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COMPLETE SPECIFICATION.

Improvements in Computing or Calculating and Recording Machines.

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I, CHARLES AUBREY DAY, of 321, High Holborn, London, England, Chartered Patent Agent, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in machines for making computations, and for printing the results of such computations upon suitable recording strips. The machine as herein shown is designed especially for use in banks, for printing a list of the checks drawn by each customer, adding the amounts of said checks together, and printing the total amount of such checks.

The invention consists generally in a listing and computing machine provided with a suitable key-board and computing mechanism, the keys of said key-board being adapted to be set in positions for operating said computing mechanism, and said key-board and said computing mechanism being capable of relative movement one past the other, for the purpose of causing the moved or operated keys to engage with and operate said computing mechanism.

The invention consists further in novel means for transferring the movements of the primary or listing wheels to the total-result wheels.

The invention consists further in novel constructions and combinations hereinafter described and particularly pointed out in the claims.

In the accompanying drawings forming part of this specification:

Fig. 1 is a perspective view of a listing and computing machine embodying the invention.

Fig. 2 is a side elevation.

Fig. 3 is a view looking at the opposite side of the machine from that shown in Fig. 2, a portion of the casing being removed or broken away to show the interior of the machine, and the movable carriage being at the limit of its reverse or backward movement.

Fig. 4 is a view similar to Fig. 3 but showing the carriage at the limit of its forward movement.

Fig. 5 is a plan view of the machine.

Fig. 6 is a horizontal section of the machine taken on a line just above the spiral shafts.

Fig. 7 is a transverse section of the machine taken on the line *x*—*x* of Fig. 4.

Fig. 8 is a section through the listing type-wheels, their supporting shafts and bearings and the operating wheels.

Fig. 9 is a detail of one of the worm wheels.

Fig. 10 is a perspective view showing portions of the interior of the machine, the carriage being at the limit of its backward or reverse movement.

Fig. 11 is a perspective view of portions of the interior of the machine showing the carriage at the limit of its forward movement.

[*Price* 8*d.*]

Figs. 12 and 13 are details illustrating the operation of the repeat device.

Figs. 14 and 15 are details of the key restoring device.

Fig. 16 is a detail and partial side elevation illustrating a portion of the means for printing the amounts from the type-wheels.

Fig. 17 is a side elevation and partial section illustrating the operation of printing from the total-result wheels.

Fig. 18 is a perspective view of a number of the spiral shafts and their locking devices and showing the position of two of the depressed or operated keys.

Fig. 19 is a side elevation of the movable carriage and a partial side elevation and section of portions of the casing.

Fig. 20 is a detail of the aligning device.

Fig. 21 is a side elevation of the type-wheels.

Fig. 22 is a view similar to Fig. 21, illustrating the means for carrying from one of the total-result wheels to the next and showing also the aligning device.

Fig. 23 is a view similar to Fig. 22, with the total-result wheels separated from or out of engagement with the transfer-wheels, and showing also a different position of the aligning device.

Fig. 24 is a partial end elevation of the recording wheels and transfer device.

Fig. 25 is a detail of one of the transfer-wheels and its support.

Figs. 26 and 27 are perspective details illustrating the means for moving the total-result wheels into and out of engagement with the transfer-wheels.

Fig. 28 is a detail section of the means for returning all of the total-result wheels to zero, and also illustrating the means for preventing the printing of zeros from those wheels beyond the highest number to be printed.

Fig. 29 is a perspective detail showing the means employed for covering the wheels that are not to print; and

Figs. 30 and 31 are details of the device for restoring the total-result wheels to zero.

The Casing.

In the drawings 2 represents the case of the machine, which may be of any suitable or preferred form of construction, but is shown as a metallic case having a broad, substantially flat base and a box-like enclosure having the forward portion of its top wall inclined. This inclined portion 3 of the top wall forms the support and guide or key-board for the keys hereinafter referred to. As shown the case is also provided with glass panels 5, but these may be omitted.

The Keys.

Mounted in the inclined wall 3 of the case are the vertically movable keys 7, each consisting, preferably, of a flat bar divided or forked at its lower end, and provided also near its lower end with a shoulder 9. These keys are provided at their upper ends with the usual buttons or tops provided with suitable figures or characters. The bars 7 are of increasing length from the front to the back of the key-board, so that the lower ends of the keys are in substantially the same plane, and the shoulders are in substantially the same plane. The keys 7 are arranged in rows, running from the front to the back of the key-board, and are numbered consecutively, as shown in Figs. 1 and 5. There are shown eight rows of keys which permits one to register and print numbers up to 99,999,999, or, when recording amounts representing (say,) United States or Canadian money $999,999.99. There may, however, be any other convenient number of the rows of keys. Each key is provided with a suitable spring 11, preferably having its upper end secured to the key and its lower end free, and provided with a projection or raised portion which holds the key in its elevated position by engagement with the wall of the slot or opening through which the key passes. The keys are, by these springs, all held normally in an elevated position. When any key is depressed its spring 11 is compressed and the key passes to its lower position, as illustrated by the position of one of the keys in Fig. 4 and by the position of one of the keys in Fig. 12.

THE MOVABLE CARRIAGE.

The casing of the machine is provided, in the base portion thereof, with suitable guide-rails 13 and a guide-way 13^1, which extend longitudinally of the machine and preferably nearly its full length. Mounted upon these guide rails and adapted to slide back and forth thereon is a suitable carriage 15 having preferably also a roll 15^1 that moves in the guide way 13^1 (see Fig. 7). The carriage is adapted to be reciprocated in the casing by means of a suitable handle 17 arranged upon a crank-arm 19 that extends through a slot 21 near the bottom of the casing. The carriage 15 has mounted upon it the type-wheels, their supports, and means for operating said wheels, as hereinafter described. In Fig. 3, the carriage is shown at the rear end of the casing or in the position that it occupies while the keys are being depressed. In Fig. 4, the carriage is shown at the limit of its forward movement, with one of the keys depressed and in position for engagement with the type-wheel operating mechanism.

THE SPIRAL SHAFTS.

Mounted in bearings 22 and 24 are the spirally grooved shafts 23. These shafts extend longitudinally of the machine, or in the direction of the movement of the carriage, and there are as many of these spiral shafts as there are rows of keys on the machine. As shown, the ends of the shafts are provided with journals which are mounted in the bearings or bars 22 and 24 so as to permit the spiral shafts to turn freely in either direction. The bars 22 and 24 are secured upon suitable standards 27, 29, on the forward and rear ends of the carriage. The spiral shafts 23 normally remain stationary while the carriage is reciprocated, but when any key of the corresponding row is depressed its forked lower end is brought into position to engage the spiral shaft as the carriage is moved forward, causing the shaft so engaged to be rotated, and the amount of rotation given to such shaft depends on the position of the key which engages said shaft. For instance, if a key bearing the figure 9 is depressed, it engages the spiral shaft in line therewith almost immediately after the carriage begins its forward movement, and this engagement continues throughout the movement of the carriage, and the spiral shaft is continuously turned until the forward movement of the carriage ceases. If, however, the key bearing the figure "1" in any row is depressed, it does not engage the corresponding spiral shaft until the carriage has nearly reached the limit of its forward movement. Hence, the spiral shaft is rotated only during a short portion of the movement of the carriage.

It is preferred to provide means for locking each spiral shaft in a stationary position except while it is in engagement with one of the operating keys. For this purpose there is provided in connection with each spiral shaft a locking-plate 31 mounted upon pivots 32 in the bars 22 and 24 that support the spiral shaft. A spring 33 is provided for each plate 31 and these springs hold the plates against the spiral shafts. Each shaft is also provided with a pin 35 that engages a slot 37 in the plate 31 whereby said shaft is locked except when the plate is held away from the shaft. The operation of this part of the mechanism is clearly illustrated in Fig. 18. Each of the plates 31 is provided at its upper edge with a substantially horizontal flange 30 having a beveled forward end 34. When one of the keys 7 is depressed and the carriage is moved forward, the forked end of the key straddles the upwardly projecting portion of the bar 22 forming the bearing for the corresponding spiral shaft 23, and in the further movement of the carriage straddles the spiral shaft. The initial portion of the shaft is made flat, as shown in Fig. 18, and the engagement of the flange of the plate 31 with the outer surface of the keys turns the upper edge of the plate 31 outward away from the spiral shaft, freeing the pin 35 from the slot 37 before the shaft begins to rotate. The key remains in its depressed position and rotates the spiral shaft during the remaining portion of the forward movement of the carriage,

and then rotates the shaft in the reverse direction during the reverse movement of the carriage until the end of the shaft passes out of the fork of the key. As soon as this is done, the plate 31 is forced by its spring back against the surface of the spiral shaft, and the slot in the plate engaging the pin on the shaft locks the shaft and prevents further movement thereof until the plate is again turned away from the shaft by its engagement with one of the keys.

THE LISTING TYPE-WHEELS AND TUBULAR SUPPORTING SHAFTS.

Mounted in bearings 39 and 41 on the carriage 15 are the series of tubular shafts 43, arranged one within another, and each provided upon one end with a worm-wheel 45 that is engaged by one of the spiral shafts 23, and upon the other end with a type-wheel 47. These type-wheels I term the primary or listing type-wheels, but may also be termed the temporary or indicating wheels, as each amount that is to be listed is temporarily indicated or shown on these wheels and is then transferred to the total-result wheels. The wheels 45 may be secured by any suitable means upon the tubular shafts. As shown, each wheel is provided with a threaded split hub 42 and with a clamping collar 44 screwed upon this hub and clamping the hub upon the shaft (see Figs. 8 and 9). Any other convenient means for securing the wheels to the shafts may be used. Each of the tubular shafts, it will be seen, is mounted in an independent bearing at each end, so that any one of the shafts may turn independently of all the others. Each tubular shaft and type-wheel carried by it rotates at all times with the corresponding spiral shaft 23. Each of the type-wheels is provided upon its circumference with a series of type-figures from "0" to "9," and when in normal position, with the spiral shafts locked against rotation, the type-wheels all stand with the zero-types in line with one another and in printing position. As each spiral shaft is rotated by engagement with one of the keys in the corresponding row, the type-wheel upon the corresponding tubular shaft is correspondingly rotated, so as to bring the figure corresponding to that on the depressed key into printing position. When the carriage is reversed the type-wheels are turned back to zero. If, when the carriage is moved forward, there are any rows of keys in which no key has been depressed, the spiral shafts in line with these rows of keys will remain stationary and zero will be printed by the corresponding type-wheels.

It will be understood that by means of the keys, the spiral shafts, the connected tubular shafts and the type-wheels carried thereby, any desired numbers may be brought into position, by turning the type-wheels, to be printed by the means hereinafter described, and that the type-wheels are restored to zero after the printing of each number or amount. By this means, therefore, where the machine is used for making lists of bank checks the amounts of the separate checks may be printed.

THE TOTAL-RESULT TYPE-WHEELS.

It is necessary, in addition, to provide means for adding the several numbers thus printed and printing the total or result of such addition whenever desired. This means will now be described, it being firstly stated, however, that one of the most important features of the invention consists in the novel and exceedingly simple means provided for recording the total result of any number of operations of the machine upon the total-result wheels, which may at any time be printed upon the recording strip, thereby showing the sum of all of the numbers previously printed on the slip. The wheels 49 (which for convenience are termed the total-result wheels) are type wheels similar to the type-wheels 47, but they are mounted loosely upon collars 51 secured upon a shaft 53 so as to turn therewith, and each collar has a disc 55, preferably formed integrally therewith and projecting between two of the type-wheels 49. Each type-wheel 49 has a pin 57 projecting laterally therefrom towards the disc 55, and each disc has a spring dog 59 (see Fig. 22) secured to or formed on it, which dog is

adapted to engage the pin 57 on the wheel 49. The dog does not prevent the free turning of the wheel in one direction, but, if the shaft 53 is turned in one direction, each of the dogs 59 will, at some point in the revolution of the shaft, come in contact with the pin 57 on the corresponding wheel 49 and said wheel will thereafter turn with said shaft. This means is employed for turning all of the wheels 49 back to zero when it is desired to begin a new set of indications and a new computation and new record. The shaft 53 is mounted in standards 61 which are secured upon a rock-shaft 63 mounted in suitable bearings 65 forming part of the carriage 15. A bell crank arm 67 is secured to the shaft 63, (see Figs. 21, 22, 23 and 24). Two parallel slots or guide-ways 69, 71, are formed in the base of the machine, and the crank-arm 67 is provided with a spring-pin 73 adapted to engage either one of the slots 69 or 71. This pin is mounted in a hole in the crank-arm and a spring 73^1 arranged in the rear of the pin tends to project said pin into one of said slots. The slots 69 and 71 are connected at their ends by cross-slots 68 and 70 (see Figs. 26 and 27). At one end the slot 71 is provided with an incline 72, and the cross-slot 70 with an incline 74, and at the other end the slot 69 is provided with an incline 66 and the cross-slot 68 is provided with an incline 64. These inclines are on the inner walls of the slots. The spring pin 73 normally projects into one of the slots 69 or 71. When it is in the slot 69, the total-result wheels 49 stand in the position shown in Figs. 23 and 24. When the pin 73 is in the slot 71, the total-result wheels 49 stand in the position shown in Figs. 21 and 22, and are then in engagement with the transfer-wheels hereinafter described. The slot or guide-way 71 extends to the end of the base to permit the pin to travel therein in putting the carriage into or removing it from the casing. When the carriage 15 is moved forward and the type-wheels 47 are turned to various positions by the moved keys, the pin 73 moves in the slot or guideway 71 and the wheels 49 are, through the transfer wheels hereinafter described, turned in unison with the wheels 47. When the carriage reaches the limit of its forward movement, the pin 73 has arrived at the end of the slot or guideway 71, has passed over the incline 72 at the end of the guide-way 71 and on to the incline 74 in the cross-slot 70. The pressure of the spring 73^1 on the pin forces the pin to travel down the incline 74, thereby bringing said pin into the end of the cross-slot 70 or the beginning of the slot or guideway 69. This movement will turn the crank-arm 67 from the position shown in Figs. 21 and 22, to the position shown in Fig. 23, and will carry the total-result wheels 49 out of engagement with the transfer wheels and into engagement with a spring locking dog 50. It will thus be seen that during the forward movement of the carriage, while the listing type-wheels 47 are being turned into position to print upon the recording slip the amounts indicated by the keys that have been depressed, the total-result wheels 49 will move in unison with said type-wheels 47, but that during the backward movement of the carriage, when the wheels 47 are turned back to zero, the total-result wheels are out of engagement with the type-wheels 47 and do not partake of this reverse or backward movement. Hence the wheels 49 constitute adding or total result wheels and indicate at any time the total-result of any desired number of operations of the machine.

