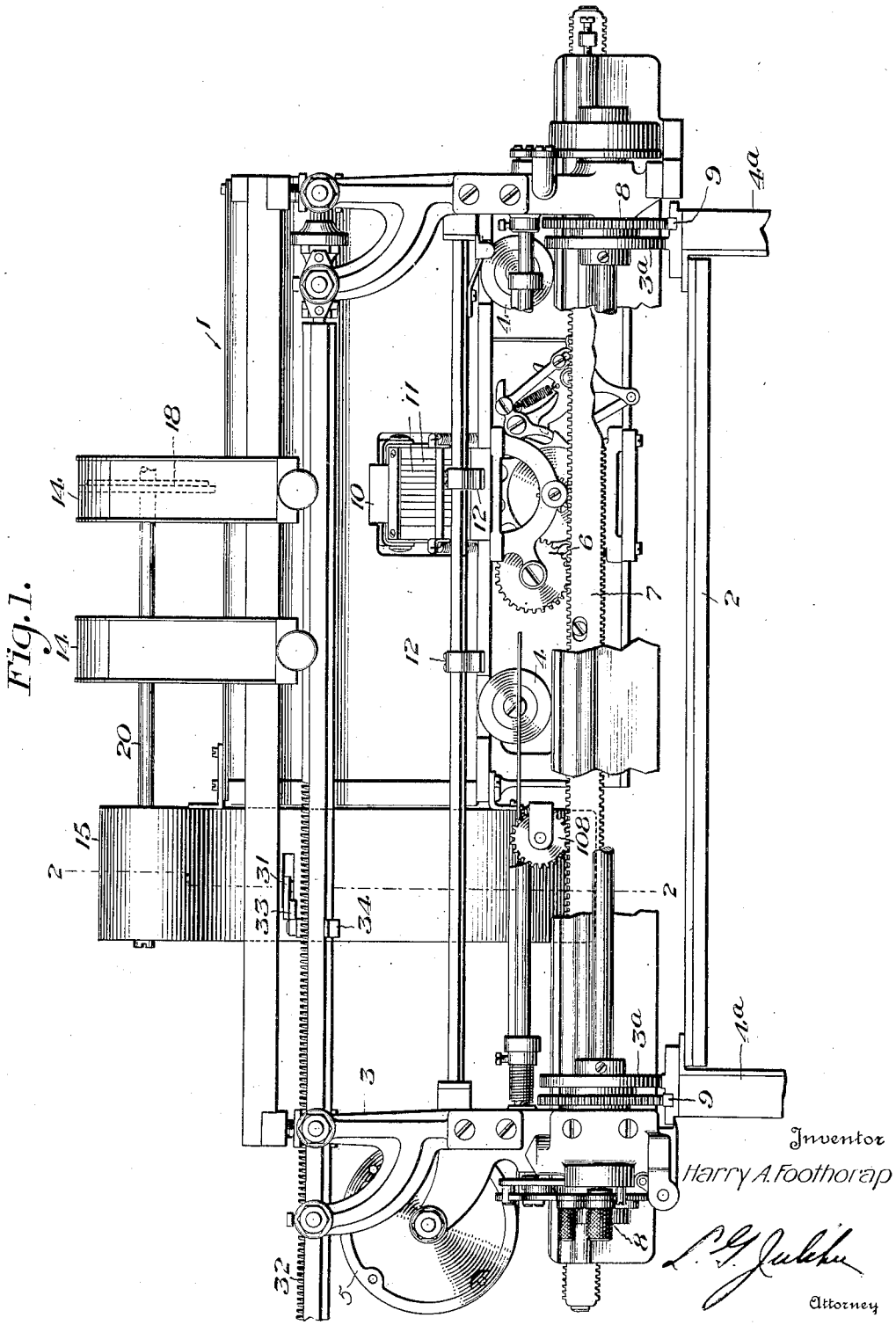
Sept. 9, 1930. H. A. FOOTHORAP 1,775,223

COMPUTING MACHINE

Filed May 14, 1925 8 Sheets-Sheet 1

Fig. 1.



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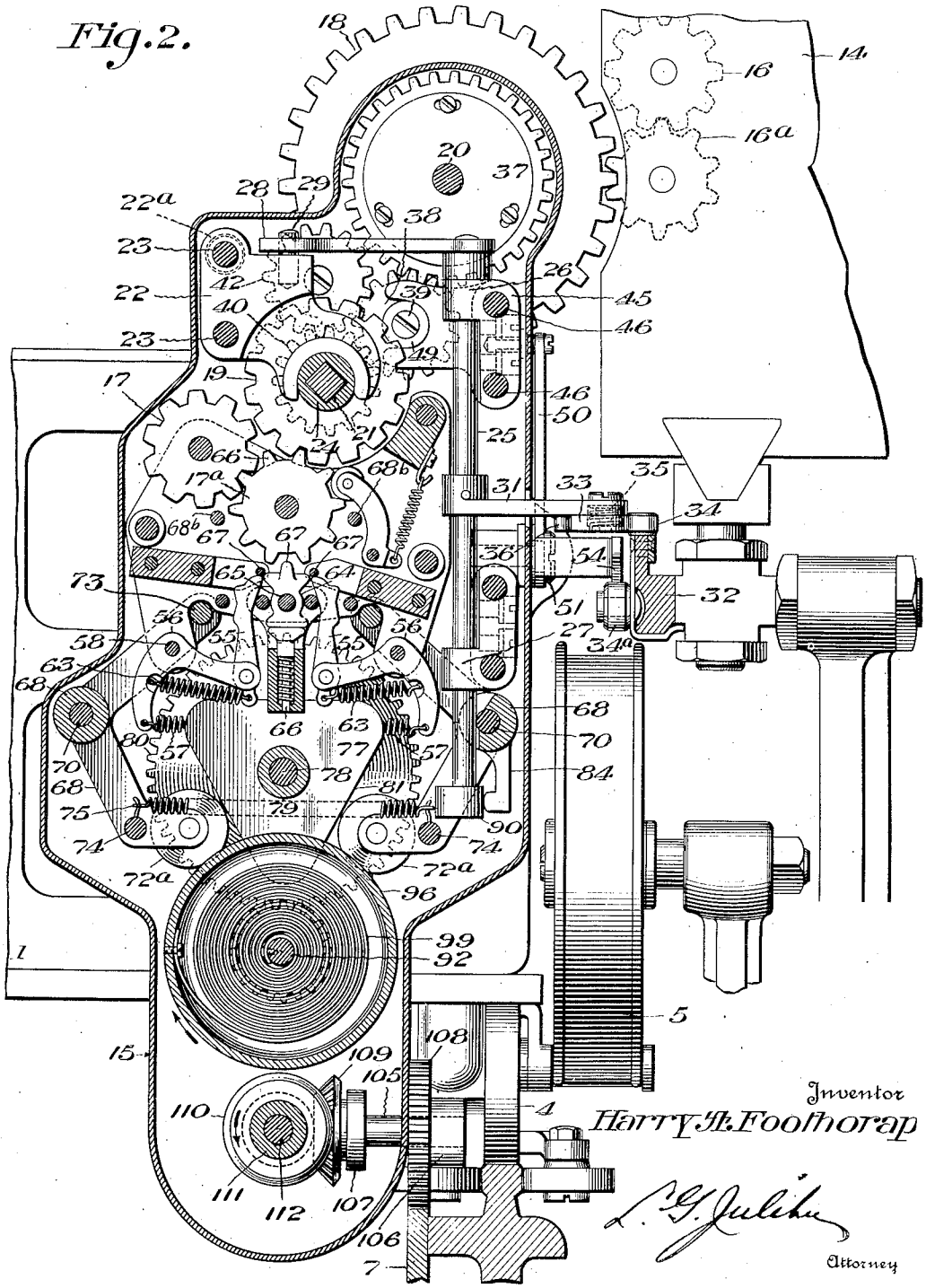
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COMPUTING MACHINE

