Nov. 14, 1939. O. E. WOLFF 2,179,536

ELECTRIC SYSTEM

Original Filed March 11, 1938 7 Sheets-Sheet 1

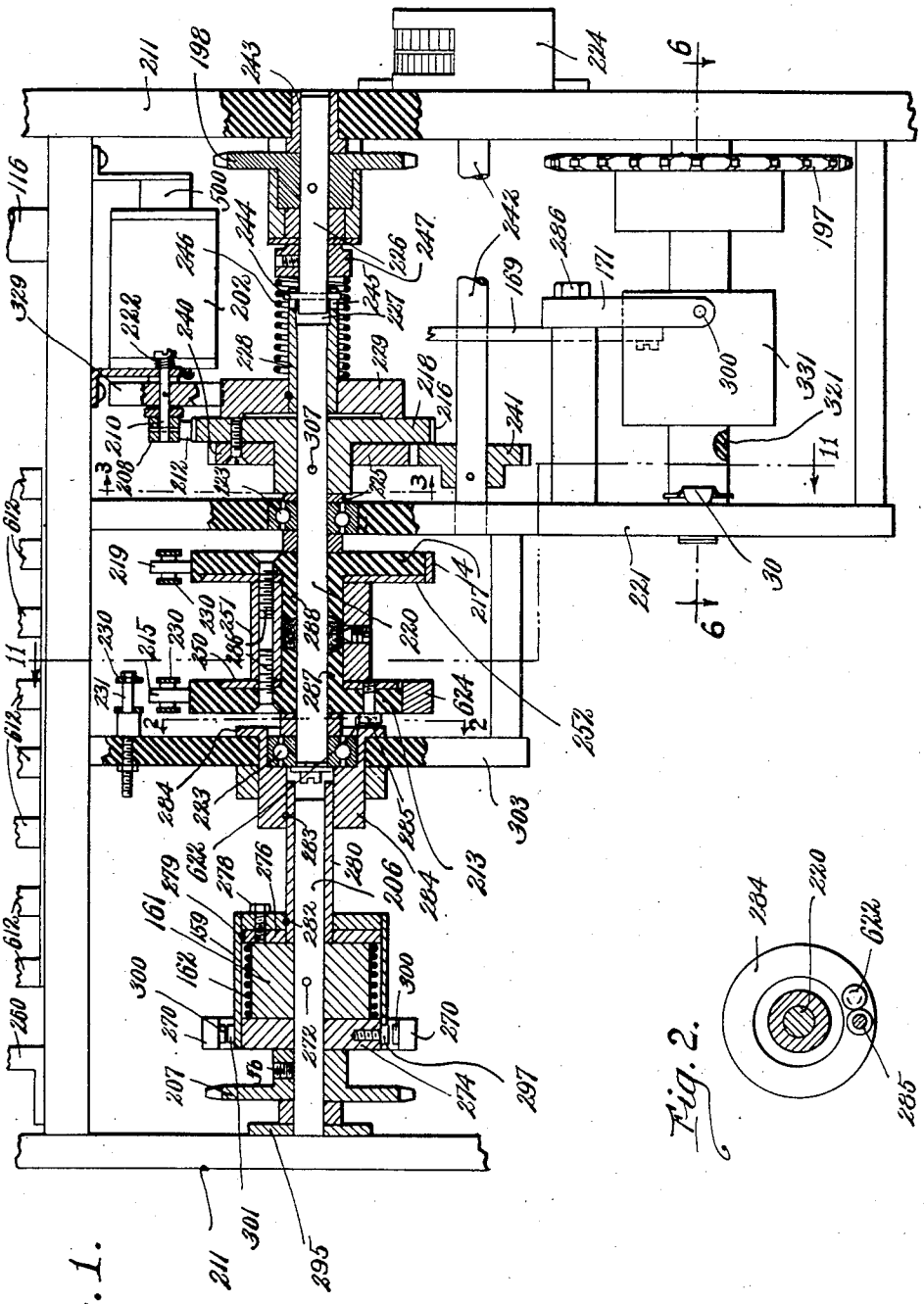


Fig. 1.

Fig. 2.

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Nov. 14, 1939. O. E. WOLFF 2,179,536

ELECTRIC SYSTEM

Original Filed March 11, 1938 7 Sheets-Sheet 2

Fig. 6.

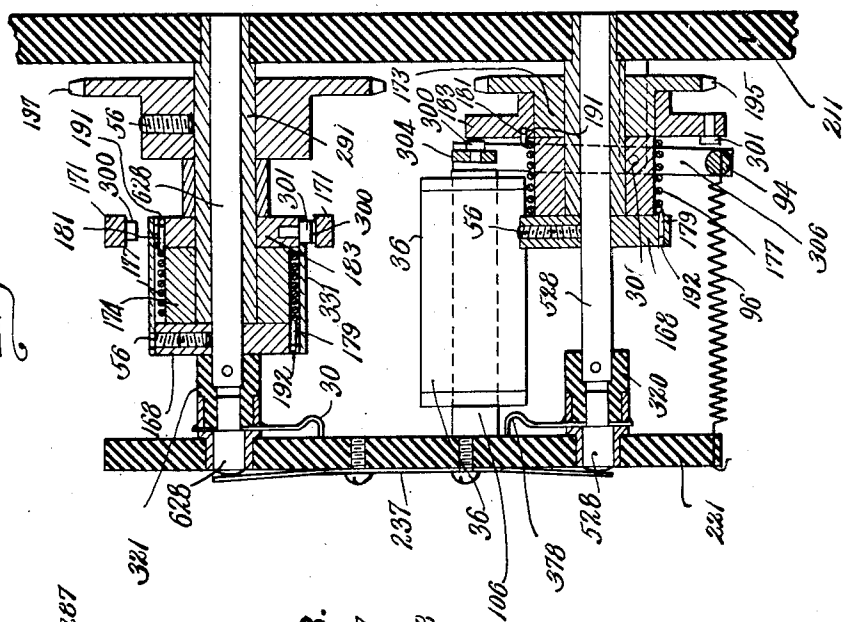


Fig. 5.

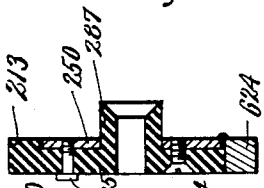


Fig. 8.

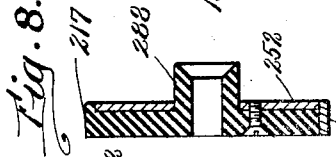


Fig. 4.

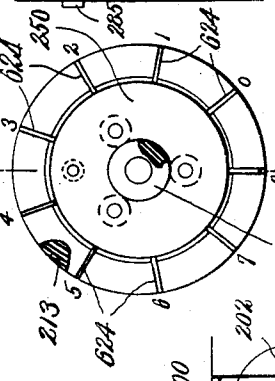


Fig. 7.

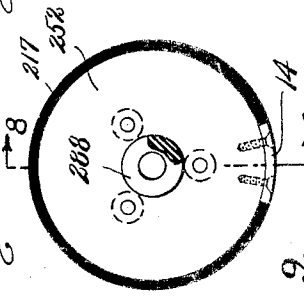


Fig. 9.

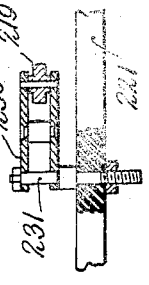
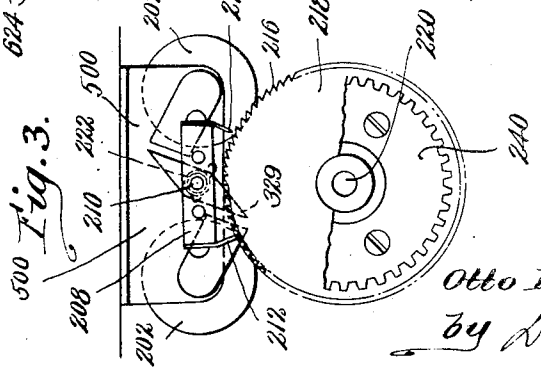


Fig. 3.



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Nov. 14, 1939. O. E. WOLFF 2,179,536

ELECTRIC SYSTEM

Original Filed March 11, 1938 7 Sheets-Sheet 3

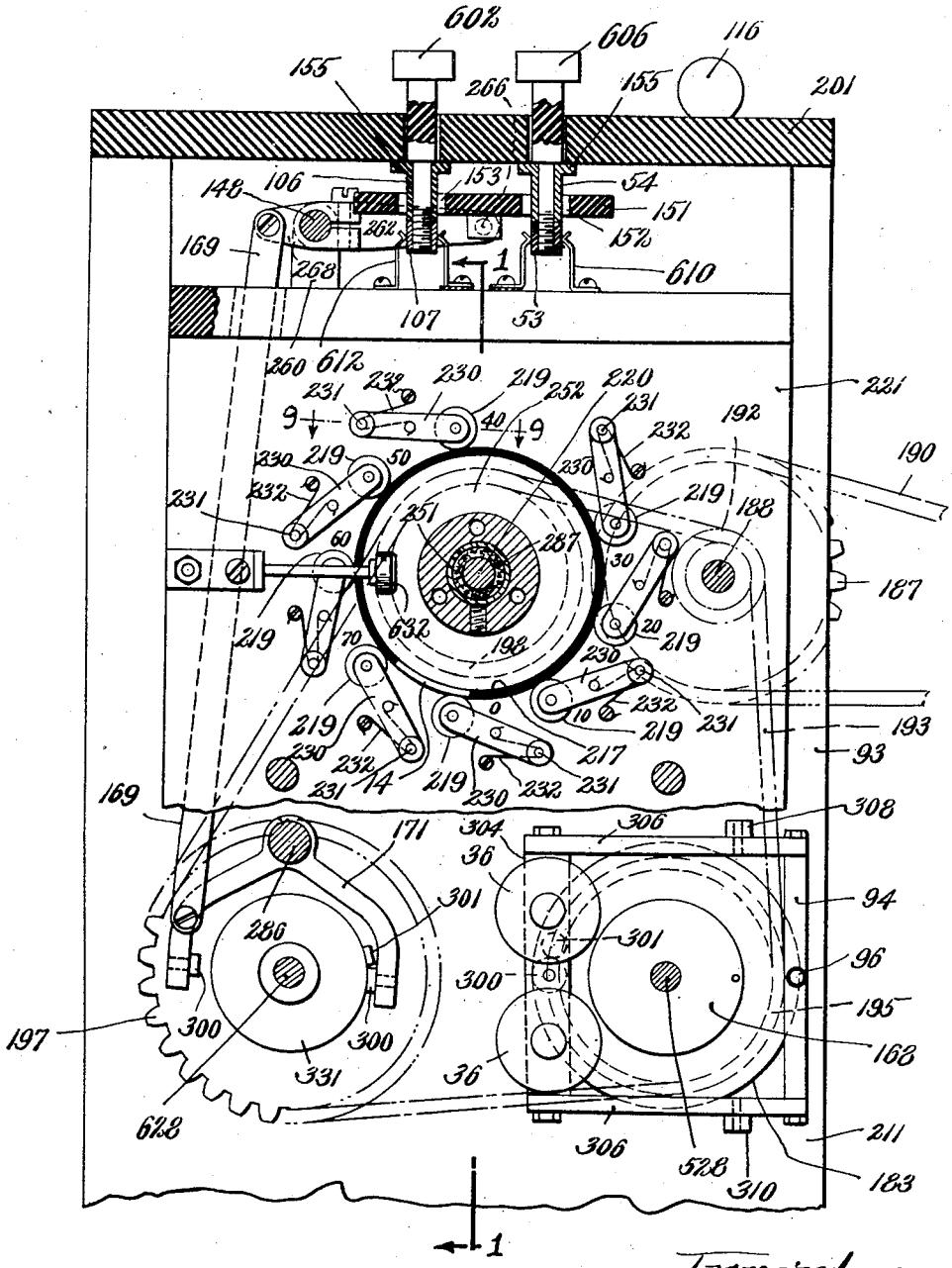


Fig. 10.

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Nov. 14, 1939. O. E. WOLFF 2,179,536

ELECTRIC SYSTEM

Original Filed March 11, 1938 7 Sheets-Sheet 4

Fig. 11.

