PUBLISHED MAY 25, 1943.

A. F. POTT

CONTROL GEAR FOR CLUTCHES IN ADDING MACHINES

BY A. P. C.

Filed March 26, 1940

Serial No. 326,111

12 Sheets-Sheet 1

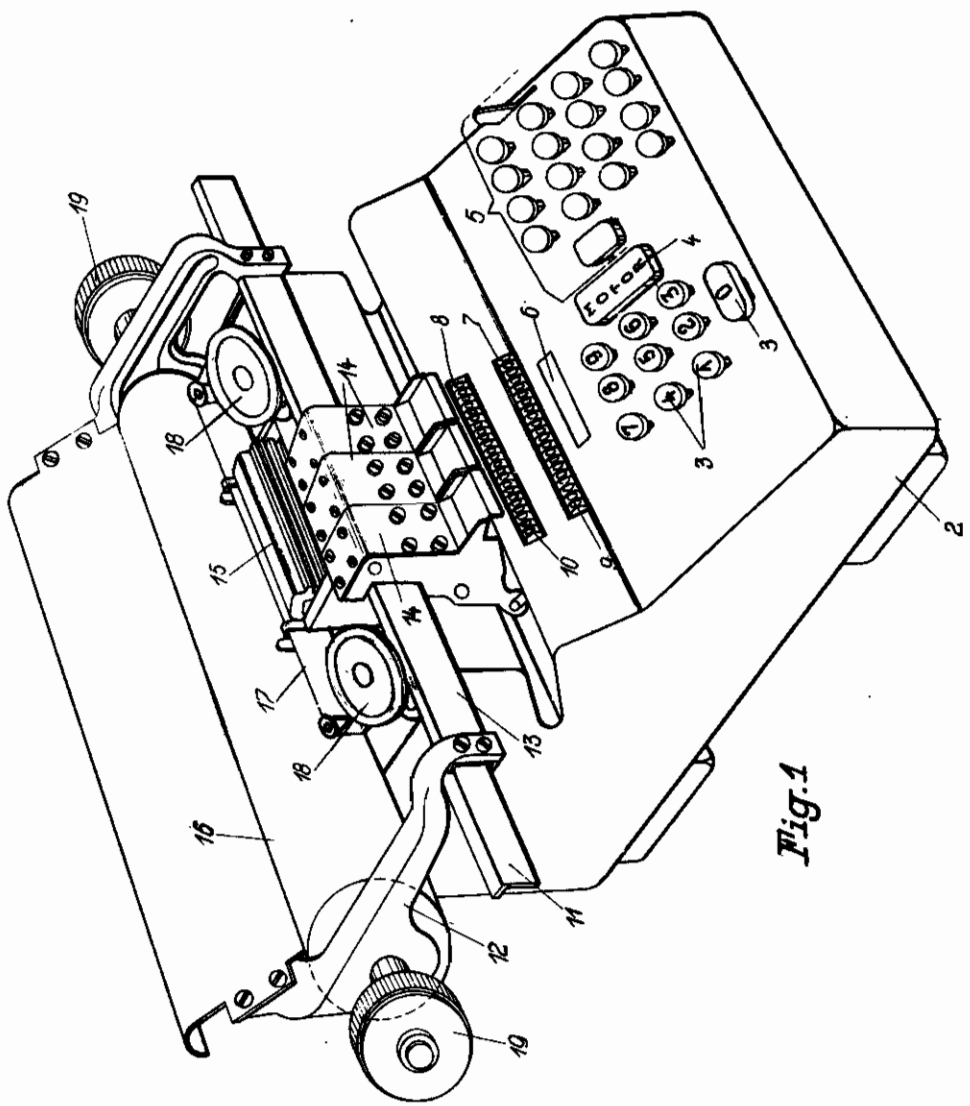

Fig. 1

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BY A. P. C. Filed March 26, 1940 12 Sheets-Sheet 2

Fig.2

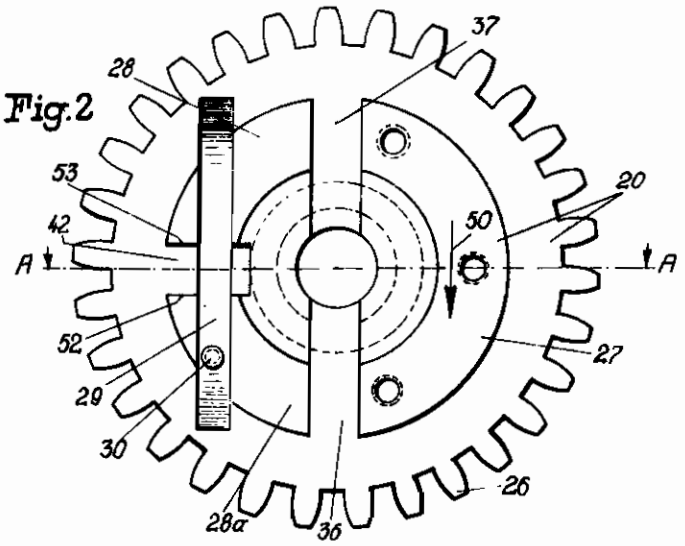


Fig.3

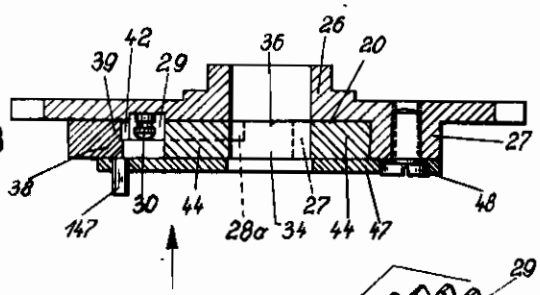
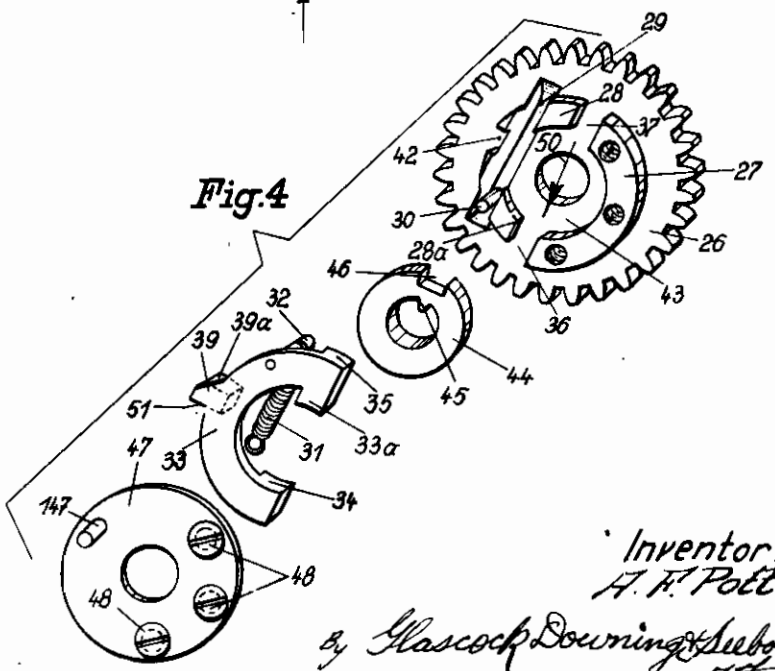


Fig.4



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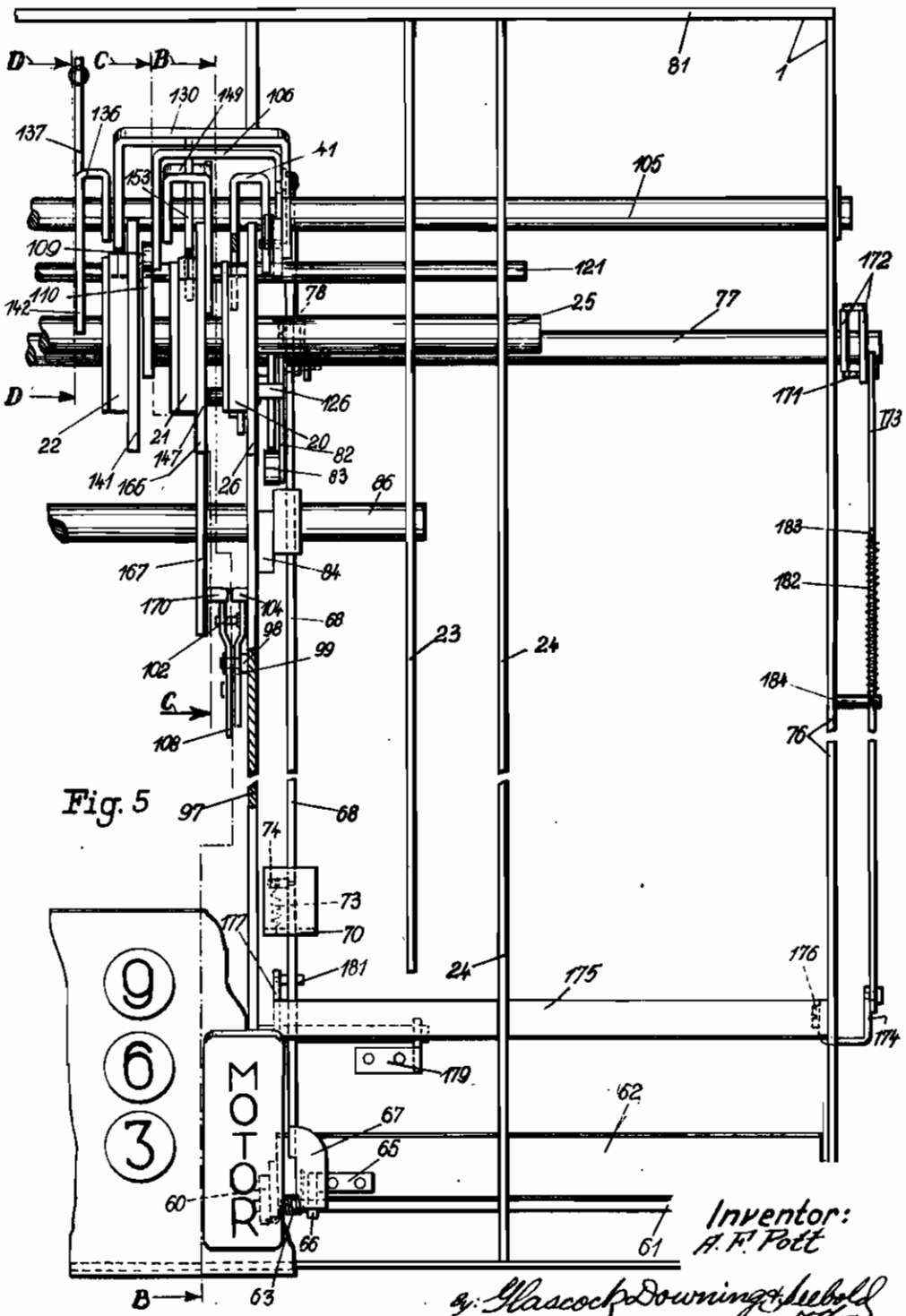
12 Sheets-Sheet 3



