

April 7, 1942.

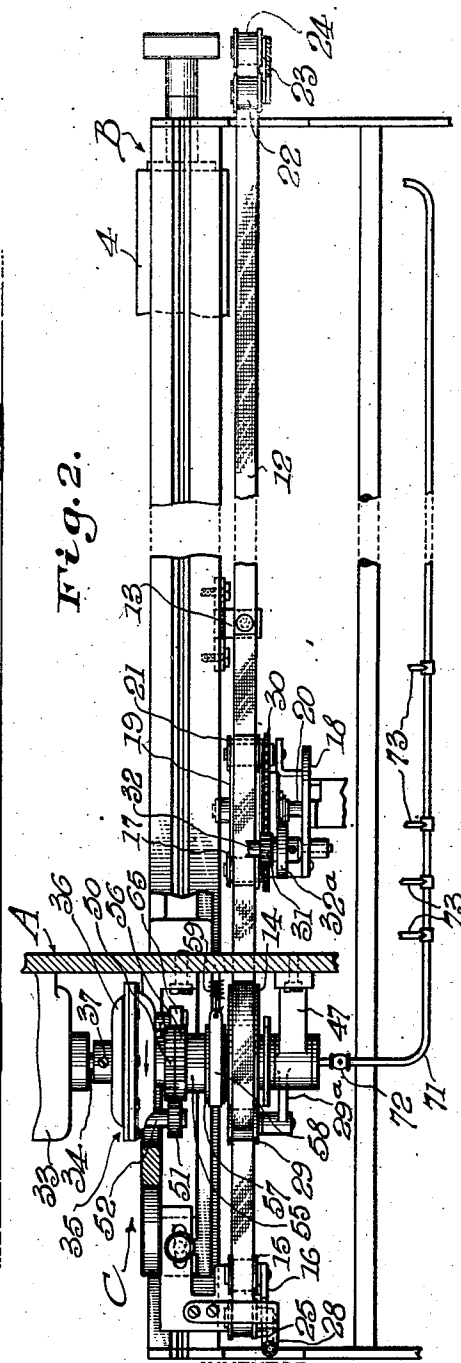
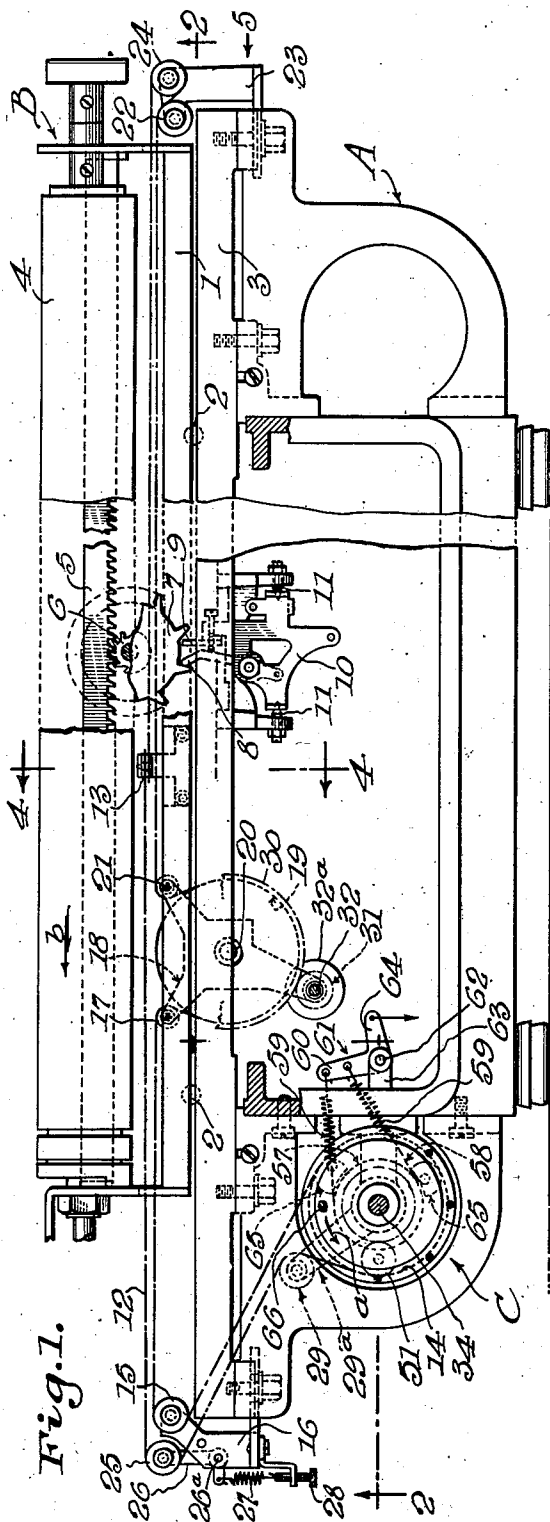
J. J. KITTEL

2,279,141

TYPEWRITING MACHINE

Filed April 3, 1940

9 Sheets-Sheet 1



INVENTOR
John J. Kittel
BY *Baldern + Wight*
his ATTORNEYS

April 7, 1942.

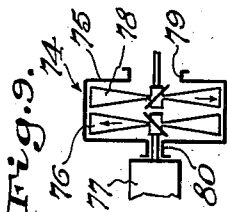
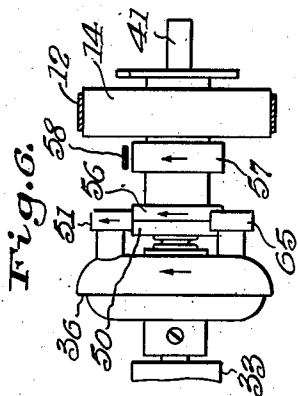
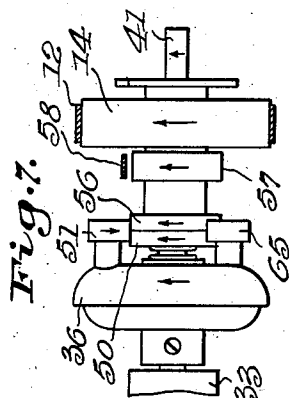
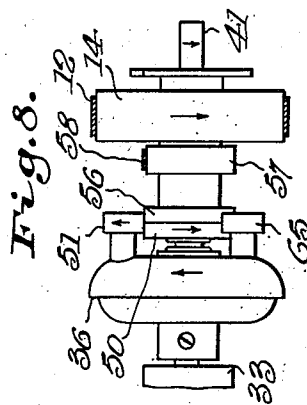
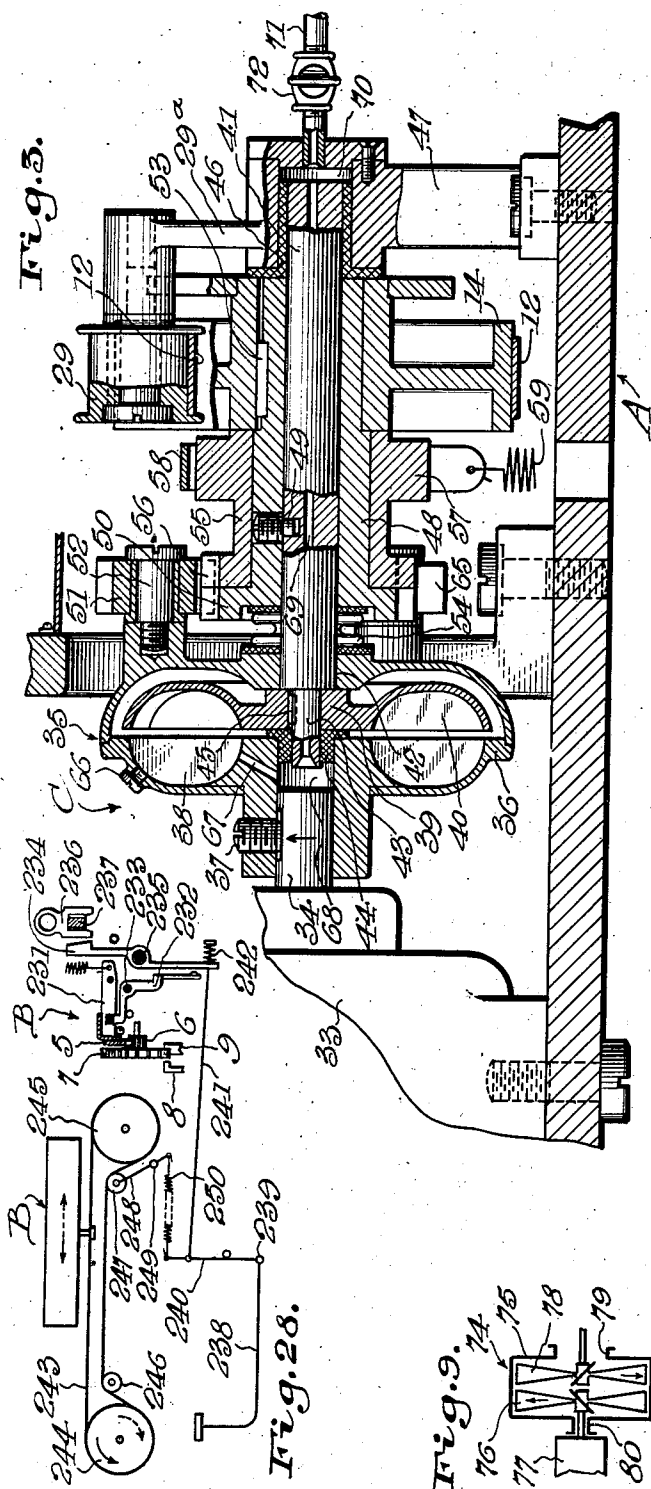
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TYPEWRITING MACHINE

Filed April 3, 1940

9 Sheets-Sheet 2



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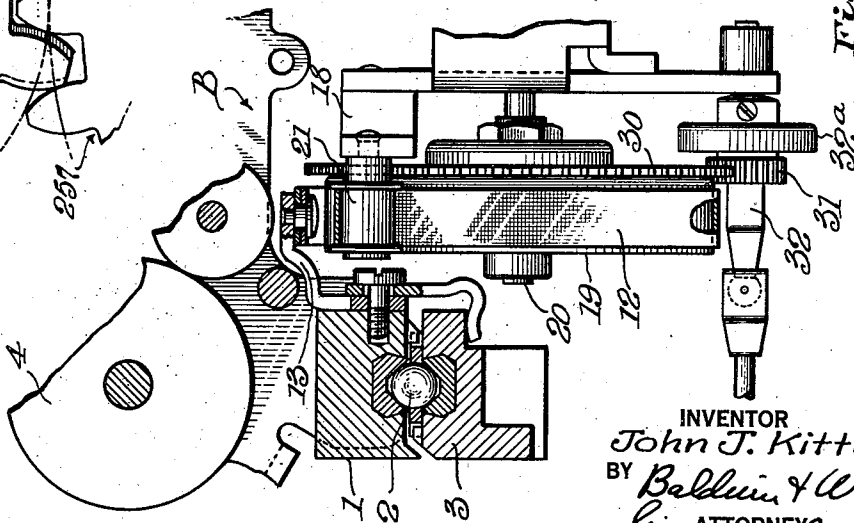
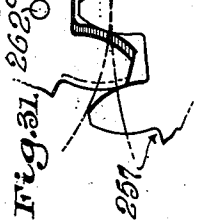
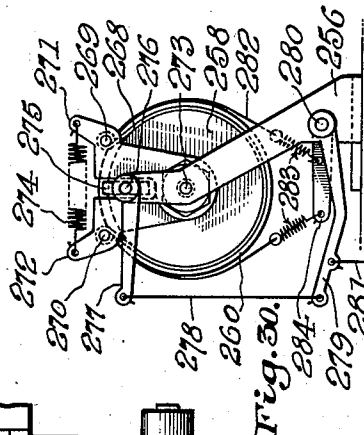
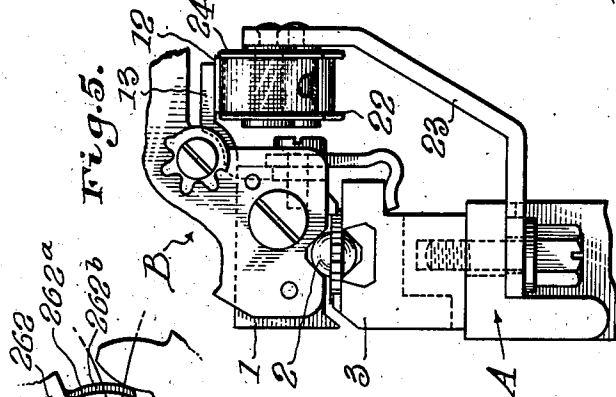
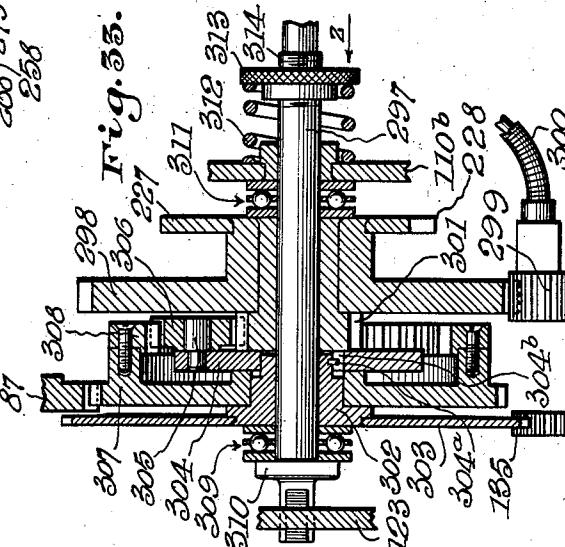
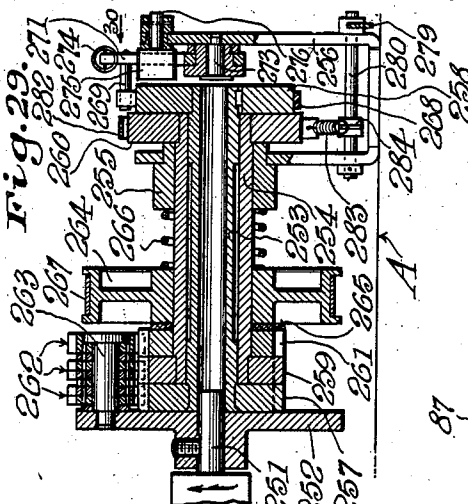
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TYPEWRITING MACHINE