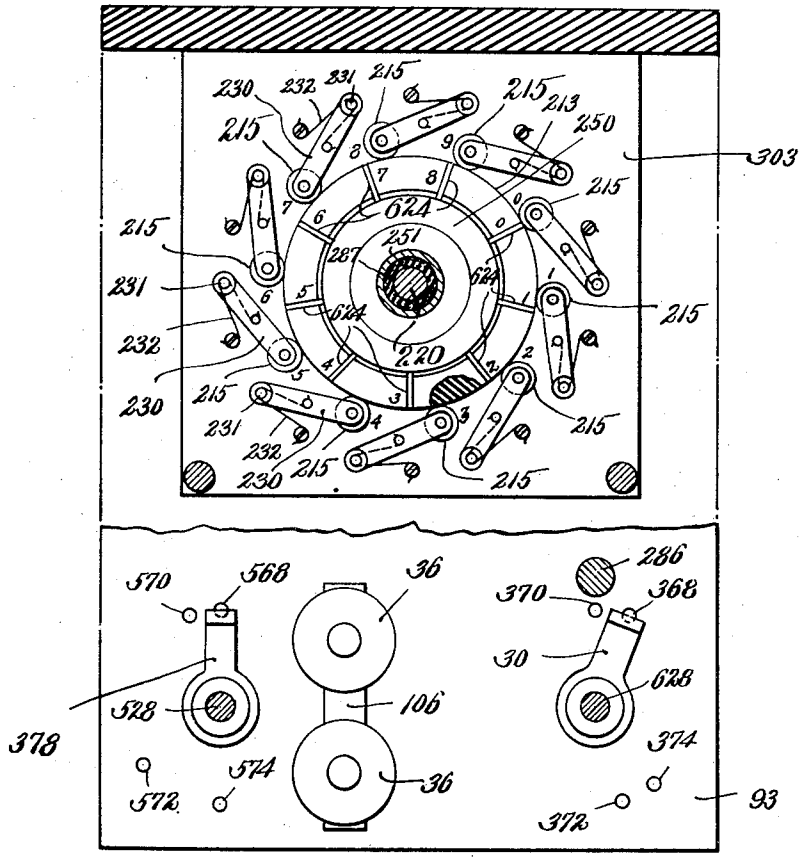


Fig. 12.

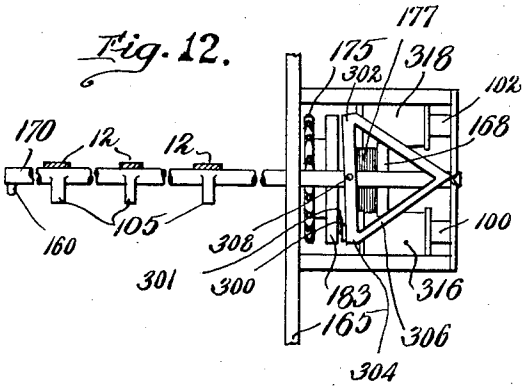
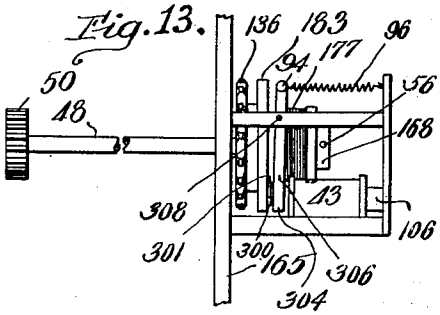


Fig. 13.



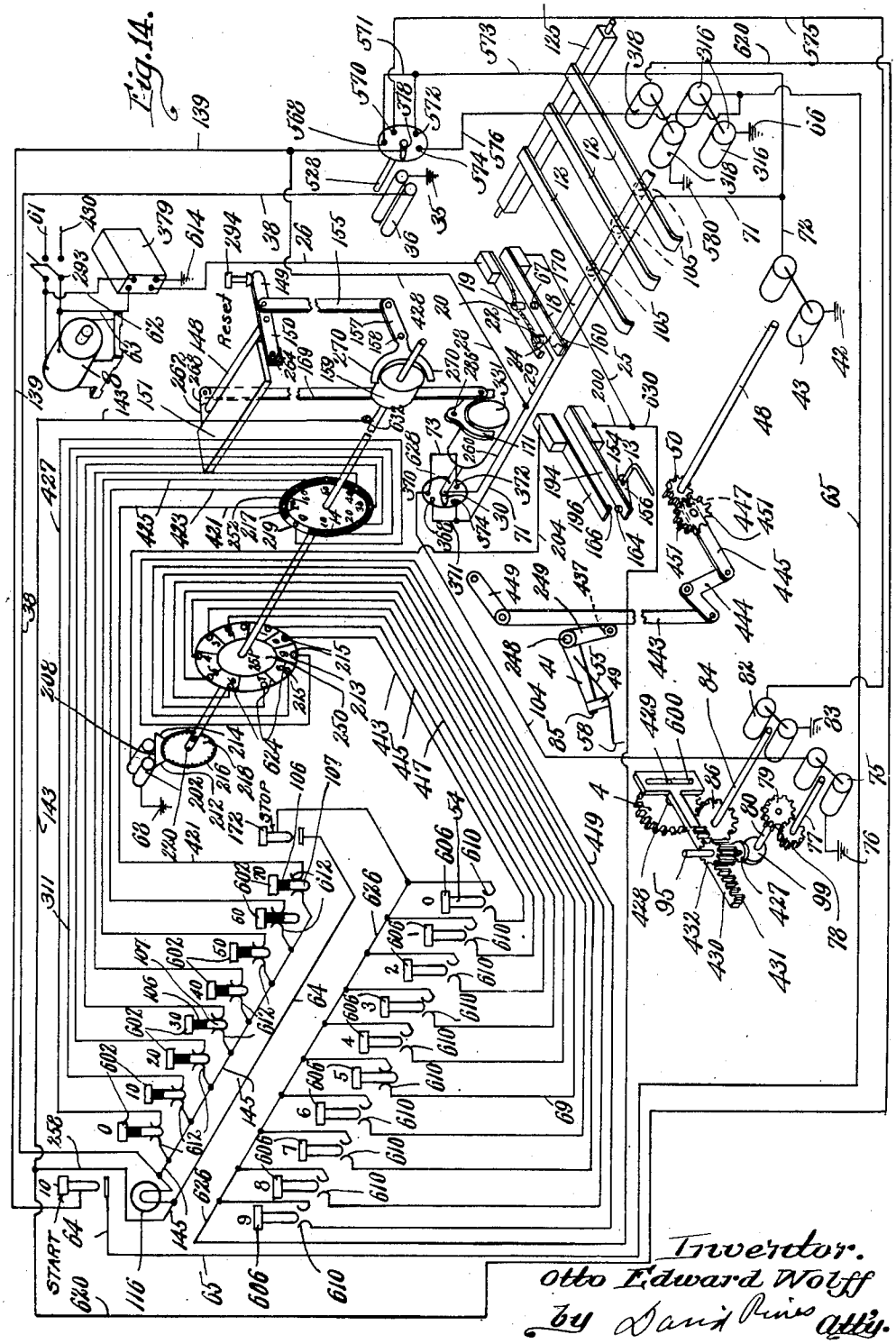
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Nov. 14, 1939. O. E. WOLFF 2,179,536

ELECTRIC SYSTEM

Original Filed March 11, 1938 7 Sheets-Sheet 5

Fig. 14.



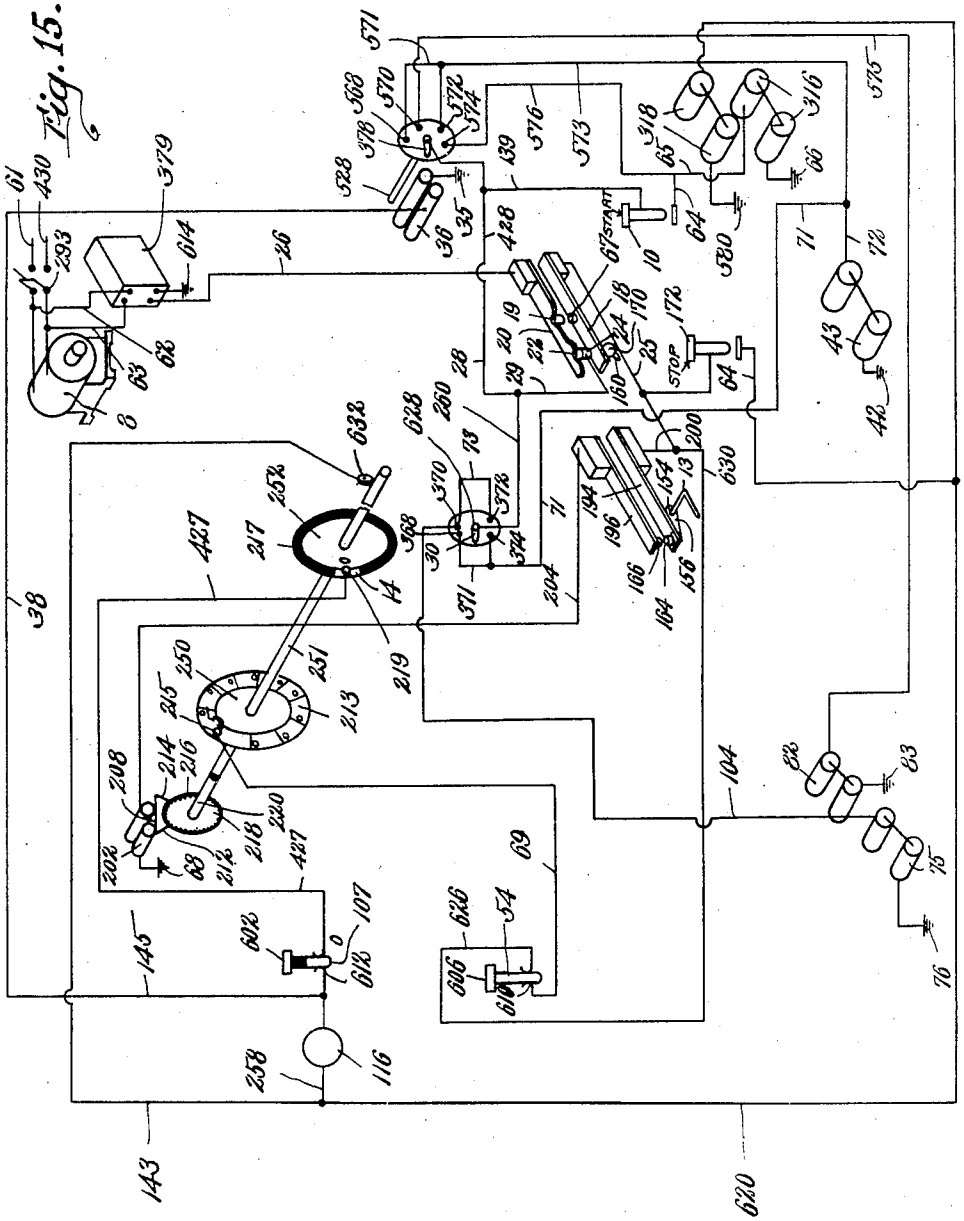
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ELECTRIC SYSTEM

Original Filed March 11, 1938 7 Sheets-Sheet 6

Fig. 15.