The Transfer-wheels and Carrying Device.

As the type-wheels 47 simply indicate single transactions or single entries made by the machine, no carrying device is needed in connection therewith, but the total-result wheels must be provided with a carrying device which will cause each wheel in the series to be turned one step each time that the preceding wheel makes a complete revolution. This result is effected by the peculiar manner in which the intermediate or transfer-wheels are mounted and operated.

The transfer-wheels 75 are arranged in engagement with the type-wheels 47, and there are as many of these intermediate or transfer-wheels as there are of the type-wheels 47. Each of the wheels 75 is mounted on a shaft-stud or shaft 77

in a vertically sliding standard 79 (see Fig. 25). Each of said standards is provided with a notch or recess 81 and is arranged to slide vertically between the transverse rod 83, the transverse bar 85, and frames 87. Said rod 83 and said bar 85 are mounted in the vertically projecting frames 87 which form a part of the sliding carriage. The lower ends of the vertically sliding standards 79 are preferably forked (see Figs. 22, 23 and 24) and one end of one portion of the fork comes above a transverse rod 89 arranged in slots 91 in depending lugs 93. A pivoted bell-crank lever 95 is arranged in connection with each of the vertically moving standards 79 (see Figs. 23 and 24). These levers extend over the tops of the standards 79, and each lever is provided with a hook 97 adapted to engage the notch 81 in the standard. A spring 99 is connected to the short arm of each lever and to the standard, as shown in Figs. 21, 22, 23, and 24. As the carriage is moved backward, the rod 89 rides over the inclined bars 101, one of which is arranged at each end of the rod 89 (see Fig. 7). As the rod 89 rides over the inclined bars 101, it raises all of the standards 79 that may be in the lower position shown in Fig. 23 to the position shown in Fig. 21 when the hook 97 on the bell-crank lever 95 engages the notch 81 in each standard 79 and holds said standard in its elevated position. The transfer-wheels 75 are then in the position shown in Fig. 21, and when the total-result wheels are engaged with the transfer-wheels namely, during the forward movement of the carriage, the motion of the type-wheels 47 is transmitted through the transfer-wheels to the total-result wheels. If any one of the wheels 47 remains idle during the forward movement of the carriage, by reason of the keys controlling said wheel not being depressed, the corresponding transfer-wheel 75 and total-result wheel 49 will also remain idle except as hereinafter stated. Each of the wheels 49 is provided at the proper point on its side with a pin 103 (see Figs. 21 and 22). This pin is in such position that when the nine type passes the printing point, this pin comes into engagement with the lever 95 of the next succeeding transfer-wheel or the transfer-wheel intermeshing with the next succeeding total-result wheel of a higher denomination. The engagement of this pin with the lever 95 disengages the hook 97 from the notch 81 and the standard 79 is depressed or drawn downward by the spring 99, and the transfer-wheel carried by said standard is moved from the upper position shown in Figs. 22 and 23, to the lower position shown in the same figures. As, however, one tooth of this wheel is in mesh at all times with the type-wheel 47, which is either stationary or moving in the direction indicated by the arrow in Figs. 21, to 24, the lowering or downward movement of the transfer-wheel will give to the corresponding total-result wheel a one-step movement. This operation will take place whether the corresponding wheel 47 is moving or not, and whether the transfer-wheel is moving or not, and, hence, whether the corresponding total-result wheel is being rotated by the type-wheel 47 and transfer-wheel 75, or is stationary. When any one of the wheels 77 has been depressed or lowered in the manner described, it remains in this position, and if the corresponding type-wheel is moving, continues to turn and transmit such movement to the total-result wheel until the total-result wheel is disengaged therefrom at the beginning of the backward movement of the carriage. During the return or reverse movement of the carriage, any of the standards 79 that have been moved down are elevated by the passage of the rod 89 over the inclined bars 101, and by the engagement of the hooks 97 on the levers 95 with said standards, the latter are locked in an elevated position. The bars 101 are each pivoted at one end to the lugs or projections 105 (see Figs. 7, 21 and 24) and their opposite ends (which are cut off diagonally on the underside) rest by gravity upon the base of the machine, so that, as the carriage is moved backward after each registration and printing operation, the rod 89 rides up over the inclined bars 101, as before stated, and raises all of the movable standards 79 that have been released and depressed by the carrying operation of the total-result wheels, and causes them to be engaged by the hooks 97 on the bell-crank levers 95,

whereby said standards and transfer-wheels are held in this elevated position. Upon the forward movement of the carriage, however, the ends of the rod 89 pass under the raised ends of the bars 101, and, lifting the free ends of said bars, pass under them also. As the first transfer-wheel in the series need never be moved downward, the first carrying operation being performed by the second transfer-wheel, the first transfer-wheel is mounted on a fixed standard 78 secured upon the first frame 87 (see Fig. 21). While there are eight rows of keys, nine total-result wheels are shown, but any number of such wheels may be used. The last total-result wheel in the series is not rotated except that it is moved one step each time the preceding wheel makes a complete revolution, or, in other words, the preceding wheel "carries" to this wheel. To produce this carrying operation, it is necessary to provide a corresponding transfer-wheel and moveable standard, and as the opposite tooth of the transfer-wheel must be held when the standard is moved downward, a ninth type-wheel 47 is shown. This wheel, however, does not rotate and need not be provided with type, and instead of being a complete wheel, it need only be a portion of a wheel provided with two teeth with a recess between them to act as a stop for the tooth of the transfer-wheel that projects into this space. Any suitable means may be provided to hold the movable standards 79 in a vertical position and to guide them while they are being moved. As shown, a series of the frames 87 is provided, one between every two standards, with the transverse rod 83 and the transverse bar 85 passing through all of said frames. The lower end of each standard 79 also passes through a slot in the base of the machine and these devices serve to hold the standards 79 independently in upright positions, and to guide said standards as they are moved. It will be seen that only one spring is used both for the pivoted bell-crank lever 95 and for the movable standard 79. The spring is, as before stated, connected to a hook on the standard and to the short arm of the bell-crank lever. When the standard is in its elevated position, as shown in Figs 21 and 24, the spring is distended and is under tension. As soon as the pin on the total-result wheel strikes the lever 95 and throws the hook 97 out of engagement with the notch 81, this spring draws the standard and the transfer-wheel carried by it downward, and gives to the next succeeding total-result wheel from that by which the lever was moved, a one-step movement. When the standard 79 is raised by the rod 89 riding over the inclined bars 101, the spring 99 acting on the bell crank lever 95 throws the hook 97 into position to engage with the notch 81 and thereby to lock the standard in its elevated position.

While the transfer-wheels are described as being given a downward movement for the purpose of carrying from one total-result wheel to another, and means are shown for thus moving this wheel vertically, it will be understood that the invention is not restricted to this particular way of moving the transfer-wheel for this purpose. It is only necessary to give to each transfer-wheel during the carrying operation a bodily or what may be termed an "axial" movement; that is to say, the axis of the transfer-wheel is moved down (or it might be moved up) either vertically or in a curved path, in the direction of the movement of the intermeshing portion of the total-result wheel and in the opposite direction to the motion of the intermeshing portion of the corresponding temporary or listing wheel.

The Printing Device.

The printing device may be of any suitable or preferred construction. It consists preferably and generally of suitable rolls and a spool carrying a strip of paper, a suitably supported and operated inking ribbon, and means for forcing the paper against the type over the inking ribbon when it is desired to print any one of the numbers that have been registered on the machine, or the total result of any number of such registrations. It will be understood from the foregoing portion of the description that both the primary or listing type-wheels 47

and the total-result wheels 49 are mounted upon the reciprocating carriage 15, and are, therefore, moved back and forth with said carriage. The carriage may be stopped with either set of wheels in printing position, and the drawings show a simple device for printing from either set of wheels. As shown, the carriage 15 has mounted at its rear end in the standards 29 a suitable rock-shaft 107, at one end of which there is secured a double crank 109, 111. The crank-arm 19 to which the handle 17 is secured, is connected to the short crank 111 and said crank-arm 19, as before stated, passes through the slot 21 in the casing of the machine. The part of the crank-arm 19 that passes through the slot 21 is broad and flat and slides freely in said slot. The crank-arm 109 is of considerable length and carries at its end the roller 113 which projects into the horizontal groove or way 115 Fig. 16. Connected with the groove or way 115 are the transverse grooves 117, 119, which preferably extend downward from said grooves 115 (see Figs. 16, 17 and 19). The groove 115 may be formed in the wall of the casing, but it is preferred to form this groove in an independent part 116 arranged inside of the wall of the casing and suitably supported upon the base of the machine. The short groove 119 is normally closed at the top by a switch 121 (see Fig. 19), consisting of a block having a smooth upper face and secured upon a circular plate 123 inserted in the part 116 in which said grooves or guides are located. Arranged at one side of the key-board is the key 125 Fig. 3, which may be designated as the total-result key. This key consists of a vertically movable bar provided with suitable means for guiding it and having at its lower end a slot 127 (Fig. 4) that engages a pin 129 eccentrically placed on the plate 123. A stop 131 is formed upon or secured to a stationary part on the machine under the lower end of the key 125. A spring 133 bearing against the side of the key tends to hold the lower end directly over the top of the stop 131. This stop, when the key is in this position, prevents any depression of the key and thereby prevents an accidental printing from the total-result wheels. When it is desired to print from the total-result wheel, the key 125 is depressed, being first given a slight backward movement at its lower end against the tension of the spring 133 to free it from the stop 131. The key is then depressed and it rotates the plate 123 and turns the switch-block 121 from the position shown in Figs. 13 and 16 to the position shown in Fig. 17. The switch-block then forms a stop in the groove 115 while leaving the groove 119 open at its upper end. The printing and paper-feed rolls 135, 137, are mounted on suitable shafts 136 that are mounted on the arms 139, secured to the diagonally arranged shaft 141 (see Figs. 5 and 11). The shaft 141 is mounted in suitable bearings 143 on the casing of the machine. The spool of paper 145 is mounted on suitable standards 147 and the paper passes under the shaft 141, through a slotted guide 149 secured at one end to the frame 139 and at its opposite end to the cam hub 183 on the shaft 141, parallel with the shafts 136. The paper then passes over the roll 135 (speaking of the roll in the position that it occupies in Fig. 1 of the drawings) and then between the rolls 135 and 137. The shaft 141 carries at one end a pinion 153 (see Figs. 2, 5, 7, 9, 11, 22 and 23), which is engaged by a vertically sliding rack-bar 155 which is held in position by a suitable guide 157. The lower end of the rack-bar 155 is provided with an open-ended slot 159. Pivoted upon the carriage 15 are the two bars 161 preferably suitably connected together and carrying at their free ends a plate 163. A crank-arm 165 secured upon the rock-shaft 107 also engages one end of the plate 163 (see Figs. 10 and 11). During a part of the movement of the carriage the plate 163 is out of engagement with the rack-bar, but, as the carriage is drawn forward into printing position, the plate 163 enters the slot 159 in the lower end of the rack-bar, and this plate is of sufficient length to be in engagement with said rack-bar when the carriage is in position to bring either set of type-wheels to the printing point. An inking ribbon 167, mounted upon suitable spools 169, 171, is brought forward from one spool, is carried around a wire 173 in a slotted aligner plate, hereinafter described, and is carried back to the other

spool. The top wall of the casing at this point is provided with an opening 175 through which the paper is brought in contact with the inking ribbon, while it is directly over said type-wheels, and suitable pressure is applied to the paper to cause an impression from the types that are uppermost upon said wheels to be made upon said paper. The paper may be brought in contact with either the primary type-wheels or the total-result type-wheels. In listing checks, for instance, the amount of each check will be registered upon the primary type-wheels and will then be printed therefrom, and after all of the checks of one customer are thus listed the total amount of said listed checks will be printed from the total-result wheels. To print from the primary type-wheels the carriage is drawn forward by the handle 17 and crank 19 the full limit of its movement. This movement of the carriage turns the primary type-wheels 47 so as to bring under the printing ribbon the types on said wheels corresponding to the depressed keys. The end of the crank-arm 109 will now be over the slot or guideway 117, and a further movement of the handle 17 in a downward direction will rock the shaft 107, the roll 113 traveling downward in the guideway 117 (see Fig. 16) and through the crank-arm 165 and plate 163, which will now be in engagement with the slot 159 in the rack-bar 155, said rack-bar will be moved downward, the shaft 141 will be given a partial turn upon its axis and the rolls and the paper will be turned from the position shown in Figs. 1, 5 and 10, to the position shown in Figs. 11 and 23, and the paper will be forced with considerable pressure against the uppermost row of types on said wheels. The inking ribbon will be between the paper and the types and thereby an inked impression of the types will be formed upon the paper. By reversing the movement of the handle and crank-arm the paper carrying rolls will be turned back to the position shown in Fig. 1 and the amount printed upon the slip will then be visible to the operator, right-side up, as indicated in Fig. 1. The carriage may now be moved back to the rear end of the casing, during which operation the keys will be restored to their elevated position, by means hereinafter described, and the machine will be in condition for recording the amount of the next check. When it is desired to print the total result from the total-result wheels, the total-result key 125, hereinbefore described, is operated to turn the switch-block 121 into the position shown in Fig. 17 of the drawings. The carriage is now drawn forward in the same manner as before but is stopped when the roll 113 on the end of the crank-arm 109 strikes the switch-block 121. The roll 113 is now directly over the guideway 119 and the total-result wheels are in printing position. The handle and crank-arm 17 and 19 are then depressed and the printing operation takes place exactly as before, and the total amount of the listed checks will be printed on the slip below the columns of figures representing the amounts of the separate checks.