Filed April 3, 1940

9 Sheets-Sheet 3



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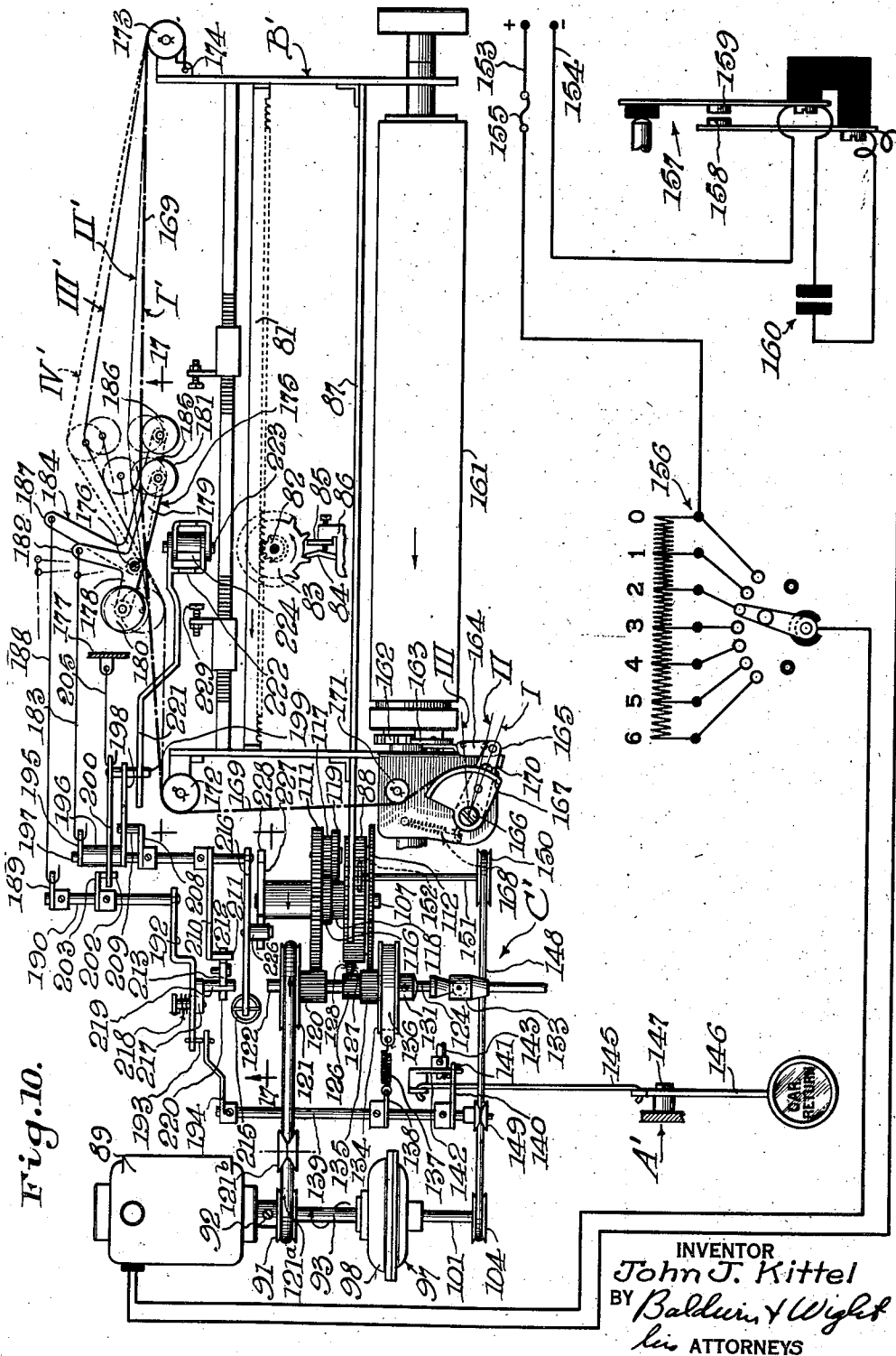
J. J. KITTEL

2,279,141

TYPEWRITING MACHINE

Filed April 3, 1940

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April 7, 1942.

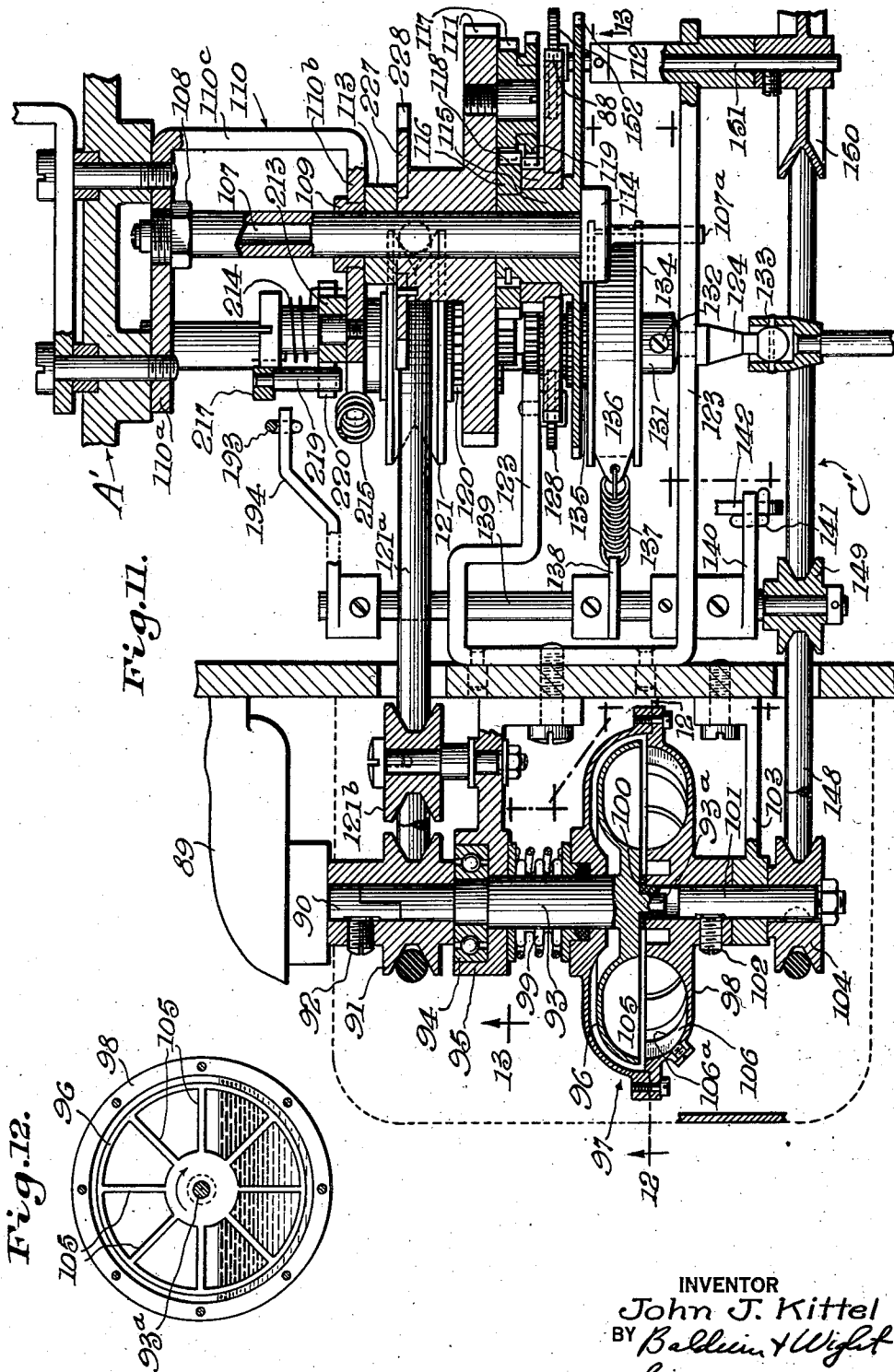
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2,279,141

TYPEWRITING MACHINE

Filed April 3, 1940

9 Sheets-Sheet 5



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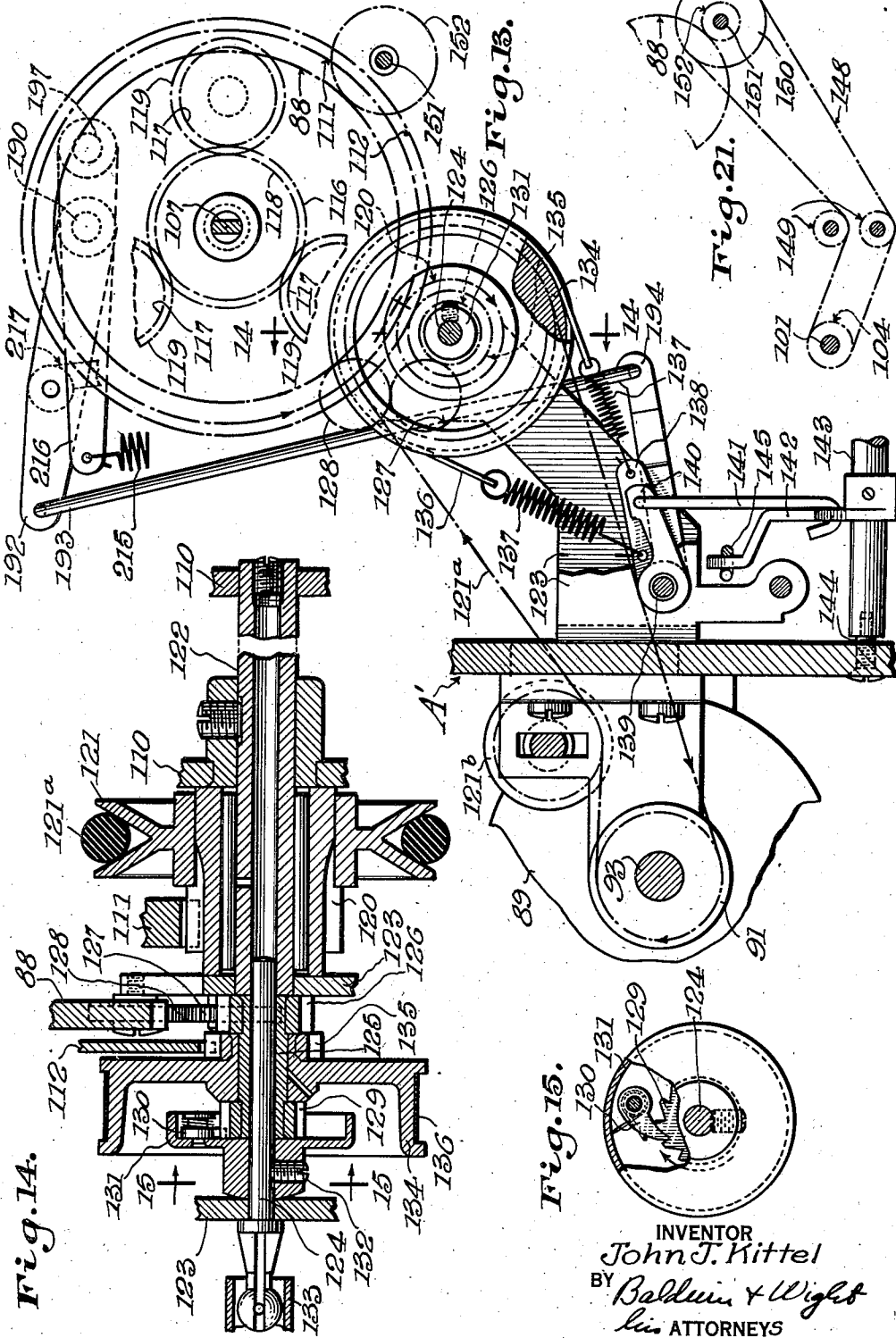
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2,279,141

TYPEWRITING MACHINE

Filed April 3, 1940

9 Sheets-Sheet 6



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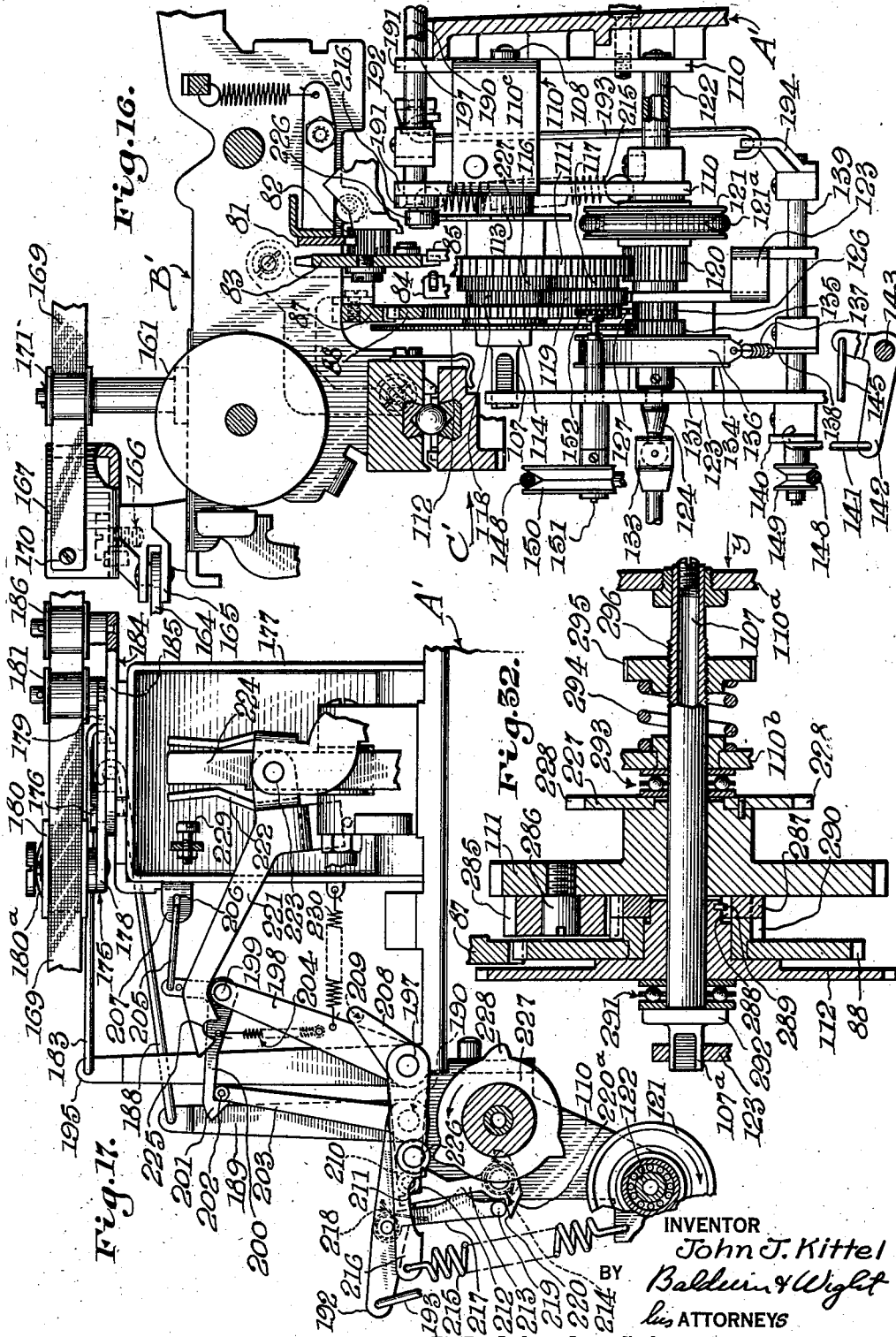
J. J. KITTEL

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TYPEWRITING MACHINE

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April 7, 1942.

J. J. KITTEL

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TYPEWRITING MACHINE

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Fig. 18.