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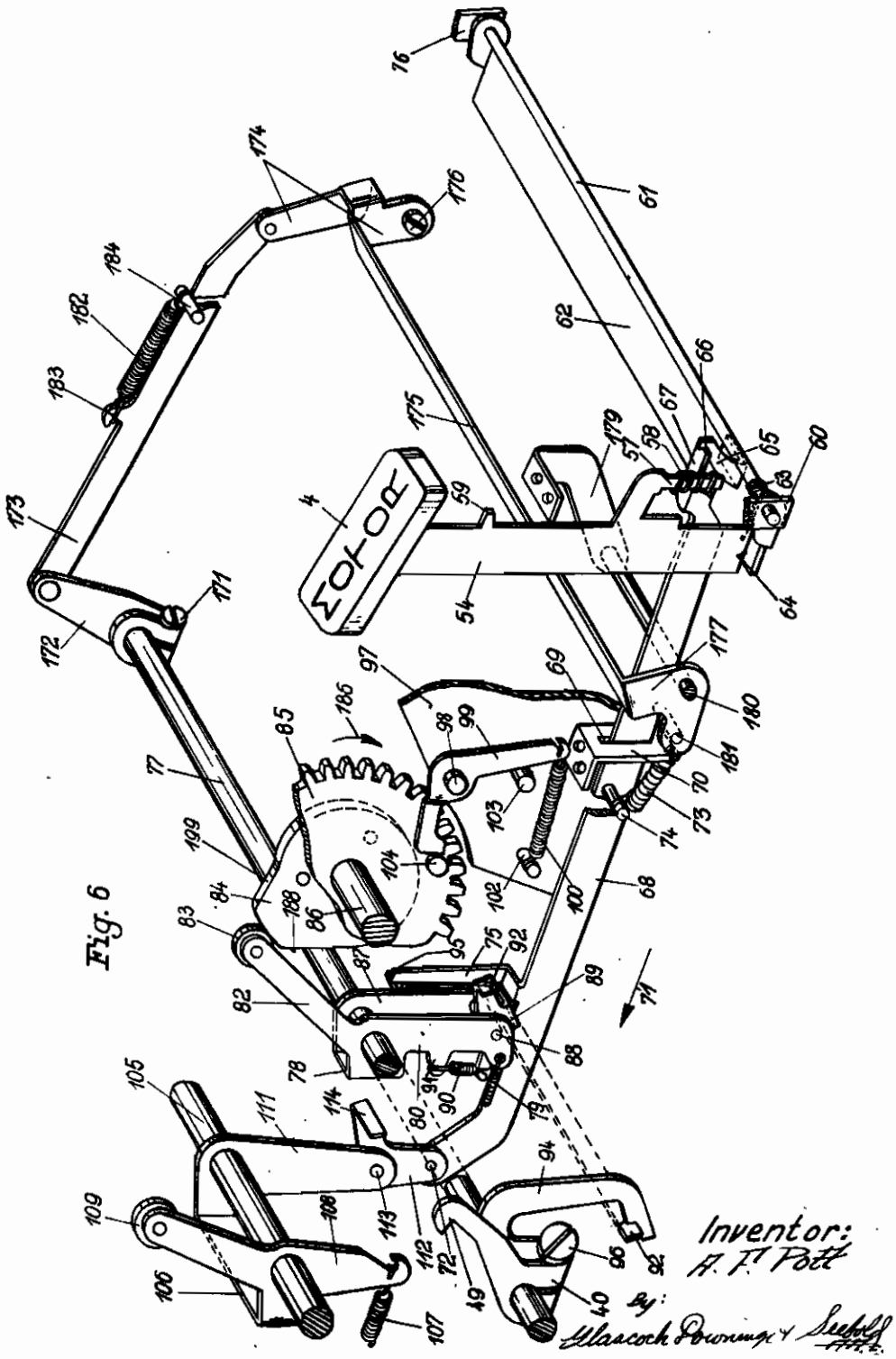

Fig. 6

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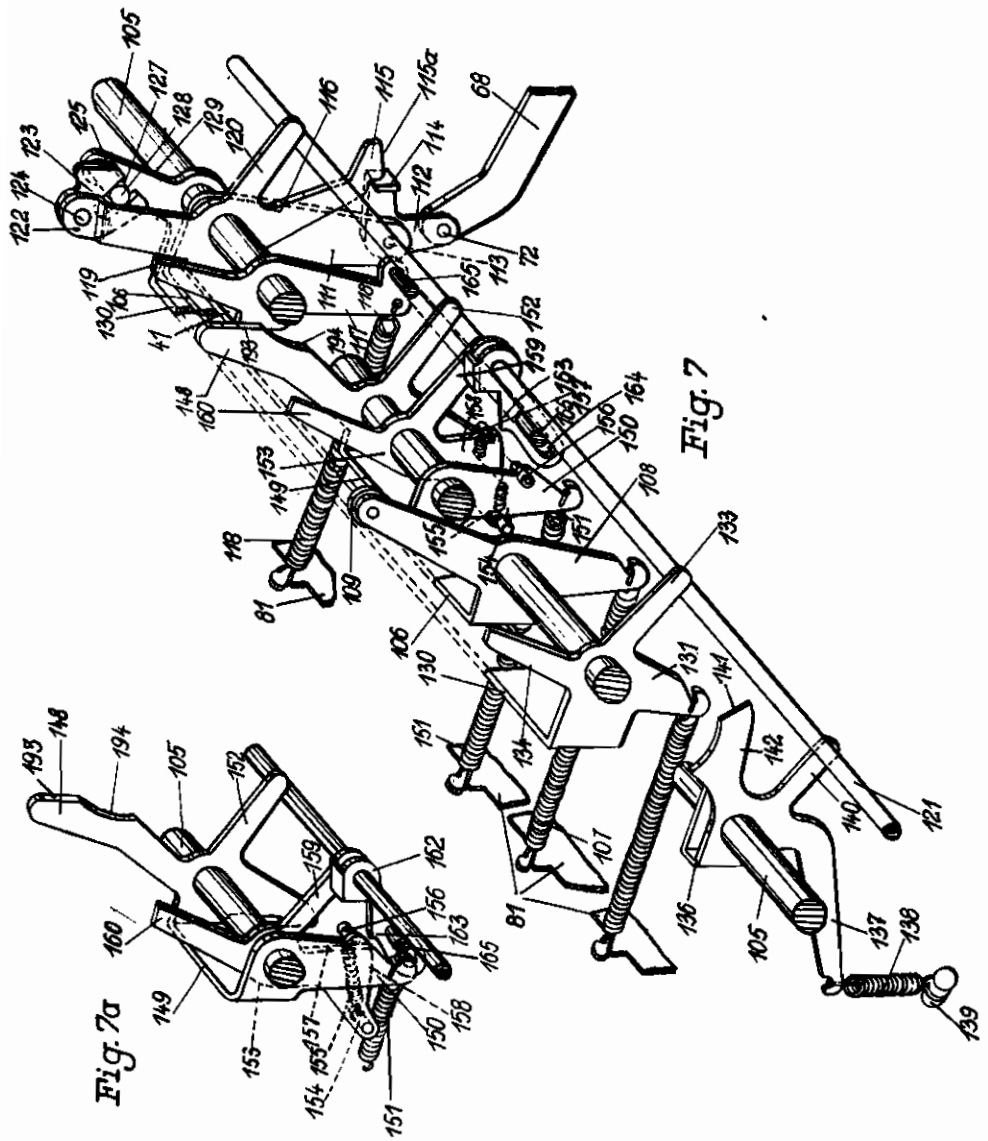

