said gearing.

17. In a typewriting machine having a letter-feeding carriage and types operable by key-controlled means driven by a spring-motor, the combination with means for rewinding said spring-motor, means, depending on the condition of the spring-motor, for automatically registering the need to rewind said spring-motor or to terminate said rewinding, and carriage-returning means operable by power, of a single driving motor, a train of differential gearing including a driving member connected to said driving motor and also including two driven members, means for restraining either driven member, each driven member operable by the driving member while the other driven member is restrained, said driven members connected respectively to the carriage-returning means and to the spring-motor rewinding means, whereby, when the driven member connected to the rewinding means is restrained, a return of the carriage may be effected, and, when the driven member connected to the carriage-returning means is restrained, rewinding of the spring-motor may be effected, and means effective upon said restraining means whereby the restraining of the driven member connected to the carriage-returning means is automatically controlled by said registering means to thereby automatically start and stop a rewinding operation.

18. In a typewriting machine having a letter-feeding carriage and types operable by key-controlled means driven by a spring-motor, the combination with means for rewinding said spring-motor, carriage-returning mechanism operable by power and normally disconnected from said carriage to permit free carriage movement, and means whereby said carriage may be connected to said returning mechanism, of a single driving motor, a train of differential gearing including a driving member connected to said driving motor and also including two driven members, means becoming effective upon the engagement of said carriage with the carriage-returning mechanism for restraining

one of said driven members, said one driven member being connected to the rewinding means, and means for restraining the other driven member, said other driven member being connected to the carriage-returning mechanism, each driven member operable by the driving member while the other driven member is restrained to thereby effect a return of the carriage or rewinding of the spring-motor depending on which driven member is restrained.

19. In a typewriting machine having a letter-feeding carriage and types operable by key-controlled means driven by a spring-motor, the combination with means for rewinding said spring-motor, carriage-returning mechanism operable by power and normally disconnected from said carriage to permit free carriage movement, a carriage-return key, and means controlled by said key whereby said carriage may be connected to said carriage-returning mechanism, of a single driving motor, a train of differential gearing including a driving member connected to said driving motor and also including two driven members, means becoming effective upon the operation of said carriage-return key for restraining one of said driven members, said one driven member being connected to the rewinding means, and means for restraining the other driven member, said other driven member being connected to the carriage-returning mechanism, each driven member operable by the driving member while the other driven member is restrained to thereby effect a return of the carriage or rewinding of the spring-motor depending on which driven member is restrained.

20. In a typewriting machine having a letter-feeding carriage and types operated by means including a spring-motor, the combination with means for rewinding said spring-motor, and carriage-returning mechanism for said carriage, of a driving motor, differential gearing driven by said driving motor and including two gears, one gear being connected to the carriage-returning mechanism, the other gear being connected to the rewinding means, each gear being enabled and caused to rotate when the other gear is held, and means for holding either one of said gears, said latter means including projections on each of said gears and a member for each gear normally disengaged from the projections thereon, but movable to engage said projections to hold its gear.

21. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, of a driving motor, means connecting said driving motor and spring-motor whereby said driving motor may rewind said spring-motor, said connecting means being normally ineffective, a member movable into position to coact with said connecting means and thereby re-

der same effective, means positively actuated by said driving motor and capable of causing said member to be positively withdrawn, said positively-actuated means being normally ineffective to withdraw said member, and means controlled by said spring-motor for automatically rendering said positively-actuated means effective to withdraw said member when the spring-motor has become fully rewound.

22. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, of a driving motor, differential gearing, including planetary pinions, means whereby said planetary pinions are revolved by said driving motor, and two gears co-operating with said planetary pinions, means connecting one of said gears to said spring-motor, a member movable into position to cause the other gear to be held to cause rotation of the gear connected to the spring-motor for rewinding the same, reciprocating means positively operated by the planetary pinion-revolving means and capable of causing the withdrawal of the gear-holding member, said reciprocating means being normally ineffective to withdraw said member, and means controlled by said spring-motor for automatically rendering said reciprocating means effective when said spring-motor has become fully rewound.

23. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, of a driving motor, differential gearing, including planetary pinions, means whereby said planetary pinions are revolved by said driving motor and two gears co-operating with said planetary pinions, means connecting one of said gears to said spring-motor, a member movable into position to cause the other gear to be held to cause rotation of the gear connected to the spring-motor for rewinding the same, a reciprocating member driven by the planetary pinion-revolving means, a spring-pressed shiftable dog on said reciprocating member which is capable, by means of said dog, of causing the withdrawal of the gear-holding member, and a latch on said reciprocating member normally keeping said dog ineffective to cause said withdrawal, and means including an interponent controlled by said spring-motor to cause a displacement of said latch to release said dog when said spring-motor has become fully rewound, said displacement being effected by the opposition of said interponent against the movement of said latch with said reciprocating member.

24. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, of a driving motor, differential gearing, including planetary pinions, means whereby said planetary pinions are revolved by said driving motor and two gears co-operating with

said planetary pinions, means connecting one of said gears to said spring-motor, a member movable into position to cause the other gear to be held to cause rotation of the gear connected to the spring-motor for rewinding the same, a reciprocating member driven by the planetary pinion-revolving means, a spring-pressed shiftable dog on said reciprocating member which is capable, by means of said dog, of causing the withdrawal of the gear-holding member, a latch on said reciprocating member normally keeping said dog ineffective to cause said withdrawal, means including an interponent controlled by said spring-motor to cause a displacement of said latch to release said dog when said spring-motor has become fully rewound, said displacement being effected by the opposition of said interponent against the movement of said latch with said reciprocating member, and means controlled by said spring-motor for causing said dog to be relatched before the spring-motor requires rewinding.

25. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, of a driving motor, differential gearing, including planetary pinions, means whereby said planetary pinions are revolved by said driving motor and two gears co-operating with said planetary pinions, means connecting one of said gears to said spring-motor, a spring-pressed member movable into position to cause the other gear to be held to cause rotation of the gear connected to the spring-motor for rewinding said spring-motor, said other gear having projections interceptable by said spring-pressed member, a second spring-pressed member overlapping the first spring-pressed member in a manner rendering it capable to withhold said first spring-pressed member and to withdraw same when engaged, driving motor starting and stopping means operated by the movement of the second spring-pressed member, and a latch serving to release the second spring-pressed member and the first spring-pressed member when the spring-motor requires rewinding, said second spring-pressed member being independently movable to effect starting of the driving motor in case one of said projections is in position to oppose the immediate engagement of the first spring-pressed member.

26. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, of a driving motor, differential gearing, including planetary pinions, means whereby said planetary pinions are revolved by said driving motor, and two gears co-operating with said planetary pinions, means connecting one of said gears to said spring-motor, a spring-pressed member movable into position to cause the other gear to be held to

cause rotation of the gear connected to the spring-motor for rewinding said spring-motor, said other gear having projections interceptable by said spring-pressed member, a second spring-pressed member overlapping the first spring-pressed member in a manner rendering it capable to withhold said first spring-pressed member to withdraw the same when engaged, driving motor starting and stopping means operated by the movement of the second spring-pressed member, a latch serving to release the second spring-pressed member and the first spring-pressed member when the spring-motor requires rewinding, said second spring-pressed member being independently movable to effect starting of the driving motor in case one of said projections is in position to oppose the immediate engagement of the first spring-pressed member, and means automatically controlled by said spring-motor as it becomes fully rewound whereby said second spring-pressed member is withdrawn to effect termination of the rewinding and stopping of the driving motor.

27. In a typewriting machine having types, the combination with key-controlled means including a spring-motor for operating said types, of spring-motor rewinding means including a driving motor, a train of differential gearing having a driving member connected to said driving motor, and also having two elements co-operating with said driving member to form said train, means for restraining one of said elements, the other element being connected to the spring-motor and rotatable to rewind said spring-motor when said one element is restrained, means controlled by the condition of the spring-motor whereby the need to rewind the spring-motor or the need to terminate the rewinding is automatically registered, and means co-operating with said registering means to render the restraining means effective or ineffective depending on whether the rewinding is to be initiated or terminated.

28. In a typewriting machine having a box-like frame and types, the combination with means including a spring-motor for operating said types, of a driving motor, means connecting said driving motor and spring-motor, and capable of enabling the driving motor to rewind the spring-motor, said connecting means normally ineffective, means controlled by the condition of the spring-motor whereby the need to rewind the spring-motor or the need to terminate the rewinding is automatically registered, and means co-operating with said registering means to render said connecting means effective or ineffective depending on whether the rewinding is to be initiated or terminated, said spring-motor being in the form of an elongate cylinder located for compactness of arrangement alongside of said frame, said driving motor, connecting means, and regis-

tering means located for compactness of arrangement at the rear of said typewriter-frame.

29. In a typewriting machine having types and a letter-feeding carriage, the combination with means including a spring-motor for operating said types, means operable by power for returning said carriage, and means operable to rewind said spring-motor, of a driving mechanism including a driving motor, means including differential gearing whereby said driving motor may operate either the carriage-returning means or the spring-motor rewinding means, means, including worm gearing connecting said driving motor to said differential gearing, means, controlled by said spring-motor and by said carriage-returning means, to condition said differential gearing for effecting rewinding of said spring-motor or the returning of said carriage, and a driving mechanism supporting fixture including a support for said motor, a worm-gear housing integral with said support, and a housing for said differential gearing and conditioning means, a side of the latter housing forming a closure for the worm-gear housing to which said latter housing is removably secured.

30. In a typewriting machine having types and a letter-feeding carriage, the combination with means including a spring-motor for operating said types, means operable by power for returning said carriage, and means operable to rewind said spring-motor, of a driving mechanism including a driving motor, means including differential gearing whereby said driving motor may operate either the carriage-returning means or the spring-motor-rewinding means, means, including worm gearing, connecting said driving motor to said differential gearing, means, controlled by said spring-motor and by said carriage-returning means, to condition said differential gearing for effecting rewinding of said spring-motor or the returning of said carriage, a driving mechanism supporting fixture including a support for said motor, a worm-gear housing integral with said support, and a housing for said differential gearing and conditioning means, a side of the latter housing forming a closure for the worm-gear housing to which said latter housing is removably secured, and a carriage-returning shaft extending through both housings and serving to support a worm-gear of said worm-gearing, said worm-gear being loosely mounted on said shaft, said shaft also serving to support said differential gearing, a carriage-returning member of said differential gearing being fastened to said shaft.

31. In a typewriting machine having types and a letter-feeding carriage, the combination with means including a spring-motor for operating said types, means operable by power for returning said carriage, and means

operable to rewind said spring-motor, of a driving mechanism including a driving motor, means including differential gearing whereby said driving motor may operate
 5 either the carriage-returning means or the spring-motor-rewinding means, means, including worm gearing, connecting said driving motor to said differential gearing, means, controlled by said spring-motor and by said
 10 carriage-returning means, to condition said differential gearing for effecting rewinding of said spring-motor or the returning of said carriage, and a driving mechanism supporting fixture including a support for said
 15 motor, a worm-gear housing integral with said support, and a housing for said differential gearing and conditioning means, a side of the latter housing forming a closure for the worm-gear housing to which said latter
 20 housing is removably secured, said worm-gear having a hub projecting through said side of the differential gear-housing for connection with a driving member of said differential gearing.

32. An elongate type-bar-actuating power-drum of the character described, having a plurality of longitudinal cam-faces, said drum built up of separate sheet-metal stampings on each of which a cam-face is formed, said
 30 stampings having panel openings whereby superfluous material is eliminated and the drum thereby lightened, and said stampings being joined and fastened together in such manner that the cam-faces project beyond the cross-section formed by the joined portions
 35 of said stampings.