The Type-aligning Device.

I prefer to provide means in combination with the printing device for positively aligning the types that are turned into printing position in the operation of the machine. As shown, the projecting portions of the wheels which bear the types are slightly curved so as to make these projections of somewhat wedge shape. A lever 177 is pivoted below the upper wall of the casing and is provided with the aligning bars 179 having a wedge-shaped opening between them (see Figs. 20, 22 and 23). The shaft 141 is provided near the end which carries the pinion 153 with the cam 181. When the paper-carrying rolls 135, 137, are in the position shown in Fig. 1, the cam 181 is in engagement with the end of the lever 177 and the aligning bars 179 are held in the elevated position shown in Fig. 22. When the shaft 141 is given a partial rotation in the printing operation, the cam 181 moves away from the lever 177 and a cam 183 engages a plate 185 carried by the other end of the lever, as shown in Figs. 22 and 23. The cam 183 now forces downward the end of the lever 177 carrying the aligning bars 179 down, one on each side, of the uppermost tooth of each wheel. By

this means, if the types are slightly out of line, they will be brought into positive alignment just before the paper is pressed against them, and the type impressions upon the paper will all be in line. It will be noted that the wire 173 about which the ribbon 167 passes is also carried by the lever 177. The aligner is also provided with a slot 178[1] through which the rod 201, hereinafter described, passes. (See Figs. 20 and 28.)

THE PAPER FEED.

For the purpose of feeding the paper, the shaft 136 of the roll 135 is provided with a ratchet wheel 187 (see Figs. 2, 7 and 23). Upon the side of the casing there is also pivotted the upright bar 189 adapted to move to a limited extent between the stops 191 and 193. A spring 195 engages this bar and tends to hold it against the stop 193. When the shaft 141 is rotated in the printing operation, one tooth of the ratchet 187 strikes the upper end of the bar 189 just before the paper is brought against the type. This causes the roll to be turned a distance equal to one tooth of the ratchet wheel 187, and the further downward movement of the ratchet brings the ends of two of the ratchet teeth against the edge of the bar 189, as shown in Fig. 23, and locks the roll against rotation.

MEANS FOR PREVENTING CERTAIN OF THE TYPE FROM PRINTING.

It will be noticed that when either set of type-wheels is brought into printing position those wheels that have not been rotated by the movement of the carriage in conjunction with the operating keys of the key-board will have their zero-types uppermost, and if no means were employed for preventing it, there would be a number of zeros printed at the left of the first figure of the printed number. To prevent this, means are provided for covering the types of the wheels above in consecutive order, those wheels that have been operated being in fact those wheels at the right hand looking from the front of the machine in the drawings. For this purpose there is provided, under the opening 175 in the top of the casing through which the printing is done, a laterally movable slide 197, which is open at its center, as shown in Fig. 29, and has hinged to one side the thin plate 199, and also carries the pointer or finder 201. A post 203 is arranged in suitable bearings 205 upon the inner wall of the casing (Figs. 10 and 29) and is provided with an arm 207 to which is connected a spring 209, the opposite end of the spring being connected to the wall of the casing. A wire 211 is connected to the post 203 and bears upon the end of the slide 197 (see Figs. 10 and 29). Each of the type-wheels, both the primary type-wheels and the total-result wheels, has a hole 213 extending through it, preferably near its circumference. These holes are preferably directly under the zero types, and a spring-actuated post tends to push the rod or finder 201 into these holes. If all of the wheels stand with the zero types in printing position, these holes will all be in line and the rod 201 will be forced through all of them and all of the types will be covered by the plate 199. As soon, however, as any wheel has been turned so as to bring its hole 213 out of the path of the finder 201, said finder will be stopped by striking against the imperforate side of the wheel, and only the preceding wheels in the series will have their zero-types covered by the plate 199. The operation of this device is clearly illustrated in Figs. 28 and 29. In Fig. 28, the finder 201 is shown extending through three of the wheels and as abutting against the side of the fourth wheel, and the plate 199 is shown covering the zero-types of the first three wheels. For withdrawing the finder 201 there is provided a rotatable post 215 which has secured to it a collar 217 carrying an arm 219 that engages the slide 197 (see Fig. 29). This collar also carries a pin 221 that engages an inclined slot 223 in a sliding plate 225, which is secured to and moving with the rack bar 155 (see Fig. 10). When the rack bar 155 is moved upward at the end of the printing operation, the post 215 is turned and the slide 197 is drawn back against the tension of the spring 209, the finder 201 is drawn out of the holes in the type-wheels with which it may then be in engagement, if any, and the

plate 199 is drawn back from over the type-wheels. The slide 197 and rod 201 will stand in this retracted position at all times except during the printing operation. When the rack-bar 155 is depressed in the printing operation the post 215 is turned and the arm 219 moves in position to permit the slide to be moved inward by the action of the spring 209.

Ribbon-feed and Shift.

Means are also provided for feeding the ribbon and for shifting the feed so as to cause the feed-device to operate in the opposite direction after the ribbon has been wound upon one spool. As shown, the ribbon spools 169, 171, (Figs. 1, 2, 5 and 7) are mounted upon suitable shafts 168 that project through the walls of the casing and have mounted upon their inner ends the ratchet wheels 170 (Fig. 10). A vertical slide 172 carrying a dog 174 and upon its lower end a roll 176 is arranged between said ratchet wheels. The dog 174 may be turned by means of a handle 178 upon the outside of the machine so as to engage either of said ratchet wheels. As the carriage is reciprocated, the slide 172 is raised and it then falls by gravity, and this reciprocating movement of the slide turns the wheels with which the dog is in engagement, thereby winding the ribbon off from one spool and on to the other.

Returning Total-result Wheels to Zero.

It will generally be necessary to return the total-result wheels so as to bring the zero-type on each wheel uppermost or into printing position after each printing operation from these wheels. For this purpose, the shaft 53 upon which the wheels are mounted is provided with a suitable pinion 52. Except when the wheel 52 is to be operated for turning the total-result wheels back to zero, it is locked by means of a lever 54 carrying a pin or projection that enters an opening in the wheel (Fig. 28). This lever is pressed against the side of the wheel by means of a spring 56. A rod 58 is mounted in bearings, one of which is formed at the rear of the sliding carriage (see Fig. 6) and the other in the casing of the machine near the front end thereof. This rod is capable of a slight rocking movement, being adapted to be turned from the position shown in Fig. 30, to that shown in Fig. 31. The rod is provided with the short rack-bar 60, with the lug or projection 92 and with the projection 88. A vertically sliding key-rod 84 carrying a key-button 86 on its upper end (said button, as shown, being located at the left of the main group of keys and being marked "0" in Fig. 5,) is provided with a notch 90 into which the projection 88 extends when the key-bar is in its elevated or normal position. A spring 82 connected to an arm 80 on the rod 58 and having its opposite end connected to any convenient point of the interior of the casing, tends to hold the rod 58 in the position shown in Fig. 30. The zero key for the total-result wheels is then held in an elevated position and the rack-bar 60 is turned into an inclined position, as shown in Fig. 30. So long as the rod 58 remains in this position, the reciprocating movement of the carriage does not rotate the shaft 53. When, however, it is desired to set the total-result wheels back to zero, the key-bar 84 is depressed, thereby turning the rod 58 into the position shown in Fig. 31, and bringing the projection 92 into position to engage the lever 54 and unlock the wheel 52. The key 86 and the key-bar 84 are depressed when the carriage is at the forward limit of its movement. A backward movement of the carriage now causes the wheel 52 and shaft 53 to be rotated and through the pins 57 on the total-result wheels and the dogs 59 on the discs 55, which are secured to the shaft 53, said total-result wheels are all brought back to zero, or, in other words, into position with their zero types uppermost or in printing position.

Restoring Keys to Elevated Position.

Below the key board it is preferred to provide a horizontal plate 4 (Fig. 3) having a series of openings in it corresponding to the openings in the key-board,

through which the key-bars 7 pass. This plate, together with the key-board, forms means for guiding the keys and causing them to move vertically when they are depressed or elevated. A key-restoring frame 6 is arranged upon the plate 4 and is provided with series of bars that extend longitudinally of the machine between the keys. This frame is provided with the laterally extending pins 8 that project into inclined slots in the projections 10 on the plate 4. The frame 6 is also provided with the depending lug 12, one face of which is vertical and the other inclined (see Fig. 3). Arranged upon the forward end of the carriage 15 is the pivoted dog 14. When the carriage is moving forward, this dog strikes the lug 12 and the dog turns upon its pivot so as to pass under said lug, *vide* Fig. 12. When the carriage is moving in the opposite direction, the dog 14 engages the other face of said lug and causes the pins 8 to travel upward in the inclined slots in the projections 10, thereby raising the frame 6 while keeping it in a horizontal position, and the bars on said frame 6 engage the projections 9 on all of the keys that have been depressed and raise said keys into their uppermost or elevated positions, where they are held by the springs 11. The rear end of the plate 4 is preferably turned upward and is secured to a plate 18 depending from the top of the casing. The frame 6 is provided with a suitable buffer-spring 16 which strikes against said plate 18. When the frame 6 reaches substantially the limit of its upward movement, the dog 14 passes under the lug 12 and the frame immediately drops upon the plate 4.

Repeat Device.

It is sometimes desirable to repeat one or more times the record of any number that has been set up by the primary or listing type-wheels. To accomplish this, it is only necessary to prevent the key restoring device from operating and then to move the carriage back and forth and perform the printing and adding operations any desired number of times. For this purpose there is provided a horizontal rod 227 mounted in a bearing in the forward part of the machine and supported also by passing through a bearing in the rear end of the reciprocating carriage. This rod is capable of a partial rotation upon its axis and is provided with a lug or projection 229. A key 231 provided with a button 233 is arranged preferably at the front of the key-board and by depressing this key the rod 227 may be turned partially upon its axis, thereby bringing the lug 229 into the path of the dog 14, causing said dog to be turned into a substantially horizontal position and to pass under the lug 12. The keys will, therefore, remain in whatever position they were placed prior to the forward movement of the carriage and the operation of the machine in printing from the primary or listing wheels will be repeated. This operation may be continued as many times as desired.

Operation.

The operation of the machine may be briefly described as follows:—The carriage being at the rear of the casing and the parts of the machine being in the position shown in Figs. 1, 2, 3, 5 and 6, the operator depresses in any preferred order the requisite keys on the key-board to record the desired number. For instance, if it is desired to list a check for $765.43, the keys representing these numbers in the five right-hand rows are depressed, it being immaterial in what order they are operated. Then, taking hold of the handle, the operator draws the carriage forward in the casing. When it has been brought forward to the limit of its movement, the handle is depressed and the roll 113 on the crank arm 109 travels down the guide-way 117, and the printing mechanism is operated. During the forward movement of the carriage, the depressed keys which stand in the path of the forwardly moving spiral shafts, cause said shafts to be turned on their axes, the number of revolutions given to each shaft depending upon the position of the key by which it is operated. By this means, the primary or listing type-wheels are turned so as to bring into printing position the types corresponding to the numbers on the depressed keys. As

the handle 17 is depressed when the carriage reaches to the end of its forward movement, the paper carrying rolls through the means hereinbefore described are turned from the position shown in Figs. 1, 2, 5 and 10 to the position shown in Figs. 11 and 23, and the paper is pressed upon the types above the inking ribbon, and an impression from the types is formed upon the paper. During the printing operation, the types are aligned and the zero-types beyond the types required to print the desired number are covered and prevented from printing by the means hereinbefore described. After the printing operation, the handle is reversed and the carriage is moved back to the rear end of the machine. This operation restores the keys to their original position unless the "repeat key" has been depressed. During the forward movement of the carriage, the total-result type-wheels are in engagement with the transfer-wheels and rotate with said wheels and with the primary or listing wheels. During the reverse movement of the carriage, the primary or listing wheels are returned to zero but the total-result wheels are out of engagement with the transfer-wheels and are not reversed. After any desired number of amounts have been recorded, the sum thereof may be printed on the slip by first operating the total-result key which moves the switch-block 121, as hereinbefore described, and the carriage now stops with the total-result wheels in printing position, and, by depressing the handle, the sum of the previously listed or recorded numbers is printed on the slip. By depressing the key at the left hand of the key-board, the total-result wheels are turned to zero during the next backward movement of the carriage.

While I have described and shown a machine having a movable carriage carrying the type-wheels and connections, and a stationary key-board and printing device, it will be seen that the relation of these parts may be readily reversed and the key-board and printing device placed upon the movable carriage while the type-wheels and connecting devices are upon a stationary part. I wish, therefore, to be understood as including such a construction as an obvious mechanical equivalent for that shown and described. It will be obvious also that many details of the construction may be varied without departing from the invention.

Having now particularly described and ascertained the nature of the said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. The combination, with a key-board provided with a series of movable keys, of a series of type-wheels and a support therefor carrying a transmitting mechanism, and means for moving said type-wheel support along said key-board and thereby causing said type-wheels to be operated by selected and previously operated keys of said key-board, substantially as described.

2. The combination, with a key-board provided with a row of independent keys numbered from "1" to "9," of a sliding carriage provided with a spiral shaft in line with said keys and engageable with said keys, a type-wheel carried by said carriage, and connections between said type-wheel and said spiral shaft whereby, as said carriage is moved, said type-wheel is rotated by engagement of said spiral shaft with any previously operated key of said row, substantially as described.