Fig. 7

Fig. 7a

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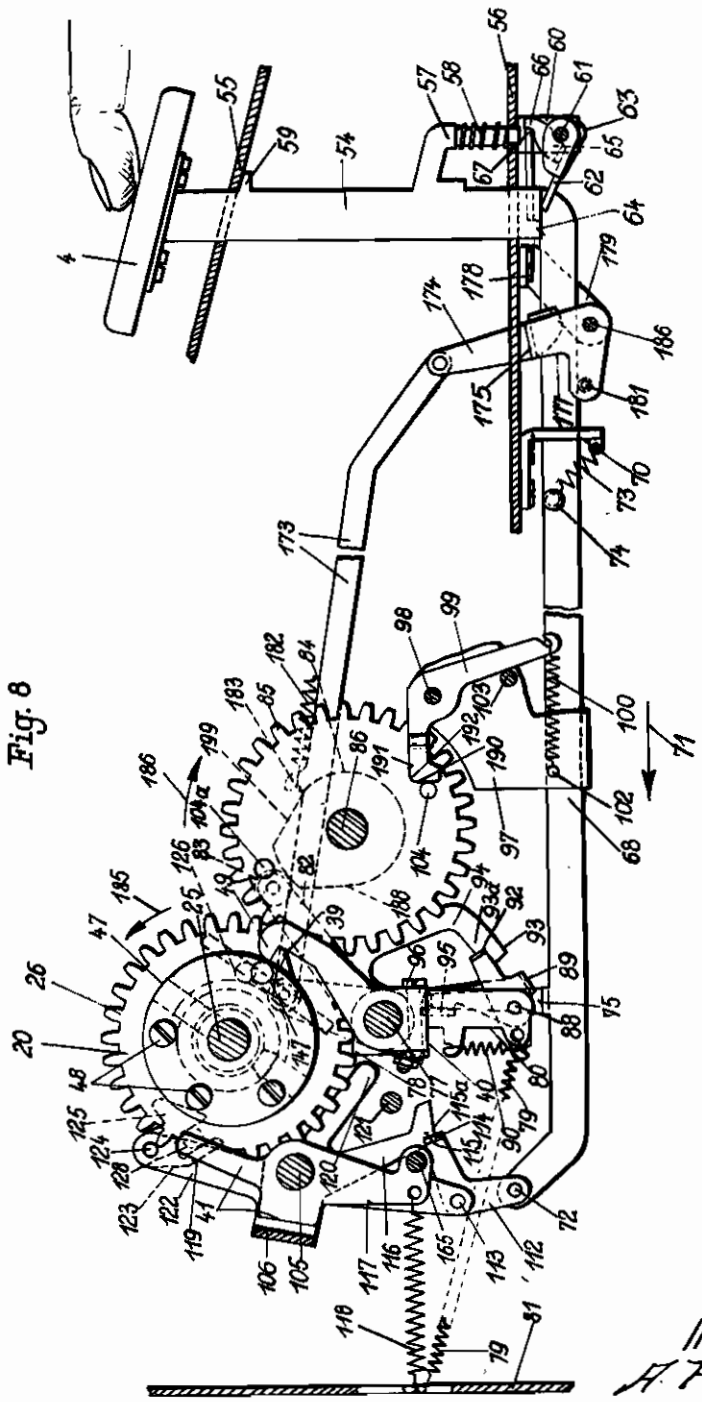

Fig. 8

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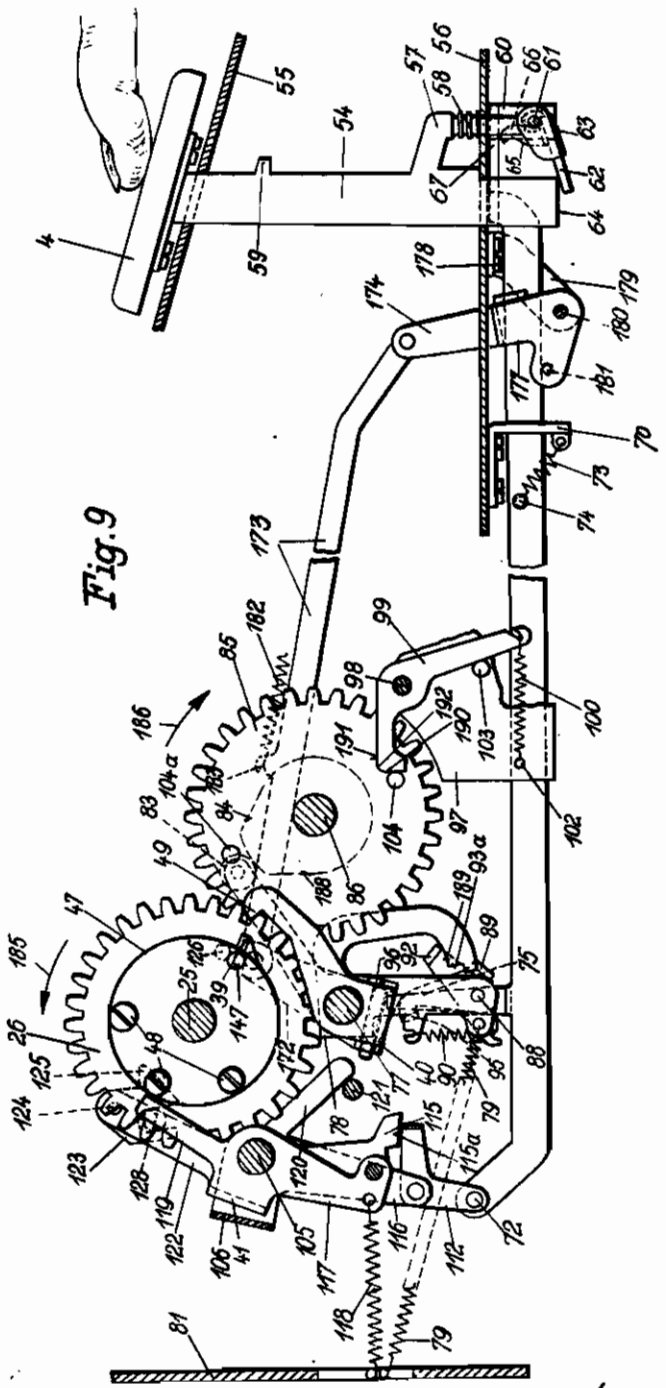
Fig. 9



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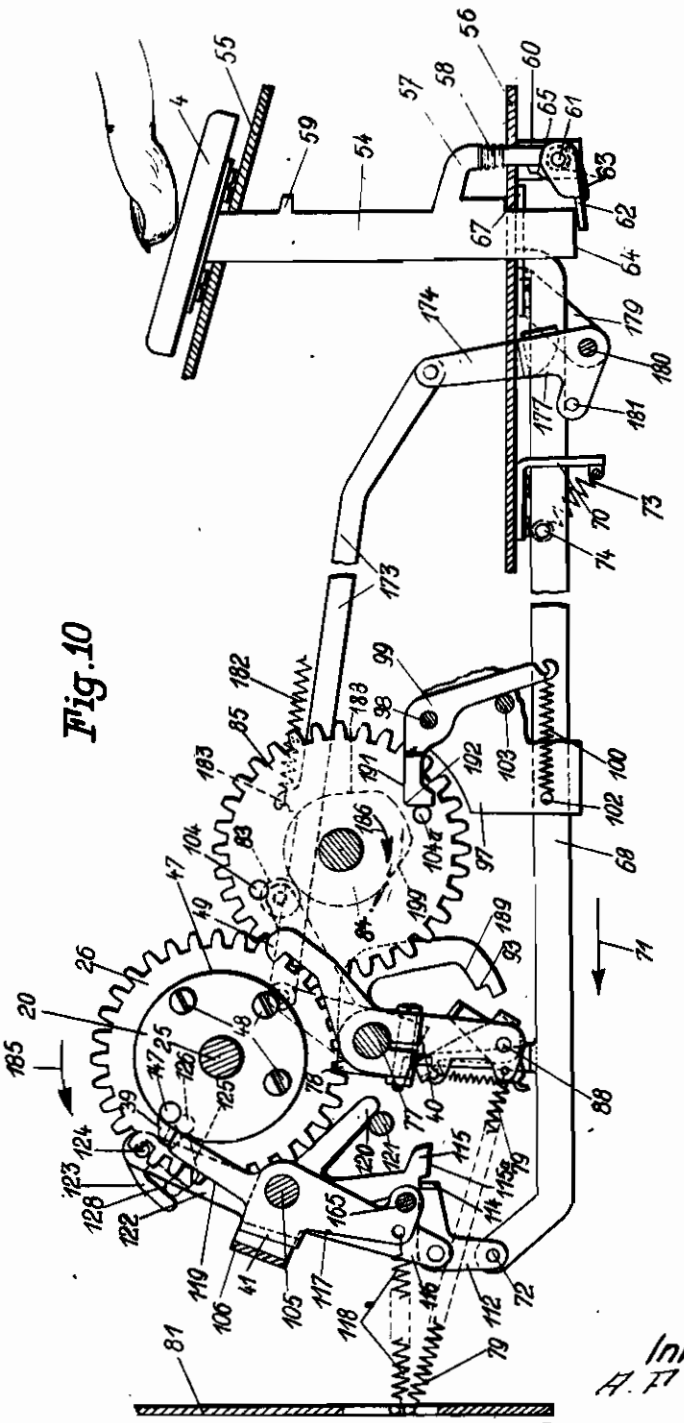