33. An elongate type-bar-actuating power-drum of the character described, having four longitudinal cam-faces, said drum built up of
 40 four separate sheet-metal stampings on each of which a cam-face is formed, said stampings being fastened together in such manner that the cam-faces project beyond the quadrilateral section formed by the joined portions
 45 of said stampings.

34. An elongate type-bar-actuating power-drum of the character described, having four longitudinal cam-faces, said drum built up of four separate sheet-metal stampings on
 50 each of which a cam-face is formed, said stampings being fastened together in such manner that the cam-faces project beyond the quadrilateral section formed by the joined portions of said stampings, and said stampings
 55 having tongue-and-slot formations whereby they may be fastened together.

35. An elongate type-bar-actuating power-drum of the character described, having four longitudinal cam-faces, said drum built up of four separate sheet-metal stampings on
 60 each of which a cam-face is formed, said stampings being fastened together in such manner that the cam-faces project beyond the quadrilateral section formed by the joined portions of said stampings, and hub-forming

ends joined to the ends of the assembled stampings.

36. An elongate type-bar-actuating power-drum of the character described, having four longitudinal cam-faces, said drum built up
 70 of four separate sheet-metal stampings on each of which a cam-face is formed, said stampings being fastened together in such manner that the cam-faces project beyond the quadrilateral section formed by the joined
 75 portions of said stampings, and hub-forming ends joined to the ends of the assembled stampings, said hub-forming ends and stampings having tongue-and-slot formations whereby they may be joined and fastened together.
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37. In a front-strike typewriting machine, the combination with a series of radially arrayed type-bars of the character described, a series of paired arms, one pair of arms for
 85 each type-bar and pivotally connected to said type-bar and to fixed fulcrums for shifting and swinging said type-bar bodily from a normal cumbent position to a printing position, the pairs of links arranged in arcuate radial
 90 array corresponding to the radial array of their respective type-bars, one of each pair of arms forming an operating arm swingable in a fore and aft direction to shift said type-bar, and means including a standard typewriter-frame for supporting said type-bars and, said
 95 arms, of a series of key-levers extending in parallel and horizontal array rearwardly from a typewriter-keyboard at the front of said frame toward a common fulcrum-axis at the interior of said frame, a second series of
 100 levers, one for each key-lever, disposed in parallel and horizontal array above the key-levers but below the arcuate array of type-bars and their aforesaid arms, each of said second series of levers having an arm swingable fore
 105 and aft, a series of intermediate levers of the third order, extending from points opposite the horizontally arrayed arms of the second series levers to points opposite the arcuately
 110 arranged type-bar-operating arms and fulcrumed below said points, a series of links extending substantially fore and aft and connecting said intermediate levers to the aforesaid arms of the second series of levers, a second
 115 series of links extending substantially fore and aft and connecting said intermediate levers to the corresponding operating arms of the type-bars, each of said second series of levers forming with a corresponding intermediate
 120 lever and the links connected thereto a train directed from a type-bar-operating arm toward a corresponding key-lever, and means whereby said second series levers are operatively connected to said key-levers.
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38. In a front-strike typewriting machine, the combination with a series of radially arrayed type-bars of the character described, a series of paired arms, one pair of arms for
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each type-bar and pivotally connected to said type-bar and to fixed fulcrums for shifting and swinging said type-bar bodily from a normal cumbent position to a printing position, the pairs of links arranged in arcuate radial array corresponding to the radial array of their respective type-bars, one of each pair of arms forming an operating arm swingable in a fore and aft direction to shift said type-bar, and means including a standard typewriter-frame for supporting said type-bars and said arms, of a series of key-levers extending in parallel and horizontal array rearwardly from a typewriter-keyboard at the front of said frame toward a common fulcrum-axis at the interior of said frame, a second series of levers, one for each key-lever, disposed in parallel and horizontal array above the key-levers but below the arcuate array of type-bars and their aforesaid arms, each of said second series of levers having an arm swingable fore and aft, a series of intermediate levers of the third order, extending from points opposite the horizontally arrayed arms of the second series levers to points opposite the arcuately arrayed type-bar-operating arms and fulcrumed below said points, a series of links extending substantially fore and aft and connecting said intermediate levers to the aforesaid arms of the second series of levers, a second series of links extending substantially fore and aft and connecting said intermediate levers to the corresponding operating arms of the type-bars, each of said second series of levers forming with a corresponding intermediate lever and the links connected thereto a train directed from a type-bar-operating arm toward a corresponding key-lever, a power-driven actuator extending transversely of and common to the second series levers for engagement therewith but normally disengaged therefrom, and means controlled by said key-levers, whereby said actuator may be caused to engage and operate corresponding second series levers for operation of corresponding type-bars.

39. In a front-strike typewriting machine, the combination with a series of radially arrayed type-bars of the character described, a series of paired arms, one pair of arms for each type-bar and pivotally connected to said type-bar and to fixed fulcrums for shifting and swinging said type-bar bodily from a normal cumbent position to a printing position, the pairs of links arranged in arcuate radial array corresponding to the radial array of their respective type-bars, one of each pair of arms forming an operating arm swingable in a fore and aft direction to shift said type-bar, and means including a standard typewriter-frame for supporting said type-bars and said arms, of a series of power-levers disposed in horizontal and parallel array below the arcuate array of type-bars and their aforesaid links, each of said levers having an arm carrying at its end a shiftable spring-pressed member, and also having an arm extended in a substantially vertical direction to swing fore and aft, a series of intermediate levers of the third order extending from points opposite the horizontally arrayed vertical arms of said power-levers to points opposite the arcuately arrayed type-bar-operating link-arms and fulcrumed below said points, a series of links extending substantially fore and aft and connecting said intermediate levers to the vertical arms of said power-levers, a second series of links extending substantially fore and aft and connecting said intermediate levers to the corresponding type-bar-operating link-arms, a power-driven actuator extending transversely of the power-levers for engagement with the aforesaid shiftable members thereon, and a series of key-levers engaging and thereby