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Fig. 2.



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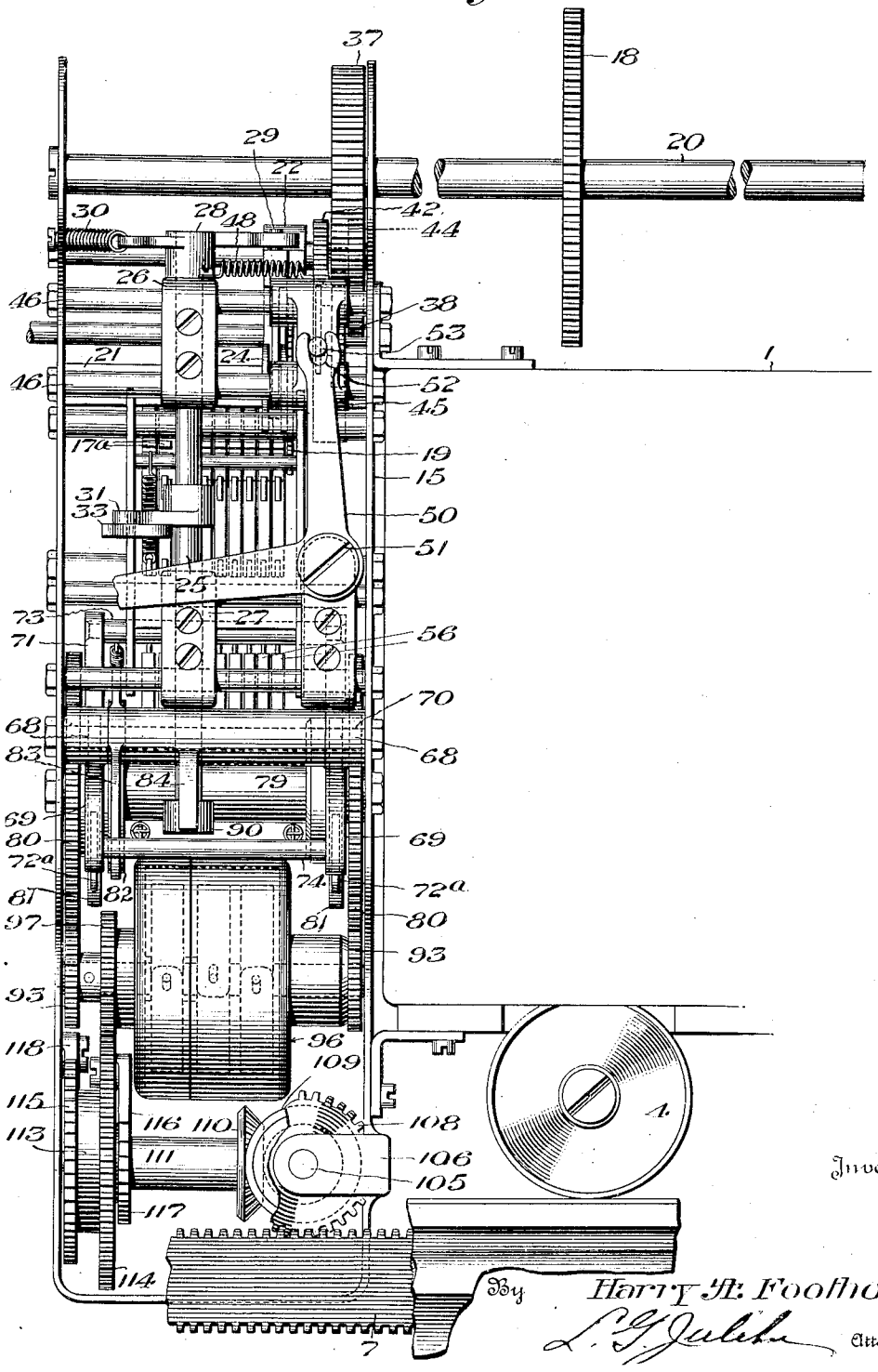
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Sept. 9, 1930. H. A. FOOTHORAP 1,775,223

COMPUTING MACHINE

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Fig. 3.



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Sept. 9, 1930. H. A. FOOTHORAP 1,775,223

COMPUTING MACHINE

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Fig. 4.