Fig. 10

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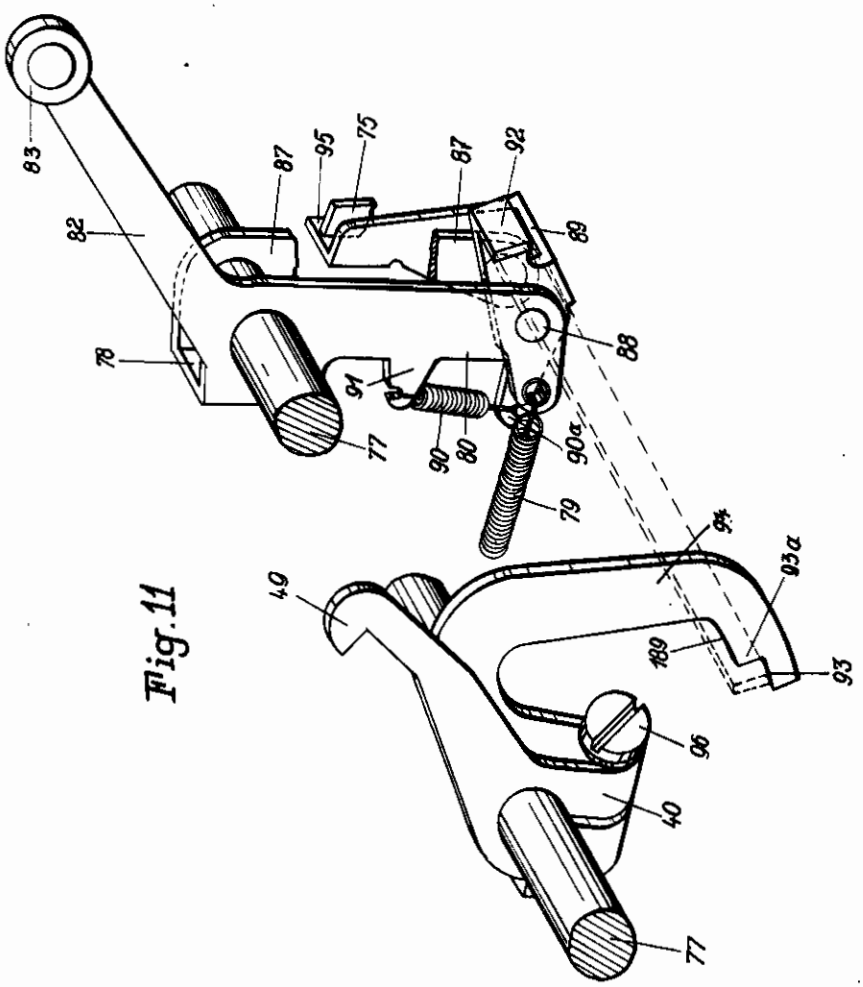

Fig. 11

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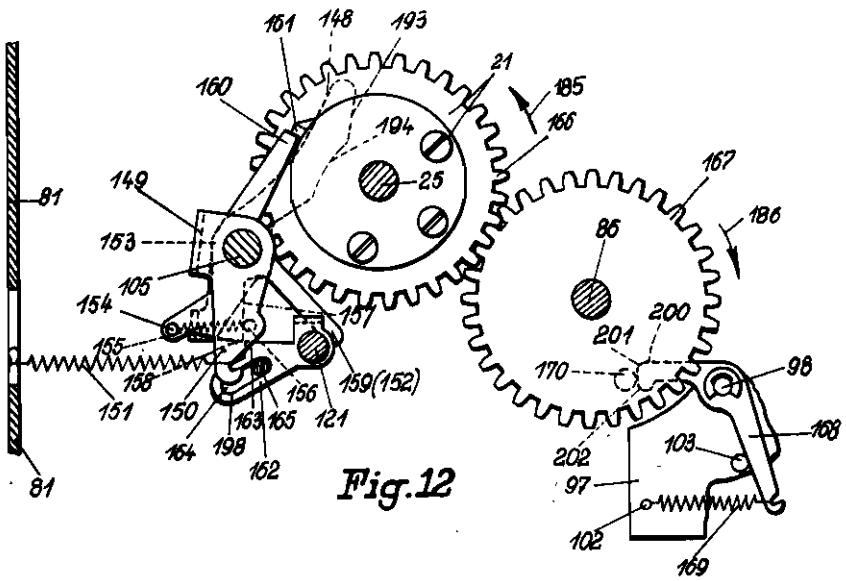

Fig. 12

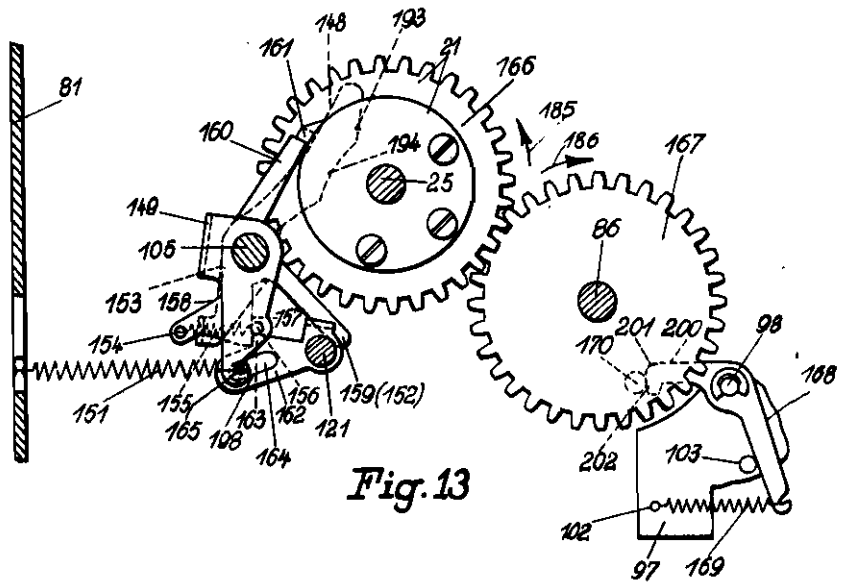

Fig. 13

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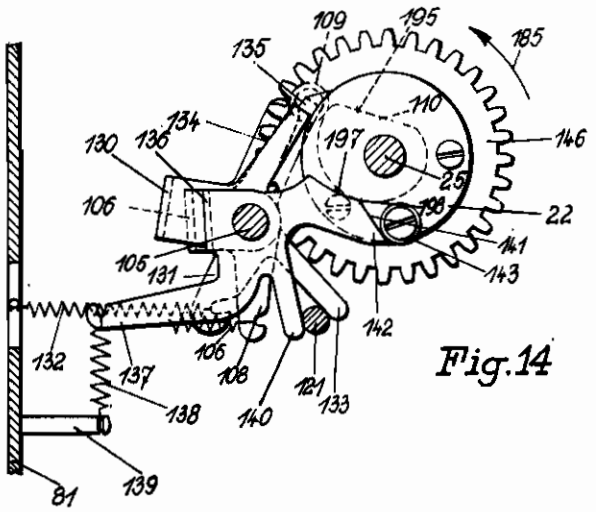

Fig.14

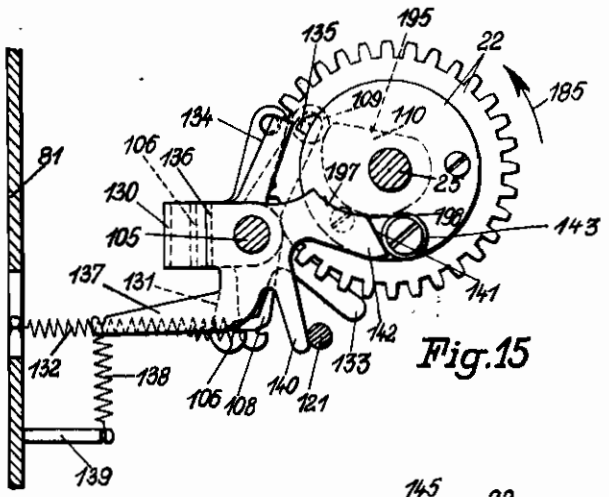

Fig.15

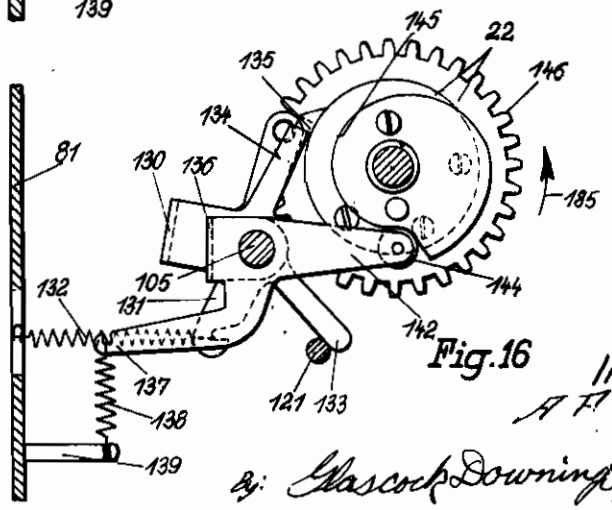

Fig.16

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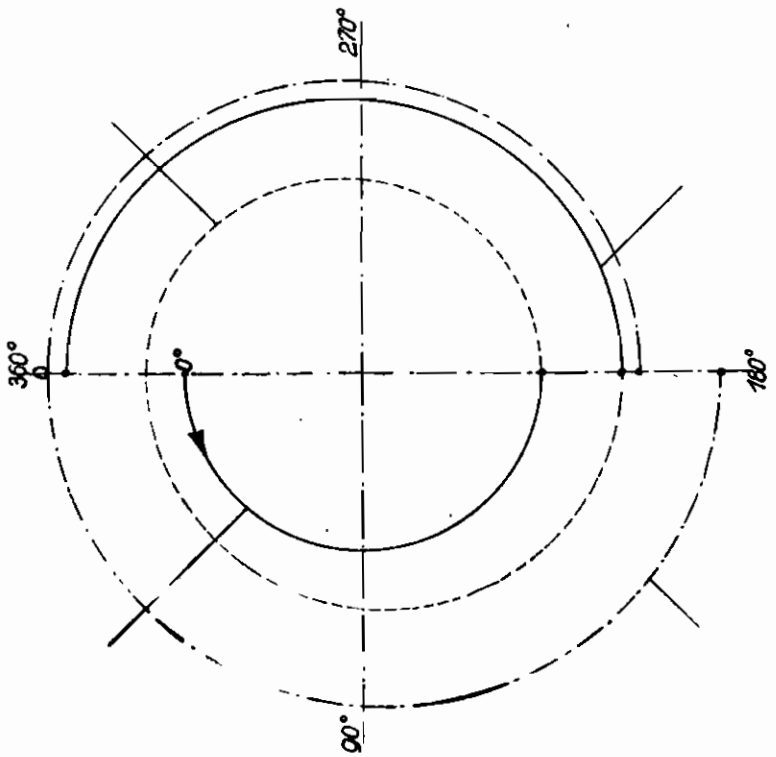