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Nov. 14, 1939. O. E. WOLFF 2,179,536

ELECTRIC SYSTEM

Original Filed March 11, 1938 7 Sheets-Sheet 7

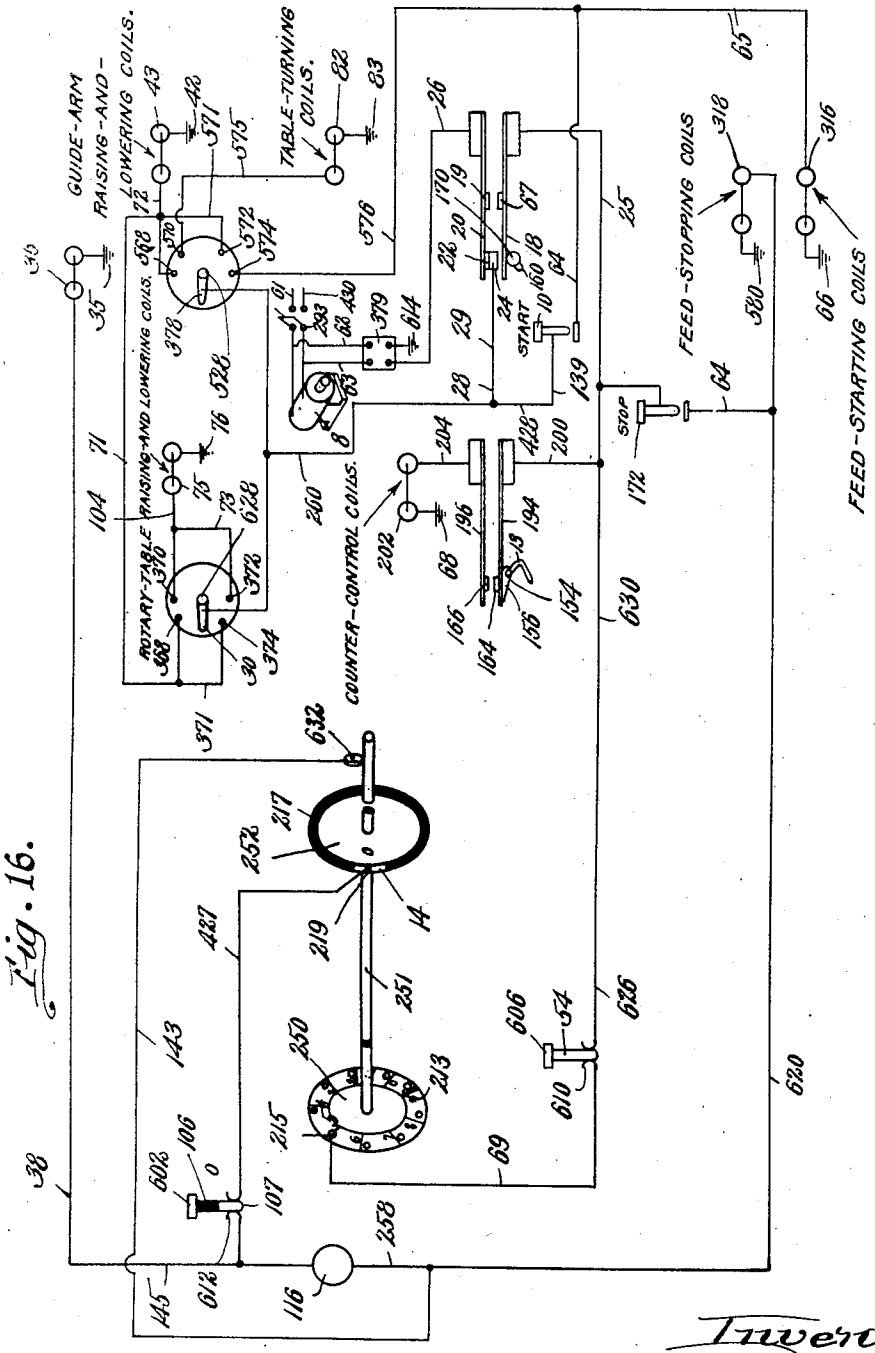


Fig. 16.

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UNITED STATES PATENT OFFICE

2,179,536

ELECTRIC SYSTEM

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Original application March 11, 1938, Serial No. 195,408. Divided and this application April 18, 1938, Serial No. 202,708

30 Claims. (Cl. 171—97)

The present invention relates to electric systems, and more particularly to systems for feeding and stacking sheet material, like newspapers and periodicals. This application is a division of application, Serial No. 195,408, filed March 11, 1938.

An object of the present invention is to provide a new and improved electric system for feeding and stacking sheet material.

A further object is to provide a novel control for an electric system.

Still another object is to provide a novel switch structure.

Other and further objects will be explained hereinafter, and will be particularly pointed out in the appended claims.

The invention will now be described in connection with the accompanying drawings, in which

Fig. 1 is a vertical section of a machine embodying the present invention, in preferred form, the section being taken upon the line 1—1 of Fig. 10, looking in the direction of the arrows;

Fig. 2 is a vertical section taken upon the line 2—2 of Fig. 1, looking in the direction of the arrows;

Fig. 3 is a vertical section taken upon the line 3—3 of Fig. 1, looking in the direction of the arrows;

Fig. 4 is a detail view of the units commutator disc;

Fig. 5 is a section taken upon the line 5—5 of Fig. 4, looking in the direction of the arrows;

Fig. 6 is a horizontal section, taken upon the line 6—6 of Fig. 1, looking in the direction of the arrows;

Fig. 7 is a detail view, similar to Fig. 4, of the tens commutator disc;

Fig. 8 is a section taken upon the line 8—8 of Fig. 7, looking in the direction of the arrows;

Fig. 9 is a section taken upon the line 9—9 of Fig. 10, looking in the direction of the arrows;

Fig. 10 is a vertical section taken approximately upon the line 11—11 of Fig. 1, looking in the direction opposite to the direction of the arrows;

Fig. 11 is a vertical section taken upon the line 11—11 of Fig. 1, looking in the direction of the arrows;

Figs. 12 and 13 are views of details;

Fig. 14 is a circuit diagram; and

Figs. 15 and 16 are circuit diagrams, simplified with respect to Fig. 14.

Many parts of the machine illustrated herein are described briefly, or not at all, because full descriptions thereof will be found in the applicant's United States Letters Patents Nos. 2,132,451, 2,133,259, 2,133,260, 2,133,261, 2,133,262, 2,133,263, 2,133,264 and 2,133,165, granted October 11, 1938, and the said application, Serial No. 195,408, to which reference may be made. One of the side frame plates or walls of the machine is shown in Figs. 12 and 13 at 165, but the controlling mechanisms therefor described herein are contained within a housing 93.

The invention may, for example, be explained in connection with the machine of Letters Patent 2,133,263.

A plurality of newspapers may be placed, in lapped relation, upon inclined continuously traveling conveyor belts, indicated in the said Letters Patent 2,133,263, at 3, by which and other feed mechanism, they are fed forward into a hopper, shown in the said Letters Patent 2,133,263, at 339. At the bottom of this hopper, there are shown in the said Letters Patent 2,133,263 inclined continuously traveling belts 9 that feed the newspapers further forward toward a table, shown in the said Letters Patent 2,133,263, at 91, on which they become accumulated in the form of a stack. During the feeding of the papers out of the said hopper 339, and before they reach the table 91, they are counted. As each newspaper 2 advances forward out of the said hopper 339, its forward edge engages, and passes under, a counting finger, illustrated in Figs. 14 to 16 of the present drawings at 13. The finger 13 is integrally fixed to a horizontally disposed shaft 154, about which it is pivotally actuated toward the left by the traveling newspapers, becoming thus raised, in opposition to the force exerted by a two-way leaf spring 194, above a supporting plate (not shown) upon which the finger 13 normally rests.

The two-way leaf spring 194 carries a contact member 164 that, as illustrated more particularly in the said Figs. 14 to 16, is normally separated from a cooperating contact member 166, carried by a two-way leaf spring 196. The leaf spring 196 is normally biased, so as normally to contact with a limiting stop (not shown). In response to each pivotal raising of the finger 13 by the successive papers, as they travel out of the said hopper 339, a cam 156, that is fixed to the pivotal shaft 154, effects engagement of the contact member 164 with the contact member 166, raising the leaf spring 196 out of contact with the said limiting stop (not shown). The spring 194 continuously engages the cam 156 to force the finger 13 back into contact with its supporting plate (not shown) after each paper has traveled on beyond it, toward the said table 91, illustrated in the said Letters Patent 2,133,263.

Each raising and lowering of the counting finger 13 will result in registering a count, as will be hereinafter explained, to indicate that another newspaper has been conveyed by the said conveyor belts 9 from out of the said hopper 339 and stacked on the said table 91.

As illustrated in Figs. 14 to 16, contact member 164 is connected, through the leaf spring 194, to a conductor 200, and the contact member 166, through the leaf spring 196, to a conductor 204. The contact member 166 is connected, by way of the leaf spring 196 and the conductor 204, to one side of counter-controlling electromagnetic coils 202. The coils 202 are mounted upon a magnet core 500 provided with an armature 329, that is intermediately pivoted at 210, as illustrated more particularly in Figs. 1 and 3. The contact member 164 is similarly connected, by way of the leaf spring 194 and the conductor 200, and by way of other connections that will be described hereinafter, to the other side of the counter-controlling electromagnetic coils 202. The said other connections include a movable contact member 22 on a two-way leaf spring 20 that is normally in engagement with a stationary contact member 24.

The contact member 164 is also connected by the leaf spring 194 and the conductor 200 to a set of ten units push-button switches 606, a set of tens push-button switches 602, and selector commutating discs 213 and 217. The number of paper to be conveyed out of the said hopper 339, and stacked on the said table 91, is predetermined manually by manual adjustment of the proper push-button switch or switches 602 and 606.

At each closing of the contact members 164 and 166, in response to the actuation of the counting finger 13, therefore, the circuit of the counter-controlling electromagnetic coils 202 becomes closed, by way of the conductors 200 and 204 to control the actuation of a counter 218.

The counter 218 is shown as a ratchet wheel provided with slightly offset ratchet teeth 216. This ratchet wheel 218 is fixed to a counter shaft 220, which is connected by gears 240 and 241 and a shaft 242, as shown more particularly in Fig. 1, or any other suitable mechanism, to actuate a dial 224. The shaft 220 is journaled in ball bearings 223 provided in walls 303 and 221 in the housing 93, and extends to the right of the wall 221 as viewed in Fig. 1, toward one of the outer walls 211 of the housing 93. The left-hand ball bearing 223, as viewed in Fig. 1, is mounted in a rotary collared sleeve 284, for a purpose that will appear hereinafter. The collar of the sleeve is disposed at the right of the wall 303, as viewed in Fig. 1, and the body thereof extends through the wall 303, to the left thereof. The counter ratchet wheel 218 is fixed by means of a pin 307 on the extending part of the shaft 220 and is separated from the wall 221 by a shim 225 against which it is thrust by a coil spring 246. The ratchet wheel 218 is shown engaged by a friction-clutch disc 229 to provide a slip-clutch connection between the shaft 220 and a shaft 226 alined therewith. The clutch disc 229 is fixed o a sleeve 228 that is loosely mounted upon the shaft 220 and is constantly driven from a constantly driven sprocket wheel 198 upon the shaft 226. One end of the shaft 226 is journaled in a bearing 243 in one of the frame plates 211, and the other end extends freely into a socket 227 at the free end of the sleeve 228, and is locked to the sleeve 228 by a key 244 fixed to the shaft 226 and extending into a key slot 245 in the said end of the sleeve 228. The spring 246, coiled about the sleeve 228, thrusts against the friction-clutch disc 229 and a collar 247 that is fixed to the shaft 226. The friction-clutch disc 229 is thus yieldingly pressed constantly against the counter wheel 218 to provide a loose connection between the shafts 226 and 220 and to transmit rotative movement to the counter wheel 218 from the constantly driven sprocket wheel 198.

Continuous rotative movement of the counter wheel 218 is, however, prevented by a spring-controlled ratchet double pawl 208 mounted upon the armature 329 so as to be pivoted therewith at 210.

The pawl 208 is provided at its ends, on opposite sides of its pivot 210, with two oppositely acting pawl teeth 212 and 214 for engaging the ratchet teeth 216 of the ratchet counter wheel 218. The tooth 212 of the ratchet pawl 208 is held normally in engagement with a ratchet tooth 216 of the counter wheel 218 by a spring 222 that is mounted about the pivot 210 (Figs 1 and 3). Upon the closing of the circuit of the electromagnetic coils 202 by the contact members 164 and 166, in response to the actuation of the counting finger 13, the armature 329 will be actuated by the energized coils 202 about its pivot 210, clockwise, as viewed in Fig. 3, in opposition to the action of the spring 222. The pawl 208 will be rocked with the armature 329 upon which it is mounted, effecting the separation of the tooth 212 of the ratchet pawl 208 from the said ratchet tooth 216. The tooth 214 is, at the same time, actuated into engagement with another tooth 216. The next moment, the finger 13, as the paper thereunder passes beyond it, will be actuated by the spring 194 to effect the actuation, in the opposite direction, of the cam 156, and the consequent separation of the contact members 164 and 166. This will result in the opening of this circuit of the coils 202. The spring 222 will thereupon rock the pawl 208 in the opposite direction, counter-clockwise, as viewed in Fig. 3, to cause the tooth 214 to release its tooth 216 and the tooth 212 to engage another tooth 216 of the ratchet wheel 218. The pawl 208 is actuated by the armature 329 of the magnet coils 202 and the spring 222 like an ordinary escapement pawl, with its teeth 212 and 214 engaging the teeth 216 of the ratchet wheel 218 alternately. The counter wheel 218 is thus rotated step-by-step from the sprocket wheel 198 through successive angular distances corresponding to one tooth 216 for each paper. Successive movements of the counting wheel 218, tooth by tooth, one tooth at a time, become thus registered on the dial 224, to register a total count corresponding to the papers 2 fed by the conveyor 9 out of the hopper 339.