3. The combination, with a key-board provided with a series of movable keys, of a sliding carriage, a series of type-wheels mounted on said carriage, and a series of spiral shafts connected with said type-wheels and adapted, as said carriage is moved, to engage previously operated keys of said key-board, for the purpose set forth.

4. The combination, with a key-board provided with a series of rows of numbered keys, of a reciprocating carriage, a series of spirally grooved shafts mounted upon and carried by said carriage, said shafts being adapted to be rotated as

said carriage is moved, by engagement with previously operated keys in respective rows of said key-board, type-wheels connected with and rotated by said grooved shafts, and means for recording the numbers registered on said type-wheels at each movement of said carriage, substantially as described.

5. The combination, with the key-board and keys, of the movable carriage, the listing-wheels and the total-result wheels mounted upon said carriage, means operated by said keys for rotating said listing-wheels, means for transferring indicated amounts from said listing wheels to said total-result wheels, and means for printing the indicated amounts from either the listing or total-result wheels, substantially as described.

6. The combination, with the listing type-wheels, of the total-result wheels, the interposed transfer-wheels mounted upon movable supports, and means for moving said total-result type-wheels into and out of engagement with said transfer-wheels, for the purpose set forth.

7. The combination, with the movable carriage, of the listing type-wheels and the total-result type-wheels mounted upon said carriage, the interposed transfer-wheels, means for moving said total-result wheels into engagement with said transfer-wheels while said carriage is being moved in one direction, means for moving said total-result wheels out of engagement with said transfer-wheels while said carriage is being moved in the opposite direction, and means for axially moving said transfer-wheels while said total-result wheels are in engagement with them, and means for restoring said transfer-wheels to their normal position while said total-result wheels are out of engagement with them, for the purpose set forth.

8. The combination, with the type-wheels and means for operating them, the carriage whereon the same are arranged, the type-aligning device adapted to engage the types of said wheels, the movement of said carriage operating said type-wheels and moving them into position to be engaged by said aligning device, and means for operating said aligning device, for the purpose set forth.

9. The combination, with the movable carriage, of the listing type-wheels and the total-result type-wheels carried thereby, an aligning device common to both sets of wheels, and means for moving said carriage so as to bring either set of said type-wheels into position to be engaged by said aligning device, for the purpose set forth.

10. The combination, with the movable carriage, the listing type-wheels and the total-result wheels carried thereby, of an impression device common to both sets of type-wheels, means for moving said carriage into position to bring type on either set of wheels into position to be engaged by said impression device, substantially as described.

11. The combination, with the series of type-wheels each provided with a transverse hole 213, of the movable slide 197 carrying the plate 199 and the pin 201 adapted to enter the holes in said type-wheels, and means for moving said slide, substantially as described.

12. The combination, of the type-wheels, the tubular shafts to which said wheels are secured, said shafts being arranged one within another, standards 39 and 41 supporting said shaft, and means for rotating said shafts, substantially as described.

13. The combination, of the type-wheels, the tubular shafts upon which said wheels are mounted, said shafts arranged one within another, independent bearings for each shaft, worm wheels upon said shafts, spiral shafts engaging said worm wheels, a movable carriage upon which said tubular shafts and type-wheels and said spiral shafts and connections are mounted, and a series of keys adapted to be moved into the paths of said spiral shafts, for the purpose set forth.

14. The combination, with the movable carriage, of type-wheels arranged upon tubular shafts that are mounted one within another upon said carriage, spiral shafts also mounted upon said carriage and engaging worm-wheels on

said tubular shafts, a key-board and a series of numbered keys arranged in line with each spiral shaft, and means for moving said carriage, substantially as described.

15. The combination, with the key-board, the series of depressible keys, and the movable frame adapted to engage the depressed keys, of the sliding carriage, and means on said carriage to positively engage and move said frame and restore said keys, for the purpose set forth.

16. The combination, with the casing, of the movable carriage mounted therein, the rock-shaft mounted in bearings upon said carriage, an operating handle connected with said rock-shaft, a crank-arm connected with said rock-shaft, a guideway in which the end of said arm travels, transverse guideways connected with the main guideway, a switch block arranged at the junction of one of the transverse guideways and the main guideway, and a key for operating said switch-block, substantially as described.

17. The combination, with the type-wheels and the spiral operating shafts, of the spring-controlled locking plates adapted to engage and lock said spiral shafts, for the purpose set forth.

18. The combination, in a computing machine of a suitable frame or casing, a key-board and keys thereon, a carriage movable within said casing, transmitting mechanisms within said casing co-operating with said keys, two sets of type-wheels provided upon said carriage and operative by said transmitting mechanism, said casing provided with a single printing device automatically operative upon either of said sets of type-wheels, substantially as described.

Dated this 18th day of April 1900.

DAY, DAVIES & HUNT,
Chartered Patent Agents, 321, High Holborn, London, W.C.,
Agents for the Applicant.

Redhill: Printed for Her Majesty's Stationery Office, by Malcomson & Co., Ltd.—1900.

A.D. 1900. April 18. N° 7172
DAY'S Complete Specification.

SHEET 1

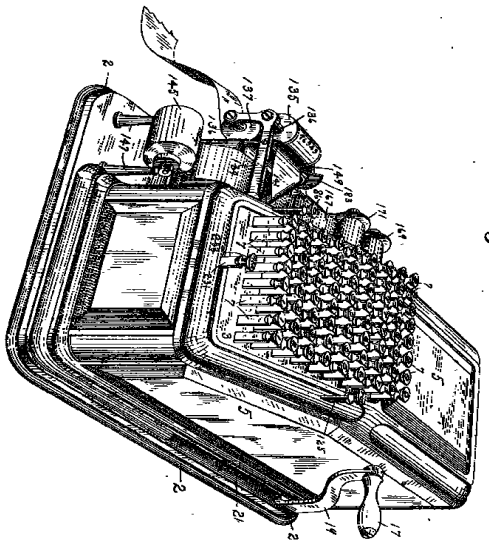

Fig. 1

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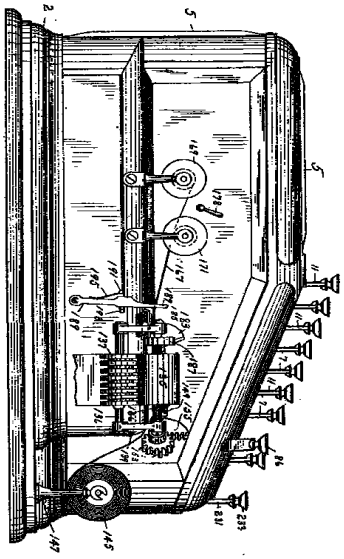

Fig. 2

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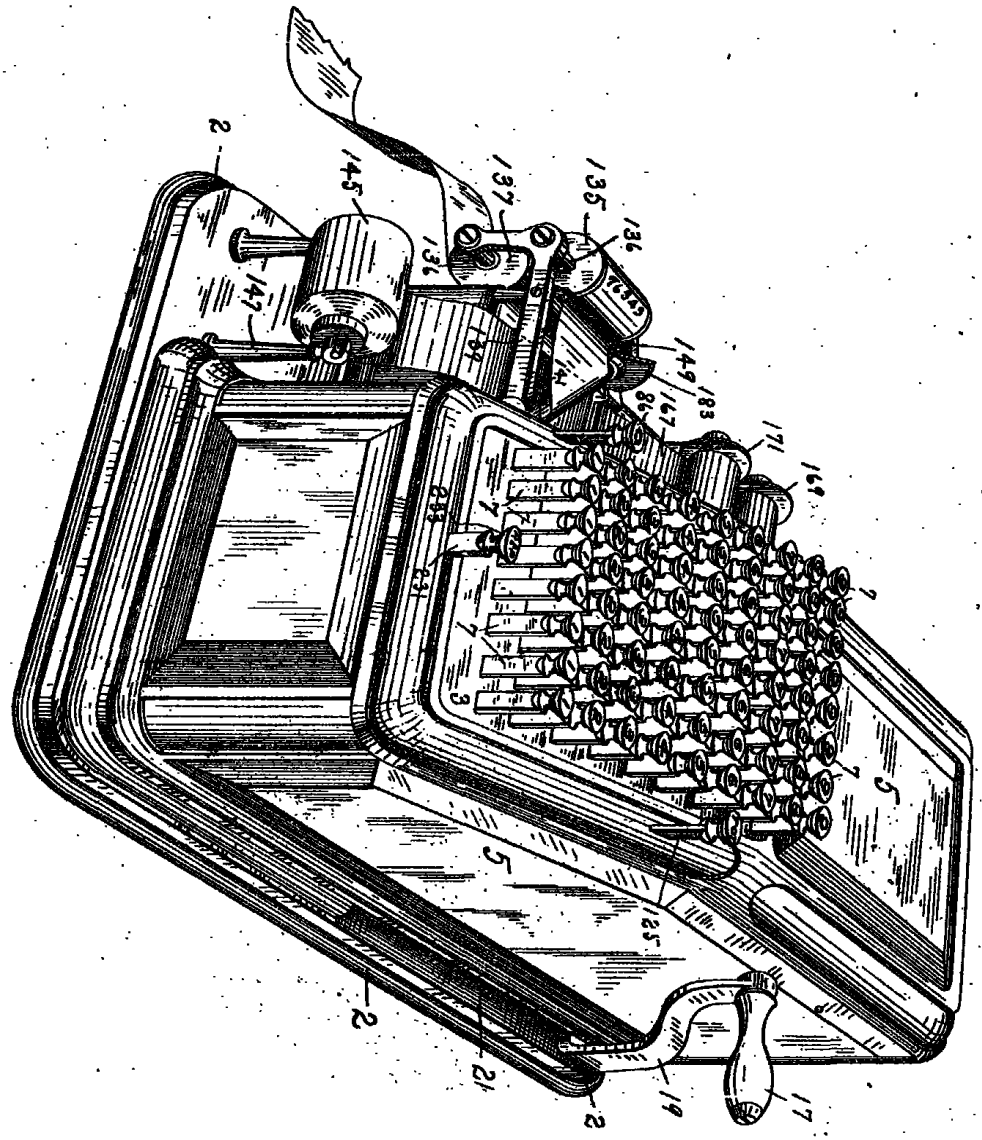

Fig. 1.

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Fig. 2.

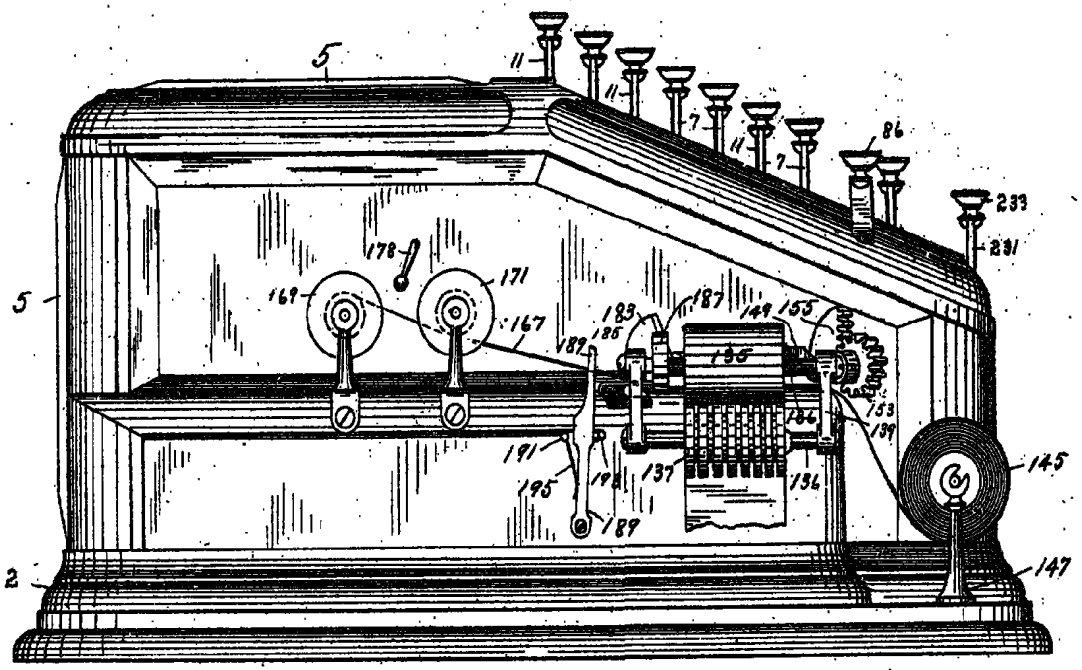

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Fig. 4.

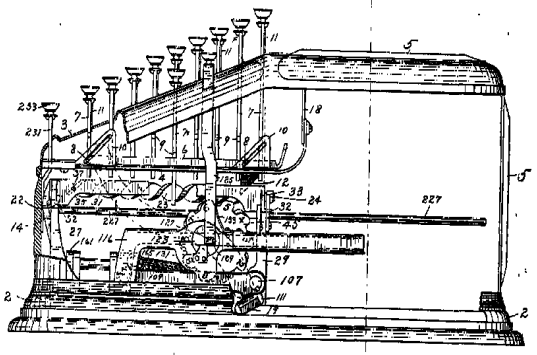

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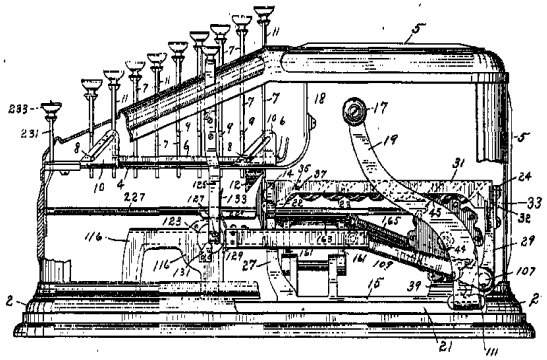
Fig. 3.