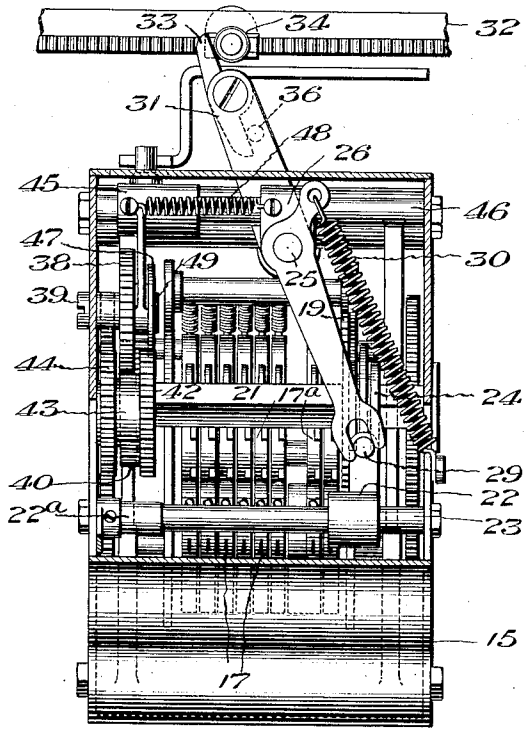
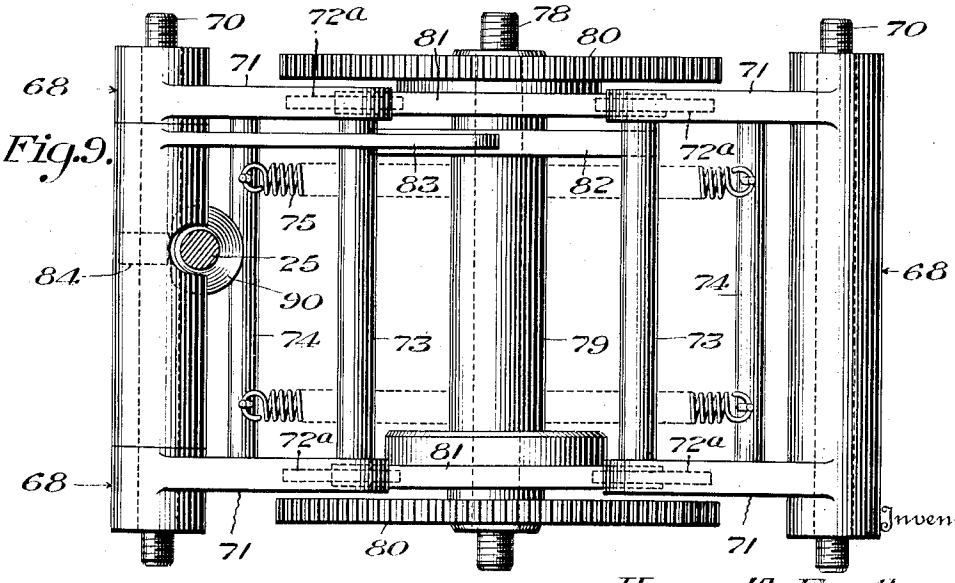


Fig. 9.



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COMPUTING MACHINE

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Fig. 5.

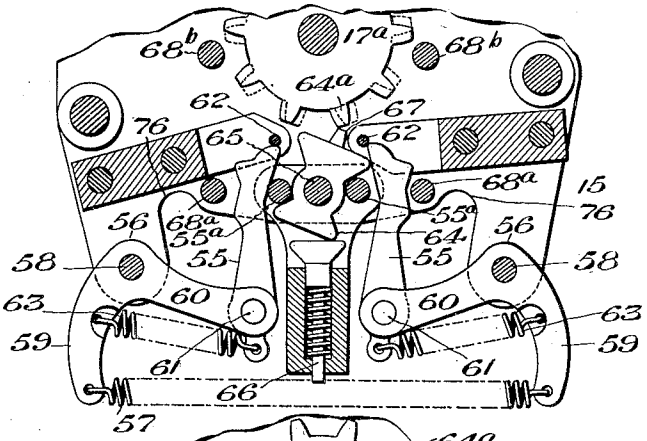
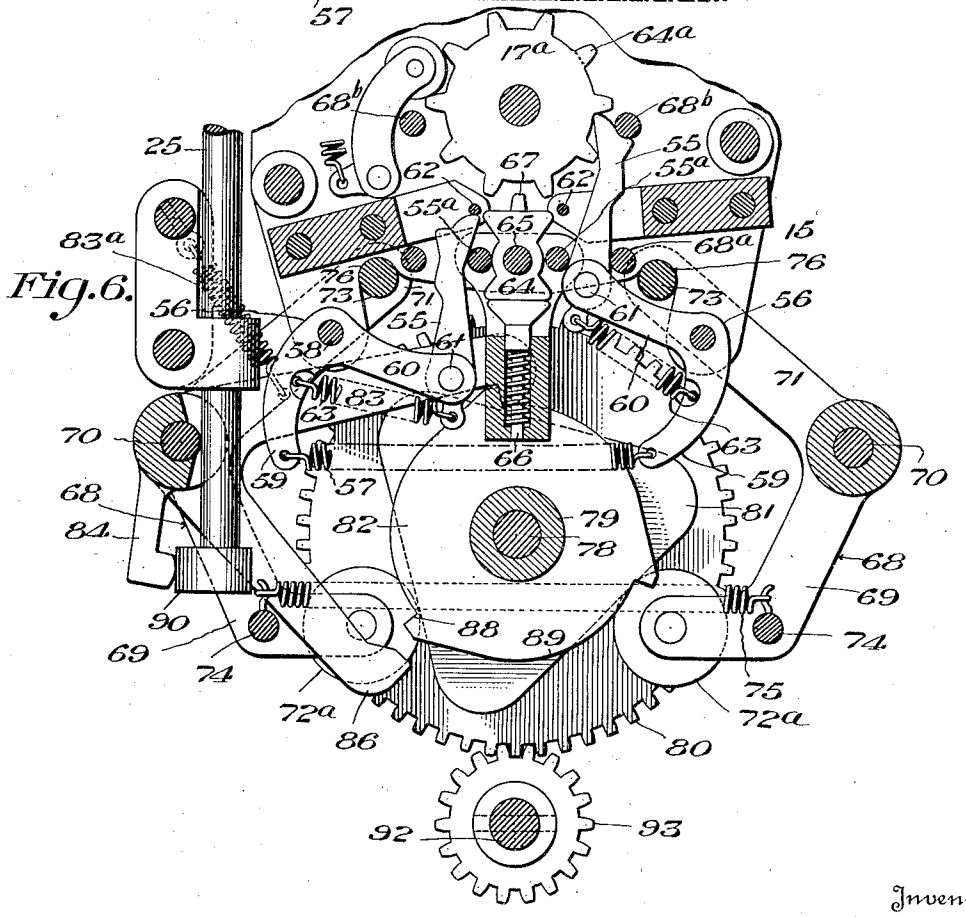


Fig. 6.