After leaving the counting finger 13, the papers 2 are fed into the bite between vertically disposed continuously traveling lift belts of a conveyor, shown in the said Letters Patent 2,133,263, at 17 and 21, which feeds the newspapers, as they are received from the said hopper 339, vertically upward.

Each paper is then fed from above the said table 91, at a downward incline, on to the top of the said stack accumulated on the said table 91. During this downwardly inclined feeding, the papers travel over a downwardly inclined guide, shown in the said Letters Patent 2,133,263, at 39, and under downwardly inclined guide arms or members, shown in the said Letters Patent 2,133,263, and in Fig. 14 herein, at 55, toward and against stops, constituted of integrally bent por-

tions 58 of the said guide members 55. The said bent portions 58 project downward, so as to be engaged by the forward edges of the newspapers, thus limiting the further travel of the papers. The newspapers thus become successively deposited on the top of the said stack on the said table 91, each on top of the previously deposited paper, in engagement with the said stops.

As also explained in the said Letters Patent 2,133,263, and as illustrated in Fig. 14 herein, to equalize the pressure exerted by them on the uppermost sheet of the said stack, these two guide members 55 may be separated by a yoke 49 that is pivoted at 85 to an arm 41. The guide members 55 are thus always maintained in proper position for guiding the papers to the top of the stack 89. The upper portion of the said conveyor 21, and related parts, are automatically raised vertically, in accordance with the height of the said stack. This is effected by the impact of the papers, passing under the said guides 55, in opposition to the force of gravity.

Half-revolutions of a collar 168 are effected by clutching the collar 168 to a drum 173 (as shown more particularly in Fig. 6) that is normally mounted loosely on a shaft 170 (Fig. 12) so as to be free to turn thereon. The drum 173 is constantly rotated, at constant speed, from a sprocket gear 175 that is integral therewith. One end 179 of a spring 177, that is wound around the outside of the drum 173, is held in a hole 192 in the collar 168 (as illustrated more particularly in Fig. 6), and the other end 181 is held in a hole 191 of a collar 183 that normally is loosely mounted on the drum 173, so as to turn freely thereon.

When the spring 177 is free to do so, it will, through its own resiliency, engage and wind itself tightly about the constantly rotating drum 173, so as to become tensioned thereagainst, by friction. The spring 177 will thus be caused to rotate with the drum 173, carrying with it the collars 183 and 168, and thereby effecting the rotation of the shaft 170, to which the collar 168 is fixed by the screw 56. The tensioned spring 177 thus effects the clutching of the shaft 170 to the drum 173, so as to become rotated from the sprocket wheel 175.

More than a half-revolution of the shaft 170 is prevented by the lug 301 on the collar 183, during its rotation in its circular path about the axis of rotation of the drum 173, coming into engagement with the lug 300 of the upper armature 302 or the lower armature 304, as the case may be. The rotation of the collar 183 will thus become interrupted, and the end 181 of the spring 177 will be held back from further rotation. This will effect a partial unwinding of the spring 177 from its frictional engagement with the drum 173, so as to render it loose again upon the drum 173. The drum 173 will continue to rotate, but the collar 168 and the shaft 170 secured thereto will have become unclutched therefrom.

The lugs 300 of the armatures 302 and 304 thus operate in alternation, to interrupt the rotation of the shaft 170 at the end of each half-revolution thereof. In response to the successive closings of the circuits of the upper and the lower electromagnetic coils 318 and 316, respectively provided with cores 100 and 102, therefore, the shaft 170 becomes rotated through successive half-revolutions to effect intermittent actuation of a table 12, up and down, into its two effective and ineffective positions, and to control the contact members 67 and 19 and the contact members 22 and 24.

The circuit of the coils 316 becomes closed to start the feed at the beginning of each cycle of operation, and the circuit of the coils 318 becomes closed to stop the feed at the end of each cycle of operation, under the control of the commutating discs 213 and 217 of the selector and the push-button switches 606 and 602. A shaft 528, on which the master switch 378 is mounted, is set into operation at the end of each cycle of operation by the closing of the circuit of electromagnetic coils 36. The final half-revolution of the shaft 170, for effecting the final raising of the table 12, to stop the further operation of the machine, is effected by closing the circuits of the electromagnetic coils 318 through the medium of the master switch 30. A shaft 628, on which the master switch 30 is mounted, may be set into operation by means of a clutch mechanism of the above-described character; not, however, under the control of electromagnetic coils, but mechanically, under the control of a reset push-button 294, as hereinafter described. The operation of the reset push-button 294 results also in actuating a similar clutch for returning the selector commutating discs 213 and 217 and related parts to their initial positions, as more fully described hereinafter. The shafts 528 and 628 of the respective master switches 378 and 30 are shown in Fig. 6 bridged by a leaf spring 237, and they are insulated from each other by separating collars 320 and 321.

Shafts 48 (Figs. 13 and 14), 77 (Fig. 14), 84 (Fig. 14) and 528 (Figs. 6, 10 and 14) are provided with continuously rotating sprocket gears for rotating them intermittently, through the medium of a drum 173 integral therewith, in the same way that the sprocket gear 175 rotates the shaft 170. The driving sprocket gears for the shafts 48 and 528 are shown at 136 and 195, but those for the shafts 77 and 84 are not shown herein, though they are illustrated in the said application, Serial No. 195,408, at 132 and 257, respectively. These shafts 48, 77, 84 and 528, unlike the shaft 170, are actuated through complete revolutions, instead of through only half-revolutions, at each engagement of the lugs 301 of the collars 183 by the lugs 300 of the respective armatures 304. The two sets of electromagnetic coils 316 and 318 are, therefore, replaced by only a single set of coils 43 (Fig. 13), 75, 82 and 36 (Figs. 6 and 10), respectively, mounted upon a core 106, and provided with but a single armature 304. The relation of these coils to their respective shafts is shown diagrammatically in Fig. 6. A biasing spring 96, attached to a bar or other support 94, positioned opposite to the armature 304 on the yoke 306, normally maintains the yoke 306 and the armature 304 thereon in the position illustrated, for example, in Figs. 6 and 13, so that the lug 301 normally engages the lug 300 of the armature 304. In other respects, the operation is substantially the same as described above and in the said application, Serial No. 195,408.

As is further explained in the said application, Serial No. 195,408, any desired number of groups of ten, twenty-five, fifty, etc. papers may be stacked on the said table, with semi-rotations of the said table between the stacking of the successive groups. The said table 91 is turned by rotating a vertically disposed shaft 95 (Fig. 14) upon which it is mounted. Half-rotations of the shaft 95 are effected, in timed relation to the

operations above described, by means of a rack 431 that meshes with a gear 432 secured to the shaft 95. The rack 431 is provided upon a horizontally disposed bar 430 that is slidably actuated horizontally, first to the right, and then to the left, as viewed in Figs. 1 and 14. The slidable actuation of the bar 430 is effected by means of a crank pin 429 disposed in a slot 609 provided at one end of the bar 430. The crank pin 429 is mounted upon a gear 4 secured to the shaft 428. The shaft 428 is driven by a gear 86 on the shaft 84 that is controlled by the electromagnetic coils 82. The gearing is so designed that, corresponding to a half-revolution of the shaft 428, the shaft 95 shall be turned through a half-revolution; and when the shaft 428 is turned a further half-revolution to its original position, the shaft 95 shall likewise be turned a further half-revolution to its original position. These half-revolutions are effected at the end of the feeding of the papers in groups of ten, or any other desired number.

To effect the raising and lowering of the guide members 55, they are rendered pivotally movable upward in substantially vertical planes, about a pivot 248, in opposition to the action of a spring, not shown herein, but illustrated in the drawings of the said application, Serial No. 195,408, at 419. This may be effected in any desired manner, as by moving a vertically disposed link 443 toward the left, as viewed in Fig. 14, into engagement with a pin 437 mounted upon an arm 249 that is fixed to the arm 41. A bell-crank lever 444 is actuated by means of a link 445 from a crank pin 447 on a gear 451.

These operations, commencing with the raising of the guide members 55, are synchronized by the master switch 378, in the course of one complete revolution thereof, brought about by clutching the shaft 528 to the constantly rotating gear 195. In the course of this complete revolution, the master switch 378 is caused to engage successively contact members 568, 570, 572 and 574.

The contact members 568 and 572 are connected together by a conductor 571 that is connected, in turn, to a conductor 573 that leads, by way of a conductor 72, to the coils 43 for actuating the shaft 48 to raise and lower the guide members 55. The contact member 570 is similarly connected, by a conductor 575, to the coils 82 for actuating the shaft 84 to turn the said table 91 through half-revolutions. The contact member 574 is connected, by a conductor 576, to the electromagnetic coils 316 for lowering of the table 12 to restart the feeding of the papers 2 out of the said hopper 339. The engagement between the master switch 378 and the contact members 568, 570, 572 and 574 need be but momentary. As soon as the master switch 378 moves out of engagement with contact members 568 and 572, respectively, for example, the coils 43 become deenergized, and the spring 96 returns the armature 304 to its normal position.

At the end of the counting of the predetermined number of papers desired to be stacked for any particular dealer, and their accumulation in the said stack, the said stack is removed from the said table 91. To this end, the said table 91 is constituted of a frame comprising parallel horizontally disposed slats alternating in position with the positions of similarly disposed elongated rolls, illustrated in the said Letters Patent 2,133,263, at 523.

The said table 91 is raised and lowered by effecting successive half-revolutions of a cam 99 on a shaft 80 in response to actuation of the clutch controlled by the electromagnetic coils 75 for actuating the shaft 77 (Fig. 14). A gear 78 on the shaft 77 drives a gear 79 on the shaft 80. The diameter of the gear 78 is half that of the gear 79, in order that the cam 99 shall be actuated through successive half-revolutions in response to complete revolutions of the shaft 77. A cam follower 427 disposed at the lower end of the table shaft 95 follows the cam 99 downward in engagement therewith, carrying the said table with it. A further half-revolution of the shaft 80 results in restoring the cam 99 and, therefore, the said table, to their normal positions. The face of the gear 432 is wide enough so as to remain in mesh with the rack 431 both when the said table is in its uppermost and its lowermost positions.

To effect removal of the stack of sheets, the table 91 is lowered below the said continuously rotating rolls 523, with its said slats into the spaces between these rolls. The lowering of the said table effects the lowering of the stack of papers into contact with the said rolls 523. The stack becomes thereupon moved by the rolls 523 off the said table.

The contact members 368 and 374 of the master switch 30 are connected together, by a conductor 371, to a conductor 71, that is connected by the conductor 72 to the coils 43; and the contact members 370 and 372 are connected together, by a conductor 73, to a conductor 104 that is connected to the coils 75. The engagement of the master switch 30 with the respective contact members 368, 370, 372 and 374 need be but momentary, the same as the engagement of the master switch 378 with the contact members 568, 570, 572 and 574.

The commutating discs 213 and 217 of the selector are both constituted of insulating material, and are respectively provided with tubular projections 287 and 288, as illustrated more particularly in Figs. 1 and 4 to 8 (the showing of Figs. 14 to 16 is more diagrammatic), that extend oppositely to each other into a conducting sleeve 251. The discs 213 and 217 are respectively further provided with centrally disposed conducting annuli 250 and 252, that are disposed opposite to each other in electrical contact with the ends of the conducting sleeve 251, the parts being joined together into a unitary spool by screws 286. This spool is disposed between the walls 221 and 303, and the counting shaft 220 extends through the insulating tubular projections 287 and 288 thereof, so as to be insulated from the conducting sleeve 251 and the conducting annuli 250 and 252. A roll 632 (Figs. 10 and 14 to 16), that is in continuous engagement with the annulus 252, serves as a brush contact member. The counting shaft 220 engages frictionally against the interior walls of the tubular projections tightly enough to transmit the step-by-step rotary movement of the counting shaft 220 to the spool. This frictional engagement is loose enough, however, to permit rotatable adjustment of the spool about the shaft 220 to its initial position upon the completion of the stacking of each stack of papers on the said table. As hereinafter described, this return of the spool to its initial position is effected in response to manipulation of the reset push-button 294. The spool is thus rotated step by step, from the constantly rotating sprocket gear 198, under the control of the ratchet wheel 218 and the escapement pawl 208, but is reset periodically to its initial

position before the commencement of the stacking of each new stack.

The commutating disc 213 constitutes a units-counter control, and the commutating disc 217 constitutes a tens-counter control. The disc 213 may, therefore, be referred to as the units disc and the disc 217 as the tens disc. It will now be explained how these discs control the circuits of the electromagnetic coils 316, 318, 43, 75, 82 and 36 and the consequent operation of the respective shafts 170, 48, 77, 84 and 528, so as to actuate the cams 105 for controlling the position of the table 12 and the feed of the papers out of the said hopper, the raising and lowering of the guide members 55, the turning and the lowering and raising of the said table, and the actuation of the master switch 378.