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DAY'S COMPLETE SPECIFICATION.

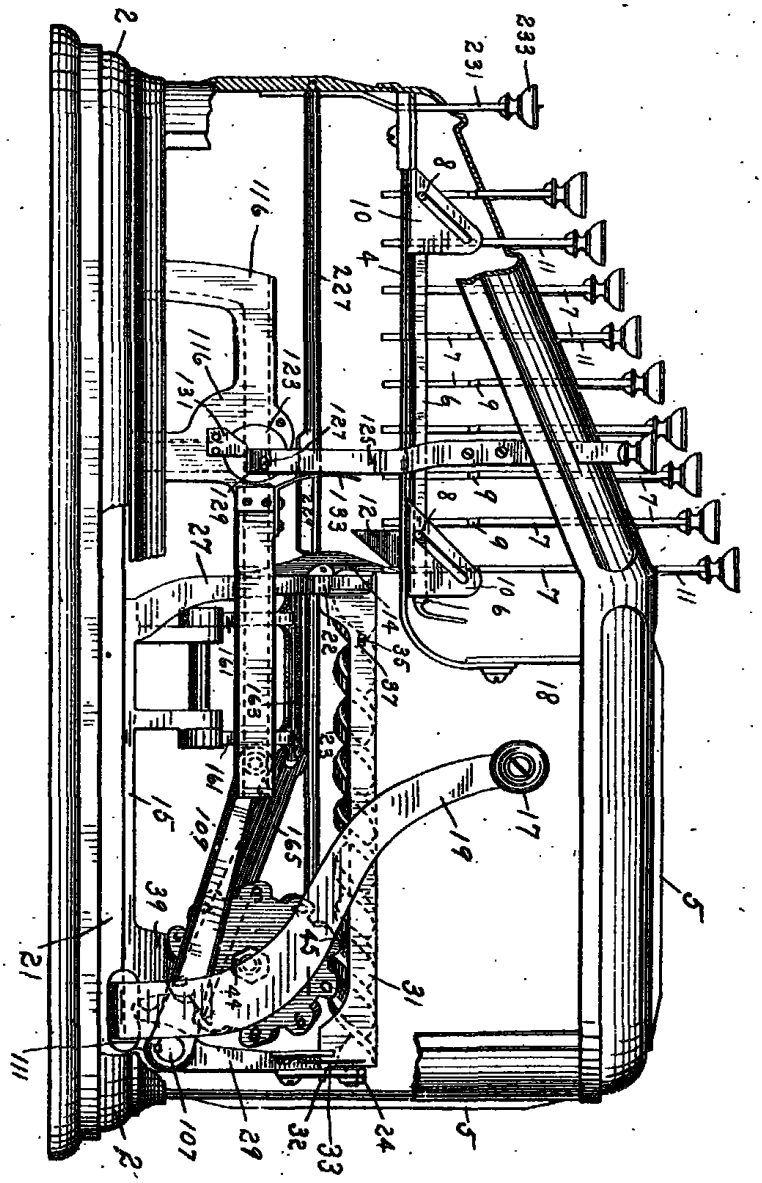

Fig. 3.

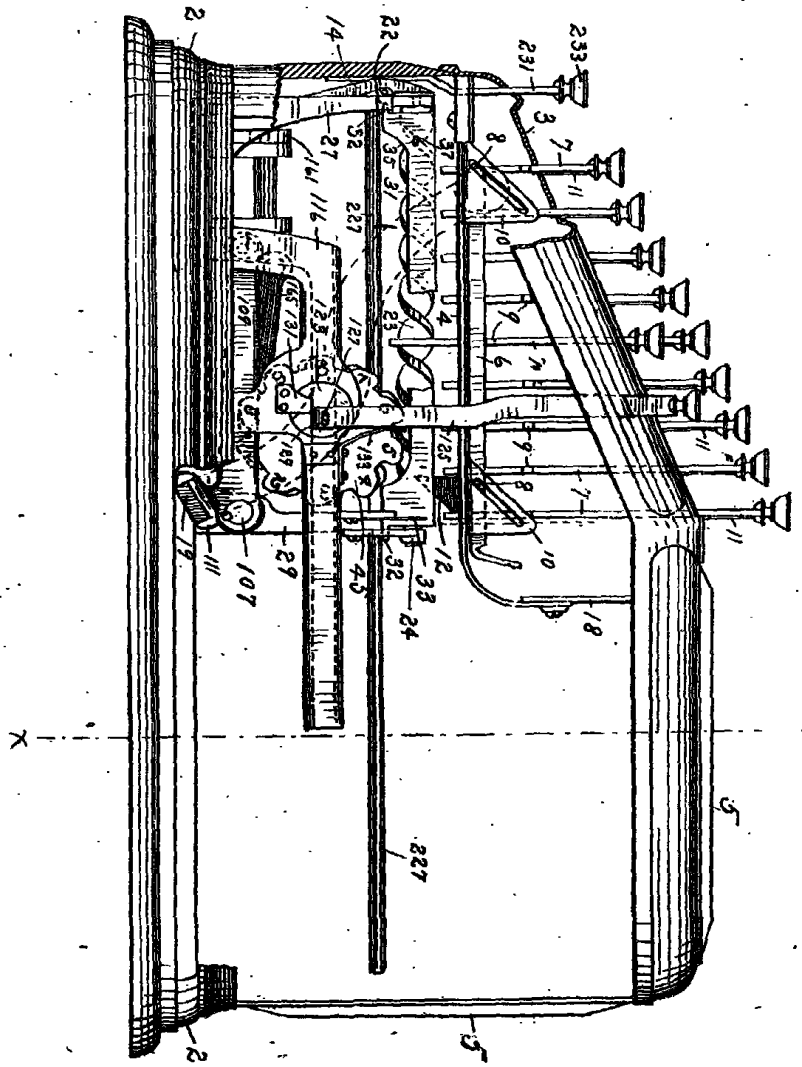

Fig. 4.

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Fig. 5.

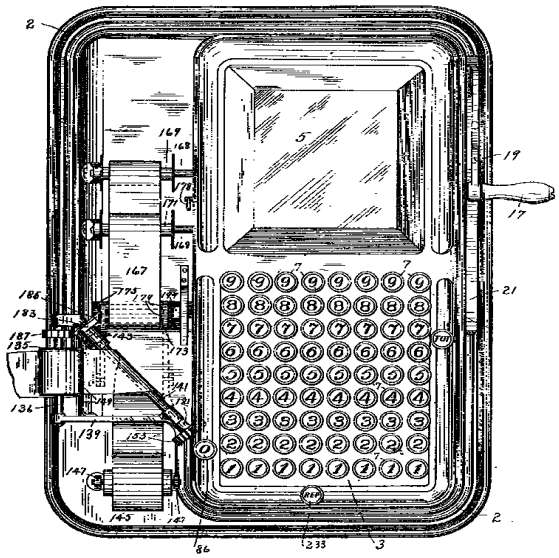

Fig. 6.

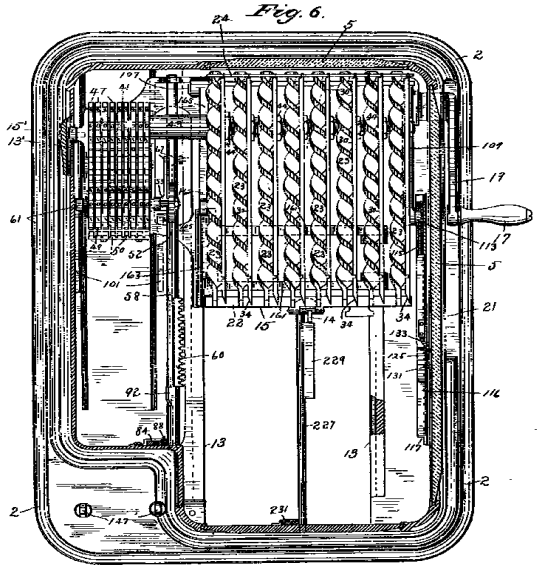

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Fig. 5.

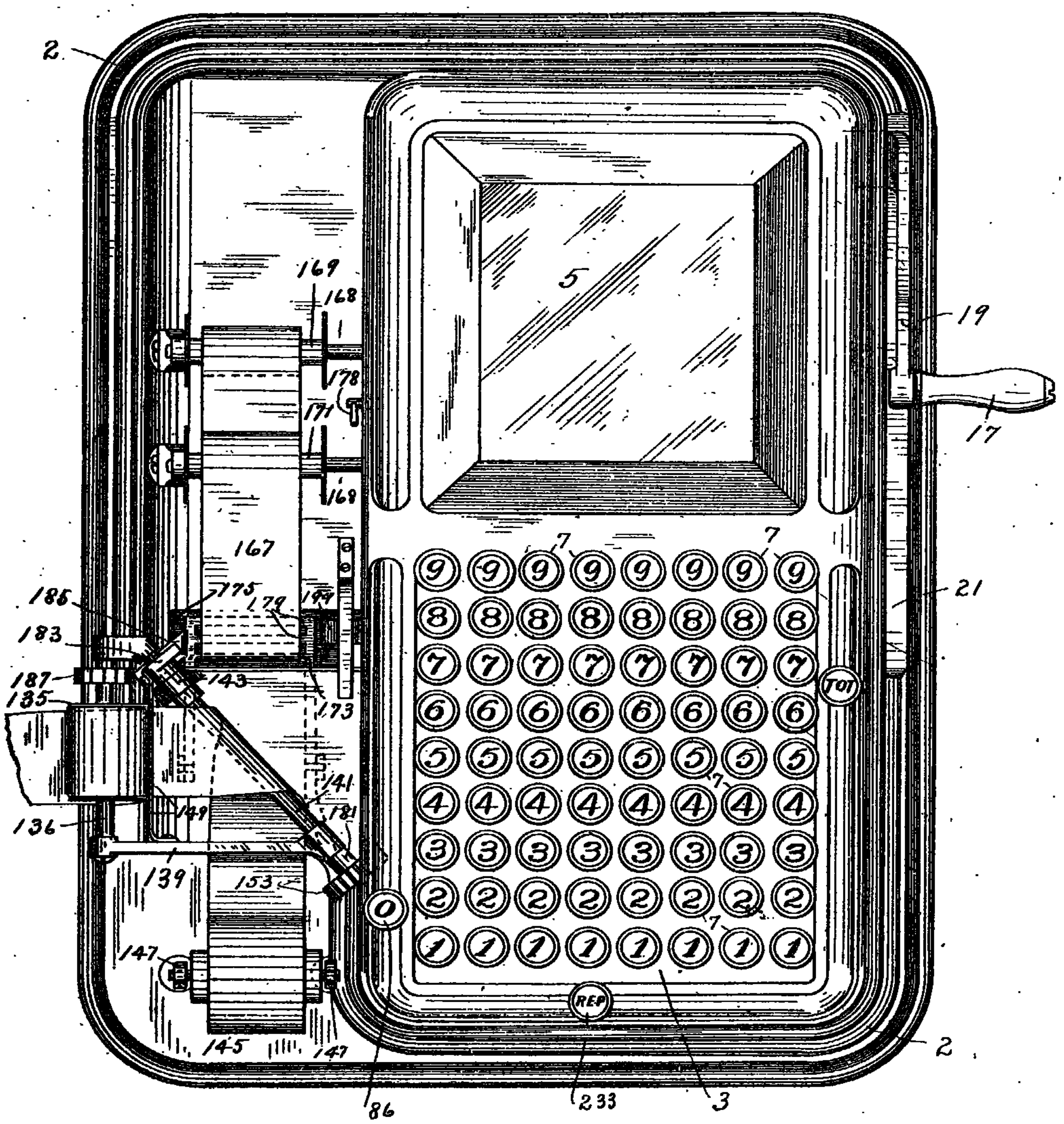
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Fig. 6.