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COMPUTING MACHINE

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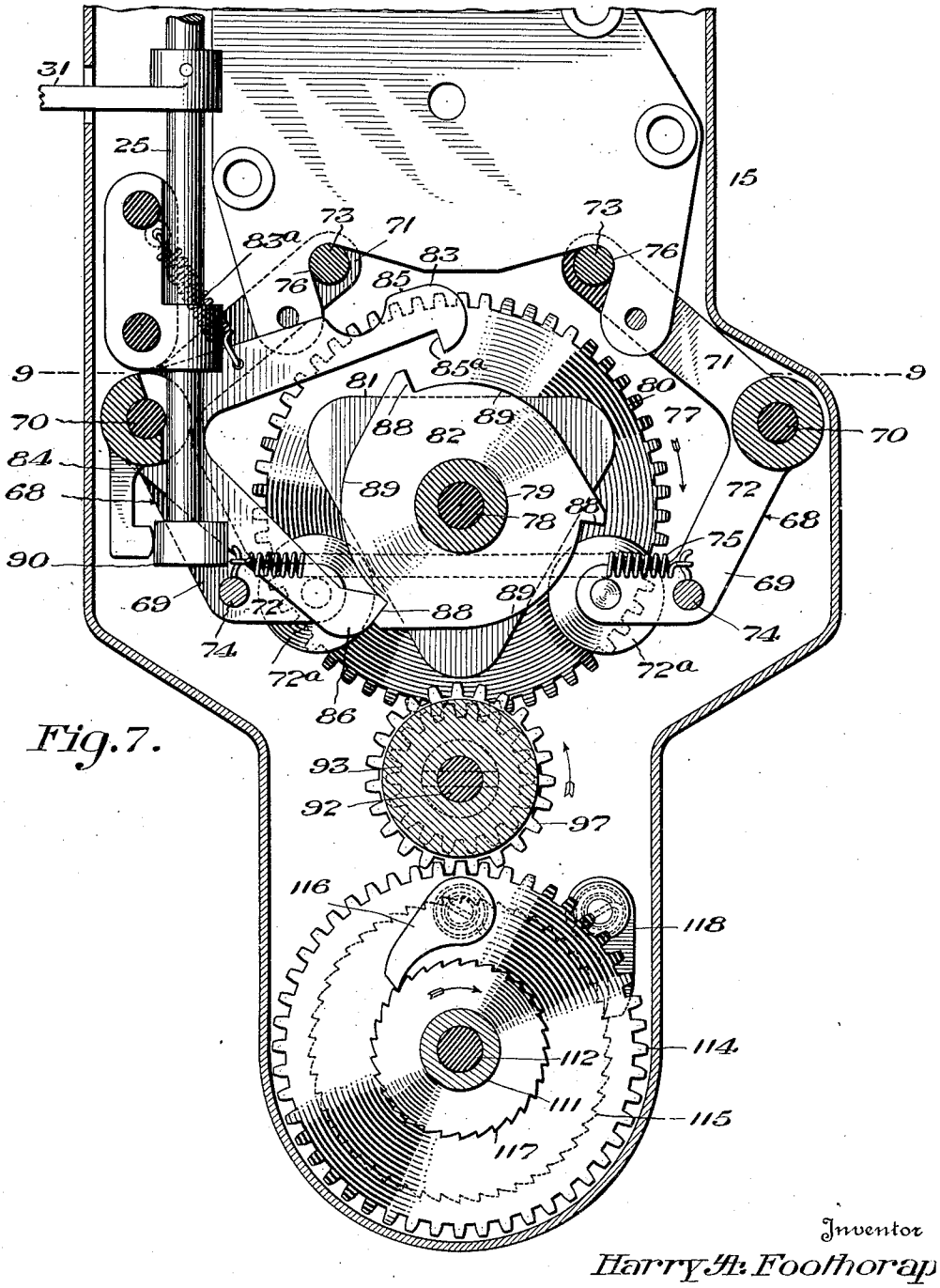


Fig. 7.

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COMPUTING MACHINE

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Fig. 8.

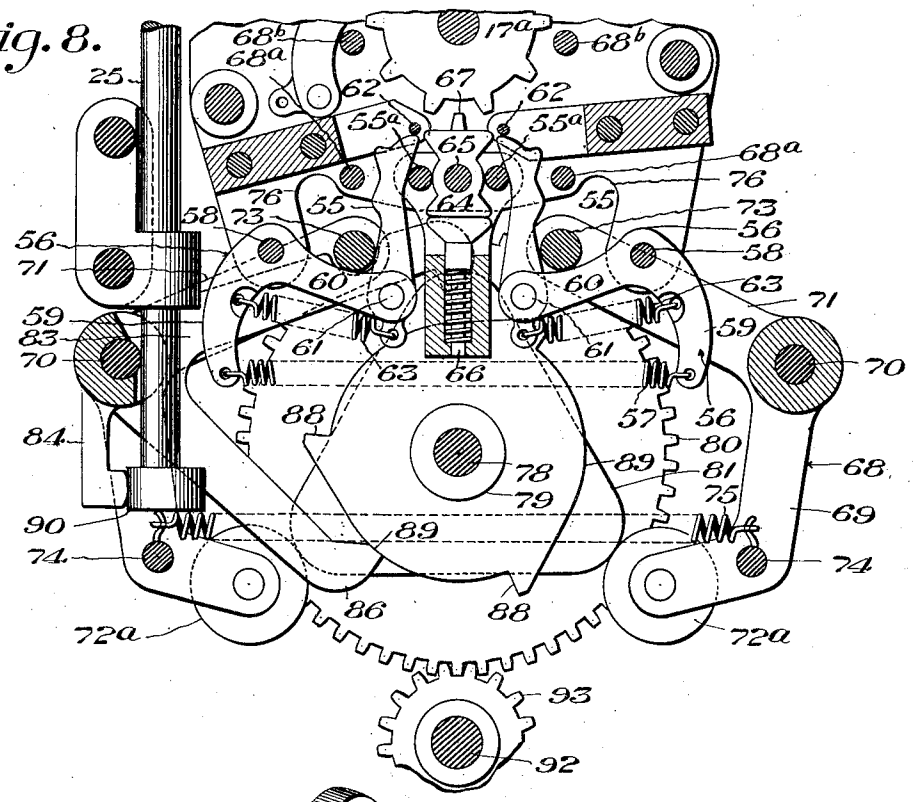


Fig. 13.