Fig. 17

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ALIEN PROPERTY CUSTODIAN

CONTROL GEAR FOR CLUTCHES IN ADDING MACHINES

August Friedrich Pott, Zella-Mehlis, Germany; vested in the Alien Property Custodian

Application filed Mareh 26, 1940

This invention relates to control gear for coupling or clutches to be installed in adding machines and the like.

In the case of machines hitherto known which have the driving mechanism for changing gears as well as for the printing mechanism and the tens-shift controlled partly by cams and partly by Malthese-drive, it has not been possible to remove the printing mechanism, for instance, when carrying out multiplications, thus entailing considerable loss of time.

It is an object of the present invention to have the printing mechanism removed when carrying out multiplications and divisions. In order to accomplish this, the old way of controlling the gear-changing as well as the printing mechanism and the tens-shift by means of cams and Malthese drives mounted on a motor-driven shaft has been abandoned. Instead, the gears are controlled in dependence of certain clutches, causing the clutch for the printing mechanism to be removed during the continued revolutions of the machine after the factor introduced into the machine has been printed once.

This is accomplished by providing a system of rods controlling a number of clutches, which are preferably mounted on a common shaft and operating the application and removal of said clutches in dependence of each other.

The invention will be better understood by reference to the following detailed description in connection with the accompanying drawings showing by way of example and schematically some embodimcnts of the invention and in which:—

Fig. 1 shows an adding machine, as viewed from left front having the invention applied thereto.

Fig. 2 shows a view towards the driving clutch, as indicated by the direction of arrow, but, to afford a clearer view of the whole, several parts have been omitted.

Fig. 3 shows a cross-section on line A—A through the clutch, in accordance with fig. 2, as viewed in the directions of arrow shown on fig. 2.

Fig. 4 is a perspective illustration of the clutch shown in fig. 3, with the different parts drawn out separately.

Fig. 5 shows a fragmentary plan view on the machine, in accordance with fig. 1, but for better display of those parts of the driving clutch connected with the motor key, as well as of the tens-shift and the printing mechanism, the coverplate and the paper carriage have been omitted on the drawing.

Fig. 6 shows a perspcctive view of the motor key and the gears which cause the separation of the motor kcy from the gears controlling the driving clutch.

Fig. 7 shows a perspective view of the operating parts controlling the driving clutch, the tens-shift clutch and the printing-mechanism clutch.

Fig. 7*a* shows one part of fig. 7 in detail.

Fig. 8 shows a cross-section of the machine on line B—B of fig. 5, viewed in direction of the arrows. The operating parts controlling the driving clutch and the driving clutch itself are shown in rest position.

Fig. 9 shows a cross-section in accordance with fig. 8, the operating parts being shown in the position assumed after depression of the motor key, while the driving clutch is still in rest position.

Fig. 10 shows a cross-section in accordance with fig. 8, the operating parts controlling the driving clutch being shown in that position into which they have been moved by a cam working in dependence of the clutch for the printing mechanism.

Fig. 11 shows a detail of fig. 10 in perspective view.

Fig. 12 shows a cross-section of a part of the machine, on line C—C of Fig. 5 in direction of the arrows, the clutch for the tens-shift and those parts controlling the same shown in rest position.

Fig. 13 shows a cross-section in accordance with fig. 12, the operating parts pertaining to the tens-shift clutch shown in a position releasing said clutch.

Fig. 14 shows a cross-section of a part of the machine, on line D—D of fig. 5, viewed in direction of the arrows, the operating parts controlling the printing-mechanism clutch as well as said clutch shown in rest position.

Fig. 15 shows a plan view in accordance with fig. 14, the operating parts controlling the printing mechanism clutch shown in a position releasing said clutch.

Fig. 16 shows another design of the locking device holding the printing mechanism clutch in rest position.

Fig. 17 shows a machine operating diagram.

General description of the machine

The machine consists of a frame 1, only partly shown on fig. 5, which supports the operating parts and is concealed by a coverplate 2 (fig. 1). On the left side of the machine the motor is located which is likewise concealed by the coverplate 2 and is not shown on the illustration. On the same side are located the value keys 3 of a ten-key keyboard. Immediately to the right of this keyboard, the motor key 4 has been arranged. On the right side of the machine there are the different operating keys 5.

Above the ten-key keyboard an inspection window 6 has been provided through which the respective values introduced into a sliding carriage, not shown on the illustration, by depressing the

keys 3 can be checked. Above the inspection window 6, two further inspection windows 7 and 8 have been provided through which the number rollers 9 and 10 of two totalizers are made visible.

A paper carriage 12 running lengthwise is arranged on the guiding rails 11 (only the front rail is visible on Fig. 1). The supporting rail 13 which is attached to the paper carriage 12, will accommodate any desired number of totalizers 14 in such a way that these are easily taken on and off.

Furthermore, in the frame 1 (Fig. 5) of the machine there is a printing mechanism 15 (Fig. 1) arranged, the types of which are made to print in known manner by means of a typewriting ribbon 17 around the roller 18 in the paper carriage 12. The ribbon 17 can be wound on, and unwound from, the two reels 18, respectively. The paper roller 18 can be suitably adjusted by means of the two turn-knobs 19.

The present invention relates to the control of the driving clutch 20 (Fig. 5), the tens-shift clutch 21 and the printing-mechanism clutch 22, all being operated in dependence of each other. Since these three clutches are essentially the same in design and construction, it is intended to further explain hereafter only the driving clutch 20.

Detailed description of the driving clutch

Mounted for rotation in the left side wall, not shown on the illustration, of the frame 1 (Fig. 5) as well as in the two intermediary walls 23 and 24 arranged in the frame 1, is a main driving shaft 25 and this shaft also supports the driving clutch 20, the tens-shift clutch 21 and the printing mechanism clutch 22.

As already mentioned under the heading "General description of the machine," it is intended hereafter only to explain the detailed construction of the driving clutch, the construction of the tens-shift clutch 21 and the printing-mechanism clutch 22 being identical.

Mounted for rotation on the main driving shaft 25 is a gear wheel 26 (Fig. 2 to 4). On the left side of this gear wheel there are certain circular segments 27, 28 and 28*a*, the last two of which are only half about as thick as the segment 27. A recess 29 is cut into the segments 28 and 28*a* as well as in the gear wheel 26. In this recess 29 there is a pin 30, attached to which is a spring 31 the other end of the spring being attached to the pin 32 of the clutch pawl 33. The pin 32 of the clutch pawl 33 extends into the recess 29 and can be moved therein. The extreme ends 34 and 35 of the clutch pawl 33 are of exactly the same thickness as the circular segment 27. The parts 34 and 35 are arranged to be moved back and forth in the interstices 36 and 37 formed by the circular segments 27, 28 on one side and 27*a*, 28*a* on the other side. The centre piece 38 (Fig. 3) of the clutch pawl 33 is of the same thickness as the two circular segments 28 and 28*a*. The centre piece 38 is formed with a projection 39 which is capable cooperating with the clutch levers 40 and 41 (Fig. 8), to be described later. The nose 39 of the clutch pawl 33 is arranged to be moved in two final positions within the recess 42 formed by the circular segments 28 and 28*a*.

Within the circular recess 43 (Fig. 4) formed by the circular segments 27, 28 and 28*a* (Figs. 2, 3 and 4) there is a clutch disk 44 arranged in fixed position on the main driving shaft 25 by the lug 45. The clutch disk 44 has a recess 46 which can be engaged by the lug 33*a* of the clutch pawl 33. The clutch pawl 33 and the clutch disk 44 are prevented from being displaced by means of a cover-disk 47 screwed on to the circular segment 27 by the screws 48.

Operating manner of the driving clutch

When depressing the motor key 4, the clutch lever 40 is moved clockwise (Fig. 8) and the lug 39 of the clutch pawl 33 is released by the lug 49 of the clutch lever 40. Furthermore by depressing the motor key 4, the motor which is not shown on the illustration, is started, causing the driving shaft 25 to revolve and to take along the clutch disk 44 (Fig. 4). As soon as the recess 46 of the clutch disk 44 has reached a point below the lug 33*a* of the clutch pawl 33, this lug 33*a* will engage the recess 46 of the clutch disk 44. By doing so, the parts 34 and 35 of the clutch pawl 33 also slide into the recesses 36 and 37. The movement of the clutch pawl in the direction of arrow 50 is stopped by the lower edge 51 of the clutch pawl 33 striking against the edge 52 (Fig. 2) of the recess 42 formed by the circular segments 28 and 28*a*.