The units commutating disc 213 is associated with an assemblage constituted of a group of nine substantially equally spaced segmental contact members 624, electrically connected to the centrally disposed annulus 250. The segmental contact members 624 are marked in Figs. 4 and 11 with the nine units numbers 0, 1, 2, 3, 4, 5, 6, 7 and 8. As the said spool is rotated with the shaft 220, step by step, as before described, these segmental contact members 624 will cooperatively engage successively an assemblage constituted of a group of ten substantially equally spaced units contact members 215 circumferentially associated with the disc 213. They are marked, in Figs. 1 and 14, with the ten units numbers 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 respectively. The contact members 215 are respectively connected by wire conductors, as shown in Fig. 14, and as hereinafter described, with the set of ten units push-button switches 606, corresponding to the ten units numbers 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9, and correspondingly marked in Fig. 14. Corresponding openings 152 in a plate 151 into which they extend may be similarly marked on the plate. The two relatively actuable assemblages of contact members 624 and 215 both extend over substantially the same distance, along the circumference of the units commutating disc 213. Any number of these units push-button switches 606 may, of course, be employed, cooperating with a correspondingly designed units commutating disc 213.

Because there are ten units contact members 215, and only nine cooperating segmental contact members 624, they may be so disposed that, as the shaft 220 is rotated, step by step, by the constantly driven sprocket gear 198, the contact members 215 shall engage singly and successively the segmental contact members 624. The spacing of the contact members 624 and 215 is so related to the step-by-step actuation of the shaft 220 and the commutating disc 213 driven thereby that one contact member 215 always engages one and one only of the segmental contact members 624.

The order in which the segmental contact members 624 engage the contact members 215 will now be described in connection with Fig. 11. It should be noted that, in this Fig. 11, the disc 213 is shown from the side opposite to that shown in Fig. 14. It will be assumed that the shaft 220 is rotated past the contact members 215 anti-clockwise, as viewed in Fig. 11 (or clockwise, as viewed in Fig. 14).

In the first or initial position of the units commutating disc 213, the first segmental contact member 624, marked 0, is alone shown in Fig. 11 engaging the first contact member 215, which is also marked 0. At the end of one count, the first segmental contact member 624 marked 0 will have been moved anti-clockwise, as viewed in Fig. 11, out of engagement with the contact member 215 marked 0, and the second segmental contact member 624, marked 1, will have been moved anti-clockwise into engagement with the second contact member 215, marked 1, which will alone, at this time, engage a segmental contact member 624. At the end of two counts, the second segmental contact member 624, marked 1, will have been moved anti-clockwise out of engagement with the second contact member 215 marked 1, and the third segmental contact member 624, marked 2, will have been moved anti-clockwise into engagement with the third contact member 215, marked 2, which will alone, at this time, engage a segmental contact member 624. At the end of three counts, the fourth segmental contact member 624, marked 3, will alone engage a contact member 215, which will be the fourth, marked 3. The fifth, sixth, seventh, eighth and ninth segmental contact members 624, respectively marked 4, 5, 6, 7 and 8, will, similarly, singly and successively, alone engage the fifth, sixth, seventh, eighth and ninth contact members 215, respectively marked 4, 5, 6, 7 and 8. In the course of the first eight step-by-step actuations of the counting shaft 220, corresponding to the first eight counts of the counting ratchet wheel 218, therefore, the eighth segmental contact members 624 marked 1 to 8, will, in that order, successively and singly engage the successively disposed eight contact members 215 marked 1 to 8. At the ninth count, the ninth segmental contact member 624, marked 8, will have been moved anti-clockwise out of engagement with the ninth contact member 215, marked 8, and the first segmental contact member 624, marked 0, will have been moved into engagement with the tenth contact member 215, marked 9. At the tenth count, the first segmental contact member 624, marked 0, will have been moved anti-clockwise out of engagement with the tenth contact member 215, marked 9, and the second segmental contact member 624, marked 1, will have been moved anti-clockwise into engagement with the first contact member 215, marked 0, which will alone, at this time, engage a segmental contact member 624. The position will then be the same as shown in Fig. 11, except that the second segmental contact member 624, marked 1, will now be in engagement with the first contact member 215, marked 0; and this will again be the only segmental contact member 624 in engagement with any contact member 215.

During these first ten step-by-step actuations of the shaft 220, therefore, the commutating disc 213 will have been actuated through an angular distance corresponding to that between two successive segmental contact members 624. The operation is obviously similar to that of a vernier.

During the next nine step-by-step actuations of the shaft 220, the operation above described will be repeated. The segmental contact members 624, marked 2, 3, 4, 5, 6, 7, 8, 0, 1, will successively and singly engage the contact members 215 marked 1, 2, 3, 4, 5, 6, 7, 8, 9. At the twentieth count, the segmental contact member marked 2 will be moved into engagement with the first contact member 215 marked 0.

During the next ten counts, this operation will again be repeated, until the fourth segmental contact member 624, marked 3, will be moved

into engagement with the first contact member 215, marked 0.

At the fortieth count, the fifth segmental contact member 624, marked 4, will be moved into engagement with the first contact member 215 marked 0; at the fiftieth count, the sixth segmental contact member 624, marked 5, will be moved into engagement with the first contact member 215 marked 0; etc. At the eightieth count, if the operation were to proceed that far, the ninth segmental contact member 624, marked 8, would be moved into engagement with the first contact member 215, marked 0.

With the arrangement illustrated, and with only eight tens push-button switches 602, as also illustrated, it is not possible to count to any greater number because of the action of the lugs 205 and 622 (Figs. 1 and 2), the function of which, as hereinafter described, is to reset the commutating discs 213 and 217 and the spool of which they constitute a part. The apparatus can, however, easily be adapted to the counting of any desired number of papers stacked, and other means than the lugs 205 and 622 can be provided for resetting the commutating disc spool. It can even be reset by hand.

The tens commutating disc 217 is provided with but a single segmental contact member 14, electrically connected to the centrally disposed annulus 252 and, therefore, through the sleeve 251, to the annulus 250 and the group of segmental contact members 624. During the step-by-step rotation of the before-mentioned sleeve by the counter shaft 220, the contact member 14 will be rotated in synchronism with the segmental contact members 624 successively to engage cooperatively a group of any desired number, usually ten, of substantially equally spaced tens or other multiple contact members 219 circumferentially associated with the disc 217. The contact members 14 and 219, like the contact members 624 and 215, may be regarded as constituting two relatively actuable assemblages, one of the assemblages comprising only the single contact member 14.

The contact members 215 and 219 are shown in the form of rolls, each freely movable pivotally, as shown more particularly in Fig. 9, about a pin at one end of an arm 230, the other end of which is pivoted about a pivot member 231 that extends through the wall 221 or 303. The arms 230 are spring-pressed, each by means of a spring 232, so as to provide yielding engagement between the contact rolls 215 and 219 and the peripheries of the discs 213 and 217, respectively. Firm contact is thus obtained between the contact members 215 and 219 and their corresponding commutating discs 213 and 217, with a minimum of friction.

The provision of ten units contact members 215 and ten tens contact members 219 will provide for counting up to one hundred papers. Additional sets of ten contact members each will usually be provided to enable counting to hundreds, thousands, etc., thus to provide for the counting and stacking of any number of papers.

For simplicity, however, only eight contact members 219 are illustrated, respectively connected by wire conductors, as shown in Fig. 14, and as hereinafter described, with the set of eight tens push-button switches 602.

The tens push-button switches 602 are marked in Fig. 14 with the tens numbers 0, 10, 20, 30, 40, 50, 60 and 70, respectively. Corresponding openings 153 in the plate 151 into which they extend may be similarly marked on the said plate. Corresponding markings are placed opposite to the contact members 219 of Fig. 10, and upon the disc 217 in Fig. 14. In Fig. 14, the tens push-button switches 602 are shown positioned in reverse order to the actual positions on the machine, in order to simplify the showing of the circuit connections.

In cooperation with the assemblages of contact members 215 and 219, and the assemblages of contact members 624 and 14, the set of tens push-button switches 602 controls the total tens, and the set of units push-button switches 606 the total units, of the total count, and together they control the total number, of the papers accumulated in the stack 89. With this arrangement, as stated, therefore, by suitable combinations of the tens push-button switches 602 and the units push-button switches 606, it is possible to count and accumulate in the stack 89 up to eighty papers.

The contact member 14 is just large enough so that one end of it becomes actuated into engagement with one of the contact members 219 when its other end is actuated out of engagement with the next-preceding contact member 219. Initially, the tens commutating disc 217 occupies a position such that the contact member 14 engages the contact member 219 marked 0, as illustrated in Fig. 10. In the course of the first ten step-by-step actuations of the counter shaft 220, while the successive segmental contact members 624 engage successively the successively positioned contact members 215, as before described, the contact member 14 will remain in engagement with only that one contact member 219, marked 0 in Fig. 10. At the eleventh count, when the segmental contact member 624 marked 2 engages the contact member 215 marked 1, as before described, the contact member 14 will be actuated from the contact member 219 marked 0 to the next contact member 219, marked 10. In the course of the next ten step-by-step actuations of the shaft 220, during which the successive segmental contact members 624 will again engage successively the successively positioned contact members 215, as before described, the contact member 14 will remain in engagement with the one contact member 219 marked 10. During the next ten step-by-step actuations of the shaft 220, the contact member 14 will similarly remain in engagement with the third contact member 219, marked 20; and so on. In all cases, the contact member 14 remains in engagement with one contact member 219 only throughout the ten step-by-step actuations of the counter shaft 220 corresponding to the ten single and successive engagements of the contact members 215 and 624, before moving into engagement with the next contact member 219.

The push-button switches 602 and 606 extend through openings in the fixed cover plate 201 of the housing 93 and also through the openings 152 and 153 alined therewith in the pivoted plate 151 therebelow. They are normally maintained raised in suitable jacks; the units switches 606 in jacks 610 and the tens switches 602 in jacks 612. One of the arms of each jack 610 is connected to a conductor 626, and the other arms are connected by hereinafter-described wire conductors to the respective contact members 215. One of the arms of each jack 612 is similarly connected to a conductor 145, and the

other arms by hereinafter-described wire conductors to the respective contact members 219.

In their raised positions, as illustrated more particularly in Fig. 10, the units push-button switches 606 are normally insulated from their respective jacks 610, so as to be normally ineffective, and the tens switches 602 are normally effective, so as cooperatively to establish electrical contact with their respective jacks 612. The push-button switches may, however, be depressed to their lowered positions, in which the units switches 606 become cooperatively effective to establish electrical contact with their respective jacks 612, and the tens switches 602 become ineffective, so as to break connection with their respective jacks 612. To this end, the units switches 606 are provided with upper conducting sleeves or collars 54 and lower insulating sleeves or collars 53 and the tens switches 602 are provided with upper insulating sleeves or collars 106 and with lower conducting sleeves or collars 107. In its raised position, therefore, each units switch 606 prevents any flow of current between the arms of its jack 610 because of the insulating collar or sleeve 53 interposed between them; in its lowered position, however, each units switch 606 bridges the arms of the jack 610 through the medium of the conducting collar 54. Each tens switch 602, on the other hand, in its raised position, bridges the arms of its jack 612 to establish electrical contact between them; and, in its lowered position, each tens switch 602 insulates the arms of these jacks 612, by means of the conducting sleeves 106, to prevent the flow of current between them.

By reason of this arrangement, as will hereinafter appear, one of the units push-button switches 606 in its lowered position, and all except one of the tens push-button switches 602, in their raised positions, control the stacking of a corresponding number of papers.

If, for purposes of illustration, it may be assumed that it is desired to stack sixty-five papers, the units push-button switch 606 marked 5 and the tens push-button switch 602 marked 60 will both be depressed in their respective jacks 610 and 612, the remaining push-button switches 602 and 606 remaining raised. The depressed push-button switches will control suitable electric circuits for effecting the feeding out of the hopper 339 and the counting of the desired number of papers and their stacking on the said table; in this case, sixty five.