their aforesaid links, each of said levers having an arm carrying at its end a shiftable spring-pressed member, and also having an arm extended in a substantially vertical direction to swing fore and aft, a series of intermediate levers of the third order extending from points opposite the horizontally arrayed vertical arms of said power-levers to points opposite the arcuately arrayed type-bar-operating link-arms and fulcrumed below said points, a series of links extending substantially fore and aft and connecting said intermediate levers to the vertical arms of said power-levers, a second series of links extending substantially fore and aft and connecting said intermediate levers to the corresponding type-bar-operating link-arms, a power-driven actuator extending transversely of the power-levers for engagement with the aforesaid shiftable members thereon, and key-controlled means normally keeping said shiftable members disengaged from said power-driven actuator, said key-controlled means being operable to effect selective engagement of said members with said actuator for corresponding type-bar operations.

40. In a front-strike typewriting machine, the combination with a series of radially arrayed type-bars of the character described, a series of paired arms, one pair of arms for each type-bar and pivotally connected to said type-bar and to fixed fulcrums for shifting and swinging said type-bar bodily from a normal cumbent position to a printing position, the pairs of links arranged in arcuate radial array corresponding to the radial array of their respective type-bars, one of each pair of arms forming an operating arm swingable in a fore and aft direction to shift said type-bar, and means including a standard typewriter-frame for supporting said type-bars and said arms, of a series of power-levers disposed in horizontal and parallel array below the arcuate array of type-bars and their aforesaid links, each of said levers having an arm carrying at its end a shiftable spring-pressed member, and also having an arm extended in a substantially vertical direction to swing fore and aft, a series of intermediate levers of the third order extending from points opposite the horizontally arrayed vertical arms of said power-levers to points opposite the arcuately arrayed type-bar-operating link-arms and fulcrumed below said points, a series of links extending substantially fore and aft and connecting said intermediate levers to the vertical arms of said power-levers, a second series of links extending substantially fore and aft and connecting said intermediate levers to the corresponding type-bar-operating link-arms, a power-driven actuator extending transversely of the power-levers for engagement with the aforesaid shiftable members thereon, and a series of key-levers engaging and thereby

normally holding said spring-pressed shiftable members disengaged from said power-driven actuator, said key-levers operable to withdraw from and thereby cause the engagement of said spring-pressed shiftable members with said power-driven actuator to effect operation of corresponding type-bars.

41. In a front-strike typewriting machine, the combination with a series of radially arrayed type-bars of the character described, a series of paired arms, one pair of arms for each type-bar and pivotally connected to said type-bar and to fixed fulcrums for shifting and swinging said type-bar bodily from a normal cumbent position to a printing position, the pairs of links arranged in arcuate radial array corresponding to the radial array of their respective type-bars, one of each pair of arms forming an operating arm swingable in a fore and aft direction to shift said type-bar, and means including a standard typewriter-frame for supporting said type-bars and said arms, of a series of power-levers disposed in horizontal and parallel array below the arcuate array of type-bars and their aforesaid links, each of said levers having an arm carrying at its end a shiftable spring-pressed member, and also having an arm extended in a substantially vertical direction to swing fore and aft, a series of intermediate levers of the third order extending from points opposite the horizontally arrayed vertical arms of said power-levers to points opposite the arcuately arrayed type-bar-operating link-arms and fulcrumed below said points, a series of links extending substantially fore and aft and connecting said intermediate levers to the vertical arms of said power-levers, a second series of links extending substantially fore and aft and connecting said intermediate levers to the corresponding type-bar-operating link-arms, a power-driven actuator extending transversely of the power-levers for engagement with the aforesaid shiftable members thereon, means normally restraining said actuator and operable to effect the operation of said actuator, key-controlled means normally keeping said shiftable members disengaged from said actuator, said key-controlled means being operable to effect selective engagement of said members with said actuator for corresponding type-bar operations, and means effective upon the actuator-restraining means for causing the operation of said actuator concomitantly with the operation of said key-controlled means.

42. In a front strike typewriting machine, the combination with a series of radially-arrayed type-bars of the character described, and means including operating arms, one for each type bar and pivotally connected thereto, for swinging same bodily from a normally cumbent position to a printing position, said arms arranged in arcuate array corresponding to

the radial array of the type-bars, of means including a standard typewriter-frame for supporting said type-bars and said arms, a series of key-controlled levers, one for each type-bar, arranged in parallel and horizontal array below the type-bar-operating arms, and means whereby the horizontally-arrayed key-controlled levers are connected to the arcuately-arrayed type-bar-operating arms, said connecting means including a series of intermediate levers, one for each key-controlled lever and the corresponding type-bar-operating arm, said intermediate levers designed to receive type-bar-operating impulses at points in rectilinear array opposite to and conforming to the horizontal array of said key-controlled levers, and to deliver said impulses to said type-bar-operating arms from points in arcuate array opposite to and conforming to the arcuate array of said arms, said connecting means, including said intermediate levers, being disposed for compactness directly behind said operating arms and said key-controlled levers.