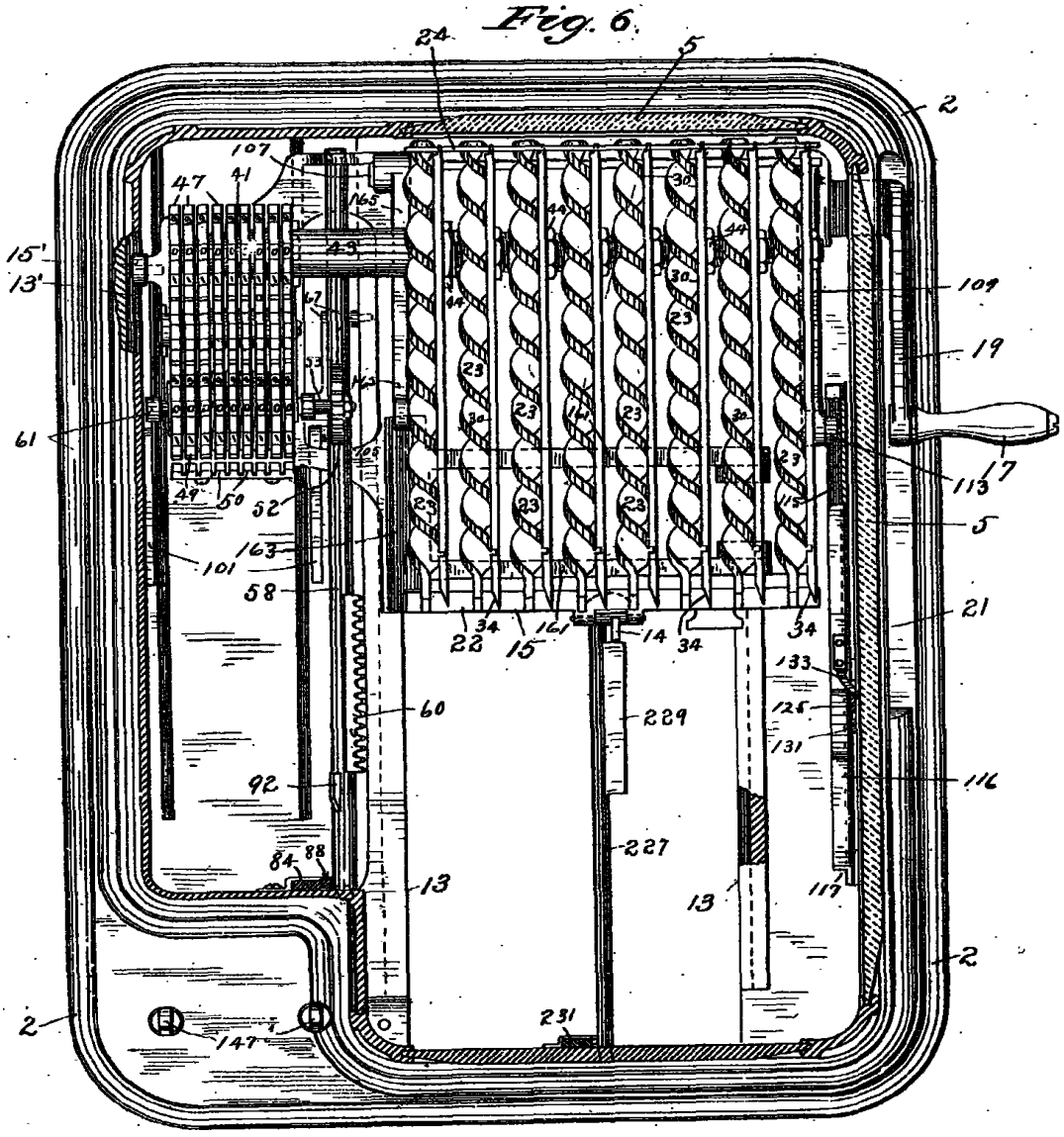

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Fig. 7.

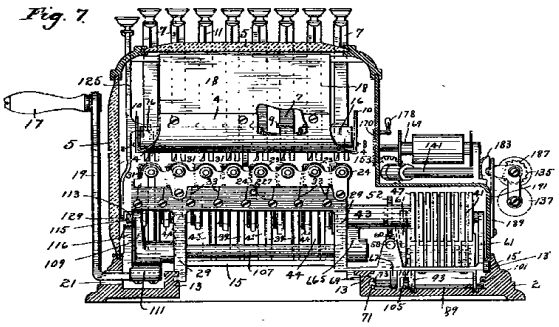

Fig. 8.

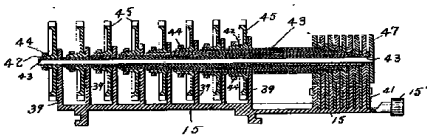

Fig. 9.

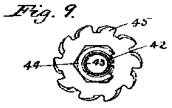

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Fig. 10.

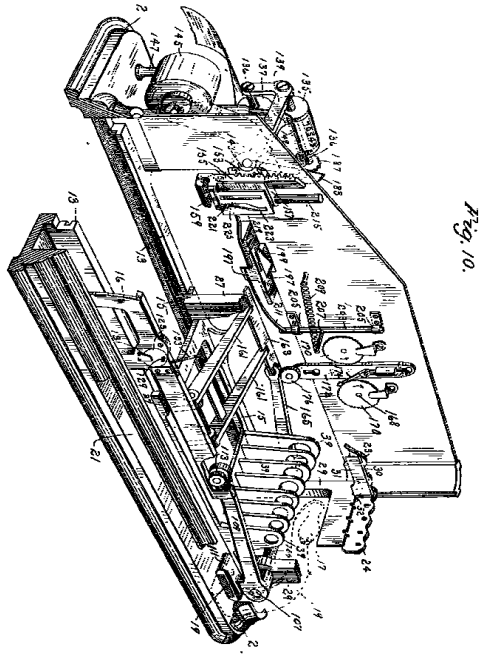

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Fig. 7.

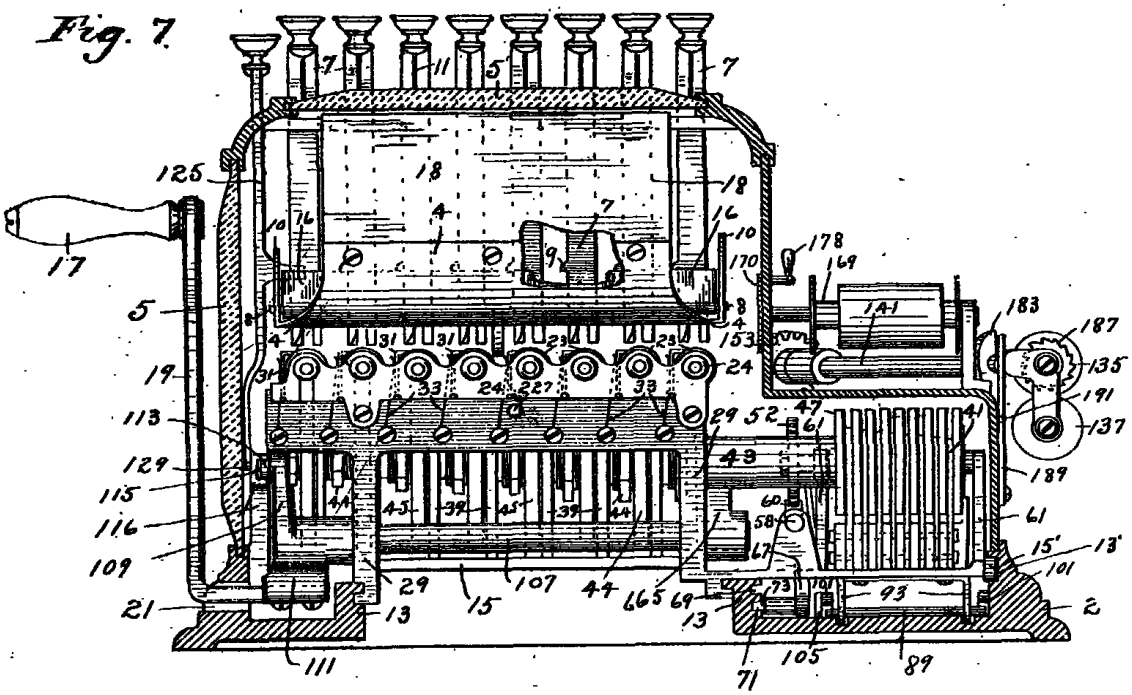

Fig. 8.

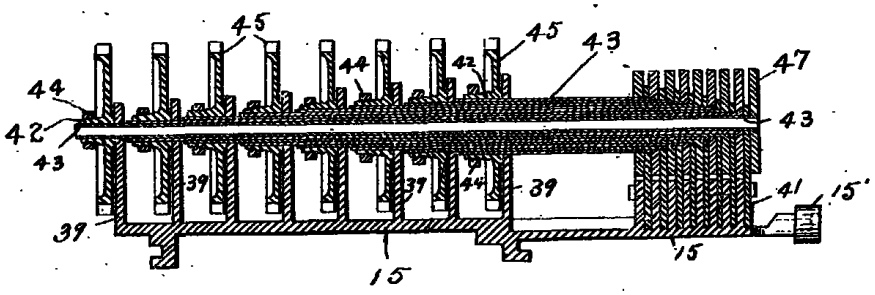

Fig. 9.

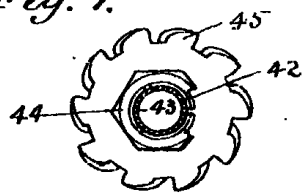

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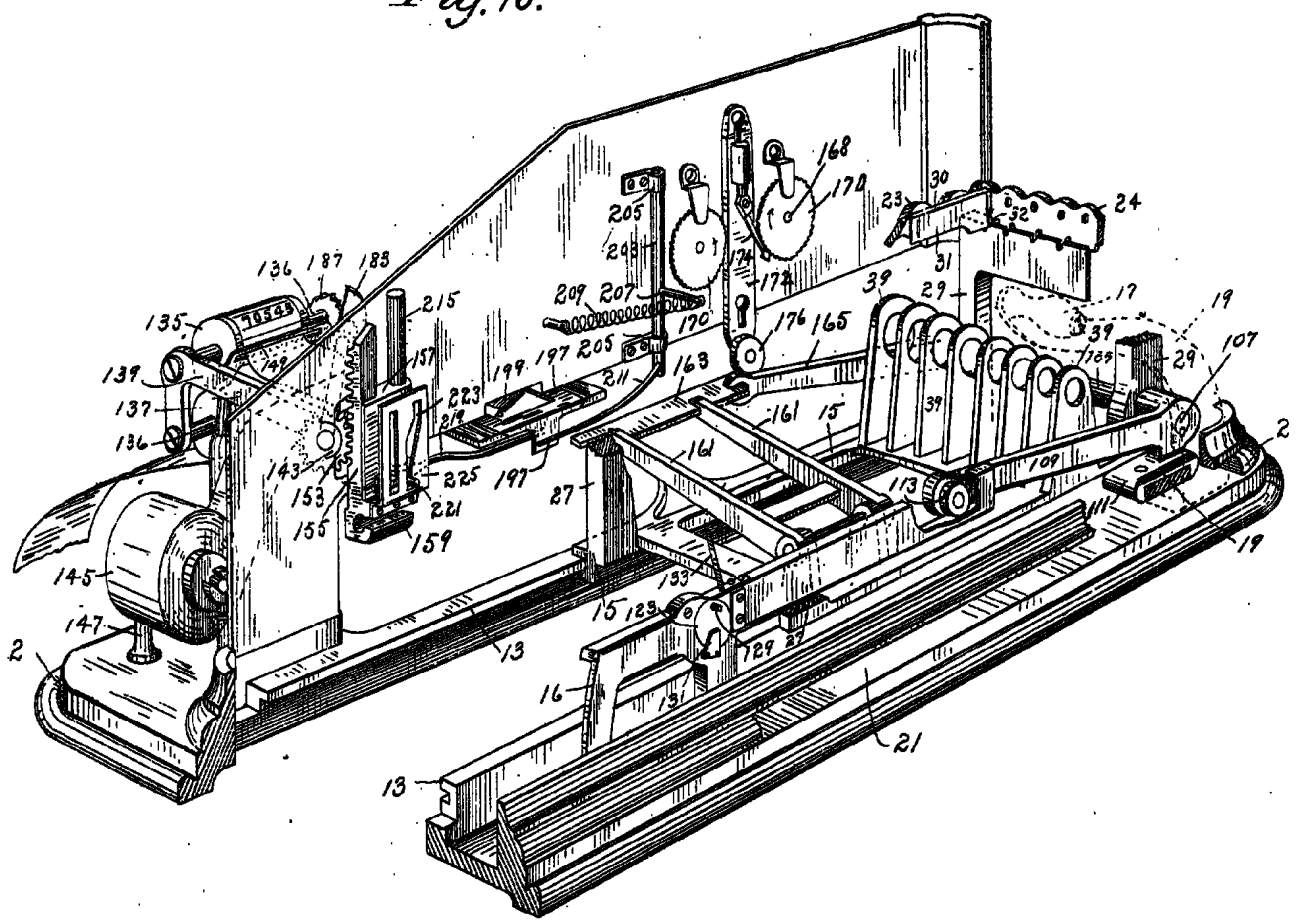
Fig. 10.



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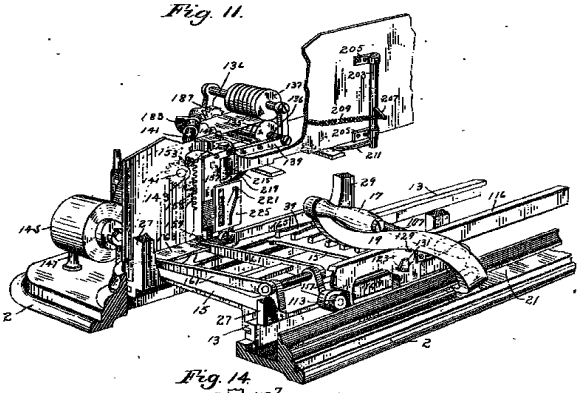
SHEET 9.

Fig. 11.



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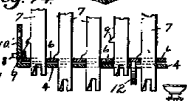

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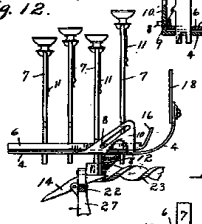

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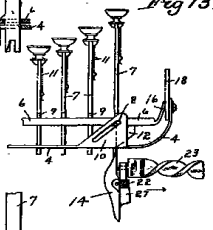

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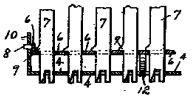
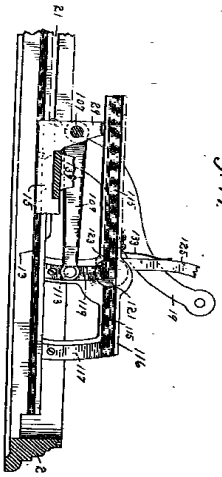


14 SHEETS.
SHEET 10

Fig. 17.