The reset push-button 294 is disposed above one end of a lever 149 that is fixed to a shaft 148 so as to extend to one side thereof, as viewed in Fig. 14. Upon the reset push-button 294 becoming depressed, the lever 149 will be pivotally actuated clockwise, as viewed in Fig. 14, effecting a corresponding rocking movement of the shaft 148 in bearings 260. Two levers 150 and 262 are secured to the shaft 148 so as to extend to the left thereof, as viewed in Figs. 18 and 19, in a direction opposite to the direction of extension of the lever 149. Rods 264 (Fig. 14) and 266 (Fig. 10) that are secured to the underside of the plate 151 are rockably mounted in bearings in the respective levers 150 and 262. The rocking movement of the shaft 148 transmitted thereto by the reset push-button 294 will, therefore, be communicated to the levers 150 and 262 and, from them, to the plate 151. The plate 151 will thereupon become raised upward, causing the walls of the openings 152 and 153 to be actuated into engagement with collars 155 provided upon the push-button switches 602 and 606 to raise these push-button switches up into their original undepressed positions.

Two further levers, one of which is shown at 268, and the other of which is shown in the drawings of the said application, Serial No. 195,408, at 205, are secured to the shaft 148. The lever 268 is connected by a link 169 to a forked arm 171 that is pivoted at 286. The lever 205 is connected by a link 155 (Fig. 14) to a forked member 157 that is intermediately pivoted about a horizontally disposed rod 158. The rod 158 is held in a plate 295 (Fig. 1) that is mounted on the frame of the housing 93, and a sleeve (not shown) that is integral with the lever 157 is mounted to turn freely thereon. Actuation of the lever 149 by the reset push-button 294 will thus rock the shaft 148 pivotally to actuate these links 155 and 169. The arm 171 and the arms 270 of the forked member 157 are provided with lugs 300, similar to the lugs 300 before described.

The lugs 300 of the arm 171 cooperate with a lug 301, similar to the lug 301 before described, on a cylindrical housing 331. The housing 331 is secured to the collar 168 that is fixed to the shaft 628 of the master switch 30 by the screw 56, as illustrated more particularly in Fig. 6. The coiled spring 177 is wound about a drum 174, similar to the drum 173, and is adapted to become tightened to clutch the shaft 628 to the constantly rotating gear 197. The gear 197 is fixed by one of the screws 56 to a sleeve 291 that is mounted loosely about the shaft 628. The end 179 of the spring 177 is held in the hole 192 of the collar 168 and the other end 181 is held in the hole 191 of the collar 183, that is free to rotate about the sleeve 291. When either lug 300 of the forked arm 171 is engaged by the lug 301 of the housing 331, therefore, the spring 177 will be unclutched from the drum 174, and the sleeve 291 will alone be constantly driven by the sprocket gear 197.

The normal position of the parts is illustrated in Fig. 10. Upon the depression of the reset push-button 294, the link 169 will actuate the forked member 171 out of its normal position, releasing the lug 301 of the forked arm 171 from engagement with the right-hand lug 300 of the housing 331, and actuating the left-hand lug into the path of rotation of the lug 301. The spring 177 will thereupon clutch the collars 183 and 168 and the shaft 628 of the master switch 30 to the constantly rotating sleeve 291, until this lug 301 becomes engaged by the left-hand lug 300 of the housing 331, at the end of a half-revolution. Upon the release of the push-button 294, the forked arm 171 with its lugs 300 will become restored, by gravity, to their normal positions, completing the revolution of the shaft 628. During the time that the reset push-button 294 is depressed, the master switch 30 will engage, in succession, the contact members 368 and 370 to effect the raising of the guide members 55 and the lowering of the said table, to remove the said stack by means of the said rolls 523. Upon the release of the push-button 294, the master switch 30 will successively engage also the contact members 372 and 374 to restore the said table to its raised position and to relower the guide members 55 to their original position.

The lugs 300 on the arms 270 of the forked member 157 cooperate with a lug 301 on a cylindrical housing 159, mounted upon a shaft 206 that is alined with, and loosely connected to, the shaft 220, as shown more particularly in Fig. 1.

A drum 161 and a spring 162 inside the housing 159 cooperate in the same way as the drum 173 and the spring 177. The upper lug 300 of the forked member 157 is actuated out of engagement with the lug 301 of the housing 159 by depression of the reset push-button 294 (Fig 1). A sprocket gear 207 is fixed to the shaft 206 by one of the screws 56, so as to be constantly rotated thereby. The sprocket gear 207, in turn, is actuated by a sprocket chain 163 that is driven from a sprocket wheel 290 on the shaft 160. The drum 161 is fixed to the shaft 206 by a pin 272, so as also to be constantly rotated.

One end of the spring 162 is held in an opening (not shown) in a collar 274 that is free to turn about the shaft 206, in the same way that the end 181 of the spring 177 is held in the opening 191. The other end of the spring 162 is held similarly in an opening 279 in an annular plate 276 that is held to the housing 159 by a screw 278. The housing 159 is secured to the collar 274 by a screw 297. When, upon the push-button 294 becoming depressed, the lug 301 of the housing 159 becomes released from its engagement with the upper lug 300 of the forked member 157, therefore, the spring 162 will wind itself tightly about the drum 161 to cause the housing 159 to be rotated with the constantly rotating shaft 206.

The housing 159 will carry with it, in its rotation, a sleeve 280 that is keyed to the housing 159 at 282. The sleeve 280 is keyed also, at 283, to the collared sleeve 284. The collar of the sleeve 284 is provided with the lug 622 for engaging the lug 285 on the disc 213, as illustrated more particularly in Figs. 1 and 10. The spool that carries the discs 213 and 217 is thus caused, by the engagement of the lugs 622 and 285, to be rotated from the continuously rotating sprocket gear 207 about the shaft 220. Upon the return of the reset push-button 294 to its upper position, to permit the parts to resume their normal position by gravity, the lug 301 on the housing 159 will be restored into engagement with the upper lug 300 of the forked member 157. The spool will then have been rotated by the lugs 622 and 285 to a position such that the selector discs 213 and 217 will be restored to their initial or zero positions, illustrated in Figs. 11 and 10 respectively.

The electric system is normally ineffective to energize the clutch-controlling coils 316, 318, 43, 83, 75 and 36. It is rendered effective by manually depressing selectively the proper push-button switches 602 and 606 and operating the machine through a cycle or group of cycles of operation. The necessary circuits will be rendered effective, in sequence, at the end of predetermined rotative movement of the counting wheel 218, as determined by the counting finger 13, and as controlled by the contact members 624 and 14 of the respective commutating discs 213 and 217.

The wiring connections will be understood from Figs 14 to 16. The first or 0 contact member 215 of the commutator disc 213 is connected by a conductor 413 with the jack 610 of the first or 0 units push-button switch 606. The second or 1 contact member 215 is connected by a conductor 415 with the jack 610 of the second or 1 units push-button switch 606. The third or 2 contact member 215 is connected by a conductor 417 with the third or 2 units push-button switch 606; and so on. The sixth or 5 contact member, for example, is connected by a conductor 69 with the jack 610 of the sixth or 5 push-button switch 606; and the last or 9 contact member 215 is connected by a conductor 419 with the jack 610 of the last or 9 units push-button switch 606.

The first or 0 contact member 219 of the commutating disc 217 is similarly connected by a conductor 427 with the jack 612 of the first tens push-button switch 602, marked 0; the second or 10 contact member 219 is connected by a conductor 311 with the jack 612 of the second contact member 602, marked 10;—the sixth or 50 contact member 219 is similarly connected by a conductor 425 with the sixth or 50 tens push-button switch 602; the seventh or 60 contact member 219 by a conductor 423 with the seventh or 60 push-button switch 606; and the last or 70 contact member 219 by a conductor 421 with the last or 70 push-button switch 606.

Though the spool on which the commutating discs 213 and 217 are mounted is rotatably actuated by the shaft 220, so that the respective segmental contact members 624 shall engage successively their respective cooperating contact members 215 and the contact member 14 shall engage the necessary contact members 219, respectively, circuits for effecting the desired operations are not completely established, notwithstanding the engagement of these contact members, except when the corresponding units and tens push-button switches 606 and 602 have been depressed. By connecting the sixth units push-button switch 606 marked 5, for example, so as to connect it, through its conducting sleeve 54, with its corresponding sixth contact member 215, a circuit will be established between this sixth units push-button switch 606 and the corresponding contact segment 624, at the end of five counts.

A motor 8 for driving the machine may be connected to power-supply mains 61 and 430 of alternating current by means of a line switch 293 (Figs. 24 to 26).

Power is supplied to the counter-and-selector mechanism from the shaft 188, driven from a sprocket chain 190, which extends through the housing 93 to support certain sprocket gears, including the sprocket gear 192, which actuates a sprocket chain 193 that passes over, to drive constantly, the three sprocket gears 196, 197 and 198 for respectively actuating, in the manner before described, the shaft 528 of the master switch 378, the shaft 628 of the master switch 30, and the shaft 247 for yieldingly driving the counter shaft 220 through the friction-clutch disc 228.

The power-supply mains 61 and 430 are also connected by the line switch 293 to a rectifier-and-filter 379 (Figs. 4 to 16). The circuit to the rectifier-and-filter 379 extends, on one side, as shown in Figs. 14 to 16, from the main 61, through the line switch 293, and by way of a conductor 62; and, on the other side, from the main 430, through the switch 293, by way of a conductor 63. One side of the rectifier-and-filter 379 is connected to a ground 614, and the other side to the conductor 26. All the hereinafter-mentioned grounds are connected to the ground 614. The ground 614 constitutes one side, and the conductor 26 the other side, of a source of rectified-and-filtered non-pulsating direct current for energizing all the hereinafter described circuits of the before-described electromagnetic coils, and also the circuit of a high-resistance neon signal lamp 116.

It will be assumed that the machine is at rest. The master switches occupy their normal illus-

trated positions, the master switch 378 between the contact members 574 and 568, and the master switch 30 between the contact members 374 and 368. The table 12 has previously, at the end of the prior cycle of operations, been raised by the cams 105 on the shaft 170 to its normal effective position, raising the papers in the said hopper, so that the machine can not feed any papers 2 out of the said hopper, as described in the said Letters Patent 2,133,263.

The cam 160 on the shaft 170 occupies, at this time, its normal position, illustrated in Figs. 14 to 16, in engagement with the two-way leaf spring 18, so that the contact members 22 and 24 are in engagement, and the contact members 67 and 19 are out of engagement. The various armatures 304 occupy positions such that their lugs 300 are engaged by the lugs 301 of the collars 183, so that the corresponding collars 168 are unclutched from the drums 173. The shaft 206 for effecting the re-setting of the discs 213 and 217, under the control of the reset push-button 294, likewise occupies its normal position.

Let it be assumed, as before, that the units push-button switch 606 marked 5, and the tens push-button switch 602 marked 60, have been depressed, as illustrated in Fig. 14, so as to count and stack 65 sheets, the remaining push-button switches 606 and 602 being maintained in their raised positions. The closing of the line switch 293 will connect the motor 8 and the rectifier-and-filter 378 to the power-supply mains 61 and 430. The motor 8 will set the belt conveyors 3 into operation to effect the feeding of newspapers into the said hopper, but the raised table 12 prevents feeding of the papers out of the said hopper. The various sprocket gears before-described are set into continuous rotation to drive continuously the drums 173 of the shafts 170, 48, 77 and 84 to which they are respectively secured. As the shafts 170, 48, 77 and 84 are not, at this time, clutched to the respective drums 173, however, they are maintained stationary. The cams 105 of the shaft 170 remain raised, therefore, to hold the table 12 in its raised, effective position.

The machine may now be started into operation by depressing the start push-button switch 10. A circuit becomes then established to effect the lowering of the table 12. This circuit may be traced in Figs. 14 to 16 from the conductor 26, through the two-way leaf spring 20 and the contact members 22 and 24, that are normally maintained closed by this leaf spring 20, and by way of the conductor 29 and conductors 28, 428 and 139, to the start push-button switch 10. The circuit continues from the start push-button switch 10, by way of conductors 64 and 65, to the lower electromagnetic coils 316, and from these coils 316, to a ground 66.