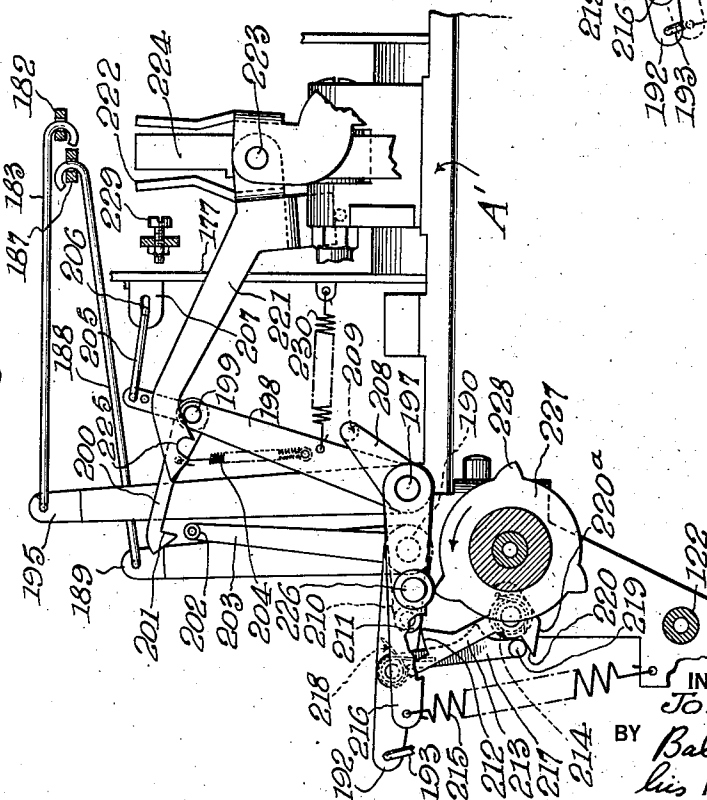
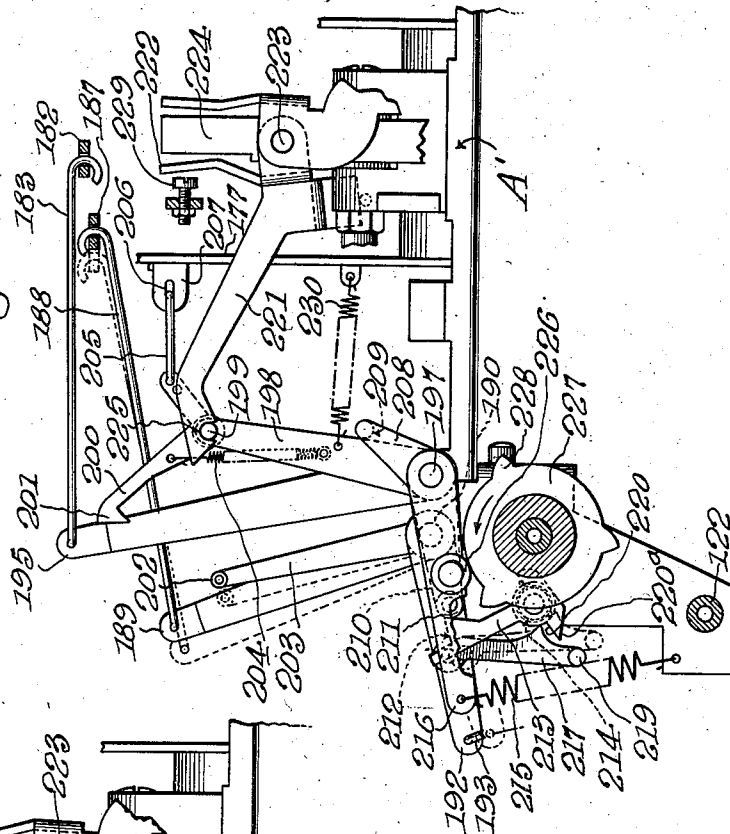


Fig. 19.



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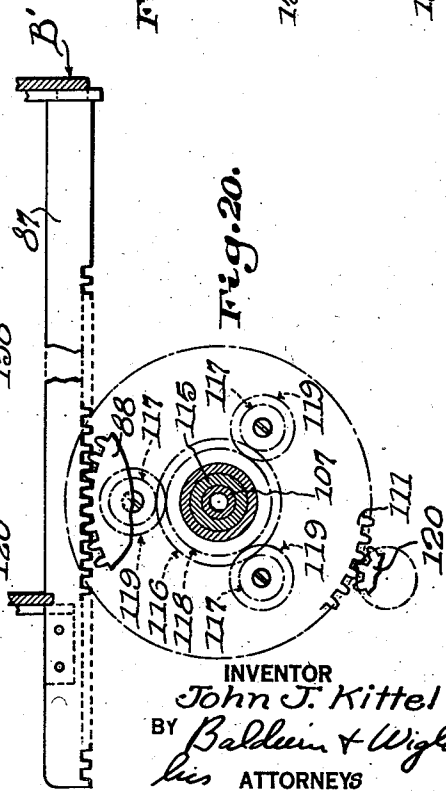
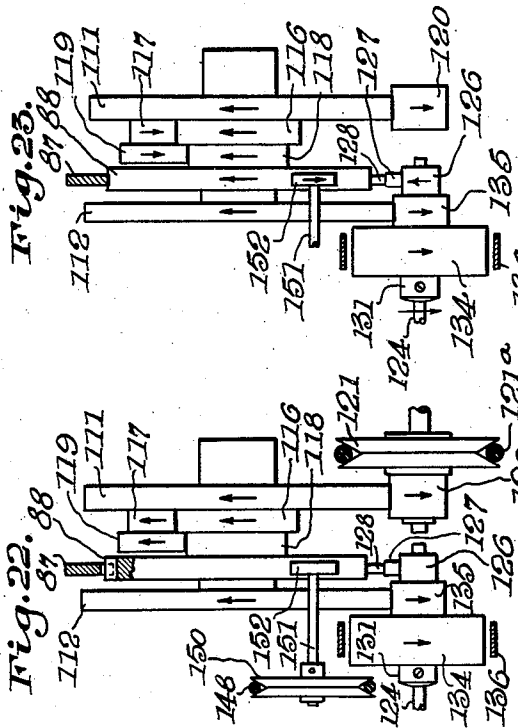
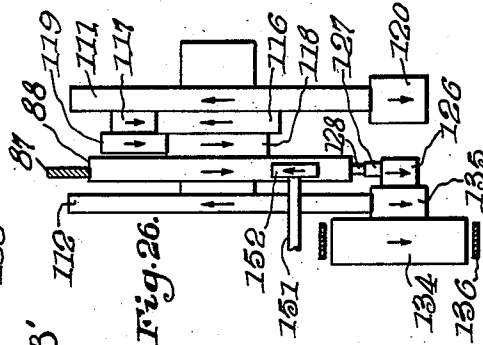
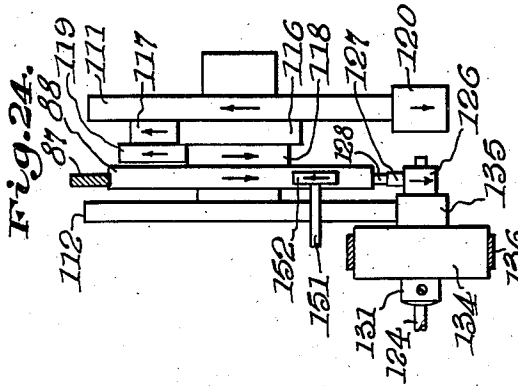
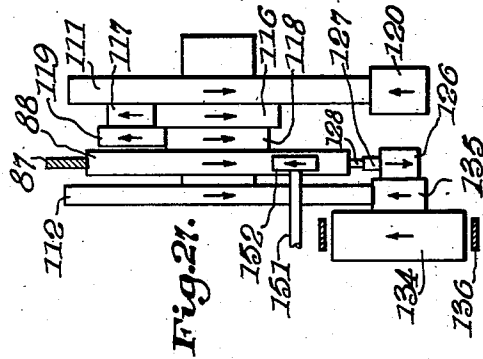
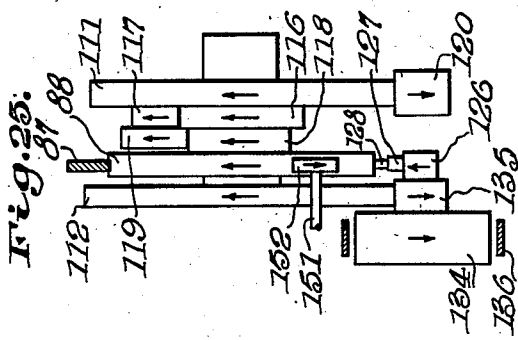
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TYPEWRITING MACHINE

Filed April 3, 1940

9 Sheets-Sheet 9



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UNITED STATES PATENT OFFICE

2,279,141

TYPEWRITING MACHINE

John Joseph Kittel, St. Albans, N. Y., assignor
to Royal Typewriter Company, Inc., New York,
N. Y., a corporation of New York

Application April 3, 1940, Serial No. 327,707

62 Claims. (Cl. 197—66)

This invention relates to typewriting machines, and more particularly to apparatus for transmitting and controlling the application of power to parts of the typewriter mechanism for operating and controlling them.

In most conventional typewriters the carriage is urged in the letter-spacing direction by means of a spring barrel connected to the carriage by a draw band or the like. It is well known that the draw or pull exerted on the carriage by such equipment varies appreciably, being greatest when the barrel spring has been wound up, i. e., with the carriage at the end of its return travel, and being least when the carriage has moved to the other limit of its travel. This variation in letter-spacing pull on the carriage prevents the action of the carriage from being entirely uniform throughout the whole range of its letter-spacing travel, which is objectionable.

Accordingly, one of the principal objects of the invention is to provide improved mechanism for moving a typewriter carriage in letter-spacing direction, one feature of this mechanism being that the force it exerts on the carriage is uniform for all positions of the carriage throughout its range of travel on the main frame. A complementary object is to provide carriage driving mechanism adapted to exert a smooth, cushioned, uniform force tending to drive the carriage for letter-spacing. In attaining this objective a source of constantly available power, such as a small electric motor, may be connected to the carriage through a drive coupling capable of slipping when the carriage is held stationary by the usual escapement mechanism or is moved in the return direction. A kinetic type hydraulic or fluid coupling device has been found to possess superior characteristics adapting it for this purpose. Such a coupling assures the steady application of smooth, cushioned force tending to move the carriage for letter-spacing with a minimum of vibration and shocks. The movements of the carriage are damped and the noises, heretofore objectionable, are muffled and thus minimized. In a modification, a mechanical slip drive coupling is provided for transmitting letter-spacing power to the carriage. Such a coupling, although lacking some of the characteristics of a fluid coupling, such as a full degree of cushioning and sound-muffling effect, assures the application of uniform driving force to the carriage irrespective of its position on the frame; and is particularly adapted for cooperation with improved carriage-returning drive equipment to be referred to below.

Another object of the invention is to provide an improved mechanism for transmitting power from a motor or the like to the carriage for moving the latter in the return direction. When associated with a hydraulic or other slip letter-spacing drive of the character referred to above, the carriage-return drive mechanism may be arranged to drive the carriage relatively positively, that is, in predominating opposition to the carriage letter spacing force exerted through the slip coupling.

Another object is to provide a carriage drive mechanism including planetary gearing. Such gearing, particularly adapted for transmitting carriage-return drive, may be used in association with suitable means for transmitting letter-spacing drive, such, for example, as and preferably a slip coupling drive of the kind previously referred to. A correlative object is to provide mechanism for controlling the operation of the planetary gearing drive.

Another object is to provide a fluid coupling device of the character referred to above which is arranged to deliver fluid under constant pressure to a branch pipe or conduit adapted to communicate with a pressure-actuated device for operating a part of the typewriter other than the carriage.

Another object is to provide an improved power-operated line-spacing mechanism and controls therefor, preferably coordinating the line-spacing operation with the carriage return travel.

A further object is to provide an improved carriage brake arranged to retard the carriage during its return travel, and controlled coordinately with the carriage travel control.

A further object is to provide an improved carriage drive mechanism including a looped band and drive pulley therefor, in association with tabulating mechanism and a tabular brake cooperable with the band.

Other objects will be apparent from a reading of the following description, the appended claims, and the accompanying drawings, in which:

Figure 1 is a longitudinal vertical sectional view of a typewriter embodying the invention in one form;

Figure 2 is an inverted sectional view taken on the line 2—2 of Figure 1 with some parts being shown in elevation and some others being omitted;

Figure 3 is an enlarged horizontal sectional view of a fluid coupling and planetary gearing

drive transmission assembly drawn on an enlarged scale;

Figure 4 is a fragmentary transverse sectional view taken on the line 4—4 of Figure 1 and drawn on an enlarged scale;

Figure 5 is a fragmentary detailed view in elevation as viewed when looking in the direction of the arrow 5 in Figure 1, and drawn on an enlarged scale;

Figures 6, 7, and 8 are diagrammatic showings indicating, respectively, the directions of movement of drive transmission parts shown in Figures 1, 2, and 3 at different stages of the operation;

Figure 9 is a schematic view illustrating a modified form of coupling employing air as the working medium, and illustrating a principle of the invention;

Figure 10 is a developed plan illustrating schematically a further embodiment of the invention;

Figure 11 is a fragmentary horizontal sectional view of drive mechanism included in the form of embodiment shown in Figure 10, and drawn on an enlarged scale;

Figure 12 is a vertical sectional view on the line 12—12 of Figure 11;

Figure 13 is a transverse sectional view on the irregular lines 13—13 in Figure 11, and drawn on an enlarged scale;

Figure 14 is a vertical cross section on the irregular line 14—14 in Figure 13;

Figure 15 is a vertical section on the line 15—15 of Figure 14;

Figure 16 is a vertical cross section showing the relationship between the usual carriage and escapement parts and drive mechanism shown in Figures 10 and 11, the parts being drawn to a smaller scale than in Figure 11;

Figure 17 is a fragmentary view, mainly in front elevation but with parts shown in section, on the line 17—17 of Figure 10, showing automatic control mechanism in its state-of-rest position;

Figure 18 is a view similar to Figure 17 but in which some parts are omitted and others are shown in the positions occupied during another stage of their controlling action;

Figure 19 is a view similar to Figure 18 but showing the parts in positions occupied during a subsequent stage of operation;

Figure 20 is a fragmentary view, mainly in elevation but with some parts shown in section and others broken away, showing a carriage drive gear and rack, and also showing the relation of parts of planetary drive gearing to the carriage drive gear;

Figure 21 is a diagrammatic illustration of belt and pulley connections between a fluid coupling and a carriage drive gear;

Figures 22 to 27 are diagrammatic illustrations indicating, respectively, the directions of movement of the parts of the mechanism shown in Figures 10 to 21, during different stages of operation;

Figure 28 is a diagrammatic showing of an arrangement in which the carriage is driven by a looped, flexible band and is coordinated by a common control means with tabulating mechanism and a tabulating brake;

Figure 29 is a longitudinal sectional view of a modified form of carriage drive including planetary gearing and a mechanical slip friction drive connection;

Figure 30 is an end elevation of a brake mech-

anism viewed in the direction of the arrow 30 in Figure 29;

Figure 31 is a fragmentary detail view illustrating the construction of gear elements from laminated blanks to compensate for back lash;

Figure 32 is a longitudinal sectional view of a further modified form of drive gearing including planetary gearing and a mechanical slip or friction drive device; and

Figure 33 is a longitudinal sectional view showing a still further modified form of drive gearing including planetary gearing and a mechanical slip or friction drive device.

Figures 1 to 9 inclusive, show one illustrative embodiment applied to a typewriter including a frame A and a carriage B mounted for travel in letter-spacing and return directions on the frame through the medium of a carriage rail 1 supported on ball bearings 2 arranged to run on a frame rail 3. The carriage is equipped with the usual platen 4 and escapement rack 5 which meshes with an escapement pinion 6 rotatable in unison with an escapement wheel 7 adapted to be controlled by dogs 8 and 9 carried in the usual manner on a dog rocker 10 pivoted on the frame A at 11—11. These parts may be of any known or suitable construction, the present invention as embodied in the form shown in Figures 1 to 9, inclusive, comprising mechanism for driving the carriage and combinations of such mechanism with the conventional parts thus far referred to.