After the parts 46 and 33*a* have thus become connected, the gear 26, being a part of the clutch, takes part in the revolving of the driving shaft 25. After half a turn of the driving clutch 20, the lug 39 of the clutch pawl 33 will run against the clutch lever 41 (Fig. 10) lying in the path of the lug 39. In consequence of this the clutch pawl 33 (Fig. 4) is moved against the action of the spring 31 in the opposite direction of the arrow 60, the upper edge of the lug 39 of the clutch pawl 33 being stopped only by striking against the edge 53 (Fig. 2) of the circular segment 28. When the clutch pawl 33 is moved in the opposite direction of the arrow 50, the lug 33*a* of the clutch pawl 33 leaves the segment 48 of the clutch disk 44 again, thus stopping the driving clutch 20. When the clutch lever 41 is moved in anti-clockwise direction (Fig. 10), it also releases the lug 39 of the clutch pawl 33, whereby the connection 46, 33*a* is resumed in the above-described manner and the driving clutch 20 is again affected by the revolving of the driving shaft 25. The separation of the driving clutch 20 from the driving shaft 25 is then again taking place, as described, after another half-turn through the action of the driving clutch lever 40, whereupon the driving clutch 20, having performed a complete revolution of 360° has resumed its rest position again, as shown in Fig. 8.

Detailed description of the operating parts of the driving clutch, tens-shift clutch and printing mechanism clutch

The key stem 54 with the motor key 4 on one end (Figs. 6, 8, 9, 10) is anchored with its other end in the coverplate 55 and the bottom-plate 56 of a key frame which is not shown in the illustration, so that it can be moved in a vertical direction. The key stem 54, furthermore, has at its lower end a projection 57 (Fig. 6) around which a spring 58 has been arranged. This spring 58 holds the key stem 54 with the motor key 4 in rest position into which it has been placed by the lug 59 striking against the coverplate 55 of the key frame from below.

A non-revolving shaft 61 is supported by the bracket 90 which is flanged to the bottom plate 56 of the key frame, as well as by the right sidewall 76 of the frame 1. On this shaft 61 a moveable trap 62 has been provided, as shown in Fig. 6, and, by the action of the spring 63 the

trap is moved clockwise to and fro (Fig. 8) around the shaft 81, whilst in its normal position the trap 62 lies flat against the lower edge 64 of the key stem 54. On the trap 62 there is an angle piece 65 (Fig. 6) fastened by a rivet which is not shown in the illustration. The free upward end 66 of the angle piece 65 is designed to engage with the part 67 projecting from the rod 68. The rod 68 (Figs. 6, 8, 10) is conducted through a slot 69 (Fig. 6) in an angle piece 70 which is fixed to the bottom plate of the machine frame in such a way that the rod 68 passing through the slot can be actuated in both directions of the arrow 71 as well as around its fulcrum 72. A spring 73 which is fastened on one end to the pin 74 of the rod 68 and on the other end to the lower extension of the angle piece 70, tends to hold the rod 68 against the lower edge of the slot 69 of the angle piece 70, when in normal position. A projection 75 (Figs. 6, 8, 9, 10, 11) is also flanged-on to the rod 68.

A revolving shaft 77 (Figs. 5, 6, 8, 9, 10, 11) is supported by the right side wall 76 (Fig. 5) and by the left side-wall (not shown in the illustration) of the machine frame 1. This shaft 77 has a U-shaped yoke 78 arranged on a pivot. The yoke 78 is moved clockwise by the action of the spring 79 which is attached at one end to the lower extension 88 of the yoke 78 (Fig. 11) and on the other end to the backwall 81 (Figs. 8, 9, 10) of the machine frame 1. The normal position of the yoke 76 will be dictated by the roller 83, which is attached to one leg bearing against the cam 84 (Fig. 6).

The cam 84 is fixed rigidly to a gear 85. The cam 84 and the gear 85 are rigidly mounted on a revolving shaft 86 which is supported by the intermediary wall 23 (Fig. 5) and the left side-wall (not shown in the illustration) of the machine frame 1. The gear 85 meshes with the gear 26. In both lower extensions 80 and 87 (Fig. 11) of the yoke 78 there is a pin 88 (Figs. 6, 8, 9, 10, 11) having a pawl 89 arranged on a pivot. A spring 90 is fastened on one end to the arm 80a, Fig. 11, of the pawl 89 and on the other end to the projection 91 of the leg 88 of the U-shaped member 78. By the action of this spring 90 the pawl 88 is actuated clockwise around the pivot 88. The normal position of the pawl 89 is fixed by the lug 92 striking against the edge 93, Fig. 8 of a lug 94 of the clutch lever 40 which is designed in U-shape and is mounted on the shaft 77. The lug 95, Fig. 11, of the pawl 89 engages with the extension 75 of the bar 68. The clutch lever 40 is fastened to the shaft 77 by a bolt 96 and is capable of cooperating by the lug 49 of its upwardly pointed arm with the lug 39 of the pawl 33 of the driving clutch.

A bolt 98, Fig. 6, is fastened in an intermediary wall 97, Figs. 5, 6, 8, 9 and 10, and an angle lever 99 is mounted to swing thereon. The lever 99 is moved clockwise around the bolt 98 by the action of a spring 100 which is attached on one end to the downwardly extending arm of the lever 99 and on the other end to a bolt 102 fastened in the intermediary wall 97. The lever 99 is stopped in its movement by a pin 103 which is likewise fastened in the intermediary wall 97. The rearwardly pointed arm of the lever 99 is capable of cooperating with the bolts 104 and 104a which are flanged to the gear 85. A shaft 105 is fixed rigidly in the right sidewall 76, Fig. 5, and in the left sidewall, not shown, of the machine frame 1. A U-shaped member 106, Fig. 7, is mounted for rotation on the shaft 105. A spring 107 which on one end is fastened to the downwardly pointed leg 108 of the U-shaped member 106 and on the other end is fastened in the backwall 81 of the machine frame 1, causes the U-shaped member 106 to turn clockwise around the shaft 105. The normal position of the U-shaped member is fixed by the roller 109 bearing against a cam 110 mounted on the printing mechanism clutch 22, Figs. 5, 14 and 15. The downwardly directed arm 111 of the U-shaped member 108 has a pawl 112 pivoted around the fulcrum 113. The bar 68 which has already been mentioned is jointed at the point 72. The lug 114 of the pawl 112 is capable of cooperating with the projection 115 of a downwardly pointed arm 116 of the U-shaped clutch lever 41. A spring 118 is attached on one end to the downwardly pointed arm 117 and with the other end in the backwall 81 of the machine frame 1. The clutch lever 41 is moved clockwise around the shaft 105 by the action of the spring 118. The normal position of the clutch lever 41 is fixed by the projection 115 of the arm 116 of the clutch lever 41 striking against the lug 114 of the pawl 112. In this normal position of the clutch lever 41 the arm 119 lies outside of the path of the projection 39 of the clutch pawl 33 of the driving clutch 20.

The clutch lever 41 has an arm 120 capable of engaging with a rod 121 which is fastened in the intermediary wall 24 and in the left sidewall, not shown, of the machine frame 1.

A pawl 123 is jointed to the arm 122 of the clutch lever 41 at the point 124 and formed with a projection 125 which is able to cooperate with a bolt 128, Figs. 8, 9, and 10, fixed to the gear 26 of the driving clutch 20. A pin 128 extending through a slot 127, Fig. 7, of the pawl 123 is secured to an arm 129 of a clutch lever 138 which is pivoted on the shaft 105, as shown in Fig. 7. A spring 132, Figs. 7, 14, 15, and 16, is fastened to one end of the arm 131 of the clutch lever 130 and with the other end is secured in the backwall 81 of the machine frame 1 for moving the clutch lever 130 clockwise around the shaft 105. The normal position of the clutch lever 130 is fixed by the arm 133 striking against the bar 121. In this normal position the arm 134 of the clutch lever 130 lies in the path of the projection 135 of a clutch pawl, not shown, which is installed in the printing-mechanism clutch 22.

A suitably shaped lever 136, Figs. 7, 14 and 15, is mounted to swing on the shaft 105. A spring 138 is fastened on one end to the arm 137 and on the other end to a pin 139 fastened in the rear-wall 81 of the machine frame 1. This spring 138 causes the lever 136 to swing around the shaft 105 anti-clockwise. The normal position of the lever 136 is fixed by the arm 140 of the lever 136 striking against the bar 121. The surface 141 of the arm 142 of the lever 136 engages with a roller 143 which is attached to the printing-mechanism clutch 22.

Another design of the lever 136 is shown in Fig. 16. This design differs from that shown in Fig. 15 only in that the arm 142 of the clutch lever 136, Fig. 16, has a roller 144 which bears on the cam 145 mounted on the printing-mechanism clutch 22. The gear 146, Figs. 14, 15 and 16, meshes with a gear for the printing mechanism, not shown and not belonging to the scope of the present invention. A pin 147, Figs. 4, 5, 8, 9 and 10, is mounted on the driving clutch 20 so as to cooperate with an arm 148 of a U-shaped member 149, Figs. 7, 12 and 13, which is mounted for rotation on the shaft 105. A spring 151 is connected to the arm 150 of the U-shaped mem-

ber 149 as well as to the rear wall 61 of the machine frame 1. By the action of this spring 151 the U-shaped member 149 is moved clockwise around the shaft 105. The normal position of the U-shaped member 149 is fixed by the arm 152 striking against the bar 121. A clutch lever 153 is also mounted for rotation on the shaft 105.