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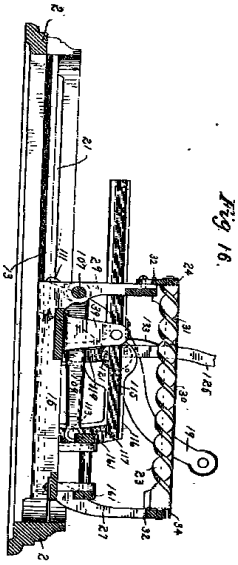

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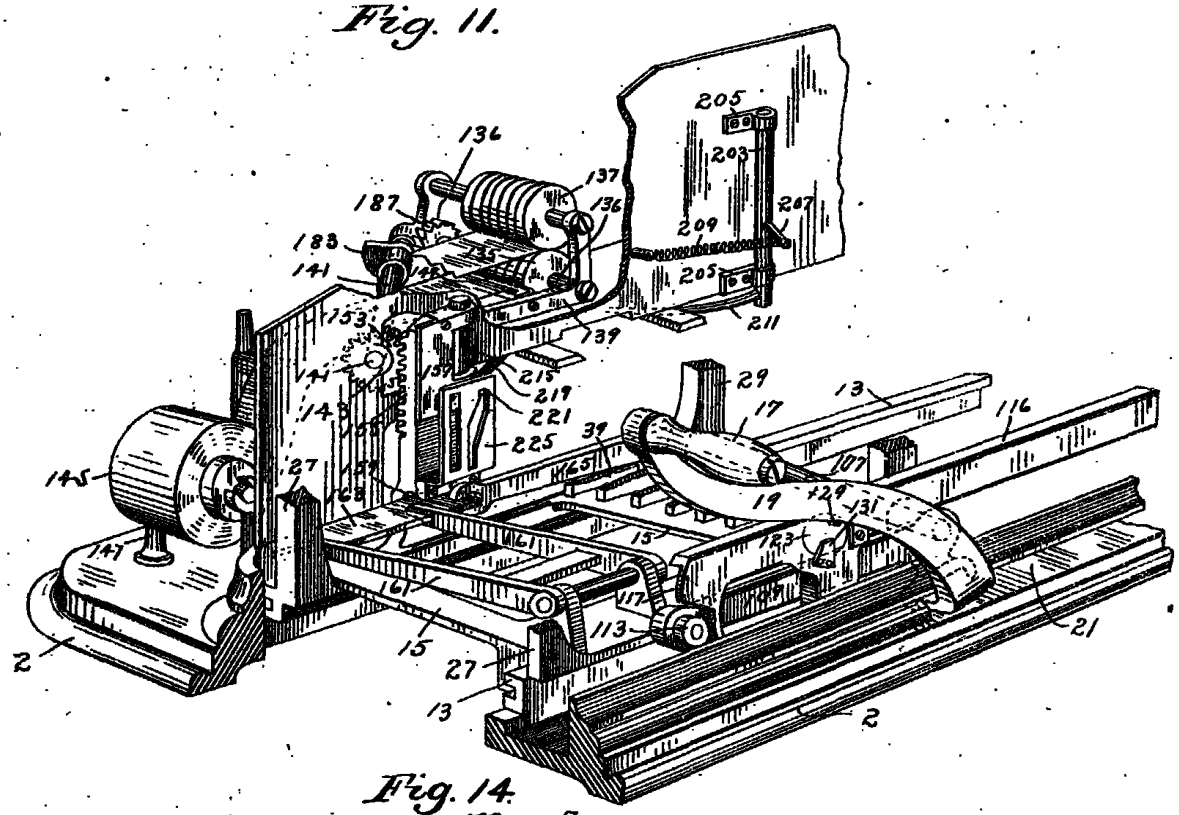

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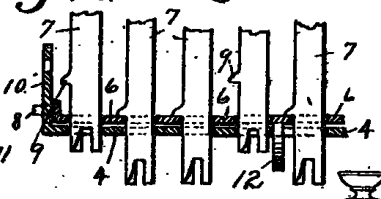

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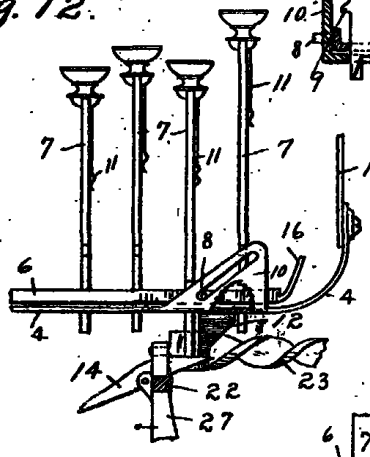

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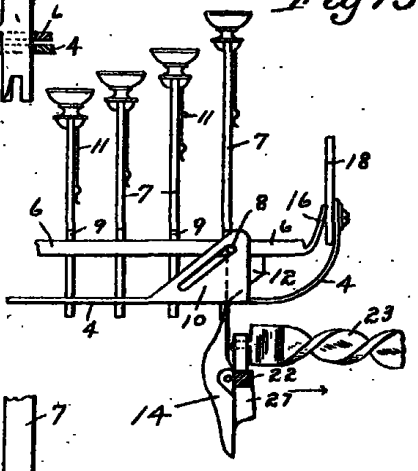

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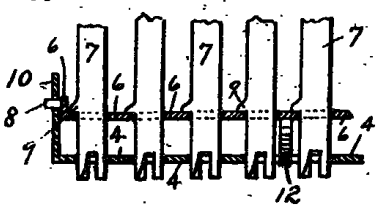

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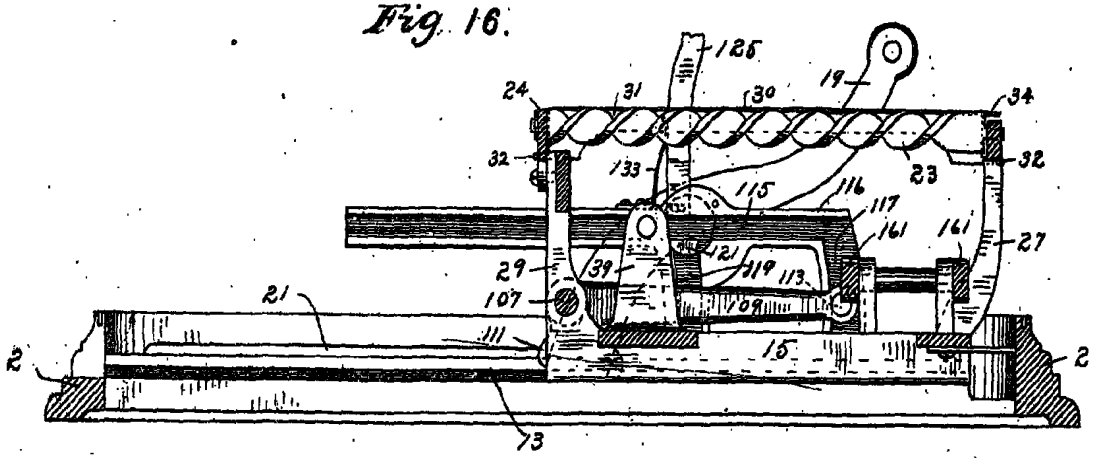
14 SHEETS)
SHEET 10

Fig. 16.



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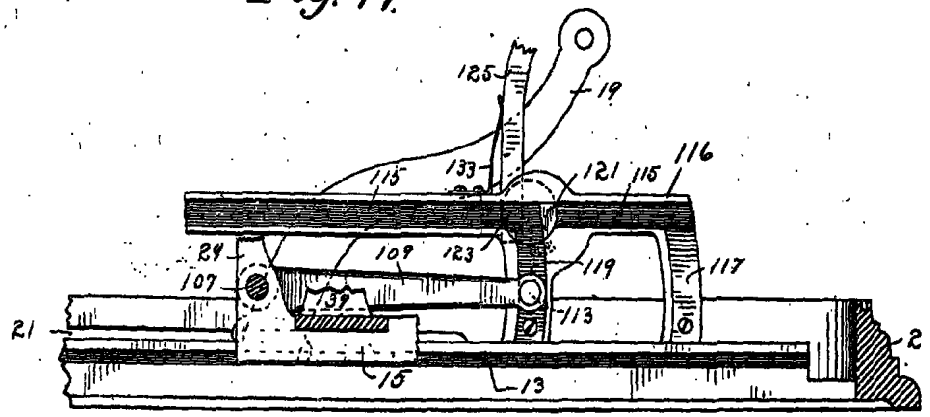

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SHEET 9.

A.D. 1900. April 18. N° 7172.
DAY'S Complete Specification.

(14 SHEETS)

SHEET 11.

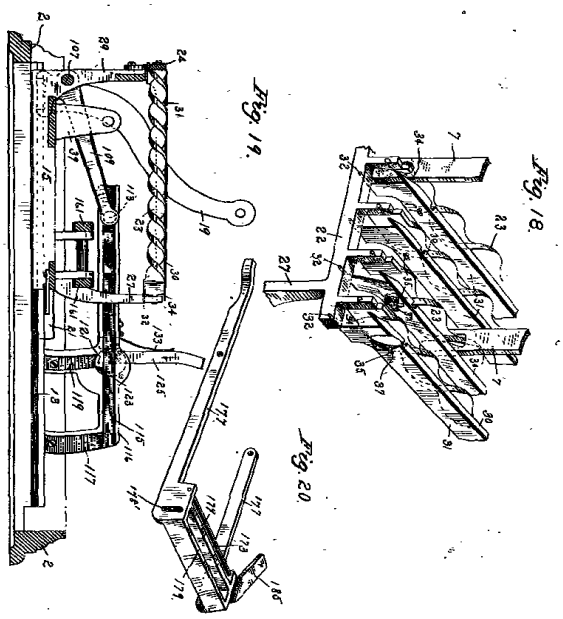


Fig. 19.

Fig. 18.

Fig. 20.

SHEET 12.

Fig. 21

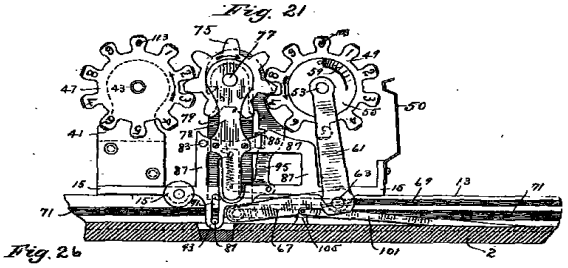


Fig. 26

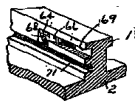
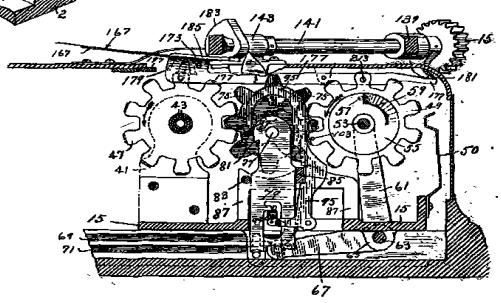


Fig. 22



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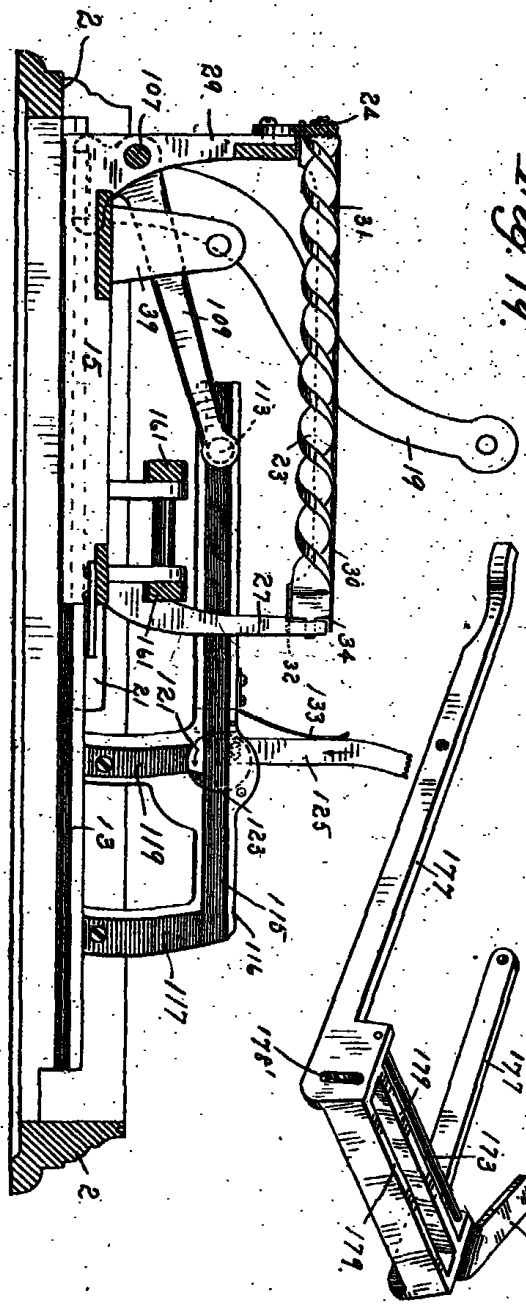

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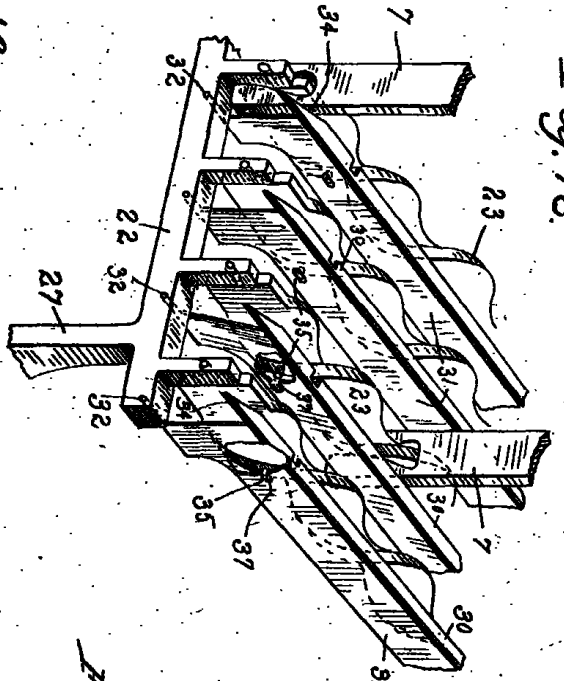