The carriage is driven by a looped belt or draw band 12 connected to a carriage bracket 13 and arranged to be operated by mechanism generally designated C, preferably mounted on and at one end of the frame A. The mechanism C includes a carriage drive pulley element 14 mounted and driven in a manner to be described later. As shown in Figure 1, the band 12 passes from the pulley 14 around a flanged roller 15 journaled on a frame-mounted bracket 16, and thence extends toward the center of the frame A and partially around a flanged roller 17 journaled on a bracket 18 carried by the frame A. The band then extends partially around and in contact with a drum 19 journaled at 20 on the bracket 18, and thence around a flanged roller 21 on the bracket 18, and passes in contact with a flanged roller 22 on a frame-mounted bracket 23. The band 12 then passes around a flanged roller 24 journaled on the bracket 23, and is returned toward the center of the frame for connection to the carriage bracket 13. From the carriage bracket 13 the band extends longitudinally of the frame around a flanged roller 25 journaled on a lever 26 pivoted as at 26^a on the bracket 16. A spring 27 connected to the lever 26 yieldably maintains the band 12 under tension, which may be adjusted by means of a screw 28 having threaded engagement with the bracket 16. The band extends from the roller 25 in contact with a flanged roller 29 on a bracket 29^a, and thence back around the pulley 14. It will be apparent that rotation of the pulley 14 in the direction of the arrow *a* in Figure 1 will drive the carriage in the letter-spacing direction (toward the left as viewed in Figure 1), as indicated by the arrow *b*, whereas rotation of the pulley in the opposite direction will drive the carriage in the return direction opposite that indicated by the arrow *b*. The spring 27 urges the roller mounting lever or device 26 to move the roller 25 away from the roller 24, that is, in the direction of the arrow *b* in Figure 1. This tends to move the carriage

in the same direction and maintains a tooth of the escapement wheel 7 pressed up against the dog 8, preventing longitudinal displacement of the carriage when the pulley 14 is not driving the band.

The drum 19 is provided with a gear 30 which meshes with a pinion 31 adapted to drive a shaft 32 through a one-way drive ratchet indicated at 32^a, the shaft 32 being adapted to be coupled to the usual or any suitable ribbon feeding equipment (not shown). The arrangement is such that, when the carriage moves in the return direction, the drum 19, gear 30, and pinion 31 will rotate idly, but, when the carriage is moved in letter-spacing direction, the drum 19, gear 30, and pinion 31 will drive the shaft 32 through the ratchet device 32^a so as to effect ribbon feeding.

The mechanism C includes an electric motor 33 arranged to drive the pulley 14 through a liquid coupling unit capable of transmitting driving force tending to move the carriage in letter-space direction, the driving force being uniform irrespective of the position of the carriage longitudinally on the frame. The motor shaft 34 is directly connected to the propeller element or section of a kinetic type hydraulic coupling unit generally designated 35. The propeller section comprises a housing 36 secured to the motor shaft 34 by a set screw 37, and vanes 38 disposed within and rotatable with the housing. The coupling 35 also includes a runner element or section 39 disposed within the propeller section housing 36 and provided with vanes 40 arranged in fluid-driving relation with the vanes 38 of the propeller section. A shaft 41 extends through the housing 36 at 42, being freely rotatable with respect to the housing, and is formed on its inner end with a reduced portion 43 journaled for rotation in a bushing 44 inserted in the housing 36. The reduced end 43 of the shaft 41 extends through and is keyed to the runner 39 as at 45. The opposite end of the shaft is journaled for free rotation in a bushing 46 carried by a standard 47 on the frame A.

An inner sleeve 48 is mounted on the shaft 41 and is constrained to rotate therewith by a pin 49. One end of the sleeve 48 is formed with a sun gear 50 which is in constant mesh with a planetary pinion 51 journaled on a stub shaft 52 carried by the propeller housing 36, and the other end of the sleeve 48 is keyed as at 53 to the pulley 14. A bellows-type liquid seal 54 surrounding the shaft 41 is interposed between the housing 36 and the adjacent end of the sleeve 48 to prevent leakage of working fluid under pressure.

An outer sleeve 55 is mounted to turn freely on the sleeve 48, and at one end is formed with a sun gear 56 which fits up against the sun gear 50 and is in mesh with the planetary pinion 51. At its opposite end, the outer sleeve 55 is formed with a brake drum 57. Surrounding the brake drum 57 is a brake band 58 connected by springs 59—59 to one arm 60 of a bell crank lever 61 pivoted at 62 on a frame-mounted bracket 63. The other arm 64 of the bell crank lever 61 is adapted to be connected to suitable control means, preferably including a part positioned conveniently with respect to the keyboard by means of which the operator may cause the bell crank lever 61 to be swung in a clockwise direction as viewed in Figure 1 so as to apply the band 58 to the brake drum 57.

The planetary reversing gearing comprised by the sun gears 50 and 56 and the pinion 51 is so

constructed as to coast with the fluid-coupled motor for moving the carriage at the desired speeds in either direction under selective operator control. Assuming, for example, that the normal operating speed of the motor 33 is 7328 R. P. M., the desired speed reduction and reversing of the direction of carriage travel will be obtained by providing the sun gear 50 with thirty-two teeth, the sun gear 56 with thirty-three teeth, and the pinion 51 with twenty-two teeth. The pitch diameters, the outside diameters, and the root diameters of the sun gears 50 and 56 may all be equal, even though the number of teeth in these gears is different. By providing each of the sun gears and pinion with the specified number of teeth, the difference in speed between the motor and sun gears will be in the ratio approximately 33.3 to 1.0 when the carriage is driven in a letter-spacing direction, and will be in the ratio 32.2 to 1.0 when the carriage is being driven in the return direction. The arrangement described, therefore, makes it possible to use a small, high-speed motor which consumes little current and which is efficient and quiet in operation. For maximum smoothness and quietness in operation, the propeller housing 36 should be statically and dynamically balanced, and to this end it is provided with weights 65 disposed to counterbalance the weight of the planetary pinion 51 and its mounting.

To describe the operation of the mechanism shown in Figures 1 to 5, inclusive, and with reference to the diagrammatic illustrations in Figures 6, 7, and 8, it will be assumed that the motor 33 has been started, that the escapement mechanism is holding the carriage against movement in the letter-spacing direction, and that the brake band 58 is in released position to permit free rotation of the brake drum 57. The holding of the carriage stationary prevents movement of the band 12, and consequently prevents rotation of the pulley 14, the sleeve 48, the shaft 41, and the sun gear 50. Slippage of the fluid between the vanes 38 and 40 will permit continued rotation of the propeller housing 36 while the runner 39 is held stationary. Rotation of the propeller housing 36 will carry the planetary pinion 51 around in an orbital path, and engagement of the pinion with the stationary sun gear 50 will cause the pinion to rotate about its own axis and drive the sun gear 56, the sleeve 55, and the brake drum 57 idly. The directions of rotation of the parts during this stage of the operation are indicated by the arrows in Figure 6.

The arrows in Figure 7 indicate the direction of movement of the various parts during release of the escapement mechanism to permit letter-spacing movement of the carriage. When the carriage has been released, as by operation of a key lever or space bar (not shown) for letter-spacing, rotation of the propeller 36 drives the runner 39 through the fluid coupling between the propeller and runner, and rotates the shaft 41, the sleeve 48, the sun gear 50, and the pulley 14 in a direction to drive the band 12 to move the carriage in the letter-spacing direction (as indicated by the arrow b in Figure 1). During this driving of the carriage, the sun gear 56, sleeve 55, and brake drum 57 will be driven idly by the pinion 51.

The arrows in Figure 8 indicate the directions of movement of the parts when the brake band 58 is applied by operation of the lever 61 to effect return movement of the carriage through mechanically coupled drive connections. When

the brake band is applied, the brake drum 57 and the sun gear 56 will be held against rotation. During rotation of the propeller housing 36 by the motor coupled directly to the housing, the pinion 51 rolls around the stationary sun gear 56 and is rotated about its own axis. The relative numbers of teeth in the sun gears 50 and 56 and the planetary pinion 51 are such that the sun gear 50 then will be rotated by the pinion 51 in a manner to drive the pulley 14 reversely independently of the runner 39 so as to drive the band 12 and move the carriage B in the return direction.

The fluid for transmitting the cushioned drive between the propeller 36 and runner 39 may be introduced into the housing 36 through an opening normally closed by a screw plug 66. Means are provided for transmitting fluid pressure to a point or points exterior of the coupling 35 for actuating fluid-responsive devices (not shown) which may be provided for operating parts of the typewriter mechanism other than the carriage-moving parts. In the form shown in Figures 1 and 2, the propeller housing 36 is formed with a passage 67 leading from the zone of the blades 38 inwardly to a space 68 between the end of the motor shaft 34 and the adjacent end of the shaft 41. An axial passage 69 in the shaft 41 opens into a space 70 at the opposite end of the shaft which communicates with a pipe 71 controlled by a valve 72. Beyond the valve the pipe is provided with a plurality of branches 73 adapted to be connected to fluid-responsive devices for operating parts of the typewriter mechanism such, for example, as the case-shifting, back-spacing, tabulating, and type bar action mechanisms (not shown). It will be understood that, regardless of the operation of the planetary gearing and pulley 14 for driving the carriage, the fluid in the coupling device 36 always will be under pressure communicable through the pipe 71 and branches 73 for operating such other mechanisms.

Figure 9 shows diagrammatically, and as illustrating a principle of operation of mechanism embodying the invention, a modified fluid coupling device 74 including a fixed housing 75, a propeller 76 driven by a motor 77, and a runner 78 adapted to be driven by an air current caused by rotation of the propeller 76, the air current being drawn in through the opening 79 at one end of the housing 75 and forced out through the opening 80 at the other end thereof.

The embodiment of the invention shown in Figures 10 to 27, inclusive, includes a fluid drive coupling of the kinetic type interposed between the power source and carriage, and arranged to cooperate with reversing planetary gearing so controlled as to provide for cushioned carriage drive and power line spacing all under the control of a manually operable device such as a key lever located conveniently with respect to the typewriter keyboard. A typewriter embodying this form of the invention is shown as including a main frame A' and a carriage B' mounted for letter-spacing and return movements on the frame in the usual manner. The carriage is provided with an escapement rack 81 in mesh with an escapement pinion 82 journaled on the frame A' and fast with an escapement wheel 83 co-operable with escapement dogs 84 and 85 carried by a rocker 86. These parts may be of known or any suitable construction.

The carriage is arranged to be power-driven in both directions by means of a drive rack 87

mounted on the carriage and in mesh with a carriage feed gear 88 forming part of mechanism generally designated C'. This mechanism includes an electric motor 89 mounted on the frame A' and having a shaft 90 which mounts a V-pulley 91 secured to the shaft by a set screw 92. A propeller shaft 93 has a flattened end portion disposed within the pulley 91 in interfitting relation with a similar end portion on the motor shaft 90 whereby the shafts 90 and 93 are constrained to rotate in unison. The shaft 93 is journaled in an antifriction bearing 94 carried by a frame-mounted bracket 95 and is formed integrally with the propeller element 96 of a kinetic type fluid coupling generally designated 97 which also includes a runner housing element 98. A spring-pressed, bellows type gland 99 interposed between the bracket 95 and the runner housing 98 prevents leakage of working fluid from within the housing and around the shaft 93. The shaft 93 is provided with a reduced end portion 93^a which is journaled in a bushing 100 fitted axially in the housing 98. A shaft 101 secured to the housing 98 by a set screw 102 is journaled in a frame-mounted bracket 103 and is fitted with a V-pulley 104. The propeller 96 is provided with vanes 105 similar to the vanes 38 described with reference to Figure 3, and the runner 98 is provided with vanes 106 which differ from the vanes previously described in that they are cut away as at 106^a in order to reduce resistance to slip between the working fluid and the impeller and runner. The vanes of the impeller or runner, or of both, may be cut away more or less to reduce or increase the resistance to slip, and thus to provide for the transmission of just the right torque for driving a carriage of a particular size or weight.

The motor pulley 91 and the runner pulley 104 are connected to planetary gearing controllable to produce cushioned carriage drive. A shaft 107 supported at 108 and 109 on a frame-mounted bracket 110 journals a carrier gear 111 and a lock gear 112, the hubs of these gears abutting each other and being confined between a spacer 113 abutting the bracket 110 and a collar 114 on one end of the shaft 107. The hub 115 of the lock gear is formed as a sleeve to which is secured a sun gear 116 in mesh with three planetary pinions 117 journaled on the carrier gear 111. A sun gear 118, fast with the carriage drive gear 88, is journaled for free rotation on the hub 115 of the lock gear 112 and meshes with three planetary pinions 119 also journaled on the carrier gear 111 and fixed respectively to the three planetary pinions 117. The three sets of planetary pinions 117-119 carried by the gear 111 are equidistantly spaced from each other as shown in Figures 13 and 20 so as to balance the carrier gear 111.

The carrier gear 111 meshes with a pinion 120 which is fast with a pulley 121 journaled antifrictionally on a hollow spindle 122 fixed to the bracket 110 and to another frame-mounted bracket 123, as shown in Figure 14. In operation, the pulley 121 is constantly and positively driven by the motor 89 through the medium of a belt 121^a guided by a pulley 121^b. A shaft 124 is journaled at its left hand end (as viewed in Figure 14) in the bracket 123, and at its opposite end projects into and is journaled by the hollow spindle 122. A sleeve 125 journaled on the shaft 124 is fast with a pinion 126 meshing with a gear 127 in turn meshing with a gear 128 which

meshes with the carriage drive gear 88 (see Figures 13 and 14). At the end of the sleeve opposite the pinion 126 is a ratchet wheel 129 fast with the sleeve and adapted to cooperate with a pawl 130 pivoted on a pawl carrier 131 held fast to the shaft 124 by a set screw 132. The shaft 124 is adapted to be connected at 133 to a ribbon feed mechanism of a known or suitable kind.

A brake drum 134 journaled for free rotation on the sleeve 125 is fixed to a pinion 135 which meshes with the lock gear 112. A control band 136 partially surrounds the drum 135 and is connected by means of springs 137 to a rock arm 138 secured to a shaft 139 mounted on the frame bracket 123. Rocking of the shaft 139 will apply the band 136 to the brake drum 134 to control the movement of the carriage drive gear 88 in a manner later to be described. For operating the rock shaft 139, connections between the shaft and a manually operable device located conveniently with respect to the keyboard are provided. In the form shown these connections include an arm 140 secured to the shaft 139 and connected by a link 141 to one arm of a lever 142 secured to a shaft 143 pivoted as at 144 on the frame A'. The other arm of the lever 142 is connected by a link 145 to a control key lever 146 pivoted as at 147 to the frame A' (see Figures 10, 11, 13, and 16).

The cushioned drive from the fluid coupling runner 98 is transmitted by a belt 148 engaging the runner pulley 104 and being guided by pulleys 149 to a pulley 150 secured to a shaft 151 which is journaled on the frame-mounted bracket 123 and is provided with a gear pinion 152 meshing with the carriage feed gear 88.

Figure 10 shows, by way of example, one suitable form of control for the motor 89. Two conductors 153 and 154 lead from a source of electric power, and interposed in the conductor 153 are a fuse 155 and speed control rheostat 156. Interposed in the conductor 154 is a starting and stopping switch 157 including contact elements 158 and 159 shunted by a condenser 160 adapted to reduce sparking and eddy currents, and to demagnetize the contacts 158 and 159.