43. In a front strike typewriting machine, the combination with a series of radially-arrayed type-bars of the character described, and means, including operating arms, one for each type-bar and pivotally connected thereto, for swinging same bodily from a normally cumbent position to a printing position, said arms arranged in arcuate array corresponding to the radial array of the type-bars, of means including a standard typewriter-frame for supporting said type-bars and said arms, a series of key-controlled levers, one for each type-bar, arranged in parallel and horizontal array substantially below the arcuately-arrayed type-bar-operating arms, a series of intermediate levers, one for each type-bar-operating arm and key-controlled lever, a link connecting each key-controlled lever to an intermediate lever, and a second link connecting each intermediate lever to a corresponding type-bar-operating arm, each of said intermediate levers being designed so that the point of attachment thereto of the first-mentioned link is, with similar points of the other intermediate levers, in a horizontal and rectilinear array opposite to and conforming to the horizontal array of the key-controlled levers, and being further designed so that each point of attachment thereto of the second link is, with similar points of the other intermediate levers, in an arcuate array opposite to and conforming to the arcuately-arrayed type-bar-operating arms, said key-controlled levers, intermediate levers, and links being disposed for compactness wholly within the confines of said standard typewriter-frame.

44. In a front strike typewriting machine, the combination with a series of radially-arrayed type-bars of the character described and means including operating arms, one for each type-bar and pivotally connected thereto

to, for swinging same bodily from a normally
cumbent position to a printing position, said
arms arranged in arcuate array corresponding
to the radial array of the type-bars, of
means including a standard typewriter-frame
for supporting said type-bars and said arms, a
series of key-controlled levers, one for each
type-bar, arranged in parallel and horizontal
array substantially below the arcuately-
arrayed type-bar-operating arms, a series of inter-
mediate levers, one for each type-bar-oper-
ating arm and key-controlled lever, a link
connecting each key-controlled lever to an inter-
mediate lever, and a second link connecting
each intermediate lever to a corresponding
type-bar-operating arm, each of said interme-
diate levers being designed so that the point
of attachment thereto of the first-mentioned
link is, with similar points of the other inter-
mediate levers, in a horizontal and rectilinear
array opposite to and conforming to the hori-
zontal array of the key-controlled levers, and
being further designed so that each point of
attachment thereto of the second link is, with
similar points of the other intermediate lev-
ers, in an arcuate array opposite to and con-
forming to the arcuately-arrayed type-bar-
operating arms, said intermediate levers be-
ing of the third order with their fulcrums so
disposed that the extent of movement at each
point of attachment to the second link is uni-
form for all intermediate levers, said key-con-
trolled levers, intermediate levers and links
being disposed for compactness wholly within
the confines of said standard typewriter-
frame.

45. In a front-strike typewriting machine,
the combination with a series of radially ar-
rayed type-bars of the character described, a
series of paired arms, one pair of arms for each
type-bar and pivotally connected to said type-
bar and to fixed fulcrums for shifting and
swinging said type-bar bodily from a normal
cumbent position to a printing position, the
pairs of links arranged in arcuate radial ar-
ray corresponding to the radial array of their
respective type-bars, one of each pair of arms
forming an operating arm swingable in a fore
and aft direction to shift said type-bar, and
means including a standard typewriter-frame
for supporting said type-bars and said arms,
of a series of power-levers disposed in hori-
zontal and parallel array below the arcuate
array of type-bars and their aforesaid links,
each of said levers having an arm carrying
at its end a shiftable spring-pressed member,
and also having an arm extended in a substan-
tially vertical direction to swing fore and aft,
a series of intermediate levers of the third
order extending from points opposite the
horizontally arrayed vertical arms of said
power-levers to points opposite the arcuately
arrayed type-bar-operating link-arms and
fulcrumed below said points, a series of links

extending substantially fore and aft and con-
necting said intermediate levers to the ver-
tical arms of said power-levers, a second series
of links extending substantially fore and aft
and connecting said intermediate levers to the
corresponding type-bar-operating link-arms,
a power-driven actuator extending trans-
versely of the power-levers for engagement
with the aforesaid shiftable members thereon,
a revoluble power-driven drum having longi-
tudinal cam-faces extending transversely of
the power-levers for engagement with the
aforesaid shiftable members thereon, an
escapement-device including an escapement-
wheel keyed to said drum and a co-operating
pallet-frame, said device normally restrain-
ing said drum and operable to rotate said
drum one cam-face step at a time, a series of
key-levers engaging and thereby normally
holding said spring-pressed shiftable mem-
bers disengaged from said drum, said key-
levers operable to withdraw from and thereby
cause the engagement of corresponding
spring-pressed shiftable members with a cam-
face of said drum, and means effective upon
said pallet-frame for causing the rotation of
said drum through one cam-face step con-
comitantly with the operation of any key-
lever.

46. In a front strike typewriting machine,
the combination with a series of radially ar-
rayed type-bars of the character described,
and means including operating arms, one for
each type-bar and pivotally connected there-
to, for swinging same bodily from a normally
cumbent position to a printing position, said
arms arranged in arcuate array corresponding
to the radial array of the type-bars, of means
including a standard typewriter-frame for
supporting said type-bars and said arms, a
series of key-operated levers, one for each
type-bar, arranged in horizontal and parallel
array below the type-bars, a series of power-
levers in horizontal and parallel array sub-
stantially below the type-bars and above the
key-operated levers, an elongate, revoluble
power-driven drum having longitudinal cam-
faces spanning said power-levers, said power-
levers having devices controlled by said key-
operated levers for selectively enabling said
power-levers to be actuated by said cam-faces,
and means connecting the power-levers and
type-bar-operating arms, said power-levers,
drum and connecting means being disposed
for compactness wholly within the confines
of said standard typewriter-frame.

47. In a front-strike typewriting machine,
the combination with a series of radially ar-
rayed type-bars of the character described,
and means including operating arms, one for
each type-bar, for swinging the same bodily
from a normally cumbent position to a print-
ing position, said arms arranged in arcuate
array corresponding to the radial array of the
type-bars, of a series of key-controlled levers,

one for each type-bar, arranged in parallel and horizontal array below the type-bar-operating arms, and means whereby the horizontally arrayed key-controlled levers are connected to the arcuately arrayed type-bar-operating arms, said connecting means including a series of intermediate levers, one for each key-controlled lever and the corresponding type-bar-operating arm, said intermediate levers designed to receive type-bar-operating impulses at points in rectilinear array opposite to and conforming to the horizontal array of said key-controlled levers, and to deliver said impulses to said type-bar-operating arms from points in arcuate array opposite to and conforming to the arcuate array of said arms.