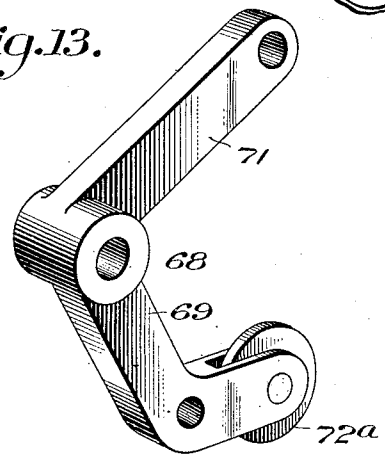
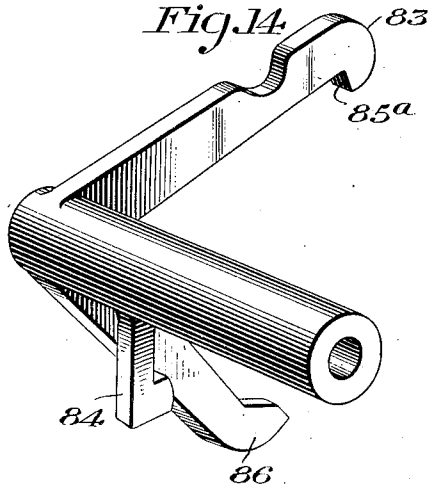


Fig. 14



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COMPUTING MACHINE

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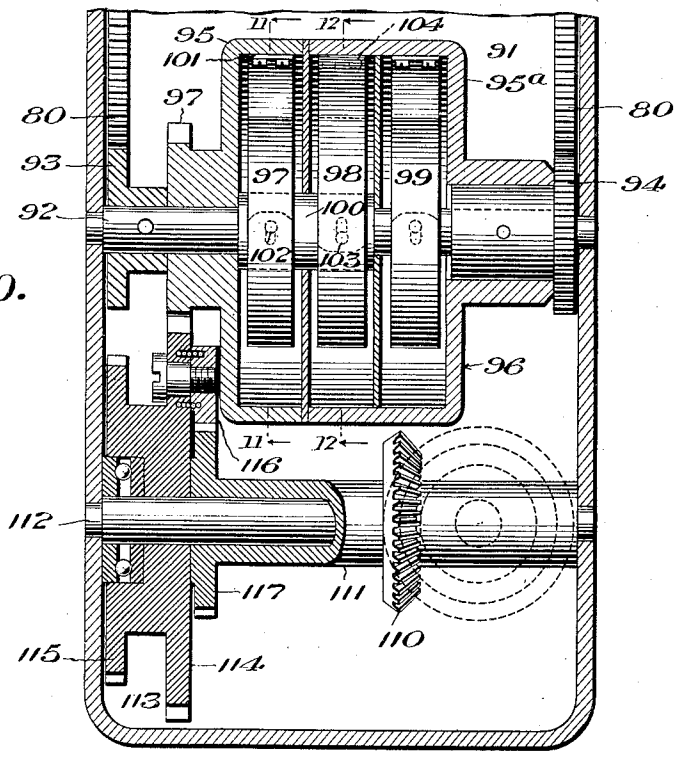


Fig. 10.

Fig. 11.

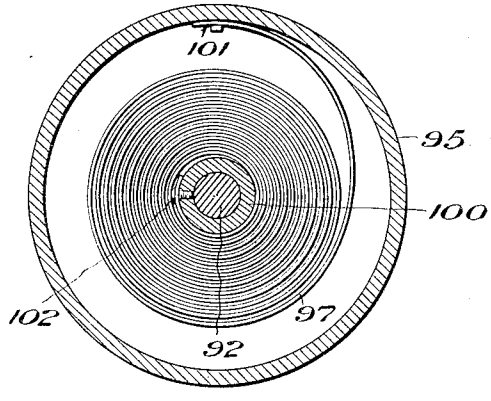
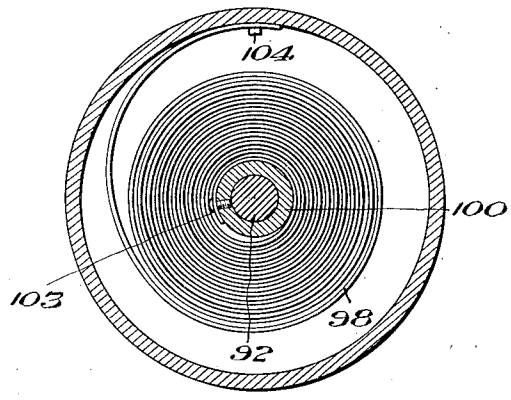


Fig. 12.



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UNITED STATES PATENT OFFICE

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COMPUTING MACHINE

Application filed May 14, 1925. Serial No. 30,270.

My invention relates to improvements in writing computing machines and particularly to computers of the class in which a combined printing and computing mechanism, and a work supporting platen, are relatively movable for line letter and column spacing of the work.

The primary object of the invention, generally stated, is to provide a machine of the specified character with automatic means for restoring the carrying or transfer mechanism one or more times in a single excursion of the machine in the direction of its letter space advance.

Another object of the invention is to automatically restore the carrying mechanism during the advance of the machine, from one column position to another.

Still another object of the invention is to provide motor operated mechanism for effecting the restoration of the carrying devices and mechanism for restoring the energy of the motor by relative movement of the platen and printing mechanism.

Other objects of the invention will hereinafter appear.

In the drawings:

Figure 1 is a rear elevation illustrating a preferred embodiment of my invention.

Figure 2 is a somewhat enlarged vertical sectional view on the line 2—2 of Figure 1.

Figure 3 is a rear elevation of the computer, and part of the printing and actuating mechanisms.

Figure 4 is a top plan view of the computer.

Figure 5 is a transverse section illustrating the carrying mechanism of the computer.

Figure 6 is a similar view of the restoring mechanism and its relation to the carrying mechanism before the restoring operation.

Figure 7 is a transverse vertical section of the restoring mechanism and its operating mechanism in normal position.

Figure 8 is a similar view showing the restoring mechanism and its relation to the carrying mechanism during operation.

Figure 9 is a horizontal sectional view on the line 9—9 of Figure 7.

Figure 10 is a vertical transverse section of a portion of the computer showing the motor for driving the restoring mechanism and the means for restoring the motor.

Figure 11 is a detail section taken on the line 11—11 of Figure 10.

Figure 12 is a similar view taken on the line 12—12 of Figure 10.

Figure 13 is a perspective view of a detail of the restoring mechanism, and

Figure 14 is a similar view of another detail of the restoring mechanism.

In the drawings, I have illustrated my invention as applied to the well known Elliott-Fisher billing machine of commerce. In order that the operation of this invention and its relation to machines of the Elliott-Fisher type may be clearly understood, a brief description of this machine and its operation follows.

The Elliott-Fisher billing machine comprises two characteristic units, i. e., a traveling printing and computing unit 1, usually called the carriage, and a flat work supporting platen 2. The carriage is movable to space the letters or numbers printed on a work sheet supported by the platen. This advance of the machine is known as the letter spacing movement and not only selects the denominational positions in which digits are printed in a column, but also the columns or fields in which numbers are printed.

The carriage 1 is mounted on a line space frame 3 by means of rollers 4 and travels back and forth transversely of the platen 2. The advance of the carriage is effected by a spring motor 5 and is controlled by well known mechanism including a key operated escapement 6 and a feed rack 7. The carriage is retracted manually.