In the operation of the mechanism thus far described, the switch 157 is closed so as to start the motor 89. The rheostat 156 should be set to provide the desired motor speed, but after once being set will not often require further adjustment, the motor operation being controlled mainly by the starting and stopping switch 157. When the motor is running and before typing has been started, the escapement will hold the carriage against movement on the frame. The arrows applied to the various parts shown diagrammatically in Figure 22 illustrate the direction of movement of the parts when the escapement mechanism is holding the carriage stationary. The carriage feed gear 88 and the sun gear 118 fast therewith cannot turn because the carriage rack 87 is held stationary. Consequently, the fluid coupling runner 98 which is connected to the feed gear 88 by means of the belt 148, shaft 151, and gear 152 likewise will be held stationary, as is permitted by the slippage of fluid between the vanes 105 and 106 of the coupling 97. The carrier gear 111 will be driven positively by the motor 89, belt 121a, pulley 121, and pinion 120, thus carrying the planetary pinions 117 and 119 in an orbital path around their respectively associated sun gears 116 and 118. The planetary pinions also will rotate about their own axes in the directions indicated by the arrows, which will cause the sun gear 116 and the lock gear 112 fast therewith to rotate

freely, this being permitted because the band 136 is not applied to the brake drum 134 which is geared to the lock gear 112 through the pinion 135. Thus the motor 89 may run continuously while the escapement mechanism holds the carriage against movement.

When the operator operates the escapement mechanism to release the carriage for travel in the letter-spacing direction, as by depressing a key lever or the space bar, the parts of the drive mechanism C' will move in the directions indicated by the arrows applied to the several parts in Figure 23, it being noted that at this stage of the operation also the brake drum 134 is free to rotate without restraint by the band 136. The fluid coupling runner 98 will transmit drive through the belt 148, shaft 151, and gear 152 to the carriage feed gear 88 so as to apply a cushioned driving force to the carriage rack 87 for moving the carriage in the letter-spacing direction. The carrier gear 111 still will be driven positively by the motor so as to carry the planetary pinions 117 and 119 around the associated sun gears 116 and 118, and this will rotate the sun gear 116 and the lock gear 112 fast therewith in the direction indicated by the arrows.

To effect a return movement of the carriage, the key lever 146 is depressed partially, only to an extent required to apply the band 136 to the brake drum 134, which, through the pinion 135, holds the lock gear 112 and the sun gear 116 stationary. The movement of the parts then will be as indicated by the arrows in Figure 24. The carrier gear 111 will continue to be positively driven, and will carry the planetary pinions 117 and 119 in an orbital path around their sun gears 116 and 118, and, since the sun gear 116 will be held stationary, the sun gear 118 and the feed gear 88 now will be rotated reversely to drive the rack 87 and carriage in the return direction. During the return movement of the carriage, the reverse rotation of the feed gear 88 will drive the gear 152, the shaft 151, the belt 148, and the fluid coupling runner 98 reversely, this being permitted by slippage of the fluid between the vanes 106 and 105.

The key lever 146 is depressed only partially for effecting return movement of the carriage as explained above, because control mechanism, now to be described, is associated with the key lever in such a manner that further depression of the lever effects power line-spacing of the platen and applies a brake for retarding the carriage return movement. As shown in Figure 10, the carriage is provided with a platen 161 rotatable for line-spacing by means of a ratchet 162 and a line space actuator pawl 163 operated by a link 164, these parts being of known or any suitable construction. The link 164, instead of being connected to the usual manually operable line-spacing handle, is connected to a line-spacing lever 165 pivoted on the carriage as at 166 and provided with a sector 167 concentric with the pivot 166. A spring 168 interposed between the lever 165 and a fixed part on the carriage urges the lever and sector 167 to their normal or state-of-rest positions indicated by the line I in Figure 10.

A band 169 secured at 170 to the sector 167 passes around guide rollers 171 and 172 journaled on the carriage and thence longitudinally in the back of the carriage, around a roller 173, and into a fixed anchorage 174 on the carriage. Mechanism for tensioning the band 169 to swing the sector 167 and lever 165 includes a three-armed lever 175 pivoted at 176 on the usual tabu-

lar finger cover 177. Two arms 178 and 179 of the three-armed lever are provided with band-operating roller elements 180 and 181, respectively, and the third arm 182 of the lever is connected to an operating link 183. Pivoted coaxially with the lever 175 is a two-armed lever 184, one arm 185 of which pivotally mounts a band-operating roller element 186, the other arm 187 of the lever 184 being connected to an operating link 188. An intermediate portion of the band 169, in passing longitudinally in back of the carriage, extends in front of the roller 180 on the three-armed lever 175, in back of the roller 181 on the three-armed lever, and in back of the roller 186 on the two-armed lever 184. As will be described later, the levers 175 and 184 are operated sequentially in timed relation to tension the band 169, to effect power line-spacing of the platen 161, and to retard the carriage during its return travel.

The link 188 is connected to an arm 189 fast on a shaft 190 supported by bearings 191 on the bracket 110 (see Figure 16). An extension control arm 192 fixed to the shaft 190 is connected by a link 193 to an arm 194 secured to the shaft 139. Depression of the key 146 which rocks the shaft 139 will rock the arm 194 so as to pull the link 193 and rock the arm 192, the shaft 190, and the arm 189, thus pulling the link 188 and rocking the two-armed lever 184 in a counterclockwise direction as viewed in Figure 10.

The link 183 extending from the three-armed lever 175 is connected to an arm 195 fast with a sleeve 196 which is free to rock on a shaft 197 pivoted on the bracket 110 (see Figure 16). Fast with the bushing 196 is an arm 198 provided at its upper end with a pin 199 on which is pivoted a hook pawl coupling 200, the nose 201 of which is adapted to engage an anti-friction roller 202 on an intermediate arm 203 fixed to the shaft 190. A restoring spring 204 connected between the pawl and the arm 198 urges the pawl normally to maintain it in engagement with the roller 202. A link 205 is connected at one end to the pawl and at its other end is engaged in a slot 206 in a bracket 207 supported by the tabulator mechanism housing 177.

In operation, when the key 146 is depressed throughout about one-quarter of its stroke, the shaft 139, arm 194, and link 193 will be moved as previously explained, and the three-armed member comprising the arms 189, 192, and 203 will be rocked in a counterclockwise direction as viewed in Figure 17, pulling the pawl 200 and arm 198 to the left. Rocking of the two-armed member comprised by the arm 198, the sleeve 196, and the arm 195 will pull the link 183 toward the left as viewed in Figure 10 so as to rock the three-armed lever 175 in a counterclockwise direction. Thus the initial depression of the key 146 will rock the two-armed lever 184 and the three-armed lever 175 so as to move the band 169 from the I' position to the II' position shown in Figure 10, thus pulling on the band and rocking the line-space lever 165 from position I to position II, such movement constituting only the line-space idling movement, that is, the movement sufficient to bring the pawl 163 into engagement with but not to move a tooth on the ratchet wheel 162. Rocking of the two-armed member 198—196—195 will cause the link 205 to pull on the pawl 200 and rock it to disengage the nose 201 from the roller 202, thereby conditioning the three-armed member 189—192—202 for further rocking movement. The operation as

carried out thus far moves the parts to the positions shown in Figure 18 and sets up or conditions the mechanism for subsequent power-operated line-spacing of the platen.

Referring now to the mechanism for supplying power to effect line-spacing of the platen in sequence to the manual conditioning of the line-spacing mechanism, an arm 208 fast on the shaft 197 is provided with a pin 209 which extends behind the arm 198. An arm 210 also fast on the shaft 197 is provided with a roller 211 which normally rests upon and is held up by a seat 212 on a retaining member or dog 213 pivoted on the bracket 110 and biased by a spring 214 into position for engaging and supporting the roller 211. A line-spacing power spring 215 is interposed between the bracket 110 and a line-space drive member or operating arm 216 fast with the shaft 197, and constantly urges the arms 216, 210, and 208 to rock in a counterclockwise direction, but normally the arms are held against such rotation by means of the dog 213. For releasing the dog, an interponent 217 is pivotally mounted on the extension arm 192 and is urged by a spring 218 to the position shown in Figure 17 in which a pin 219 at the lower end of the interponent engages a heel 220 on the dog 213. When the key 146 is depressed so as to rock the control arm 192, the interponent 217 will be moved downwardly and will swing the dog 213 to the position shown in Figure 18, releasing the roller 211 and permitting the spring 215 to rock the three-armed member comprised by the arms 208, 210, and 216 to the position shown in Figure 19. The pin 219 will then slide off the dog heel 220, moving to the position shown in full lines in Figure 19. Rocking of the arm 208 to the Figure 19 position will cause the pin 209 to drive the arms 198 and 195 counterclockwise to the position shown in Figure 19, pulling the link 183 further and rocking the three-armed lever 175 to move the band 169 to position III' and move the line-spacing lever 165 to position III, thereby effecting power-operated line-spacing.

It is desirable that the arms 198 and 195 be held in the positions shown in Figure 19 during carriage return movement. To this end a holding device comprising an extension 221 on the margin stop locator 222 pivoted at 223 on the center stop 224 is formed with a seat or depression 225 which is adapted to receive the pin 199 carried by the arm 198 when the arm has been moved to the Figure 19 position. When the pin 199 is engaged in the seat, the arm 198 and parts movable therewith will be held in the positions shown in Figure 19 until the extension 221 is raised.

When the arm 216 moves downwardly, a restoring roller 226 thereon enters a dwell in the three-lobed cam 227 fixed to and rotatable with the carrier gear 111. When a lobe 228 on the rotating cam 227 engages the restoring roller 226, the arm 216 will be returned to its Figure 17 position, and the spring 214 will move the dog 213 clockwise so as again to position the seat 212 under the roller 211 on the arm 210. The dog 213 is free to return to this position even during continued depression of the key 146 because the interponent pin 219, in sliding off the dog heel 220, became operatively disconnected from the dog, and is disposed under the inclined surface 220a below the dog heel 220, as shown in dotted lines in Figure 19. By holding the key 146 down, the brake band 136 is applied to the brake drum

134 to effect power-operated carriage return in the manner already described.

For restoring the power-operated line-spacing parts and its control mechanism to the positions shown in Figure 17, preparatory to the start of another line of typing, the usual margin stop 229 supported on the carriage engages the stop locator 222 when the carriage approaches the end of its return travel, and rocks the extension 221 upwardly so as to release the pin 199 from the seat 225, permitting the arm 198 to be returned to its initial position by a spring 230 interposed between the arm and the tabulator mechanism cover 177. This return movement of the arm 198 also returns the arm 195, link 183, and three-armed lever 175 to their initial positions. The two-armed lever 184 and the connections between it and the key 146 will be returned to their initial positions when the key 146 is retracted or raised. During retraction of the key and consequent rocking of the arm 192 and lifting of the interponent 217, the pin 219 will be cammed outwardly by the inclined surface 220^a on the dog 213 to permit the pin to ride over the edge of the dog and then to be moved by the spring 218 over the dog heel 220.

To recapitulate the manner of operation of the embodiment shown in Figures 10 to 27, inclusive, assuming the motor 89 to be running and the carriage to be positioned at the end of its return travel in readiness for the writing of a line, the carriage will be held at rest by the escapement mechanism, and the carriage-driving connections between the motor and carriage, including the planetary gearing and the fluid coupling 97, will be moving in the directions indicated by the arrows in Figure 22, as previously explained. Each time a key lever or space bar is depressed for typing and letter-spacing, the escapement will be released, permitting the driving parts to move in the directions indicated by the arrows in Figure 23. When the typing of a line has been completed, the key 146 is depressed approximately one-quarter of its full stroke, thus applying the brake band 136 to the brake drum 134 and rocking the two-armed lever 184 and three-armed lever 175 to position the band 169 in the II' position shown in Figure 10, and thus moving the line-spacing lever 165 idly to position II in Figure 10. The driving connections between the motor and the carriage will then move in the directions indicated by the arrows in Figure 24. Further depression of the key 146 will move the arm 192 and interponent 217 downwardly to disengage the dog 213 from the roller 211. This permits the spring 215 to move the arm 216 downwardly, thereby rocking the shaft 197, arm 208, and arms 198 and 195 so as to move the link 183 to the left and rock the three-armed lever 175 coincidentally with key-effected rocking of the two-armed lever 184. The band 169 thereby will be moved to position III' and the line-space lever 165 will be moved to position III, thus line-spacing the platen by the power provided by the spring 215. As soon as a lobe 228 in the cam engages the roller 226 on the arm 216, the arm 216, shaft 197, and arm 210 will be returned to their starting positions, and the dog 213 will move under the roller 211, again to hold the arm 216, arm 210, and arm 208 in their starting positions.

Further depression of the key will rock the two-armed lever 184 additionally so as to move the band 169 to the position IV' shown in Figure

10, placing the band under tension to produce a drag retarding the carriage and acting as a brake to overcome the inertia of the moving carriage, thus reducing its speed and avoiding shock at the end of its return travel.

To increase the effectiveness, i. e., retarding action, of the brake band 169, friction washers may be arranged to bear on one or more of the band-contacting elements or rollers 180, 181, and 186. One such washer 180^a is shown bearing on the roller 180 in Figure 17.

When the carriage reaches the end of its return travel and is arrested by engagement of the margin stop 229 with the stop locator 222 and engagement of the latter with the center stop 224, the key 146 is released, thus releasing the brake band 136 from the drum 134 and permitting the gears to rotate in the directions indicated by the arrows in Figure 22. Should the operator not release the key 146 by the time the carriage has been stopped, the springs 137 will yield sufficiently to permit the drum 134 to slip in the band 136.

If desired, the carriage may be moved manually in either direction while the motor 89 continues to run. To move the carriage manually in the letter-spacing direction, the escapement rack is lifted in the usual manner and the parts of the drive mechanism will then operate in the directions indicated by the arrows in Figure 25. When the carriage is moved manually in the return direction, the parts of the drive mechanism will move in the directions indicated by the arrows in Figure 26.

The arrows in Figure 27 indicate the movements of the parts when the motor 89 is stopped and the carriage is moved manually, or by the back spacer, in the return direction.

The foregoing description has had reference to two general kinds of carriage drive, Figures 1 to 9 and the accompanying description disclosing a carriage driven by a flexible band in turn driven by a pulley, and Figures 10 to 27, inclusive, with the accompanying description, disclosing a carriage driven by a rack cooperating with the drive gear. Both types of drive are capable of being modified in various ways. In accordance with one such embodiment, means may be provided for applying a brake to the carriage during tabulating operations so as to prevent excessive carriage speed, particularly on long carriage runs.

One example of mechanism for applying a brake to the carriage during tabulating movement is shown diagrammatically in Figure 28 as being adapted for use in connection with typewriters in which the carriage is driven by an endless band engaging a drive pulley, the arrangement being broadly similar to that described with reference to Figures 1 to 9. As shown in Figure 28, the carriage B is provided with the escapement rack 5 engaging the escapement pinion 6 fast with the escapement wheel 7 controlled by dogs 8 and 9. The escapement rack 5 is carried by pivoted arms one, 231, of which is shown. For performing tabulating movements, the rack is lifted from the pinion 6 by means of a lifting arm 232 pivoted as at 233 on the carriage, the lifting movement of the arm 232 being effected by movement of the lower end of a tabulating finger 234 pivoted on the carriage as at 235. The upper end of the tabulating finger 234 is engageable in the usual manner with the tabular stops one of which, 236, is shown carried on a tabular stop bar 237 fixed to

and movable with the carriage B. A tabular key 238 pivoted on the frame as at 239 has an arm 240 connected by a link 241 to the lower end of the tabulating finger 234, a spring 242 interposed between the end of the link 241 and the finger 234 providing for continued depression of the key 238 after the finger 234 has moved to tabulating position. The carriage is adapted to be driven by means of a band 243 passing around a drive pulley 244 and an idler pulley 245, one stretch of the band being guided by rollers 246 and 247. The roller 247 is carried on a swinging arm 248 pivoted on the frame as at 249 and connected to the upper end of the key arm 240 by means of a spring 250.