48. In a front-strike typewriting machine, the combination with a series of radially arrayed type-bars of the character described, and means including operating arms, one for each type-bar, said arms swingable through substantially uniform angles to swing their respective type-bars from a normally cum-bent position to a printing position, said arms arranged in arcuate array corresponding to the radial array of the type-bars, of a series of key-controlled levers, one for each type-bar, arranged in parallel and horizontal array below the type-bar-operating arms, and means whereby the horizontally arrayed key-controlled levers are connected to the arcuately arrayed type-bar-operating arms, said connecting means including a series of intermediate levers, one for each key-controlled lever and the corresponding type-bar-operating arm, said intermediate levers designed to receive type-bar-operating impulses at points in an array opposite to and conforming to the horizontal array of said key-controlled levers and to deliver said impulses to said type-bar-operating arms from points in an array opposite to and conforming to the arcuate array of said arms, said intermediate levers being further designed so that the extents of movement of the latter points are uniform to correspond to the uniform movements of said operating arms.

49. In a typewriting machine, the combination with type-bars, of keys, a revoluble drum having a plurality of cam-faces, type-bar-operating means selectively brought into engagement with one of the cam-faces of said drum by said keys, an escapement-mechanism including an escapement-wheel connected to said drum and also including a pallet-frame, said escapement-mechanism operated at each key operation to cause the drum to rotate one cam-face step under the influence of potential power applied to said drum, and sound-deadening means used in connection with said escapement-mechanism for deadening the noise otherwise attending the operation of same, said sound-deadening

means including a resilient shock-absorbing support for said escapement-wheel, and also including a resilient shock-absorbing support for said pallet-frame.

50. In a front strike typewriting machine having a box-like frame including side members, the combination with a radial array of type-bars supported within said frame, of typewriter-keys, a shaft journaled in said side members, an elongate drum fastened to said shaft and having longitudinal cam-faces, type-bar-operating means selectively brought, by means of said keys, into engagement with one of the cam-faces of said drum, a spring-motor connected to said drum, an escapement-wheel connected to said drum by means including a journal on which said wheel is mounted, a pallet-frame coacting with said escapement-wheel to normally hold said drum against rotation by said spring-motor, said pallet-frame actuable at each key operation to cause the drum to rotate one cam-face step, and sound-deadening means for the escapement devices, including a resiliently supported bearing for said journal and a resiliently supported mounting carrying said pallet frame.

51. In a front strike typewriting machine having a box-like frame including side members, the combination with type-bars, of keys, a shaft journaled in said side members, an elongate drum fastened on said shaft and having longitudinal cam-faces, type-bar-operating means selectively conditioned, by operation of said keys, for engagement with one of said cam-faces, and means for rotating the drum one cam-face step at each key operation to actuate the type-bar-operating means conditioned by said key operation, said last-mentioned means including a spring-motor constantly urging said drum to rotate, an escapement-wheel on said shaft adjoining the bearing in the side member in which one end of said shaft is journaled, and also including a pallet-frame co-operating with said escapement-wheel, said bearing being of shock-absorbing construction and said pallet-frame having a shock-absorbing mounting to reduce the noise and shock otherwise attending the operation of said escapement-wheel and pallet-frame.

52. In a front strike typewriting machine having a box-like frame including side members, the combination with type-bars, of keys, a shaft journaled in said side members, an elongate drum fastened on said shaft and having longitudinal cam-faces, type-bar-operating means selectively conditioned, by operation of said keys, for engagement with one of said cam-faces, and means for rotating the drum one cam-face step at each key operation to actuate the type-bar-operating means conditioned by said key operation, said last mentioned means including a spring-motor

constantly urging said drum to rotate, an escapement-wheel on said shaft adjoining the bearing in the side member in which one end of said shaft is journaled, and also including a pallet-frame co-operating with said escapement-wheel, said bearing being of shock-absorbing construction and said pallet-frame having a shock-absorbing mounting to reduce the noise and shock otherwise attending the operation of said escapement-wheel and pallet-frame, said shock-absorbing bearing including an arm adjoining said bearing, said arm partly supported by and rotatable on said shaft, said pallet-frame mounted on said arm, and yieldable means holding said arm against a stop projecting from the adjacent typewriter-frame side member, all reactions against said pallet-frame being absorbed by said yieldable means and the shock-absorbing bearing of the shaft on which the pallet-frame arm is partly supported.

53. In a front strike typewriting machine having a box-like frame including side members, the combination with type-bars, of keys, a shaft journaled in said side members, an elongate drum fastened on said shaft and having longitudinal cam-faces, type-bar-operating means selectively conditioned, by operation of said keys, for engagement with one of said cam-faces, and means for rotating the drum one cam-face step at each key operation to actuate the type-bar-operating means conditioned by said key operation, said last-mentioned means including a spring-motor constantly urging said drum to rotate, an escapement-wheel on said shaft adjoining the bearing in the side member in which one end of said shaft is journaled, and also including a pallet-frame co-operating with said escapement-wheel, said bearing being of shock-absorbing construction and said pallet-frame having a shock-absorbing mounting to reduce the noise and shock otherwise attending the operation of said escapement-wheel and pallet-frame, said shock-absorbing bearing construction including a sleeve forming the bearing proper, and a resilient material substantially surrounding said sleeve and separating the same from the typewriter-frame side member in which said bearing is retained.