Line spacing mechanism shown generally at 8 cooperates with racks 9, and is operable to effect a line space movement of the frame 3 and consequently of the carriage and printing mechanism. Tabulating mechanism 10, including denominational blades 11, are operated by the usual tabulating keys (not shown) to engage column stops 12 adjustably mounted on the carriage 3. The tabulator keys also release the escapement mechanism 6 so that the carriage or printing unit may be shifted quickly from one column po-

sition to another, and arrested in printing position by the tabulator stops. The carriage is equipped with the usual printing mechanism, including keys and actuating mechanism for one or more column registers 14 and a grand totalizing or cross footing computer 15.

The column registers 14 are mounted on the line space frame 3, and the cross-footing computer is mounted on one end of the carriage 1, and travels therewith. Each register is provided with the usual toothed registering wheels, 16 in the registers and 17 in the computer, the wheels in each instance being arranged in the denominational order in which numbers are printed in a column.

These registering wheels 16 and 17 are rotated by number wheels 16^a, in the registers 14 and 17^a in the computer 15. The number wheels 16^a of the column registers are engaged and operated by a master wheel 18, while a grand master wheel 19 operates the wheels of the cross-footer. Denominational selection is effected by the letter spacing movement of the carriage, which advances the master wheels across the registers as numbers are printed in columns.

The grand master wheel 19 is splined upon a shaft 21, mounted in the computer 15. A shiftable master wheel carriage 22, carried by bars 23, engages a grooved hub 24 of the master wheel 19 and is shifted to advance the grand master wheel 19 by a vertical shaft 25, journaled adjacent its ends, as illustrated at 26 and 27, and provided at its upper end with an advancing arm 28 fast thereon and engaging a stud 29 arising from the carriage 22. A retracting spring 30 connected to the advancing arm 28 holds the carriage 22 against a stop 22^a, at one end of the series of wheel 17^a. Intermediate its ends, the shaft 25 is provided with a rearwardly projecting arm 31, having a pivoted engaging member 33 coacting with one or more control stops 34 on a control bar 32. A spring 35 and pin 36 maintain the member 33 in a position to contact the stop 34, and further movement of the carriage rotates the shaft 25, swings the advancing arm 28, and shifts the carriage 22 to advance the master wheel to successive number wheels as the printing point of the machine advances to successive denominational positions of a column. The member 33 moves out of contact with the stop 34, before the next column position is reached and the spring 30 rotates the shaft 25 in the opposite direction and retracts the carriage 22 and master wheel 19. Upon return movement of the carriage 1, the member 33 yields and wipes past the stop 34.

It has not been deemed to be necessary to a proper understanding of this invention to illustrate the operating keys and their connections. It is sufficient to say that the master wheel 18 is rotated, in different degree or a number of increments corresponding to the value of the key operated, by suitable key operated connections known in the art as differential mechanism and corresponding movement is imparted to the wheel 19. To attain this result a gear 37 on the shaft 20 is in constant mesh with a shiftable reversing gear 38, mounted on a stud 39. In its normal position the reversing gear 38 meshes with a gear 40 fast on the shaft 21 and meshing with one member 42 of a twin gear 43. The other member 44 of the twin gear 43 is laterally offset from the plane of the gear 40 so that it is disengaged therefrom but may be meshed with the reversing gear 38 when the latter is shifted from its normal position. In its normal position the reversing gear 38 rotates the master wheel shaft 21 to effect addition in the computer 15. In the shifted position of the gear 38, the master wheel shaft 21 is reversed for subtraction. The reversing gear 38 is shifted automatically by means of a shifter 45 mounted to slide upon guides 46 and embracing a grooved hub 47 of the gear. A retractile spring 48, normally maintains the shifter 45 and gear 38 in adding position against the head 49 of the stud 39.

Pivoted to the computer 15 as at 51, is a bell crank 50, one arm of which is forked as at 52 and engages a stud 53 projecting from the shifter 45. The other arm of the bell crank 50 provides a cam element 54 which travels parallel with the stop bar 32. When it is desired to subtract in the computer 15, a subtracting stop 34, having a roller 34^a projects into the path of the cam element 54 and rocks the bell crank 50 to shift the reversing gear 38 to subtracting position as the carriage moves to the column position in which subtraction is desired.

The carrying mechanism for the computer 15 is similar to that disclosed in Patent #1,455,196, issued to me May 15, 1923. Its essential features are two series of carrying dogs 55 and horizontally aligned dog carriers 56, the dogs and carriers being arranged in associated pairs beneath each number wheel 17^a, except that of lowest order, and operated to engage and carry, by motor springs 57, one for each pair of carriers 56. Each pair of dog carriers 56 take the form of oppositely arranged bell cranks pivoted respectively, as at 58, upon opposite sides of the vertical center of their associated number wheel 17^a to oscillate in the plane thereof. The carrying dogs 55 are pivoted as at 61 intermediate their ends and in a vertical position upon the extremities of the horizontal arms 60 of the bell cranks, to engage their associated number wheel. The motor spring 57 for each pair of dog carriers connects the extremities of their vertical arms 59. Each pair of carrying dogs 55 is set in normal position by swinging its car-

riers against the action of their motor spring 57, the upper ends of said dogs engaging under parallel stationary bars 62, and being held against bars 55[a] by springs 63. Each pair of carrying dogs 55 is associated with a trip 64 mounted to oscillate between said dogs upon a stationary bar 65, and normally centered in vertical position by individual spring pressed plungers 66. Each trip 64 is provided with an upstanding lug 67, laterally offset from the trip to project into the plane of the number wheel of next lower order, to be engaged and swung in one direction, or the other for addition or subtraction, by a widened tooth 64[a] on said wheel. A trip 64 is thus rocked in one direction or the other when a wheel 17 has been rotated nine increments and unlatches the carrying dog 55, associated with the wheel of next highest order. The carrier 56 of the unlatched dog 55 is immediately swung by its motor spring 57 to project the dog 55 upwardly to engage and rotate the wheel to be carried. Stops 68[a] and 68[b] engaged, respectively, by the dogs 55 serve to arrest their carrying movement.

From the foregoing, it will be seen that my invention is particularly concerned with machines characterized by the following features; to wit, a combined printing and computing unit traveling relative to a flat work supporting platen, under the control of an escapement and tabulating mechanism, to move the printing point of the machine in the normal printing direction and thus through different column positions of the work, the computer including reversing mechanism and duplex motor operated carrying mechanism adapting it for addition or subtraction.