In operation, when the key 238 is depressed, the rack 5 is lifted clear of the escapement pinion 6 and the carriage is driven in the direction of the full-line arrow in Figure 28 by rotation of the pulley 244 driven and controlled similarly to the pulley 14 embodied in the form shown in Figures 1 to 9. While the carriage is being driven during the tabulating movement, it may be retarded to prevent excessive speed by further depression of the key 238, permitted by yielding of the spring 242, which will rock the arm 248 and the roller 247 carried thereby so as to place the band 243 under increased tension, and thereby to exert a drag which retards the carriage.

Figures 29, 30, and 31 show a modified form of planetary gear drive particularly suited for use in connection with high speed motors. This embodiment has in common with the embodiment shown in Figures 1 to 9 that the carriage is driven by a band operated by a pulley driven through planetary gearing, but differs from the form shown in Figures 1 to 9 in that a mechanical friction drive is used instead of a fluid coupling for transmitting letter-space movement drive to the carriage. As shown in Figure 29, a high speed motor shaft 251 extends through and is secured to a carrier 252, the projecting end of the shaft extending into an inner sleeve 253 which is surrounded by and journals an outer sleeve 254 supported for rotation in a bushing 255 carried by a frame-mounted bracket 256. Fast to one end of the sleeve 253 is a sun gear 257 having forty-seven teeth, and a brake drum 258 is fixed to the other end of the sleeve. Fast to one end of the outer sleeve 254 is a sun gear 259 having forty-nine teeth, and fast with the other end of the sleeve 254 is a brake drum 260. A third sun gear 261 having forty-eight teeth is loose on the sleeve 254. The sun gears 257, 259, and 261 all mesh with pinions 262 fixed to rotate together on a stud 263, the pinions all having the same pitch diameters and all having the same number of teeth, preferably twenty-four teeth. Thus the gear ratios between the pinions and the sun gears 257, 259, and 261 are, respectively, relatively low, high, and intermediate. Since the number of teeth in all of the pinions 262 is the same, and since the numbers of teeth in the sun gears 257, 259, and 261 are different, although the gears are of the same pitch diameter, it is desirable to compensate for back lash. The teeth of the sun gear 261 and the teeth of the cooperating pinion 262 may be formed to mesh with no more than a permissible back lash. To compensate for somewhat greater back lash between the teeth of the sun gears 257 and 259 and the teeth of their associated pinions with manufacturing economy, each pinion 262 is stamped from blanks of standard pitch and epi-

cycloidal tooth profile. The pinion 262 cooperating with the sun gear 257 may be formed of two of such blanks, 262^a and 262^b, laid together and secured in angularly displaced relation by rivets 262^c, as shown in Figure 31, to take up or compensate for the undesirable back lash which otherwise would be present. The pinion 262 cooperating with the sun gear 259 may be constructed similarly to reduce back lash.

A pulley 264 free on the outer sleeve 254 is held up against a friction disc 265 interposed between the pulley and the sun gear 261 by means of a spring 266. A band 267 trained around the pulley 264 is adapted to be connected to and to drive the carriage in a manner similar to the band 12 in the embodiment shown in Figures 1 to 9. The arrangement is such that, when the sun gear 261 is rotated in one direction and the carriage is held by the escapement mechanism, the friction drive between the sun gear and pulley 264 will slip, permitting the carriage to be held by the escapement mechanism. When the escapement mechanism is released and the sun gear continues to rotate in the same direction, drive will be transmitted frictionally to the pulley 264 for effecting letter-space movement of the carriage. When the sun gear 261 is rotated in the opposite direction, drive will be transmitted frictionally through the disc 265 to the pulley to return the carriage.

For controlling the rotation of the sun gear 261 and pulley 264, a brake band 268 surrounds the brake drum 258 and has its ends connected to pins 269 and 270, respectively, on levers 271 and 272 pivoted as at 273 on the bracket 256, and urged together by a spring 274. The spring 274 normally holds the band 268 applied to the drum 258. For releasing the band 268, a double-acting cam 275 carried by a rock shaft 276 is interposed between the levers 271 and 272. An arm 277 secured to the shaft 276 is connected by a link 278 to an arm 279 fast on a shaft 280 pivoted on the bracket 256. A pull link 281 connected to the arm 279 is adapted to be connected to a suitable carriage return key, not shown. A brake band 282 surrounding the brake drum 260 normally is not applied to the drum, but is connected through springs 283 to an arm 284 fast with the shaft 280, so that, upon rocking of the shaft, the band 282 will be applied frictionally to the drum 260.

In operation of the form shown in Figures 29, 30, and 31, and assuming the motor shaft 251 and carrier 252 to be rotating in a clockwise direction as viewed when looking in the direction of the arrow 30 in Figure 29, and the carriage to be held against letter-spacing movement by the usual escapement mechanism, the band 268 will be applied to the drum 258, but the band 282 will be free of the drum 260. The sun gear 257 will be held stationary by the brake band 268 acting upon the drum 258. The planetary pinions 262 will move clockwise in an orbital path and will rotate clockwise about their own axes. The sun gear 259, the sleeve 254, the brake drum 260, and the sun gear 261 all will turn clockwise. Turning of the sun gear 261 while the pulley 264 is maintained stationary by the escapement mechanism is permitted by slippage of the gear 261 on the friction disc 264.

When the operator depresses a key lever or the space bar and thus releases the escapement, the parts continue to rotate in the same manner as just described, but the pulley 264 also will be driven clockwise by the sun gear 261 and fric-

tion disc 265 so as to drive the band 267 and move the carriage in the letter-spacing direction.

In order to return the carriage, the link 281 is pulled by means of a suitable control such as a key (not shown), thereby releasing the brake band 268 so as to free the sun gear 257 and, simultaneously, to apply the brake band 282 to the drum 260 so as to hold the sun gear 259 against rotation. The pinions 262 will continue to be moved clockwise in an orbital path, and will rotate clockwise about their own axis, because of the engagement of the middle pinion 262 with the locked sun gear 259. The pinion 262 engaging the sun gear 261 will drive the latter reversely, that is, in a counterclockwise direction, to drive the pulley 264 reversely through the friction disc 265 so as to drive the band 267 and move the carriage in the return direction.

Figure 32 shows a simple form of mechanical friction drive planetary gear apparatus which is adapted for use in connection with the mechanism shown in Figures 10, 11, and 16, wherein the carriage is driven by a rack engaging a drive gear. The mechanism shown in Figure 32 is carried by a shaft 107 mounted on brackets 110 and 123, as in Figures 11 and 16. The bracket 110 comprises a flange 110^a fixed to the frame A and a flange 110^b spaced from the frame A and connected to the flange 110^a by a web 110^c, the flange 110^b therefore being capable of a slight displacement axially of the shaft 107, due to the resiliency of the bracket. The end of the shaft 107^a carried by the bracket 123 is so mounted on the bracket as to be capable of axial sliding movement. The carrier gear 111 is rotatable on the shaft and is equipped with the cam 227 in the same manner as shown in Figures 10, 11, and 16. The carrier gear also is equipped with a planetary pinion 285 having twenty-two teeth rotatable on a stud 286. The lock gear 112, similar to that shown in Figures 10, 11, and 16, is rotatable on the shaft 107 and is connected for rotation with a sun gear 287 having twenty-seven teeth. The connection between the lock gear 112 and sun gear 287 comprises a slot 288 in the sun gear extending parallel to the axis of the shaft 107 and receiving a pin 289 fixed to the hub of the lock gear 112, the arrangement being such that the lock gear and the sun gear are constrained to rotate together but can have relative axial sliding movement. A drive gear 88 fast with a sun gear 290 having twenty-six teeth is in mesh with a carriage rack 87. An anti-friction bearing 291 is interposed between a collar 292 on the shaft 107 and the lock gear 112. An anti-friction bearing 293 is interposed between the cam 227 on the carrier gear 111 and the flange 110^b of the bracket 110. For adjustably urging the bracket flange 110^b toward the left as viewed in Figure 32 to increase the frictional contact between the carrier gear 111 and the sun gear 287, and between the sun gear 287 and the sun gear 290, a spring 294 is interposed between the bracket flange 110^b and a knurled nut 295 screwed onto a threaded portion 296 of the shaft 107. The carrier gear 111 is adapted to be driven constantly, as by means of a pinion, not shown in Figure 32, but similar to the pinion 120 shown in Figures 10, 11, and 16. However, no gear corresponding to the gear 152 in Figures 10, 11, and 16 is provided for driving the gear 88 shown in Figure 32, this gear being driven by mechanical friction. The lock gear 112 is adapted to mesh with a brake pinion, not shown, but similar to the pinion 135 shown in Figures 10, 11, and 16.

In operation, and having reference to the mechanism shown in Figure 32 when viewed in the direction of the arrow y, the carrier gear 111 will be driven continuously in a clockwise direction. When the carriage is held at rest by the escapement mechanism, the lock gear 112 and the sun gear 287 will be free. Hence the carrier gear 111 will rotate idly, as permitted by the slip between the carrier gear and the sun gear 287 and the slip between the sun gear 287 and the sun gear 290. When the escapement is released as by the depression of a key lever or the space bar, the lock gear 112 will still be free to turn, and the gear 88 will be driven clockwise through the frictional contact between the carrier gear 111 and the sun gear 287, and the frictional contact between the sun gear 287 and the sun gear 290. The clockwise rotation of the gear 88 will drive the rack 87 to drive the carriage in letter-spacing direction.

To return the carriage, a brake mechanism such as that shown in Figures 10, 11, and 16 is operated to hold the lock gear 112 and sun gear 287 stationary. Continued rotation of the carrier gear 111 will move the planetary pinion 285 clockwise in an orbital path and cause it to rotate clockwise about its own axis, thereby rotating the sun gear 290 and carriage drive gear 88 counterclockwise so as to drive the rack 87 and move the carriage in the return direction.

Figure 33 shows another modification in which the carriage is driven in letter-spacing direction through a mechanical friction connection. In this embodiment a shaft 297 is carried by the bracket 123 and bracket flange 110^b capable of some movement axially with respect to the shaft. A gear 298 in mesh with a pinion 299 driven by a flexible shaft 300 is rotatable about the shaft 297 and is equipped with a re-setting cam 227 similar to the cam shown in Figures 10, 11, and 16. The gear 298 is fast with a sun gear 10 which is journaled on the shaft 297. A hub 302 journaled on the shaft 297 mounts a lock gear 303 in mesh with the brake pinion 135. A carrier 304 is mounted on the hub 302 for limited axial movement but is constrained to rotate with the hub and the gear 303 by means of a pin 304^a fixed to the hub and engaged in a slot 304^b formed in the carrier. The lock gear 303, the hub 302, and the carrier 304 together constitute a lock gear and carrier assembly. The carrier 304 is provided with a stud 305 journaling a planetary pinion 306. A carriage drive gear 307 journaled on the hub 302 is in mesh with the carriage rack 87 and is equipped with an annular internally toothed gear 308 meshing with the planetary pinion 306.

An anti-friction bearing 309 is interposed between a collar 310 on the shaft 297 and the lock gear hub 302. An anti-friction bearing 311 is interposed between the gears 298 and 301 and one side of the bracket flange 110^b. A spring 312 is positioned between the other side of the bracket flange 110^b and a knurled nut 313 engaging a threaded portion 314 of the shaft 297, the arrangement being such that turning of the nut 313 will vary the frictional contact between the face of the sun gear 301 and the contiguous face of the carrier 304 and will vary the friction between the opposite face of the carrier and the gear 307.

In operation, and viewing the gearing shown in Figure 33 in the direction of the arrow z, the shaft 300 is driven constantly to drive the gear 298 and sun gear 301 clockwise. When the rack

87 is held against movement by the escapement mechanism (not shown), and the lock gear and carrier assembly is free to turn, slippage can occur between the constantly driven sun gear 301 and the lock gear and carrier assembly, and slippage also can occur between the assembly and the drive gear 307. Consequently, the gear 298 and sun gear 301 can continue to revolve while the carriage is held stationary. When the escapement is released by the depression of the key lever or the space bar, the friction between the sun gear 301 and the lock gear and carrier assembly drives the latter clockwise, and the friction between the assembly and the gear 307 will drive the gear 307 clockwise so as to move the rack 87 and carriage in the letter-spacing direction.

In order to effect a carriage return movement, the lock gear and carrier assembly is held stationary, as by application of a brake to a drum fast with the pinion 135. The gear 298 and sun gear 301 will continue to rotate clockwise, and, since the carrier 304 is held stationary, the planetary pinion 306 will rotate counterclockwise, thereby driving the annular gear 308 and gear 307 counterclockwise, and moving the rack 87 and carriage in the return direction.

The structures disclosed herein embody the invention in practical and the now preferred forms, but it will be understood that various changes may be made without departing from the invention as defined in the claims.

I claim:

1. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; a fluid coupling including an impeller connected to the motor and a runner fluid-driven by the impeller; a carriage driving element; driving connections interposed between the driving element and both the motor and the runner and including planetary gearing interposed between the driving element and the motor; and means for controlling the connections including the gearing to transmit drive to said driving element selectively from said runner, or from said motor independently of said runner.

2. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; a fluid coupling including an impeller connected to the motor and a runner fluid-driven by the impeller; a carriage driving element; driving connections interposed between the driving element and both the motor and the runner and including planetary gearing interposed between the driving element and the motor; and means for controlling the connections including the gearing to transmit drive to said driving element selectively from said runner to move the carriage in letter-spacing direction or from said motor independently of said runner to move the carriage in the return direction.

3. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; a fluid coupling including an impeller connected to the motor and a runner fluid-driven by the impeller; a carriage driving element; a first sun gear in driving connection with the carriage driving element and with the runner; a second sun gear; planetary pinion means meshing with both sun gears and being rotatable orbitally around the sun gears by said motor; and normally released control means operable at will for preventing rotation of said second sun gear.

4. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; a fluid coupling including an impeller connected to the motor and a runner fluid-driven by the impeller; a carriage driving element; a first sun gear in driving connection with the carriage driving element and with the runner; a second sun gear; planetary pinion means meshing with both sun gears and being rotatable orbitally around the sun gears by said motor; and normally released control means operable at will for preventing rotation of said second sun gear, the effective drive ratios between said pinion means and said two sun gears respectively being such that, when said second sun gear is released by said control means, said first sun gear is rotated by said runner to letter-space the carriage, and, when said second sun gear is prevented from rotating by said control means, said first sun gear is rotated reversely to return the carriage.

5. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; a fluid coupling including an impeller connected to the motor and a runner fluid-driven by the impeller; a carriage driving element; a first sun gear in driving connection with the carriage driving element and with said runner; a second sun gear coaxial with the first sun gear; planetary pinion means engaging both sun gears and adapted to be motor-driven orbitally about the sun gears, the drive ratio from said first sun gear to said pinion means being lower than the drive ratio from said second sun gear to said pinion means; a brake drum rotatable with said second sun gear; and control means including a friction member normally operatively disengaged from said drum but engageable therewith at will.

6. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a constantly running motor; connections between said motor and carriage comprising a shaft, a carriage-driving element fast with said shaft, a first sun gear fast with said shaft, a brake drum, a second sun gear fast with said brake drum, said second sun gear and brake drum being rotatable relatively to said first sun gear and said shaft, a fluid coupling including an impeller connected directly to said motor to be driven thereby and a runner connected to said shaft for driving the latter, said impeller, said runner, said sun gears, said shaft, and said brake drum being coaxial, and planetary pinion means journaled on said impeller and in mesh with said sun gears; and a normally inactive brake band adapted to be applied to said brake drum.

7. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a constantly running motor; connections between said motor and carriage comprising a shaft, a carriage-driving element fast with said shaft, a first sun gear fast with said shaft, a brake drum, a second sun gear fast with said brake drum, said second sun gear and brake drum being rotatable relatively to said first sun gear and said shaft, a fluid coupling including an impeller connected directly to said motor to be driven thereby and a runner connected to said shaft for driving the latter, said impeller, said runner, said sun gears, said shaft, and said brake drum being coaxial, and planetary pinion means journaled on said impeller and in mesh with said sun gears; a normally inactive

brake band adapted to be applied to said brake drum; a brake band operating member; and a yieldable connection between said member and said brake band.

8. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return movements; a motor; driving connections between said motor and said carriage including a fluid coupling device which comprises a pressure fluid housing, an impeller, and a runner; and a branch pipe connection communicating with the interior of said housing and adapted to conduct fluid under pressure to fluid-pressure responsive apparatus arranged to operate a part of the typewriter other than the carriage.

9. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a pulley journaled on the frame; a roller journaled at one end of said frame; a lever pivoted at the other end of the frame; a second roller journaled on said lever; a looped band passing around and in contact with said pulley and said rollers so as to extend adjacent the carriage in the direction of its travel; means connecting the band to the carriage; an adjustably tensioned spring connected to said lever for urging the lever to rock about its pivot for variably tensioning said band; and means for driving said pulley selectively in opposite directions for effecting carriage letter-spacing and return travel respectively.

10. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a pulley journaled on the frame; a looped band peripherally engaging said pulley and being connected to said carriage; means cooperable with said pulley for mounting said band and for training it to extend adjacent the carriage and in the direction of its travel; means for driving said pulley selectively in opposite directions for effecting carriage letter-spacing and return travel respectively; a ribbon feed drive shaft; and one-way drive connections between said shaft and said band.

11. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a pulley journaled on the frame; a looped band peripherally engaging said pulley and being connected to said carriage; means cooperable with said pulley for mounting said band and for training it to extend adjacent the carriage and in the direction of its travel; means for driving said pulley selectively in opposite directions for effecting carriage letter-spacing and return travel respectively; a drum journaled on said frame and being peripherally engaged by said band; a gear rotatable with said drum; a ribbon feed drive shaft; and a pinion connected to said shaft and meshing with said gear.

12. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a rack fixed to said carriage; a gear journaled on said frame and meshing with said rack; a motor; fluid coupled and cushioned drive connections between said motor and said gear for driving the latter to move the carriage in letter-spacing direction; and planetary gearing driving connections between the motor and said gear operable at will for driving the carriage in return direction.

13. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; a shaft; a carrier journaled on said shaft; a lock gear journaled

on said shaft; a carriage drive gear journaled to rotate about said shaft; a first sun gear fast with said drive gear; a second sun gear fast with said lock gear, said sun gears and said drive gear being coaxial with said shaft; planetary pinion means journaled on said carrier and engaging said sun gears respectively, the drive ratio from said first sun gear to said pinion means being lower than the drive ratio from said second sun gear to said pinion means; a pinion meshing with said lock gear; a brake drum rotatable with said pinion; a brake band adapted to be engaged with said drum; means drivingly connecting said motor to said carrier; and fluid-coupled driving connections between the motor and the carriage drive gear.

14. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; a shaft; a carrier journaled on said shaft; a lock gear journaled on said shaft; a carriage drive gear journaled to rotate about said shaft; a first sun gear fast with said drive gear; a second sun gear fast with said lock gear, said sun gears and said drive gear being coaxial with said shaft; planetary pinion means journaled on said carrier and engaging said sun gears respectively, the drive ratio from said first sun gear to said pinion means being lower than the drive ratio from said second sun gear to said pinion means; a pinion meshing with said lock gear; a brake drum rotatable with said pinion; a brake band adapted to be engaged with said drum; belt and pulley drive connections between said motor and said carrier; a kinetic type fluid coupling device including an impeller driven by said motor and a runner; and belt and pulley drive connections between said runner and said carriage drive gear.

15. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; a shaft; a carrier journaled on said shaft; a lock gear journaled on said shaft; a carriage drive gear journaled to rotate about said shaft; a first sun gear fast with said drive gear; a second sun gear fast with said lock gear, said sun gears and said drive gear being coaxial with said shaft; planetary pinion means journaled on said carrier and engaging said sun gears respectively, the drive ratio from said first sun gear to said pinion means being lower than the drive ratio from said second sun gear to said pinion means; a pinion meshing with said lock gear; a brake drum rotatable with said pinion; a brake band adapted to be engaged with said drum; means drivingly connecting said motor to said carrier; fluid-coupled driving connections between the motor and the carriage drive gear; a ribbon feed drive shaft; and gear and pinion connections between said drive shaft and said carriage drive gear.

16. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; letter-spacing and return travel driving connections between the motor and carriage including planetary gearing comprising a carrier driven by said motor, a sun gear drivingly connected to the carriage, a second sun gear, planetary pinion means journaled on the carrier and meshing with said sun gears, a brake drum connected to said second sun gear, and a friction brake element engageable with said brake drum; and key-controlled means for effecting engagement of said friction brake element with said drum smoothly and gradually.

17. In a typewriting or like machine, a frame;

a carriage mounted thereon for letter-spacing and return travel; a motor; letter-spacing and return travel driving connections between the motor and carriage including a slip drive device for transmitting letter-spacing travel drive, normally inactive planetary gearing comprising a carrier driven by said motor, a sun gear drivingly connected to said carriage, a second sun gear, planetary pinion means mounted on said carrier and meshing with said sun gears, a brake drum connected to said second sun gear, and a friction brake element engageable with said brake drum; and key-controlled means for effecting engagement of said friction brake element with said drum smoothly and gradually.

18. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; and letter-spacing and return travel driving connections between the motor and carriage including planetary gearing comprising a first sun gear drivingly connected to the carriage, a second sun gear, a carrier driven by the motor, planetary pinion means journaled on the carrier and meshing with said sun gears, a slip drive between said motor and said first sun gear, and control means for preventing rotation of said second sun gear.

19. In a typewriting or like machine, a frame; a carriage mounted therein for letter-spacing and return travel; a motor; and letter-spacing and return travel driving connections between the motor and carriage including planetary gearing comprising three sun gears, a carrier driven by said motor; planetary pinion means journaled on said carrier and meshing with said sun gears, the gear ratios between said pinion means and said sun gears respectively being relatively high, intermediate, and low, a brake connected to the low-ratioed sun gear, another brake connected to the high-ratioed sun gear, and a drive connection between the intermediately ratioed sun gear and the carriage.

20. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; letter-spacing and return travel driving connections between the motor and carriage including planetary gearing comprising three sun gears, a carrier driven by said motor, planetary pinion means journaled on said carrier and meshing with said sun gears, the gear ratios between said pinion means and said sun gears respectively being relatively high, intermediate, and low, a brake connected to the low-ratioed sun gear, another brake connected to the high-ratioed sun gear, a drive connection between the intermediately ratioed sun gear and the carriage; and control mechanism for rendering one of said brakes operative and the other inoperative, and vice versa.

21. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; mechanism associated with said carriage and adapted to be operated in increments; a first member connected to said mechanism; a second member connected to said mechanism; a third member adapted when moved in one direction to drive said second member; a spring tending to move said third member in said direction; a dog normally restraining said third member from such movement; an interponent between said first member and said dog; a pawl for coupling said first member to said second member during a limited part of the operating movement of said first member; and manually operable means for moving said first member

to move said second member through said limited part of its operating movement to apply manually exerted force to said mechanism and effect an initial operating increment thereof, and to move said interponent to disengage the dog from said third member to permit the spring to drive said third and second members to apply additional force to said mechanism and effect a further operating increment thereof.

22. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; mechanism to be operated by increments including a flexible band mounted on the carriage and extending in the direction of carriage travel, a two-armed lever pivoted on the frame, a roller on one arm of said lever adjacent one face of the band, a three-armed lever pivoted on said frame, and rollers on two arms of said three-armed lever respectively adjacent opposite faces of said band; and means for operating said levers sequentially including manually operable means connected to the other arm of said two-armed lever, normally inactive power-operable means connected to the third arm of the three-armed lever; and a device responsive to predetermined movement of the manually operable means for rendering the power-operable means active to move the three-armed lever.

23. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line space actuator operatively connected to the platen and adapted to have an initial idling movement followed by effective platen line-spacing movement; a carriage brake; normally inactive power-operable means adapted when rendered operative to effect line-spacing movement of said actuator beyond said idling movement thereof and operation of said brake; and control means for sequentially imparting the initial idling movement to said actuator and then rendering said power-operable means operative.

24. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line-spacing sector on said carriage operatively connected to the platen; a flexible brake band connected at one of its ends to and arcuately engaging the sector; means supporting the band on the carriage with the other end thereof connected to the carriage and with an intermediate portion of the band extending in the direction of carriage travel; and a brake element movably mounted on said frame and being adapted to press against said intermediate portion of the band for retarding the carriage travel and for displacing said intermediate band portion to move said sector and effect platen line-spacing.

25. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line-spacing sector on said carriage operatively connected to the platen; a flexible brake band connected at one of its ends to and arcuately engaging the sector; means supporting the band on the carriage with the other end thereof connected to the carriage and with an intermediate portion of the band extending in the direction of carriage travel; a two-armed lever pivoted on said frame; a brake roller on one arm of said lever positioned adjacent one face of the band and adapted upon swinging of the lever

from normal position to displace said intermediate band portion to pull the band and effect an initial movement of the sector and to effect a relatively light carriage-retarding roller pressure on said band; manually operable means connected to the other arm of said lever; a three-armed lever pivoted on said frame; brake rollers on two arms thereof respectively positioned adjacent opposite faces of the band; normally inactive power-operable means connected to the third arm of the three-armed lever; and means responsive to predetermined movement of the manually operable means and the two-armed lever for rendering the power-operable means active to move the three-armed lever to effect line-spacing movement of the sector and to effect relatively heavy carriage-retarding roller pressure on said band.

26. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line space actuator operatively connected to the platen and adapted to have an initial idling movement followed by effective platen line-spacing movement; normally inactive power-operable means adapted when rendered operative to effect line-spacing movement of said actuator beyond said idling movement thereof; and control means for sequentially imparting the initial idling movement to said actuator and then rendering said power-operable means operative.

27. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line space actuator operatively connected to the platen and adapted to have an initial idling movement followed by effective platen line-spacing movement; normally inactive power-operable means adapted when rendered operative to effect line-spacing movement of said actuator beyond said idling movement thereof; control means for sequentially imparting the initial idling movement to said actuator and then rendering said power-operable means operative; a motor; and means driven thereby for restoring said power-operable means to inactive condition.

28. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; and line-spacing actuating mechanism including a normally inactive line-spacing drive member adapted when moved in one direction to rotate the platen, means for urging said member to move in said direction, a retaining member normally engaged with said drive member for normally preventing such movement thereof, and control means for displacing said retaining member to permit operating movement of said drive member in said direction.

29. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; line-spacing actuating mechanism including a normally inactive line-spacing drive member adapted when moved in one direction to rotate the platen, means for urging said member to move in said direction, a retaining member normally engaged with said drive member for normally preventing such movement thereof, and control means for displacing said retaining member to permit operating movement of said drive member in said

direction; a motor; means driven by the motor for restoring said line-spacing drive member to inactive position; and a spring connected to said retaining member for moving it to re-engage said line-spacing drive member.

30. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen rotatably mounted on the carriage for line-spacing; and line-spacing actuating mechanism including an operating arm adapted when rocked in one direction to line-space the platen, a spring urging said arm to rock in said direction, a dog normally holding said arm against such rocking movement, and means for operatively disengaging said dog from said arm.

31. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen rotatably mounted on the carriage for line-spacing; and line-spacing actuating mechanism including an operating arm adapted when rocked in one direction to line-space the platen, a spring urging said arm to rock in said direction, a dog normally holding said arm against such rocking movement, means for temporarily disengaging said dog from said arm, a cam continuously movable adjacent said arm a part on said arm engageable with the cam when the arm has been rocked to effect line-spacing, and a lobe on said cam engageable with said arm part for rocking said arm in the opposite direction.

32. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen rotatably mounted on the carriage for line-spacing; and line-spacing actuating mechanism including an operating arm adapted when rocked in one direction to line-space the platen, a spring urging said arm to rock in said direction, a dog normally engaging said arm to hold it against such rocking movement and having a heel, a control arm, an interponent movably mounted thereon and biased normally to operatively engage said dog heel, means for moving the control arm and with it the interponent to thereby move the dog from holding engagement with said arm, said interponent and said dog heel being so formed that upon continued movement of the control arm the interponent will become operatively disengaged from said heel to permit said dog to return to holding engagement with said operating arm, means for rocking said operating arm in the opposite direction to restore it to its initial position, and a spring for then returning said dog to holding engagement with said operating arm.

33. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line-space actuator operatively connected to the platen and adapted to have an initial idling movement followed by effective platen line-spacing movement; normally inactive power-operable means adapted when rendered operative to effect line-spacing movement of said actuator beyond said idling movement thereof; and manually operable means for first applying manually exerted force to impart initial idling movement to the actuator and for then rendering said power-operable means active to effect line-spacing.

34. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line-

spacing lever on said carriage operatively connected to the platen; a flexible band connected at one of its ends to said lever; means supporting the band on the carriage with the other end thereof connected to the carriage and with an intermediate portion of the band extending in the direction of carriage travel; a band-operating element movable on said frame and being provided with means adapted to engage said intermediate portion of the band; and means for moving said operating element to displace said intermediate band portion to thereby move said lever and effect platen line-spacing movement.

35. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line-spacing sector on said carriage operatively connected to the platen; a flexible band connected at one of its ends to and arcuately engaging the sector; means supporting the band on the carriage with the other end thereof connected to the carriage and with an intermediate portion of the band extending in the direction of carriage travel; first and second band-operating elements mounted for mutually independent movement on said frame and each being provided with means adapted to engage said intermediate portion of the band; manually operable means for moving said first band-operating element to displace said intermediate band portion to thereby effect an initial movement of the sector; and power-operated means for moving said second band-operating element to displace said intermediate band portion further to effect further movement of the sector beyond said initial movement thereof and thereby effect line-spacing platen movement.

36. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line-spacing sector on said carriage operatively connected to the platen; a flexible band connected at one of its ends to and arcuately engaging the sector; means supporting the band on the carriage with the other end thereof connected to the carriage and with an intermediate portion of the band extending in the direction of carriage travel; first and second band-operating elements mounted for mutually independent movement on said frame and each being provided with means adapted to engage said intermediate portion of the band; manually operable means for moving said first band-operating element to displace said intermediate band portion to thereby effect an initial movement of the sector; power-operated means for moving said second band-operating element to displace said intermediate band portion further to effect further movement of the sector beyond said initial movement thereof and thereby effect line-spacing platen movement; and means operable in response to carriage return travel for restoring said power-operated band-operating element to its initial position.

37. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line-spacing sector on said carriage operatively connected to the platen; a flexible band connected at one of its ends to and arcuately engaging the sector; means supporting the band on the carriage with the other end thereof connected

to the carriage and with an intermediate portion of the band extending in the direction of carriage travel; a two-armed lever pivoted on said frame; a roller on one arm of said lever positioned adjacent one face of the band and adapted upon swinging of the lever from normal position to displace said intermediate band portion to pull the band; manually operable means connected to the other arm of said lever; a three-armed lever pivoted on said frame; rollers on two arms thereof respectively positioned adjacent opposite faces of the band; normally inactive power-operable means connected to the third arm of the three-armed lever; and means responsive to predetermined movement of the manually operable means and the two-armed lever for rendering the power-operable means active to move the three-armed lever to effect line-spacing movement of the sector.

38. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line-spacing sector on said carriage operatively connected to the platen; a flexible band connected at one of its ends to and arcuately engaging the sector; means supporting the band on the carriage with the other end thereof connected to the carriage and with an intermediate portion of the band extending in the direction of carriage travel; a two-armed lever pivoted on said frame; a roller on one arm of said lever positioned adjacent one face of the band and adapted upon swinging of the lever from normal position to displace said intermediate band portion to pull the band; manually operable means connected to the other arm of said lever; a three-armed lever pivoted on said frame; rollers on two arms thereof respectively positioned adjacent opposite faces of the band; normally inactive power-operable means connected to the third arm of the three-armed lever; means responsive to predetermined movement of the manually operable means and the two-armed lever for rendering the power-operable means active to move the three-armed lever to effect line-spacing movement of the sector; and a coupling for moving said three-armed lever with said manually operable means for effecting initial movement of the three-armed lever prior to movement thereof by the power-operable means.

39. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a platen mounted rotatably on the carriage for line-spacing; a line-spacing sector on said carriage operatively connected to the platen; a flexible band connected at one of its ends to and arcuately engaging the sector; means supporting the band on the carriage with the other end thereof connected to the carriage and with an intermediate portion of the band extending in the direction of carriage travel; a two-armed lever pivoted on said frame; a roller on one arm of said lever positioned adjacent one face of the band and adapted upon swinging of the lever from normal position to displace said intermediate band portion to pull the band; manually operable means connected to the other arm of said lever; a three-armed lever pivoted on said frame; rollers on two arms thereof respectively positioned adjacent opposite faces of the band; a coupling for moving said three-armed lever initially with said manually operable means; normally inactive power-operable means connected to the third

arm of the three-armed lever; means responsive to predetermined movement of the manually operable means and the two-armed lever for rendering the power-operable means active to move the three-armed lever further to effect line-spacing movement of the sector; and means responsive to operation of the power-operable means for disconnecting said coupling.

40. In a typewriting or like machine, a frame; a carriage mounted for letter-spacing and return travel thereon; a carriage brake; manually operable means for applying initial force to said brake; normally restrained power-operable means for applying additional force to said brake; and means operable by said manually operable means for releasing the restraint on said power-operable means.

41. In a typewriting or like machine, a frame; a carriage mounted for letter-spacing and return travel thereon; a carriage brake; manually operable means for applying initial force to said brake; spring-loaded means adapted when active to apply additional force to said brake; means for normally restraining said spring-loaded means to normally maintain it inactive; and connections between said manually operable means, said brake, and said restraining means for transmitting movement from said manually operable means sequentially to apply manual force to said brake and then release said restraining means.

42. In a typewriting or like machine, a frame; a carriage mounted for letter-spacing and return travel thereon; a carriage brake ineffective during carriage letter-spacing movement; means for rendering said brake effective for retarding the carriage during its return travel; holding means for maintaining the brake effective during return travel; and stop means on the carriage engageable with said holding means for releasing the latter at the end of the return travel.

43. In a typewriting or like machine, a frame; a carriage mounted for letter-spacing and return travel thereon; a carriage brake ineffective during carriage letter-spacing movement; manually controlled means for setting said brake in effective carriage-retarding condition; holding means for maintaining the brake effective during carriage return travel without requiring continued manual effort; and means on the carriage engageable with said holding means for releasing the latter at the end of carriage return travel.

44. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a carriage brake ineffective during carriage letter-spacing travel; a first member connected to said brake; a second member connected to said brake; a third member adapted when moved in one direction to drive said second member; a spring tending to move said third member in said direction; a dog normally restraining said third member from such movement; an interponent between said first member and said dog; a pawl for coupling said first member to said second member during a limited part of the operating movement of said first member; and manually operable means for moving said first member to move said second member through said limited part of its operating movement to apply manually exerted force to said brake and to move said interponent to disengage the dog from the third member to permit the spring to drive said third and second members to apply additional force to said brake.

45. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a carriage brake ineffective during carriage letter-spacing travel; a first member connected to said brake; a second member connected to said brake; a third member adapted when moved in one direction to drive said second member; a spring tending to move said third member in said direction; a dog normally restraining said third member from such movement; an interponent between said first member and said dog; a pawl for coupling said first member to said second member during a limited part of the operating movement of said first member; manually operable means for moving said first member to move said second member through said limited part of its operating movement to apply manually exerted force to said brake and to move said interponent to disengage the dog from the third member to permit the spring to drive said third and second members to apply additional force to said brake; and means automatically engageable with said second member for releasably holding it in the position to which it is moved by said third member.

46. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a carriage brake; a two-armed rockable member; a link connection between one arm thereof and said brake; a hooked pawl pivoted on the other arm thereof; a three-armed rockable member; a link connection between one arm thereof and said brake; a roller on another arm of said three-armed member normally engaged by the hook of said pawl, whereby rocking of said three-armed member will pull the pawl and rock the two-armed member also; a manually operable link connected to the third arm of said three-armed member; a second three-armed rockable member; a pin on one arm thereof in driving engagement with the two-armed member; a power spring connected to another arm of said second three-armed member for urging it to drive said two-armed member; a second roller on the third arm of said second three-armed member; a dog engageable with said second roller for normally resisting rocking of said second three-armed member by said spring; and means for disengaging said dog from said second roller.

47. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a carriage brake; a two-armed rockable member; a link connection between one arm thereof and said brake; a hooked pawl pivoted on the other arm thereof; a three-armed rockable member; a link connection between one arm thereof and said brake; a roller on another arm of said three-armed member normally engaged by the hook of said pawl, whereby rocking of said three-armed member will pull the pawl and rock the two-armed member also; a manually operable link connected to the third arm of said three-armed member; a second three-armed rockable member; a pin on one arm thereof in driving engagement with the two-armed member; a power spring connected to another arm of said second three-armed member for urging it to drive said two-armed member; a second roller on the third arm of said second three-armed member; a dog engageable with said second roller for normally resisting rocking of said second three-armed member by said spring; and an interponent carried by the third arm of said first three-armed member and adapted to move

said dog out of engagement with said second roller.

48. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a carriage brake; a two-armed rockable member; a link connection between one arm thereof and said brake; a hooked pawl pivoted on the other arm thereof; a three-armed rockable member; a link connection between one arm thereof and said brake; a roller on another arm of said three-armed member normally engaged by the hook of said pawl, whereby rocking of said three-armed member will pull the pawl and rock the two-armed member also; means connected to said pawl and being responsive to said rocking of said two-armed member for disengaging said pawl from said roller to permit further rocking movement of said three-armed member; a manually operable link connected to the third arm of said three-armed member; a second three-armed rockable member; a pin on one arm thereof in driving engagement with the two-armed member; a power spring connected to another arm of said second three-armed member for urging it to drive said two-armed member; a second roller on the third arm of said second three-armed member; a dog engageable with said second roller for normally resisting rocking of said second three-armed member by said spring; an interponent carried by the third arm of said first three-armed member and adapted to move said dog out of engagement with said second roller; and means for releasably maintaining said two-armed member in the position to which it has been moved by a predetermined rocking of said second three-armed member.

49. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a flexible brake band connected at its opposite ends to said carriage and having an intermediate portion extending in the direction of carriage travel; braking means mounted on the frame and movable to press against the band variably to retard the carriage travel variably; manually operable means for moving said braking means to exert a relatively low pressure on said band; and power-operable means for moving said braking means to exert a relatively high pressure on said band.

50. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a flexible brake band connected at its opposite ends to said carriage and having an intermediate portion extending in the direction of carriage travel; braking means mounted on the frame and movable to press against the band variably to retard the carriage travel variably; manually operable means for moving said braking means to exert a relatively low pressure on said band; power-operable means for moving said braking means to exert a relatively high pressure on said band; and means responsive to actuation of the manually operable means for effecting operation of said power-operable means.

51. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a flexible brake band connected at its opposite ends to said carriage and having an intermediate portion extending in the direction of carriage travel; first and second brake devices mounted on the frame for mutually independent movement to press against said band to retard carriage travel; manually operable means for moving said first brake device to press

relatively lightly against said band; a coupler for moving said second brake device initially together with said first brake device during said movement of the latter; and power-operated means for moving said second brake device further after said initial movement thereof to press relatively heavily on said band.

52. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a flexible brake band connected at its opposite ends to said carriage and having an intermediate portion extending in the direction of carriage travel; first and second brake devices mounted on the frame for mutually independent movement to press against said band to retard carriage travel; manually operable means for moving said first brake device to press relatively lightly against said band; a coupler for moving said second brake device initially together with said first brake device during said movement of the latter; power-operated means for moving said second brake device further after said initial movement thereof to press relatively heavily on said band; and means for disconnecting said coupler after power operation of said second device whereby to permit further manually effected movement of the first brake device only.

53. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a flexible brake band connected at its opposite ends to said carriage and having an intermediate portion extending in the direction of carriage travel; first and second brake devices mounted on the frame for mutually independent movement to press against said band to retard carriage travel; manually operable means for moving said first brake device to press relatively lightly against said band; a coupler for moving said second brake device initially together with said first brake device during said movement of the latter; power-operated means for moving said second brake device further after said initial movement thereof to press relatively heavily on said band; and holding means independent of said manually operable means for releasably maintaining said second braking device in the position to which it is moved by the power-operated means.

54. In a typewriting or the like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a flexible brake band connected at its opposite ends to said carriage and having an intermediate portion extending in the direction of carriage travel; a two-armed lever pivoted on said frame; a brake roller frictionally journaled on one arm of said lever adjacent one face of the band; manually operable means connected to the other arm of said lever for moving said lever to press the roller carried thereby relatively lightly against said band; a three-armed lever pivoted on said frame; brake rollers journaled on two arms thereof and respectively positioned adjacent opposite faces of the band; normally inactive power-operable means connected to the third arm of the three-armed lever; and means responsive to predetermined movement of the manually operable means for rendering the power-operable means active to move the three-armed lever to press the rollers carried thereby against said band relatively heavily.

55. In a typewriting or like machine, a frame; a carriage mounted for letter-spacing and return movements thereon; a platen mounted for line-spacing movement on the carriage; line-

spacing mechanism connected to the platen; a carriage brake adapted to retard carriage return movement; a motor; drive connections between the motor and carriage including impositively acting means for transmitting letter-spacing drive to the carriage and selectively operable relatively positive means for transmitting return drive to the carriage; a carriage return control member for rendering said return drive transmitting means operative; an operating member; and connections between the operating member, the control member, the brake, and the line-spacing mechanism.

56. In a typewriting or like machine, a frame; a carriage mounted for letter-spacing and return movements thereon; a platen mounted for line-spacing movement on the carriage; line-spacing mechanism connected to the platen; a carriage brake adapted to retard carriage return movement; a motor; drive connections between the motor and carriage including a slip coupling for transmitting letter-spacing drive to said carriage, and planetary gearing ineffective during letter-spacing but adapted to transmit return drive to the carriage; a gear brake adapted to resist movement of a gear element of said planetary gearing to render the gearing effective to transmit return drive; a manually operable member; and connections between said manually operable member, said gear brake, said carriage brake, and said line-spacing mechanism.

57. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; escapement mechanism interposed between the carriage and the frame including an escapement wheel and a cooperating dog; a roller journaled on the end of said frame towards which the carriage travels when moving in return travel direction; a roller mounting device movably mounted on the opposite end of the frame; a second roller journaled on said mounting device; a looped band passing around said rollers; means connecting the band to the carriage; means for driving said band selectively in opposite directions for effecting carriage letter-spacing and return travel respectively; and looped band tensioning means for urging said roller mounting device and said second roller to move away from said first roller to urge the carriage in letter-spacing direction and maintain said escapement wheel in firm engagement with said dog and maintain the carriage stationary when the band is not being driven.

58. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; and driving connections between the motor and carriage including planetary gearing comprising a carrier driven by said motor, a sun gear drivingly connected to the carriage, a second sun gear, planetary pinion means journaled on the carrier and meshing with said sun gears, a brake drum connected to said second sun gear, a pair of levers pivoted to rock about a common axis, a brake band partially surrounding said drum and having its ends connected respectively to said levers, a spring connected to and between said levers for urging them to rock together to apply the band to the drum, and a double acting cam disposed between said two levers and being rockable to engage both levers and rock them apart to release the band from the drum.

59. In a typewriting or like machine, a frame; a carriage mounted thereon for letter-spacing and return travel; a motor; letter-spacing and return travel driving connections between the motor and carriage including planetary gearing comprising three sun gears, a carrier driven by said motor, planetary pinion means journaled on said carrier and meshing with said sun gears, the gear ratios between said pinion means and said sun gears respectively being relatively high, intermediate, and low, a brake connected to the low-ratioed sun gear, another brake connected to the high-ratioed sun gear, one of said brakes comprising a drum rotatable with the associated sun gear, a brake band, a pair of levers pivoted to rock about a common axis, means for connecting the band to both of said levers, a spring connected to and between said levers for urging them to rock together and apply the band to the drum, a drive connection between the intermediately ratioed sun gear and the carriage; and control mechanism for rendering one of said brakes operative and the other inoperative, and vice versa, said control mechanism including a double-acting cam disposed between said two levers and being movable to engage both levers to rock them apart.

60. In a typewriting or like machine, a frame; a carriage mounted for letter-spacing and return movements thereon; a carriage brake adapted to retard carriage return movement; a motor; drive connections between the motor and carriage including a slip coupling for transmitting letter-spacing drive to said carriage, and planetary gearing ineffective during letter-spacing but adapted to transmit return drive to the carriage; a gear brake adapted to resist movement of a gear element of said planetary gearing to render the gearing effective to transmit return drive; a manually operable member; and connections between said manually operable member, said gear brake, and said carriage brake.

61. In a typewriting or like machine, a frame part; a carriage part mounted thereon for letter-spacing and return travel; power-operated means for effecting carriage return travel; and means for retarding the carriage part during its return travel including a flexible band mounted on one of said parts to extend substantially parallel to the line of carriage travel, and an element mounted on the other of said parts and being adapted to be pressed against said band to displace it laterally and thereby impose upon it an increased tension and consequent drag on the carriage part.

62. In a typewriting or like machine, a frame part; a carriage part mounted thereon for letter-spacing and return travel; power-operated means for effecting carriage return travel; and means for retarding the carriage part during its return travel including a flexible band mounted on one of said parts to extend substantially parallel to the line of carriage travel, two band-contacting elements mounted on the other of said parts and spaced from each other in the direction of extent of said band and being positioned, respectively, on opposite sides of the band, and means for moving said elements each towards and forcibly against the respectively adjacent portions of the band.

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