54. In a front strike typewriting machine having a box-like frame including side members, the combination with type-bars, of keys, a shaft journaled in said side members, an elongate drum fastened on said shaft and having longitudinal cam-faces, type-bar-operating means selectively conditioned, by operation of said keys, for engagement with one of said cam-faces, and means for rotating the drum one cam-face step at each key operation to actuate the type-bar operating means conditioned by said key operation, said last-mentioned means including a spring-motor constantly urging said drum to rotate, an es-

capement-wheel on said shaft adjoining the bearing in the side member in which one end of said shaft is journaled and also including a pallet-frame co-operating with said escapement-wheel, said bearing being of shock-absorbing construction and said pallet-frame having a shock-absorbing mounting to reduce the noise and shock otherwise attending the operation of said escapement-wheel and pallet-frame, said shock-absorbing bearing construction including a sleeve forming the bearing proper, said sleeve having a flange at one end and a clamp-nut at the other end, and also including a resilient material substantially surrounding said sleeve and separating the same from the typewriter-frame side member in which said bearing is retained by means of said flange and nut.

55. In a front strike typewriting machine having a carriage and a letter-feeding escapement controlling said carriage, the combination with a radial array of type-bars of the character described, of means including operating arms pivotally connected to said type-bars for swinging the same from a normally cumbent position to a printing position, said arms in arcuate array conforming to the radial array of the type-bars, a horizontal array of parallel key-controlled levers below said type-bar operating arms, means, including intermediate levers, for connecting said key-controlled levers and said type-bar-operating arms, said intermediate levers having projecting ends in arcuate array behind and conforming to the arcuate array of type-bar-operating arms, an arcuate universal bar disposed, for compactness of arrangement, between the arrays of type-bar-operating arms and intermediate lever-ends, said universal bar engaged at each key operation by the projecting end of the corresponding intermediate lever and moved by said intermediate lever in the final portion of its movement, and means connecting said universal bar to said escapement.

56. In a front strike typewriting machine having a carriage and a letter-feeding escapement controlling said carriage, the combination with a radial array of type-bars of the character described, of means including operating arms pivotally connected to said type-bars for swinging the same from a normally cumbent position to a printing position, said arms in arcuate array conforming to the radial array of the type-bars, a horizontal array of parallel key-controlled levers below said type-bar-operating arms, means, including intermediate levers, for connecting said key-controlled levers and said type-bar-operating arms, said intermediate levers having projecting ends in arcuate array behind and conforming to the arcuate array of type-bar-operating arms, an arcuate universal bar disposed, for compactness of arrangement, between the arrays of type-bar-oper-

ating arms and intermediate lever-ends, said universal bar engaged at each key operation by the projecting end of the corresponding intermediate lever and moved by said intermediate lever in the final portion of its movement, means connecting said universal bar to said escapement, a ribbon, and ribbon-vibrating mechanism operatively connected to said universal bar.

57. In a front strike typewriting machine having a carriage and a letter-feeding escapement controlling said carriage, the combination with a radial array of type-bars of the character described, of means including operating arms pivotally connected to said type-bars for swinging the same from a normally cumbent position to a printing position, said arms in arcuate array conforming to the radial array of the type-bars, a horizontal array of parallel key-controlled levers below said type-bar-operating arms, means, including intermediate levers, for connecting said key-controlled levers and said type-bar-operating arms, said intermediate levers having projecting ends in arcuate array behind and conforming to the arcuate array of type-bar-operating arms, an arcuate universal bar disposed, for compactness of arrangement, between the arrays of type-bar-operating arms and intermediate lever-ends, said universal bar engaged at each key operation by the projecting end of the corresponding intermediate lever and moved by said intermediate lever in the final portion of its movement, means connecting said universal bar to said escapement, a ribbon, and ribbon-vibrating mechanism operatively connected to said universal bar, said ribbon-vibrating mechanism controlled by a bi-chrome-shifting mechanism of the character described.

58. In a front strike typewriting machine having a ribbon, the combination with a radial array of type-bars of the character described, of means including operating arms pivotally connected to said type-bars for swinging the same from a normally cumbent position to printing position, said arms in arcuate array conforming to the radial array of type-bars, key-controlled means connected to said operating arms, including intermediate levers having projecting ends in arcuate array behind and conforming to the arcuate array of type-bar-operating arms, an arcuate universal bar disposed, for compactness of arrangement, between the arrays of type-bar-operating arms and intermediate lever-ends, said ends designed to engage said universal bar, a ribbon, a ribbon-vibrating mechanism, and means connecting said universal bar to said ribbon-vibrating mechanism.

59. In a front-strike typewriting machine, the combination with a series of radially arrayed type-bars of the character described,

and operating arms, one for each type-bar, for swinging said type-bar from a normally cumbent position to a printing position, said arms arranged in arcuate array corresponding to the radial array of the type-bars, of a series of key-controlled levers, one for each type-bar, arranged in parallel and horizontal array substantially below the arcuately arrayed type-bar-operating arms, a series of intermediate levers, one for each type-bar-operating arm and key-controlled lever, a link connecting each key-controlled lever to an intermediate lever, and a second link connecting each intermediate lever to a corresponding type-bar-operating arm, each of said intermediate levers being designed so that the point of attachment thereto of the first-mentioned link is, with similar points of the intermediate levers, in horizontal array opposite to and conforming to the horizontal array of the key-controlled levers, and being further designed so that each point of attachment thereto of the second link is, with similar points of the other intermediate levers, in arcuate array opposite to and conforming to the arcuately arrayed type-bar-operating arms.

60. In a front-strike typewriting machine, the combination with a series of radially-arrayed type-bars of the character described, and operating arms, one for each type-bar, for swinging said type-bar from a normally-cumbent position to a printing position, said arms arranged in arcuate array corresponding to the radial array of the type-bars, of a series of key-controlled levers, one for each type-bar, arranged in parallel and horizontal array substantially below the arcuately-arrayed type-bar-operating arms, a series of intermediate levers, one for each type-bar-operating arm and key-controlled lever, a link connecting each key-controlled lever to an intermediate lever, and a second link connecting each intermediate lever to a corresponding type-bar-operating arm, each of said intermediate levers being designed so that the point of attachment thereto of the first-mentioned link is, with similar points of the intermediate levers, in horizontal array opposite to and conforming to the horizontal array of the key-controlled levers, and being further designed so that each point of attachment thereto of the second link is, with similar points of the other intermediate levers, in arcuate array opposite to and conforming to the arcuately-arrayed type-bar-operating arms, said intermediate levers being of the third order with their fulcrums disposed so that the extent of movement at each point of attachment to the second link is uniform for all intermediate levers.