I propose to provide for machines of this general character, an automatically operated restoring mechanism, preferably motor driven in character, and controlled, primarily, by the movable unit or carriage to restore or reset the motor driven carrying mechanism, the requisite number of times during a single forward excursion of the movable unit.

Restoring frames 68, for each series of carrying dogs 55 comprise, respectively, a pair of vertically disposed bell cranks 69 mounted to oscillate upon horizontal shafts 70 at opposite sides of the vertical plane of the number wheels 17[a]. The upper arms 71 of each pair of bell cranks 69 are connected at their extremities by horizontal rods 73 and the lower arms 72 by similar rods 74. Retractile springs 75 connect the rods 74 whereby the frames are held in normal position with the rods 73 seated in stop notches 76, formed in a suitable part of the computer frame. Rollers 72[a] are provided at the ends of the arms 72 for a purpose presently apparent.

Obviously, by rocking the frames 68 against the resistance of the springs 75, any operated carriers 56 will be swung down to restore the carrying dogs to normal position.

Between the frames 68 is mounted, in the computer, a motor driven unit constituting a power transmitting mechanism 77 for rocking the frames 68 to reset the carrying mechanism. The power transmitting mechanism 77 includes a shaft 78 mounted in the computer 15 below the trips 64, and midway between the shafts 70. On the shaft 78 is a rotary sleeve 79 having gears 80 at each end, a three point cam 81 adjacent each gear, and an escape wheel 82 adjacent one of the cams. The cams 81 rotate in the vertical planes of the bell cranks 69 and engage the rollers 72[a] to rock the restoring frame 68. Normally, as in Figures 2, 6 and 7 of the drawings, one point of each of the cams 81 extends between, but not in contact with, the rollers 72[a]. An oscillating pallet 83 cooperates with the escape wheel 82 and forms therewith an escapement controlling rotation of the restoring cams. The pallet or pawl member 83 comprises upper and lower pawls 85 and 86, to engage three radial abutment shoulders 88 of the wheel 82 which is formed with cam portions 89. The pallet member 83 is urged in an upward direction by a spring 83[a]. Depending from the pallet member 83, is an arm 84, held normally in engagement with a cam 90 on the shaft 25. In this, the normal position of the escapement, one shoulder 88 of the escape wheel 82 abuts the extremity of the lower pawl 86 and holds the transmitting mechanism 77 against rotation in the direction indicated by the arrow in Figure 7. The upper pawl 85 is held in disengaged position and is provided with a hooked end 85[a] to engage the next shoulder, but occupying a position in advance thereof. When the pallet 83 is rocked to disengage the pawl 86, slight rotation of the escape wheel 82 is permitted before the hooked end 85[a] of pawl 85 is engaged by the shoulder 88, as shown in Figure 6. This slight rotation permits the previously abutting shoulder 88 to rotate past the pawl 86 so that if the pallet member 83 is now released its spring 83[a] will rock it and permit the extremity of pawl 86 to engage a cam portion 89 of the wheel as shown in Figure 8. The cams 81 are now free to complete an increment of rotation before being arrested by the engagement of the next shoulder 88 with the pawl 86. The clearance, previously noted between the cams 81 and rollers 72[a], in the normal position of said cams 81, provides for proper action of the escapement before the cams 81 contact the rollers 77, the cam portions 89 of the escape wheel effect a gradual return of the pallet 83 to its normal position as the cams rotate.

As the transmitting mechanism 77 rotates one increment, the cams 81 assume the position shown in Figure 8 in which position the

rollers 72ª are separated and the frames 68 rocked against the action of the spring 75 to lower the rods 73 and restore the carrying devices in the manner described. The pallet or pawl member 83 is rocked downwardly to assume the position of Figure 8 by rotation, in one direction, of the vertical shaft 25 and the cam 90.

It will be remembered that the shaft 25 rotates to advance the master wheel 19 of the computer across the series of number wheels 17ª as the printing point of the machine is moved, in the normal printing direction through the denominational positions of a column. The cam 90 is so constructed that, as the shaft 25 is rotated to advance the master wheel 19 across the number wheels 17ª, the arm 84 is rocked to move the pallet 83 gradually downwardly against the action of its spring 83ª. Thus before the master wheel 19 has completed its advancing movement, or in other words, before the printing point of the machine has progressed across a column, the transmission mechanism, as previously described, will be rotated slightly, and the escapement, in effect, set to permit an increment of rotation of the restoring cams when the pallet 83 is moved upwardly. As the printing point of the machine leaves the last denominational position of a column, and during its approach to the next column position, the member 33 disengages from the column stop 34, the spring 30 rotates the cam 90 reversely and the spring 83ª rocks the pallet 83 upwardly to release the cams and cause the resetting or restoring of the carrying mechanism.

From the foregoing it will be seen that the transmitting mechanism 77 is controlled to operate the restoring frames 68 and restore the carrying mechanism after the printing point of the machine has progressed, in the normal printing direction, beyond the last or lowest denominational position of a column and during the approach of said printing point to the writing position of the next column. Since this result is effected by a portion of the mechanism for advancing and retracting the shiftable master wheel or actuator 19, and is timed according to the position thereof, it may be said that the restoring mechanism is automatically controlled in timed relation to movement of the actuator, or in another aspect, by the movement of the carriage.

To supply the necessary power for the operation of the restoring mechanism controlled as described, a motor 91 is mounted within the computer 15. The motor 91 comprises a driven shaft 92 journaled at its ends below the mechanism 77 and parallel with the shaft 78 thereof. Fixed adjacent to the ends of the shaft 92 are gears 93 and 94 in mesh with the gears 80. Intermediate the gears 93 and 94 the shaft 92 supports two cylindrical drums or barrels 95 and 95ª open at one end and oppositely arranged to form a hollow housing 96 surrounding the shaft 92. The drums 95 and 95ª are freely rotatable upon the shaft 92 and one of said drums, for instance, the drum 95, carries a gear 97. The drums 95, 95ª serve to house a relay of convolute springs, preferably three in number, spaced apart and arranged to rotate the shaft 92 in the direction indicated by the arrow in Figure 7, by the application of a substantially uniform driving force. One of the springs 97 is coiled within the drum 95, with one of its ends affixed to the inner face of its drum as at 101 and its other end, as at 102, to the sleeve 100, journaled on the shaft 92 and projecting for a suitable distance into the drum 95ª. The succeeding spring 98 is coiled in the opposite direction within the drum 95ª with its end affixed respectively to the sleeve 100 as at 103, and to the inner face of drum 95ª as at 104. The third spring 99 is coiled in the drum 95ª in the opposite direction relative to spring 98 and its ends are affixed respectively to the inner face of the drum 95ª and the shaft 92. It will be seen that if drum 95 is rotated in the proper direction to wind the spring 97 about the sleeve 100, it will react to rotate said sleeve 100 about the shaft 92 and the sleeve will, in turn, wind the spring 98, which will cause the drum 95ª to wind the spring 99 about the shaft 92. Thus, the springs 97, 98, and 99 may be wound within a relatively small space to store within the housing 96 their combined reactive energy and to apply a uniform torsional driving force to the shaft 92. It will, of course, be understood that this winding or storing operation occurs only during a time when the transmitting mechanism 77 is held stationary by the escape wheel 82 and pallet member 83.