The closing of this circuit of the lower coils 316 will cause them to become energized to actuate, about pivots 308 and 310, a yoke 306, so as to move the lower armature 304 thereof toward the right, and the upper armature 302 thereof toward the left, as viewed in Fig. 12. The lug 301 on the collar 186 will thus become freed from its engagement with the lug 300 of the lower armature 304. The spring 177 will, therefore, clutch the collar 168, and the shaft 170 to which it is secured, to the constantly rotating drum 173. The shaft 170, with the substantially diametrically positioned cams 105 and 160 carried thereby, will thus become actuated through an initial half-revolution only. The resulting lowering of the cams 105 permits lowering of the bar supports of the table 12 to their ineffective position, about their pivot 125, by gravity, thereby lowering the papers in the hopper 339 into engagement with the continuously traveling belts. The resultant raising of the cam 160 effects raising of the contact member 67 into engagement with the contact member 19, that is mounted on the two-way leaf spring 20, at the same time raising the contact member 22 out of engagement with the contact member 24. The breaking of the engagement of the contact members 22 and 24 effects the opening of the above-described circuit of the electromagnetic coils 316 for effecting the lowering of the table 12. The closing of the contact members 19 and 67 effects the closing of two circuits. One of these circuits, through the contact members 164 and 166, at the successive moments when the latter become closed by the raising of the counting arm 13, includes the counter-controlling electromagnetic coils 202. The other circuit leads to the push-button switches 602 and 606 and the selector commutating discs 213 and 217.

Upon the table 12 becoming lowered, the belts 9 begin to feed the papers 2 out of the hopper 339, through the gap between them and the lower projecting finger 16 of the wall 11, and under the counting finger 13. As the papers 2 pass successively under this counting finger 13, they successively actuate it, to effect the closing of the contact members 164 and 166. The circuit of the counter electromagnetic coils 202 may be traced from the conductor 26, through the leaf spring 20, the contact members 19 and 67 which, at this time, are held closed by the cam 160, by way of conductors 25 and 200, through the leaf spring 194, the contact members 164 and 166, and the leaf spring 196, and by way of the conductor 204, to the counter electromagnetic coils 202; and from the coils 202, to a ground 68. The successive closing and opening of this circuit of the coils 202 by the counting finger 13, as before explained, results in step-by-step rotatable actuation of the counting wheel 218, the counter shaft 220 to which it is secured, and the counter 224 and the commutating discs 213, 217 of the selector.

The contact members 67 and 19 control not only the circuit of the counter-controlling electromagnetic coils 202, but also, as before stated, the circuit to the push-button switches 606 and 602. The last-named circuit extends from the conductor 26 through the leaf spring 20 and the switches 19 and 67, to the conductor 25; and from the conductor 25, by way of a conductor 630, to the conductor 626. The circuit can not be traced further from the conductor 626 through the arms of the jacks 610 unless one of the units switch buttons 606 has been depressed.

The circuit can not, for example, be traced by way of the conductor 413 to the contact member 215 marked 0, which is initially engaged with the segmental contact member 624 marked 0, because the first-push-button switch 606, marked 0, is open. The same is true as to the next four segmental contact members 624, which become actuated, singly and successively, into engagement with the next succeeding contact members 215, at the end of the next four additional counts, as before described, since their corresponding units push-button switches 606 are raised, as shown in Fig. 14. The units push-button switch 606 marked 5 alone being assumed to have been depressed, the other units push-button switches

606 being raised, as illustrated in Figs. 14 to 16, the contact member 215 marked 5 is exclusively effective, in cooperation with the units disc 213, to control the number of papers that shall be accumulated on the table 91 before the next-following operation. A similar remark applies, of course, to the contact members 219 of the disc 217 and the tens push-button switches 602.

After five step-by-step actuations of the counting shaft 220, the commutating disc 213 will have become actuated thereby, step-by-step, to its sixth position, in which contact will be made between the sixth contact member 215, marked 5, and the sixth segmental contact member 624, marked 5. A group of five papers, the number predetermined by the units push-button switch 606 marked 5, will have become counted and accumulated in the stack upon the said table. Before any more papers 2 will be stacked on the said table, the circuit of the electromagnetic coils 318 will become closed, to effect actuation of the shaft 170 through a half-revolution, in order that the cams 105 may raise the table 12, thereby to stop the feed of the papers out of the said hopper. The circuit of the said coils 318 continues from the units push-button switch 606 marked 5 and the arms of the jacks 610 bridged thereby and, by way of the conductor 69, to the sixth contact member 215 marked 5.

From the sixth contact member 215 marked 5, the circuit continues through the sixth segmental contact member 624, marked 5, which is in engagement therewith at this time, to the annulus 250 (Fig. 1); and, from the annulus 250, to the sleeve 251. The circuit continues from the roll 632, in engagement with the annulus 252, by way of conductors 143 and 620 (Figs. 14 to 16) to the electromagnetic coils 318; and from the coils 318 to a ground 580.

The coils 318 become thereupon energized to actuate the upper armature 302 to the right, as viewed in Fig. 12, thereby releasing its lug 300 from engagement with the lug 301 of the collar 183. The spring 177 thereupon binds against the shaft 170 to clutch the constantly rotating drum 173, thereby to effect a half-revolution only of the shaft 170 and the cams 105 and 160 carried thereby, as before described. This half-revolution of the shaft 170 results in raising the cams 105 to raise the table 12, thus stopping the feed of the papers out of the said hopper. The cam 160, at the same time, becomes lowered through a half-revolution to release the leaf spring 18, effecting the breaking of the engagement of the contact members 67 and 19, and the reengagement of the contact members 22 and 24. The breaking of the engagement of the contact members 67 and 19 effects the opening of the above-described circuit to the counter electromagnetic coils 202 and the circuit to the push-button switches 606 and 602, the commutator discs 213 and 217 and the coils 318. The reengagement of the contact members 22 and 24 makes possible, at the proper time, the reestablishment of the circuit of the electromagnetic coils 316, for effecting the relowering of the table 12 and the starting anew of the feeding of the papers out of the said hopper.

Immediately after the feed has been stopped by lifting the table 12, following upon the stacking on the said table of the first group of five papers 2, the guide members 55 will be raised, the said table will then be turned a half-revolution, and the guide members 55 will be relowered, after which the table 12 will become relowered, to permit the stacking on the said table of ten more papers, making fifteen papers in all. This is effected by means of the master switch 378 during its rotation through a complete revolution when the shaft 528 becomes clutched to the constantly rotating sprocket gear 195 (Fig. 6) upon energization of the electromagnetic coils 36.

The circuit of these coils 36 was established simultaneously with the establishment of the above-described circuit of the table-controlling electromagnetic coils, and before contact was broken between the contact members 67 and 19. This circuit may be traced as a branch circuit extending from the conducting sleeve 251 to the conducting annulus 252 (Fig. 1) and the contact member 14 of the disc 217 connected therewith. The contact member 14, as before explained, is at this time in contact with the first contact member 219, marked 0. The circuit continues by way of the conductor 427, the first tens push-button switch 606, marked 0, which has not been depressed, and the arms of the jack 612 thereof, by way of conductors 145 and 38, to the electromagnetic coils 36, and from these electromagnetic coils 36 to a ground 35. The electromagnetic coils 36 thereupon become energized to actuate the armature 304 (Fig. 6), thereby releasing the lug 301 of the collar 183 from its engagement with the lug 300 of the armature 304. The corresponding spring 177 thereupon clutches the shaft 528 of the master switch 378 to the constantly rotating sprocket gear 195 to actuate the master switch 378 throughout a complete revolution. Before the end of this complete revolution, the above-described circuit of the coils 36 having meantime become broken by the contact members 67 and 19, the armature 304 will have become restored to its original position by the spring 96, so that its lug 300 will become reengaged by the lug 301 of the collar 183, preventing more than the one revolution of the shaft 528 and the master switch 378 controlled thereby.

During this complete revolution of the master switch 378, it will first make contact with the contact member 568. A circuit will thereupon be established from the conductor 26, through the leaf spring 20 and the contact members 22 and 24, which have become closed by the cam 160 simultaneously with the lowering of the cams 105, and by way of conductors 29, 28 and 428, to the master switch 378. The circuit continues from the master switch 378, through the contact member 568, and by way of the conductors 571 and 573, to the electromagnetic coils 43; and from the electromagnetic coils 43 to a ground 42. The consequent energization of the electromagnetic coils 43 effects the actuation of the armature 304. The lug 300 of this armature 304 becomes moved over to the right, releasing the lug 301 on the collar 183, and permitting the spring 177 to bind tightly against the drum 173, thereby to effect clutching of the collar 183 to the collar 168. The shaft 48 becomes thereby rotated through a complete revolution, or until the lug 301 becomes reengaged by the lug 300 on the armature 304, which has become restored to its normal position by the spring 96. During this complete revolution, the gear 50 on the shaft 48 will rotate the gear 451 and the crank pin 447 mounted thereon through a half-revolution, to effect actuation of the link 443 upward and to the left, as viewed in Fig. 14, about the pivot 248, through the medium of the links 445, 444 and 449. The guide members 55 will thus become raised piv-

otally above the top of the said stack, about the pivot 248.

When the master switch 378 becomes actuated into contact with the contact member 570, a circuit becomes established from the master switch 378, through this contact member 570, by way of the conductor 575, to the electromagnetic coils 82; and from the electromagnetic coils 82 to a ground 83. The circuit of the electromagnetic coils 82 becoming thus closed, the coils will become energized to effect rotation of the shaft 84 through a complete revolution, in the same manner as before described. During this complete revolution, the gear 86 will rotate the gear 4 through a half-revolution. The crank pin 429 on the gear 4 will thus become actuated through a half-revolution, thereby effecting an actuation of the rack 431 to drive the gear 432 and the shaft 95 on which it is mounted through a half-revolution. This will result in turning of the said table and the stack thereon through a half-revolution.

Meantime, the master switch 378 has been moved out of contact with the contact member 570, and into contact with the contact member 572. A circuit becomes then established from the master switch 378, through the contact member 572 and, by way of the conductor 573, again, to the coils 43. At the time of the breaking of the contact between the master switch 378 and the contact member 568, the spring 96 returned the armature 304 to its original position. Upon this reclosing of the circuit of the coils 43, the armature 304 becomes again attracted to the right, thereby again releasing the lug 301 of the collar 183 from engagement with the lug 300 of the armature 304, and permitting a further revolution of the collar 183, and a consequent further rotation of the shaft 48. The gear 50 on the shaft 48 thereupon drives the gear 451, which is of diameter twice that of the gear 50, back to its original position, permitting the guide members 55 to become restored to the position illustrated in Fig. 14.

In its next position, the master switch 378 makes contact with the contact member 574. A circuit is then established from the master switch 378, through the contact member 574, and, by way of the conductor 576, through the coils 316, to the ground 66. The consequent energization of the coils 316 will effect a rotation of the shaft 170 through a further half-revolution, in the same manner as before described, to effect the lowering of the table 12 by the cams 105 to its ineffective position, permitting the recommencing of the feeding of the papers out of the said hopper and, through the cam 160, the reopening of the contact members 22 and 24 and the reclosing of the contact members 19 and 67.

The said table, with the stack of five sheets thereon, has now been rotated through a half-revolution, while the guide members 55 were raised, and the guide members 55 have been restored to their normal position. With the table 12 relowered, the machine again commences to feed the papers out of the said hopper and on to the stack. The closing of the contact members 19 and 67 by the shaft 160 has reestablished the circuit of the counter-controlling electromagnetic coils 202, and also the circuit to the push-button switches 606 and 602 and the commutating discs 213 and 217. The electromagnetic coils 202, therefore, will resume control, through the pawl 208, of the step-by-step actuation of the shaft 220.

During the feeding of the first group of five papers before described, the conducting segment 14 of the disc 217 has remained in contact with the first contact member 219, marked 0. The circuit to the commutating discs 213 and 217 can not, therefore, be reestablished through the units push-button switches 601 marked 6, 7, 8, 9, 0, 1, 2, 3, 4, in sequence, because these are all open. During the feeding and stacking of ten further papers 2, corresponding to these ten units push-button switches 606 in this sequence, but in a position reverse to that of the original stack of the first five papers, the shaft 220 will be actuated ten steps, corresponding to ten counts, as controlled by ten further operations of the pawl 208. The actuation of the before-described sleeve and the discs 213 and 217 mounted thereon may be regarded as in two steps; one step corresponding to the feeding of the first five papers of the next group of ten papers; and the other step corresponding to the feeding of the second five papers of this group of ten. The contact segment 14 remains in contact with the same first contact member 219, marked 0, during the feeding of the first five papers of this next group of ten papers; and in contact with the next-succeeding contact member 219, marked 10, during the feeding of the remaining five papers of this second group of ten papers.

During the feeding of this further group of ten papers, the contact segments 624 will singly and successively become actuated into engagement with their corresponding contact members 215, as before described. The first nine of these actuations will correspond to the open push-button switches 606 marked 6, 7, 8, 9, 0, 1, 2, 3, 4, to which these contact members 215 are connected. The tenth will correspond to the tenth push-button switch 606 marked 5.