61. In a typewriting machine having types and key-controlled means including a spring-motor for operating said types, the combination with a driving motor for winding said

spring-motor for a multiplicity of type-operations, of a threaded shaft geared to said spring-motor and rotatable to wind the same, a pinion threaded on said shaft, a resilient connection between said shaft and pinion through which said pinion drives said shaft, means for checking counter-rotation of said pinion, said counter-rotation being due to spring-motor reaction, said pinion movable along said shaft by reason of the thread and the varying reaction between the spring-motor and resilient connection as the spring-motor becomes wound or unwound, said varying reaction causing relative rotation of the shaft and pinion, a differential gear-train including a driving member connected to said driving motor and also including two driven members, one driven member being connected to said pinion, means, normally ineffective, for restraining the other driven member to thereby effect rotation of said one driven member by said driving member, and means controlled by the longitudinal position of said pinion relatively to said shaft for rendering said restraining means effective and ineffective to thereby start and stop a rewinding operation.

62. In a typewriting machine having types and key-controlled means including a spring-motor for operating said types, the combination with a driving motor for winding said spring-motor for a multiplicity of type-operations, of a threaded shaft geared to said spring-motor and rotatable to wind the same, a pinion threaded on said shaft, a resilient connection between said shaft and pinion through which said pinion drives said shaft, means for checking counter-rotation of said pinion, said counter-rotation being due to spring-motor reaction, said pinion movable along said shaft by reason of the thread and the varying reaction between the spring-motor and resilient connection as the spring-motor becomes wound or unwound, said varying reaction causing relative rotation of the shaft and pinion, a differential gear-train including a driving member connected to said driving motor and also including two driven members, one driven member being connected to said pinion, means, normally ineffective, for restraining the other driven member to thereby effect rotation of said one driven member by said driving member, means controlled by the longitudinal position of said pinion relatively to said shaft for rendering said restraining means effective and ineffective to thereby start and stop a rewinding operation, and a device co-operating with the last-mentioned means, for concomitantly starting and stopping the driving motor.

63. In a typewriting machine having types and a carriage, the combination with carriage-returning mechanism including a clutch operable for connecting and disconnecting the carriage to and from a source of

power, and a single key-controlled revoluble spring-motor for operating all of the types, of a driving motor, differential gearing including a driving member connected to said driving motor and also including two driven members connected respectively to the power side of said clutch and to said spring-motor, each driven member operable by the driving member while the other driven member is restrained, means dependent upon the operation of said clutch for restraining and also releasing the driven member connected to the spring-motor to thereby start and stop a carriage-return operation, and means for restraining and also releasing the other driven member to start and stop a rewinding operation.

64. In a typewriting machine, the combination with a series of type-bars, of key-controlled operating means for said type-bars, a typewriter-frame supporting said operating means and type-bars, said key-controlled means including a revoluble drum operable by power, said drum extending transversely of the lateral sides of said frame and located at the forward portion thereof, a spring-motor for driving said drum, a driving motor operable to rewind the spring-motor, and means automatically registering the need for rewinding the spring-motor and also registering the need for discontinuing the rewinding, said registering means operating to enable the driving motor to rewind the spring-motor, the driving motor and registering means secured at the rear of the typewriter-frame for compactness, the spring-motor in the form of an elongate barrel extending transversely of the power-drum along the side of the typewriter-frame and from said drum to which it is connected toward the rear of said typewriter-frame and connected to said registering means and said driving motor at the rear of the typewriter.

65. In a typewriting machine having types, the combination with means including a spring-motor for operating said types, of means for winding said spring-motor to store energy therein for numerous type-operations, said winding means also forming means for automatically registering the need to rewind the spring-motor and the need to terminate the rewinding operation, said winding and registering means including a threaded shaft geared to the spring-motor and rotatable to wind the same, a pinion threaded on said shaft, a resilient connection between said shaft and pinion through which said pinion drives said shaft, means for checking counter-rotation of said pinion, the tendency to counter-rotation being due to the spring-motor reaction, said pinion movable along said shaft by reason of the thread and the varying reaction between the spring-motor and resilient connection as the spring-motor becomes wound or unwound, said varying re-

action causing relative rotation of the shaft and pinion, and driving means effective upon said pinion and controlled by the position thereof for starting and stopping rotation of the pinion to start and stop a rewinding operation, said pinion having inclined teeth engaged by said driving means, the inclination of said teeth facilitating the movement of said pinion along said shaft, thereby to render the longitudinal movements of the pinion sensitively responsive to the condition of the spring-motor.

66. In a typewriting machine having types and a carriage, the combination with means including a spring-motor for operating said types and a carriage-return mechanism, of a driving motor, means connecting said driving motor to the spring-motor for rewinding the same for a multiplicity of type-operations and also connecting said driving motor to the carriage-return mechanism, said connecting means including a train of differential gearing having a driving member connected to said driving motor and two driven members connected respectively to the carriage-return mechanism and to the spring-motor, means for restraining either driven member, each driven member being rotatable by the driving member while the other driven member is restrained, a carriage-return key, a linkage controlled by said key for effecting restraint of the appropriate driven member for initiating a carriage-return movement, and means whereby the carriage as it reaches the end of a predeterminable extent of return movement causes the release of said appropriate driven member in accordance with the termination of said carriage-return movement.

BURNHAM C. STICKNEY.