To provide means for restoring the motor, I provide a structure including, a short horizontal shaft 105, journaled in suitable bearings 106 and 107 so that it extends below the housing 96, at a right angle to the shaft 92, to engage a gear 108 thereon with the teeth of the rack 7. Upon movement of the combined printing and computing unit or carriage 1, in either direction, the shaft 105 is rotated and with it a beveled gear 109, meshing with a similar gear 110, fixed upon a freely rotatable sleeve 111. The sleeve 111 is mounted upon a relatively longer shaft 112, positioned below the housing 96, with one of its ends projecting beyond the sleeve 111. The projecting end of the shaft 112 carries a freely rotatable member 113, comprising a gear 114 and a ratchet wheel 115, the former meshing with the gear 97 of the drum 95. The gear 114 carries a pawl 116 engaging a ratchet wheel 117 affixed to the sleeve 111 so that rotation of the sleeve 111 in one direction imparts movement to the member 113 to rotate the drum 95. The relative arrangement of the

gears 109 and 110, the ratchet wheel 117, and the pawl 116 is such that upon return movement of the carriage 1 the member 113 will be rotated to drive the drum 95 in the proper direction to wind the springs 97, 98, and 99. The member 113 is prevented from rotating in a reverse direction by a pawl 118 which engages teeth upon the ratchet 115. Since the motor winding operation is automatically effected by each return excursion of the carriage and substantially one-third only of a revolution of the transfer restoring cams 81 is sufficient to restore the carrying mechanism, it will be apparent that if the motor is properly wound initially, it will provide a substantially uniform and constant driving source for automatically restoring the carrying mechanism any number of times that may be required during a single advance movement or forward excursion of the carriage 1 without reacting to a point below driving efficiency. The gear 108 may be initially rotated manually to wind the motor 91 before the carriage is placed on the frame to mesh said gear with the rack 7.

It is believed that the foregoing will suffice to impart a clear understanding of my invention, but, it is desired to emphasize the fact that the transfer restoring mechanism is automatically controlled by movement of the carriage in normal printing direction and is intermittently operated by the motor during such movement or excursion. Likewise, the motor is automatically controlled by the forward movement of the carriage and is automatically rewound or restored as the carriage is retracted.

Obviously, the construction and arrangement of parts herein described may be varied and changed within the spirit of the invention.

What I claim is:

1. In a calculating machine, the combination with a frame and carriage, and a register including transfer mechanism and movable with the carriage, of transfer restoring mechanism including, a normally energized motor, and motor releasing means, all carried by the register, and means for operating the motor releasing means repeatedly by movement of the carriage in an advancing direction.

2. In a calculating machine, the combination with a frame and carriage, and a register including transfer mechanism and movable with the carriage, of transfer restoring mechanism including, a normally energized motor, and motor releasing means, all carried by the register, means for operating the motor releasing means repeatedly by movement of the carriage in an advancing direction, and means for restoring the motor including a driving train in the register connected to said frame for operation by movement of the carriage in the opposite direction.

3. In a calculating machine, the combination with a frame and carriage, and a register including transfer mechanism and movable with the carriage, of transfer restoring mechanism including members having separative action to reset the transfer mechanism, rotary mechanism for separating the members, escapement mechanism for controlling the rotary mechanism, and means for operating the escapement mechanism repeatedly by movement of the carriage in one direction.

4. In a calculating machine, the combination with a register and transfer mechanism, of transfer restoring mechanism including members having separative action to reset the transfer mechanism, rotary mechanism for separating said members, a motor for operating the rotary mechanism, and escapement mechanism for controlling operation of the rotary mechanism.

5. In a calculating machine, the combination with a register including transfer mechanism and denominational selecting mechanism, of transfer restoring mechanism including members having separative action to reset the transfer mechanism, rotary mechanism for separating the members, an escapement mechanism for controlling operation of the rotary mechanism and means operated by the denominational selecting mechanism to trip the escapement mechanism.

6. In a calculating machine, including a register and transfer mechanism, restoring mechanism including, restoring members operable to reset the transfer mechanism, and rotary mechanism adapted to operate the members repeatedly by its operation through a single revolution.

7. In a register including denominational selecting mechanism and transfer mechanism, restoring mechanism including opposed members having separative action to reset the transfer mechanism, rotary cam mechanism intermediate said members for causing such separative action, and escapement mechanism for controlling rotation of the rotary mechanism and operated by the denominational selecting mechanism.

8. In a register including denominational selecting mechanism and transfer mechanism, restoring mechanism including opposed members having separative action to reset the transfer mechanism, rotary mechanism adapted during a single revolution thereof to cause repeated separative action of said members, a motor for rotating said rotary mechanism, escapement mechanism for controlling rotation of the rotary mechanism and means operated by the denominational selecting mechanism to trip the escapement mechanism.

9. In a calculating machine the combina-

tion with a carriage a frame including a carriage feed rack, and a register on the carriage and including transfer mechanism, of transfer restoring mechanism including a motor carried by the register, and motor restoring mechanism having a rotatable motor-restoring member in operative connection with the feed rack for rotating said member and operated by movement of the carriage and register, and including a one way driving connection for transmitting movement to said member.

10. In a machine of the class described, the combination with a carriage travelling through successive column positions and a register having a shaft rotated by travel of the carriage through a column position, of transfer restoring mechanism including a normally energized motor, motor driven power transmitting mechanism, and means for controlling operation of the power transmitting mechanism including an escapement controlled by rotation of said shaft to release the power transmitting mechanism for operation coincidentally with travel of the carriage beyond a column position.

11. In a machine of the class described, the combination with a register adapted to tabulate from column to column, and including transfer mechanism, of a transfer restoring member, means to actuate the transfer-restoring member, a normally energized motor to drive the actuating means, an escapement to control the operation of the motor and the actuating means, and an escapement releasing device controlled by the register in its travel to trip the escapement and free the motor and actuating means for operation.

In testimony whereof I affix my signature.

HARRY A. FOOTHORAP.