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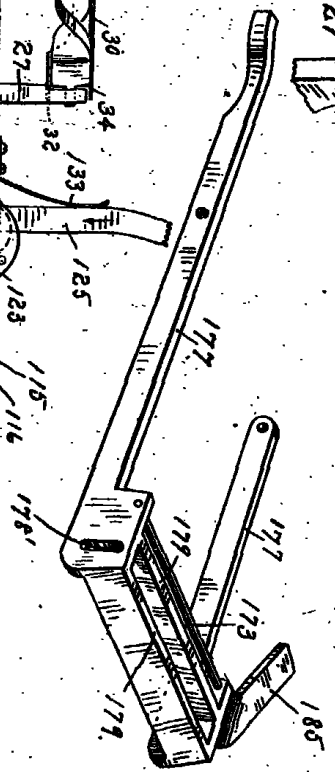
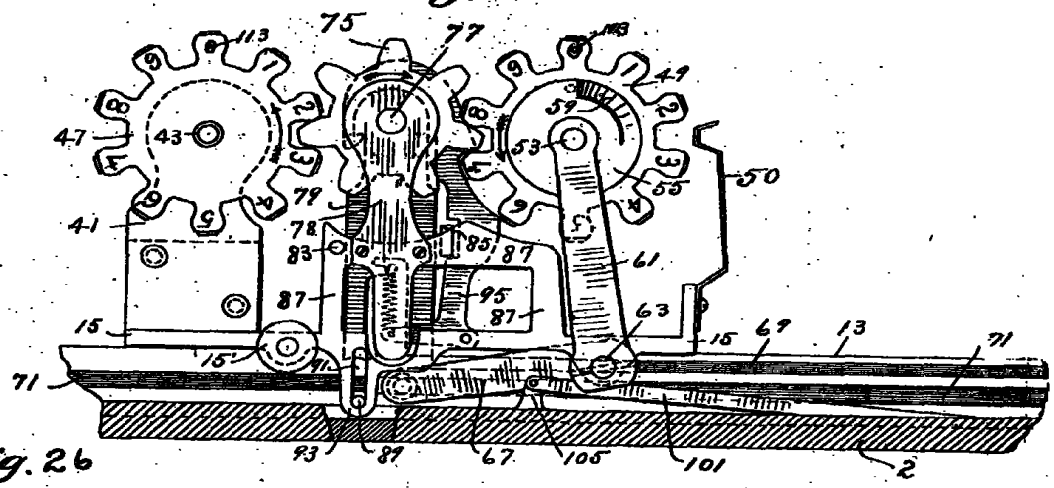


Fig. 20.

Fig. 21



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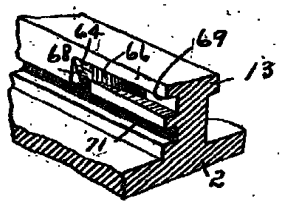

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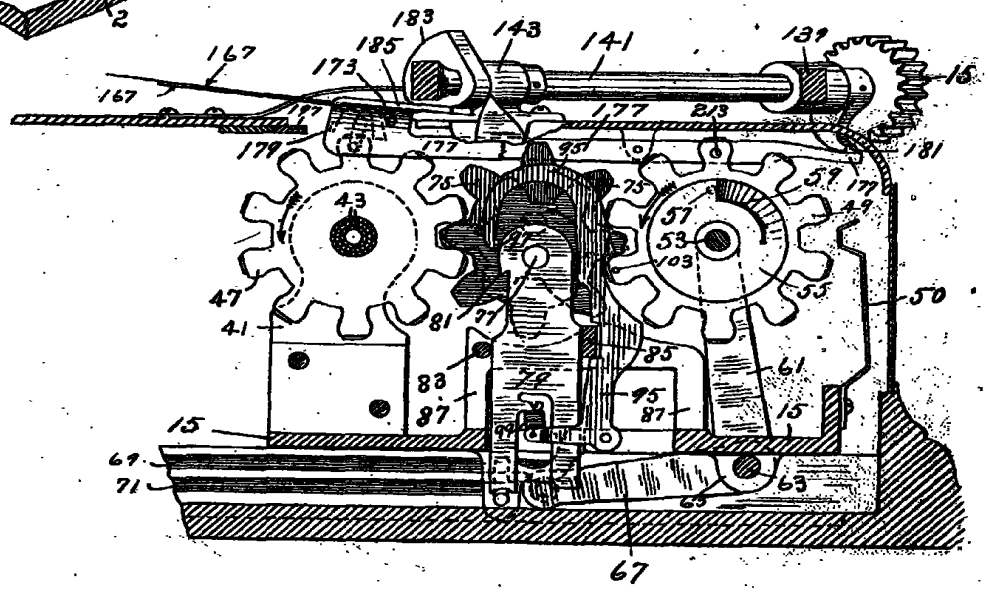

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A.D. 1900. April 18. N° 7172.
DAY'S Complete Specification.

SHEET 13

Fig. 23

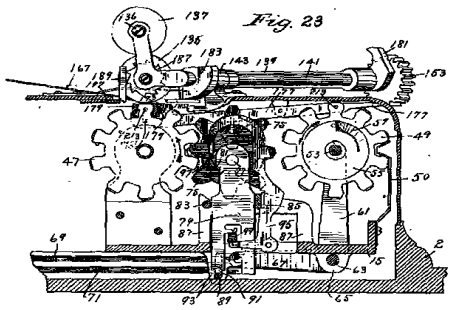
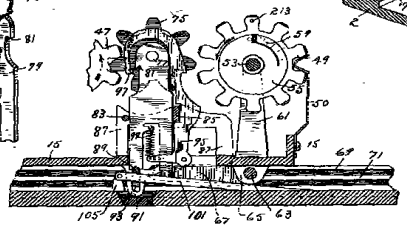


Fig. 25

Fig. 24



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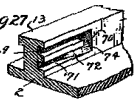
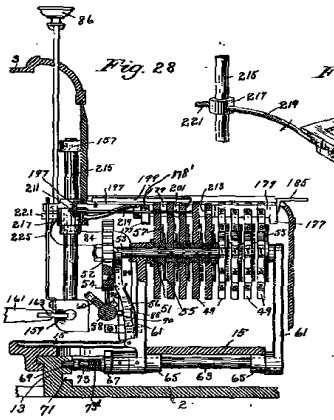


24 SHEETS
SHEET 14.

Fig. 28



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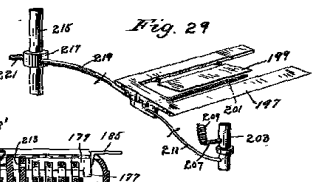

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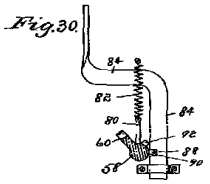

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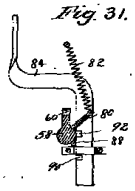

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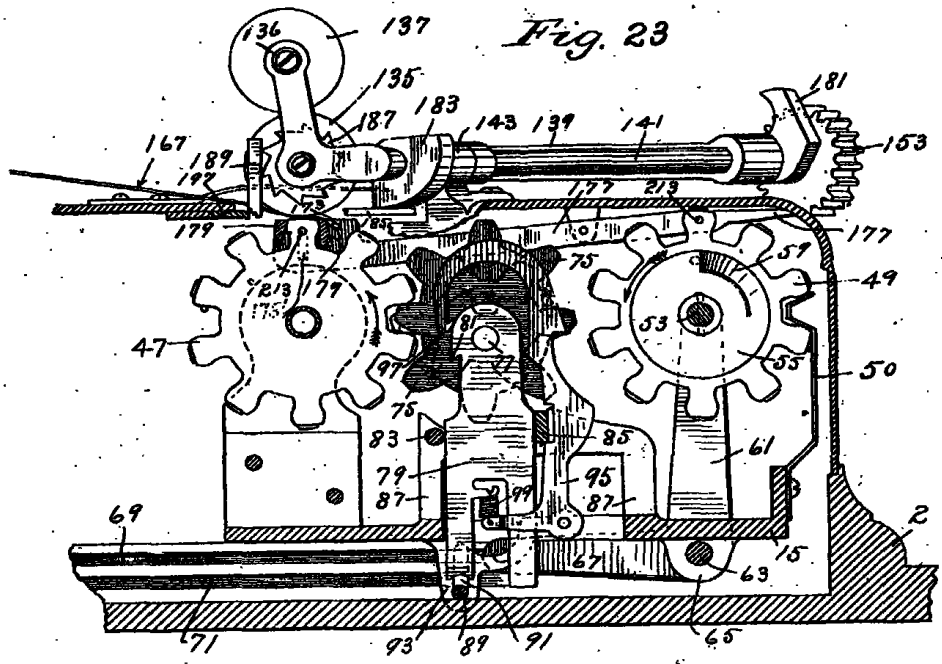
Fig. 23



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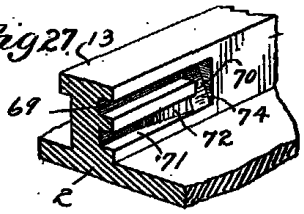

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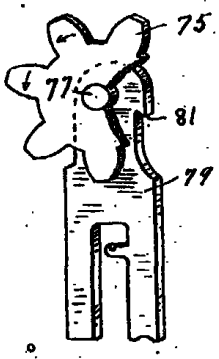

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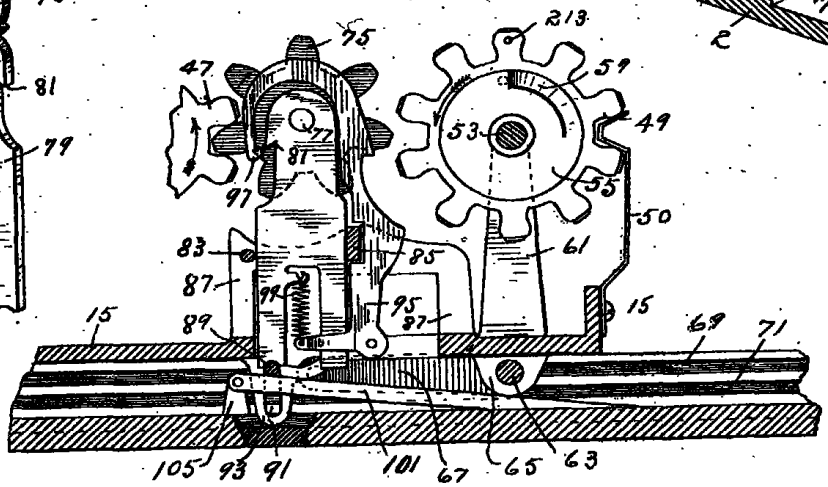

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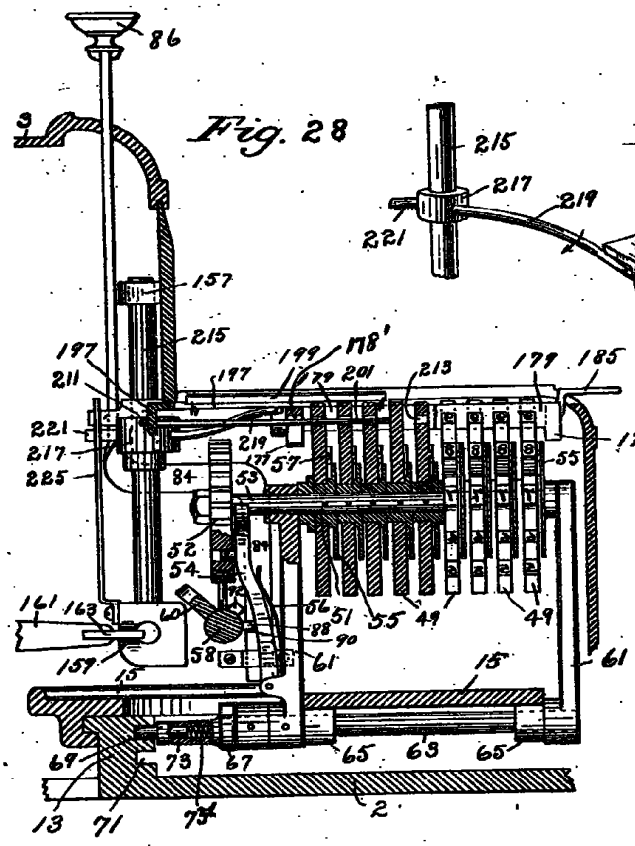

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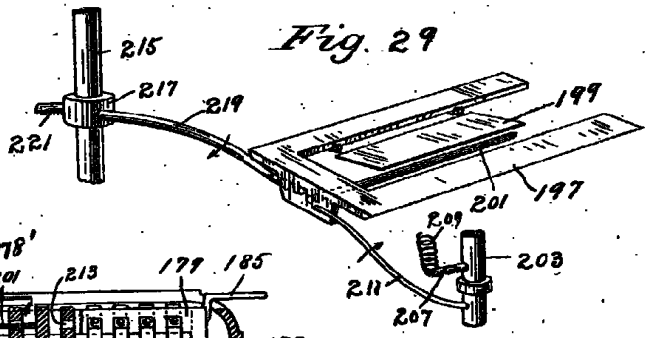

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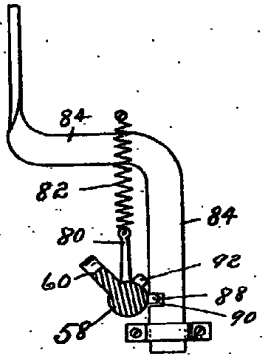

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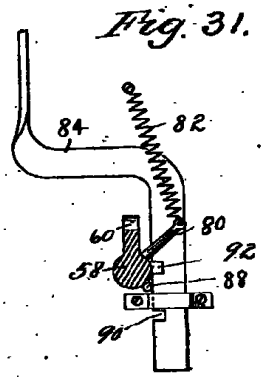

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