A spring 155 is fastened on one end to the pin 154, Figs. 7, 7a, 12, and 13, of the clutch lever 153 and on the other end to a pin 156 of the arm 150 of the U-shaped member 149. By the action of this spring 155, the clutch lever 153 is moved anti-clockwise around the shaft 105 until the edge 157 of the arm 156, Fig. 7a, of the clutch lever 153 strikes against the pin 156. The arm 159 of the clutch lever 153 cooperates with the bar 121 whilst the arm 160 of the clutch lever 153 engages with the lug 161 of a clutch pawl, not shown, installed in the tens-shift clutch 21. Mounted to rotate with its U-shaped member on the bar 121, Figs. 7, 7a, 12 and 13, in a lever 162 the projection 163 of which is able to cooperate with the edge 157 of the arm 156 of the clutch lever 153. A pin 165 fixed to the arm 117, Fig. 7, of the clutch lever 41 extends through the slot 164 of the lever 162.

A gear 166 of the tens-shift clutch, Figs. 12 and 13, meshes with the gear 167 which is mounted on a shaft 86 installed in the intermediary wall 23 and the left side-wall, not shown, of the machine frame 1.

Pivoted on a pin 98, Figs. 12 and 13, is an angle lever 168, moved clockwise around the pin 98 by the action of a spring 169 which is fastened on one end to the downwardly pointed arm of the angle lever 168 and on the other end to a pin 102. The normal position of the angle lever 168 is fixed by striking against the pin 103. The rearwardly extending arm of the angle lever 166 is capable of cooperating with a pin 170 attached to the gear 167.

Device for separating the motor key from the system of rods controlling the driving clutch

A lever 172 is fastened by a bolt, 171, Figs. 6, 8, 9, and 10, on the shaft 77. A connecting rod 173 is jointed to lever 172 on one end and jointed to an arm 174 of the U-shaped member 175 on its other end. The U-shaped member 175 is mounted to swing with one end on a bolt 176 which extends through the arm 174 in the right side wall 76 of the machine frame 1, and with the other end by its arm 177 on a shaft 160 which is fastened to the bottom plate 56 of the key frame by angle irons 179 held by bolts 170. A pin 191 which cooperates with the bar 86 is fastened to the arm 177 of the U-shaped member 175.

The parts 172, 77, and 40, Fig. 11, are moved clockwise by the action of a spring 182 which on one end is fastened to a lug 183 of a connecting rod 173 and on its other end to a pin 184 fastened in the right side-wall 76 of the machine frame 1. The normal position of these parts is fixed by the lug 93a, Fig. 11, striking against the catch 92 of the pawl 89, as the U-shaped member 78 with the pawl 89 cannot move clockwise around the shaft 77 owing to the roller 62 bearing against the cam 84.

Operation of the members for the driving clutch, the tens-shift clutch and the printing-mechanism clutch

When depressing the motor key 4, Figs. 1, 5, 6, 8, 9, and 10, the key lever 54 is moved downward against the action of spring 56. During this operation, the lower edge 64 of the key slide 54 engages the trap 62. Consequently, the trap 62 is moved anti-clockwise, Fig. 9, around the shaft 61 against the tension of the torsion spring 63. The angle piece 65 mounted on the trap 62, during the movement of the trap 62 engages with its lug 66 the member 87 of the bar 66 which is thus moved in the direction of arrow 71 against the tension of the spring 73. During this operation, the member 75, Fig. 6, 8 and 11, attached to the bar 66, engages the lug 95 of the pawl 89, moving same around the pin 86 anti-clockwise, Fig. 11, against the tension of the spring 98. When the pawl 89 is moved anti-clockwise, the lug 92 of the pawl 89 releases the projection 93a of the clutch lever 40 which is rigidly mounted on the shaft 77. Thereby the spring 182 which is fastened to the connecting rod 173, Fig. 6, operates the clutch lever 40 in clockwise direction by way of the lever 172 and the shaft 77. During this operation the projection 49, Fig. 8, of the clutch lever 40 releases the lug 39 of the clutch pawl 33 installed in the driving clutch 20, whereupon the driving clutch 20 is connected with the driving shaft 25, as has already been described under the heading "Operation of the driving clutch," so that the driving clutch 20, after a contact (not shown) has been closed, will take part in the revolution of the driving shaft.

When the shaft 77 and the lever 172 rigidly mounted thereon are moved, the connecting rod 173, Fig. 6, is turned against the direction of arrow 71, whereby the U-shaped member 175 which is jointed to the front end of the connecting rod 173 is moved clockwise around the bolt 178 and the shaft 180. During the operation the pin 101 of the U-shaped member 175 acts upon the slide 68 from below so that the slide 60 is moved around its joint 72 anti-clockwise and against the tension of the spring 73. During this movement the member 87 of the slide 66 releases the angle piece 65 of the trap 62, whereby the connection from the motor key 4 to the driving clutch 20 is broken. Should the motor key 4 again be depressed or be kept in depressed condition, a second release of the driving clutch 20 during the calculating operation has become impossible, since during the second depression of the motor key 4 the angle piece 65 is moved below the member 67 of the slide 60 without making contact when the trap 62 is moved. After the motor key 4 has been released by the operator, the trap 62 under action of the torsion spring 63 and the motor key 4 under action of the spring 58 will resume the rest position shown in Fig. 8 during which the normal position of the motor key 4 is fixed by the lug 59 of the key slide 54 striking against the coverplate 55 of the key frame from below.

When the bar 60 is moved in the direction of arrow 71, the pawl 112, Figs. 6, 7, 8, 9 and 10, which is jointed to the slide 68, is moved clockwise around the pivot 113 from the position shown in Fig. 8 into the position shown in Fig. 9. During this operation, the lug 114 of the pawl 112 releases the projection 115 of the arm 118, Fig. 7, of the U-shaped clutch lever 41, so that this lever 41 is moved clockwise around the shaft 185 by the tension of the spring 118. The movement of the clutch lever 41 is stopped by the arm 128 striking against the bar 121. By the clockwise movement of the clutch lever 41 the projection 114 of the pawl 112 strikes against the surface

115a, Fig. 7, of the lug 115 of the clutch lever 41 from below, Fig. 9. During the movement of the clutch lever 41, its arm 119 is brought into the path of the lug 39 of the clutch pawl 33 of the driving clutch 20.

During the clockwise movement of the clutch lever 41, Fig. 7, around the shaft 105, the pawl 123 which is mounted on the arm 122 is also moved anti-clockwise around the pin 128 of the arm 129 of the clutch lever 130, which pin now acts as a fulcrum causing the lug 125 of the pawl 123 to get into the path of the pin 126, Fig. 9, of the driving clutch. Owing to the clockwise movement of the clutch lever 41, the lever 182 which is mounted to rotate on the bar 121 over the pin 165, Fig. 7, of the arm 117, is moved clockwise around the bar 121 whereby the lug 163 of the clutch 162 is brought in front of the edge 157 of the clutch lever 153, Fig. 13, which is mounted for rotation on the shaft 105 and controls the tens-shift clutch 21, Fig. 5.

As soon as the driving clutch 20 starts turning in the direction of arrow 185, Fig. 8, at 0°, Fig. 17, the gear 85 is revolved through the gear 26 in the direction of arrow 186. The cam 84 which is rigidly mounted on the gear 85 partakes in this movement. When the cam 84 is revolved in direction of the arrow 186 the roller 83 which is fixed to the arm 82, Fig. 6, of the U-shaped member 78 slides off the raised part of the cam 84 and, by sliding along the surface 188 of the cam 84 under the action of the spring 79, after the first half-turn of the driving clutch 20 comes to lie upon the concentric part of the cam 84. During this operation, the U-shaped member 78 and the pawl 89 which is supported by the arms 88 and 87 is moved clockwise around the shaft 77. Furthermore, the lug 92 of the pawl 89 slides along the edge 189, Fig. 9, of the clutch lever 40 in the direction of the lug 93a until the lug 92 of the pawl 89 under the action of the spring 80 is engaged behind the lug 93a of the clutch lever 40 and thereby assumes the position shown in Fig. 8.

When the gear 85, Fig. 8, starts turning in the direction of arrow 186, the pin 104 which is mounted on the gear 85 will leave the surface 190 of the lever 98, whilst this lever 99 under action of the spring 100 with its downward pointed part engages a pin 103 and remains in its normal position shown in Fig. 8.

Shortly before a half-turn of the gear 85 has been completed, the pin 104a engages the edge 191 of the lever 99 turning it anti-clockwise around its pivot 98 against the action of the spring 108 until the pin 104a slides over the edge 192 of the lever 99. Under the tension of the spring 100, the lever 99 is moved clockwise again around the pin 98 and the surface 190 of the lever 99 now lies against the pin 104a of the gear 85, whereby the driving clutch 20 is prevented from turning back against the direction of arrow 196 of the clutch pawl 33 installed in the driving clutch 20, under the action of the spring 31.

Before the driving clutch 20 has completed its first half-turn, a pin 147 attached to the driving clutch 28, Figs. 8, 9, 10, will engage the edge 193, Figs. 12 and 13, of the arm 148 of the U-shaped member 149, Figs. 7 and 7a, whereby the pin 147 is moved anti-clockwise around the shaft 105 against the spring 151. When the driving clutch 20 has completed its first half-turn of 180°, Fig. 17, the pin 147 of the driving clutch 28 falls into the recess 194 of the arm 148 of the U-shaped member 149 and holdes the latter in its changed position. When the U-shaped member 149 has been moved anti-clockwise, the spring 155, which is fastened on one end to the pin 156 of the arm 150 of the U-shaped member 149 and on the other end is attached to a pin 154 of the clutch lever 153, is expanded since, as has been described, the clutch lever 153 cannot be influenced by the spring 155 owing to the lever 162 blocking it.

Shortly before the first half-turn of the driving clutch 20 has been completed, the pin 128, Fig. 9, which is fastened on the gear 26, will engage the lug 125 of the pawl 123, moving the latter clockwise around the pivot 124. During this operation, the clutch lever 130, Fig. 7, which is mounted for rotation on the shaft 105, is moved clockwise over the pin 128 around the shaft 105 against the spring 132 from its position shown in Fig. 15. Simultaneously the arm 134 of the clutch lever 130 releases the lug 135 of the clutch pawl which is installed in the printing-mechanism clutch 22, Fig. 5, and lifts the arm 133 of the clutch lever 130 from the bar 121. Consequently the printing-mechanism clutch 22 can now take part in the revolution of the driving shaft 25. Simultaneously the lug 39 of the clutch pawl 33 of the driving clutch 20 strikes against the arm 119, Fig. 10, of the clutch lever 41, whereby the driving clutch 20 is separated from the driving shaft 25, as has been described under the heading "Operation of the driving clutch," and the driving clutch comes to a stop after a turn of 180°, Fig. 17.

The cam 110, Figs. 14 and 15, also partakes in the movement of the printing-mechanism clutch 22 to which it is rigidly fastened. Simultaneously the roller 109, Fig. 7, of the U-shaped member 106 slides down the slope 195, Fig. 14, of the cam 110, whereby the U-shaped member 106, Fig. 6, under the action of the spring 107 is moved clockwise around the shaft 105 from the position shown in Fig. 9 into the position shown in Fig. 10.

During the clockwise movement of the U-shaped member 106, the lug 114 of the pawl 112 slides along the edge 115a of the projection 115 of the clutch lever 41 and catches below the spring 73, which is fastened to the bar 68, behind the lug 115 of the clutch lever 41, Fig. 10.

This would mean that the pawl 112 partakes in the clockwise movement of the U-shaped member 106, whereby the bar 68 is moved in the direction of arrow 71. Simultaneously the lug 75 of the pawl 112 engages again the lug 95 of the pawl 89 and moves the latter around the pin 88 against the spring 90 from the position shown in Fig. 9 into the position shown in Fig. 10.

Shortly before a complete revolution of the printing-mechanism 22 has been made, the roller 143, which is mounted on the printing-mechanism clutch 22, Figs. 14 and 15, engages the edge 197 of the multiple arm U-shaped member 136, Fig. 7, and causes the latter to be moved clockwise around the shaft 105 against the spring 138. As soon as the roller 143 of the printing-mechanism clutch 22 slides over the edge 198 of the arm 142 of the U-shaped member 136, the latter is turned clockwise again around the shaft 105 by the action of the spring 138. Simultaneously the surface 141, Fig. 14, of the U-shaped member 136 engages the roller 143 of the printing-mechanism clutch 22 and holds it in the position of rest shown in Fig. 14. Winding back of the printing-mechanism clutch 22 under the ac-

tion of the spring, not shown, which is fastened to the clutch pawl of the printing-mechanism clutch 22, is therefore not possible.

Approximately after a half-turn of the printing-mechanism clutch 22 and of the cam 110, the U-shaped member 108, Figs. 6 and 7, is moved anti-clockwise around the shaft 105 away from the cam 110, Fig. 14, and against the spring 107. During this operation, the lug 114, Fig. 8, of the pawl 112 engages the lug 115 of the clutch lever 41 of the driving clutch, whereby the clutch lever 41 is moved anti-clockwise around the shaft 38 against the action of the spring 118. The bar 68 is thus moved against the direction of arrow 71 and slides along the pin 181 of the U-shaped member 175 which is still moved clockwise. When the bar 68 is moved against the direction of arrow 71, the lug 75, Fig. 6, of the bar 68 releases the lug 95 of the clutch pawl 89. Consequently the pawl 88 is free to move clockwise around the pin 88 under the action of the spring 90 and the pawl 89 is brought from the position shown in Fig. 10 into the position shown in Fig. 8 with respect to the lug 93*a* of the clutch lever 40.

Immediately before completing a revolution of 360°, Fig. 17, of the printing-mechanism clutch 20, the arm 119 of the clutch lever 41 owing to the anti-clockwise movement of the clutch lever 41 around the shaft 105 releases the clutch pawl 33 which is arranged in the driving clutch 20, so that the driving clutch 20 can again take part in the movement of the driving shaft 25.

During the anti-clockwise movement of the clutch lever 41 the arm 122 of the clutch lever 41 is moved in the same direction. Simultaneously the lug 125 of the pawl 123 slides off below the pin 126 of the gear 28, whereupon the pawl 123 is moved from the position shown in Fig. 10, into the position shown in Fig. 9, namely, by the action of the pin 128, Fig. 7, of the clutch lever 130 which is moved clockwise around the shaft 105 by the action of the spring 132. Simultaneously the arm 134 of the clutch lever 130 is moved again into the path of the clutch pawl arranged in the printing mechanism clutch 22, which causes the printing-mechanism clutch 22 to be arrested after a turn of 360°, Fig. 17.

During the anti-clockwise movement of the clutch lever 41 the pin 165, Figs. 7 and 7*a*, which is attached to the arm 117 of the clutch lever 41, bears on the lower edge 198, Fig. 13, of the slot 164 of the lever 162, which causes the lever 162 to be moved anti-clockwise around the bar 121. During this movement, the lug 163 of the lever 162 releases the edge 157 of the clutch lever 153 of the tens-shift clutch and at that moment the clutch lever 153 is moved anti-clockwise around the shaft 105 by the action of the spring 155 which has been expanded by the U-shaped member 149. Owing to the movement of the clutch lever 153, its arm 160 releases a clutch pawl, not shown, which is arranged in the tens-shift clutch 21, so that both members, the tens-shift clutch 21 and the driving clutch 20 participate in the movement of the driving clutch 25.

During the movement of the driving clutch (second half turn) the cam 84 is moved in the direction of arrow 186 by means of the gears 26, 85, Fig. 8. Simultaneously the surface 199 of the cam 84 bears on the roller 83, Fig. 6, of the U-shaped member 78, whereby this member 78 as well as the pawl 89 are moved anti-clockwise around the shaft 77. During this movement the lug 92 of the pawl 89 engages the lug 93*a* of the clutch lever 40, Fig. 11, and tends to move it in an anti-clockwise direction, whereby the lug 49 of the clutch lever 40 is again thrown into the path of lug 39 of the clutch pawl 33 which is arranged in the driving clutch 20 and thereby causes the driving clutch 20 to be arrested after the second half-turn of 180°, Fig. 17.

The gear 85 also participates in the movement of the driving clutch 20 by means of gear 26. Shortly before the second half-turn of the driving clutch 26 as well as of the gear 85 in the direction of arrow 186 has been completed, the pin 104 of the gear 85 bears on the edge 191 of the lever 99 and tends to move it anti-clockwise against the spring 100. As soon as the pin 104 slides off the edge 192 of the lever 99, this lever 99 is again moved clockwise by the action of the spring 100 and the edge 190 of the lever 99 again comes to lie before the pin 104, Fig. 8.

After the second half-turn of the driving clutch 20 has been completed, the roller 83 of the U-shaped member 78 lies again on the raised part of the cam 84.

During the second half-turn of 180°, Fig. 17, of the driving clutch 20, the pin 141, Figs. 8, 9, 10, 12 and 13, again releases the arm 148 of the U-shaped member 149, Fig. 7*a*, whereby this member 149 is moved clockwise around the shaft 105 by the action of the spring 151.

Simultaneously the pin 156 fastened to the arm 150 of the U-shaped member 149 bears on the edge 157 of the clutch lever 153 and tends to move the latter in clockwise direction around the shaft 105. During this movement, the arm 160 of the clutch lever 153 again comes to lie in the path of the clutch pawl arranged in the tens-shift clutch 21, which causes the tens-shift clutch 21 to be arrested after a turn of 360°, Fig. 17.

During the movement of the U-shaped member 78, Figs. 6 and 11, in an anti-clockwise direction, in which also the shaft 77 participates the U-shaped member 175 is moved anti-clockwise by means of the lever 172, Fig. 6, and the bar 173. Simultaneously the pin 181 releases the bar 68, so that this bar 68 is moved downwards around the pivot 72 by the action of the spring 73. Consequently the member 87 is again placed in position towards the angle piece 65 of the trap 62, whereby the connection between the motor key 4 and the driving clutch 20 has been reestablished.

Shortly before the full turn of the tens-shift clutch 21, Figs. 12 and 13, has been completed, the pin 170 mounted on the gear 167 engages the edge 200 of the lever 168 and moves the latter anti-clockwise against the spring 169. As soon as the pin 170 of the gear 167 has moved past the edge 201 of the lever 168, the lever 168 is moved clockwise by the action of the spring 169 and with its surface 202 bears against the pin 170 of the gear 167, whereby any turning backwards of the tens-shift clutch 21 is prevented by the clutch pawl which is arranged in the ten-shift clutch 21 subjected to the action of a spring.

The apparatus of the present invention has been described in detail with reference to specific embodiments. It is to be understood, however, that the invention is not limited by such specific reference but is broader in scope and capable of other embodiments than those specifically described and illustrated in the drawing.

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