At the tenth additional count, or fifteen counts in all, corresponding to the feeding and stacking of fifteen papers, therefore, the contact member 624 marked 5 will again become actuated into engagement with the contact member 215 marked 5, which is connected to the push-button switch 606 marked 5. Thereupon, two circuits will again become established through the commutating disc 213. One of these is through the brush-contact roll 632, which is always in contact with the annulus 252, and by way of the conductors 143 and 620, to the electromagnetic coils 316. The other may be traced from the contact member 14 and the second contact member 219, marked 10, in engagement therewith, by way of the conductor 311, through the second tens push-button switch 602, marked 10, and which has not been depressed, and by way of the conductors 145 and 38, to the electromagnetic coils 36.

The coils 316 will thereupon effect a reclosing of the gap under the finger 16 of the wall 11, to prevent further feeding of the papers 2 out of the hopper 339, and the coils 36 will effect a reactuation of the master switch 378, throughout a complete revolution, into engagement with the contact members 568, 570, 572 and 574. During this revolution of the master switch 378, the guide members 55 will again be raised, the said table 91 will again be rotated through a half-revolution, the guide members 55 will again be relowered, and the coils 316 will again become energized to effect resumption of feeding of the papers out of the said hopper, in the same manner as before described.

The feeding of the papers, recommenced at the end of the stacking of the first five papers, has continued until the discs 213 and 217 became

rotated sufficiently to effect the stacking of a group of ten additional papers on the stacking table, but turned 180 degrees with respect to the said first group of five papers. The stack on the said table 91 will now contain fifteen papers, the lower group of five facing with their unfolded edges in one direction, and the next group of ten facing with their unfolded edges in the opposite direction. A further group of ten papers will now be stacked, with their edges in the same direction as those of the original five stacked papers. Upon the accumulation of these additional ten papers, making a total of twenty-five, the same operations will again take place.

In this manner, under the control of the selector commutating discs 213 and 217 and the contact members 67 and 19, which are closed when the table 12 is lowered, the cams 105 will be raised to lift the table 12, thereby to interrupt the feed of the papers out of the said hopper, at the end of the feed of groups of 5, 15, 25, 35, 45, 55 and 65 papers. Under the control of the master switch 378, in cooperation with the switch members 22 and 24, between the feeding of successive groups of the papers, the guide members 55 will be raised, the said table 91 with the stack thereon will be turned a half-revolution, the guide members 55 will be relowered, and the table 12 will be relowered to recommence the feeding and stacking of the papers.

At the end of the feeding and stacking of the 65th paper in the stack, the contact member 14 will be in contact with the contact member 219 marked 60. The above-described circuit of the coils 318, through the sixth units push-button switch 606, and from the roll 612, and by way of the conductors 143 and 620, has, therefore, again been established, as before, to stop the feed of the papers out of the hopper 339. The circuit to the electromagnetic coils 36, for actuating the master switch 378, extending from the contact member 14, by way of the conductor 423, to the tens push-button switch 602 marked 60, will, this time, however, be open, because this tens push-button switch 620 marked 60 has been depressed, to insulate the arms of its corresponding jack 612.

There will not, therefore, be any further repetition of the operations before described of actuating the guide members 55 or turning the said table 91. After 65 papers have thus become counted and stacked, the operation of the machine becomes terminated, with the stack of 65 papers 2 on the said table 91, at rest.

The operator has become notified of the completion of the stacking of the 65 sheets by the signal lamp 116, the circuit of which was established simultaneously with the final establishment of the circuit of the coils 318 and in parallel thereto. This circuit extends from the sleeve 251, by way of the conductor 143 and a conductor 258, through the signal lamp 116, by way of the conductor 38, and through the coils 36, to the ground 35.

If the tens push-button switch 606 marked 60 had not been depressed, it would have been possible to trace this circuit through the coils 36 through this push-button switch 60 in such manner as to short-circuit the signal lamp 116. The coils 36 would then have become sufficiently energized to actuate the shaft 528 of the master switch 378, as before described. The depressing of the tens push-button switch 606 marked 60 has now prevented the short-circuiting of the signal lamp 116. The signal lamp 116 will, therefore, be caused to flash. Because of the high resistance of the neon signal lamp 116, however, there will not be enough current through the electromagnetic coils 36 to actuate the shaft 378 of the master switch 528.

The illumination of the lamp 116 will constitute a signal to the operator that the stacking of the sixty-five papers has been completed. The operator will now depress the reset push-button 294 to remove the stack of papers from the said table 91. The shaft 628 will thereupon become clutched to the constantly rotating sprocket gear 197 (Fig. 6) to actuate the master switch 30 throughout a complete revolution.

In the first position of the master switch 30, since the leaf spring 20 has been restored to its original position, a circuit will be established from the conductor 26, through the leaf spring 20 and the contact members 22 and 24 and, by way of conductors 29 and 260, to the master switch 30; and from the master switch 30 to the contact member 368. The circuit continues, by way of the conductors 371, 71 and 72, to the electromagnetic coils 43 and the ground 42. The guide members 55 will therefore be raised, in the same way as before described, about the pivot 248.

When the master switch 30 engages the contact member 370, a circuit will be established from the master switch 30, through the contact member 370 and, by way of the conductor 104, to the electromagnetic coils 75. This will effect actuation, through a complete revolution, in the manner before described, of the shaft 77. A complete revolution of the shaft 77 will effect a half-revolution of the shaft 80 and the cam 99 mounted thereon. The half-revolution of the cam 99 will effect a lowering of the cam follower 427 and the shaft 95 and the said table 91 mounted thereon, but without disengaging the gear 432 from the rack 431. Upon the lowering of the said table 91, the stack of papers becomes lowered into engagement with the rolls 523, which effect removal of the stack of papers over the said anti-friction rolls 523.

In its next position, the master switch 30 engages the contact member 372, which is connected, by way of the conductor 73, to the same conductor 104, leading to the electromagnetic coils 75. The engagement of the master switch 30 with the contact member 372, therefore, effects a reclosing of the circuit of the coil 75 and a further complete revolution of the shaft 77, thereby effecting a further half-revolution of the shaft 80 and the cam 99 thereon, to effect a reraising of the said table 91 to its original position. The interval between the lowering and raising of the said table 91 is sufficient for the said rolls 523 to perform their work of removing the stack of papers.

Upon the master switch 30 reaching the contact member 374, the circuit of the coils 43 becomes reestablished by way of the conductors 71 and 72, effecting the relowering of the guide members 55 to their original position. The depressing of the reset push-button 294 has effected also the return of the commutating discs 213 and 217 to their initial position, through the clutching of sleeve 284 to the constantly rotating shaft 206 (Fig. 1). As before explained, this is effected by the lug 622 on the sleeve 284 engaging the lug 285 (Fig. 2).

The depressing of the reset push-button 294 has further returned the depressed units push-

button switch 606 and the depressed tens push-button switch 602 to their raised positions. The machine is now ready for the accumulation of a new stack of papers on the said table 91, the size of which is determined by the setting of two other push-button switches 606 and 602. As before described, the new stacking will be recommenced by operating the start push-button switch 10.

In the example given above, the stack of sixty-five papers collected on the said table 91, as determined by the units push-button switch marked 5 and the tens push-button switch marked 60, was constituted of one group of five papers and six groups each of ten papers, the said table 91 having been turned through half-rotations during interruptions of the feed between each two successive groups. The number of papers in the first group may be varied or adjusted, as desired, from zero to nine, depending upon which unit push-button switch 606 has been manually depressed. The actuation of the units disc 213 from its initial position to a position corresponding to the depressed push-button switch 602 will determine, in all cases, the variable number of papers in the first group stacked.

If the units push-button switch 606 marked 0 had been depressed, the above-described circuit from the conductor 626 would, at the very beginning, have continued through the arms of its jack 610 directly to the segmental contact member 624 marked 0 and the cooperating contact member 215 marked 0; and then, through the conducting annulus 250, the sleeve 251 and the conducting annulus 252, directly to the segmental contact member 14 of the commutating disc 217. The machine would then have stacked a first group of ten papers, a second group of ten papers reversed in position to the first group, a third group of ten papers positioned in the same direction as the first group, and so on, up to a total of sixty papers.

It will further be observed that if the tens push-button switch 602 marked 0 had been depressed, it would not have been possible to trace the above-described circuit through this tens push-button switch 602. The machine would then have stopped operating at the end of the stacking of the first group of five papers, instead of continuing until sixty-five papers were accumulated. Depending upon which units push-button switch 606 is depressed, in combination with this tens push-button switch 606 marked 0, therefore, groups of papers, each less than ten in number, may be stacked on the said table 91. The feed will be interrupted, at the end of the stacking of each of these groups, whereupon the said table 91 may be lowered, as before described, by the master switch 30, to enable the rolls 523 to remove each group before the stacking of the next group. The same result may, of course, be obtained by omitting the tens push-button switches 602 and the commutating disc 217 connected therewith, and connecting the conductor 145 directly to the conducting sleeve 251.

On the other hand, when it is desired to count into hundreds, the eight tens push-button switches 602 will be increased to ten, and a third set of push-button switches will be provided, as before stated, together with a third commutating disc, corresponding to the disc 217, and a third arrangement of contact members corresponding to the contact members 219. The contact members of the third arrangement would be connected through the third set of push-button switches to the conductor 145, in the same way that the tens push-button switches 602 are shown connected to the conductor 145 in Fig. 14. If it is desired to count into the thousands, a fourth set of push-button switches and a fourth commutating disc like the disc 217 would be provided, and so on.

The feed of the papers 2 may be stopped at any time by depressing the emergency stop push-button switch 172. A circuit is then established from the conductor 26, through the leaf spring 20, the contact members 19 and 67 and the leaf spring 18 and, by way of the conductors 25, 630 and 626, to the stop push-button switch 172, shunting the push-button switches 602 and 606, and the commutating discs 213 and 217. The circuit continues from the stop push-button switch 172, by way of a conductor 64 and the conductors 258 and 620, to the coils 318 and the ground 580. The coils 318 will thus become energized to actuate the shaft 170 through a half-revolution, thereby, through the cams 105, to raise the table 12 to stop the further feeding of the papers out of the said hopper.

By maintaining the start-push-button switch 10 depressed, the above-described circuit of the electro-magnetic coils 318 controlled thereby will be maintained continuously closed. In this manner, the papers may be caused to feed continuously through the machine, without the aid of the selector, until either the stop push-button switch 10 is raised, to enable the depressed push-button switches 602 and 606 to assume control, or until the hopper 339 becomes entirely emptied. This is an advantage when it is desired merely to count the papers to any number, at will.

Modifications will occur to persons skilled in the art, and all such are considered to fall within the spirit and scope of the invention, as defined in the appended claims.

What is claimed is:

1. A switch structure having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, and means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly the contact members of the other group.

2. A switch structure having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having one more contact member than the other group, and means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly and successively the contact members of the other group.

3. A switch structure having, in combination, a rotatable disc having a group of substantially equally spaced contact members, a group of cooperating substantially equally spaced contact members, one of the groups having one more contact member than the other group, and means for rotating the disc to cause the contact members of one of the groups to engage singly and successively the contact members of the other group.

4. A switch structure having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, two further rela-

tively actuable assemblages, one of the further assemblages having a group of contact members and the other further assemblage being constituted of a single contact member, and means for relatively actuating the assemblages.

5. A switch structure having, in combination, a rotatable disc having a group of substantially equally spaced contact members, a group of cooperating substantially equally spaced contact members, one of the groups having one more contact member than the other group, a second rotatable disc, two further groups of contact members one of which is provided on the second rotatable disc, one of the two further groups being constituted of a single contact member cooperating with the contact members of the other further group of contact members, and means for rotating the discs to cause the contact members of one of the first-named groups to engage singly and successively the contact members of the other first-named group and the single contact member to engage successively the contact members of the said further group.

6. A switch structure having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, two further relatively actuable assemblages, one of the further assemblages having a group of contact members and the other further assemblage being constituted of a single contact member, means for relatively actuating the assemblages, and further means for relatively actuating the assemblages to a predetermined position.

7. A switch structure having, in combination, a rotatable disc having a group of substantially equally spaced contact members, a group of cooperating substantially equally spaced contact members, one of the groups having one more contact member than the other group, a second rotatable disc, two further groups of contact members one of which is provided on the second rotatable disc, one of the two further groups being constituted of a single contact member cooperating with the contact members of the other further group of contact members, means for rotating the discs to cause the contact members of one of the first-named groups to engage singly and successively the contact members of the other first-named group and the single contact member to engage successively the contact members of the said further group, and further means for rotating the discs to a predetermined position.

8. An electric system having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, two further relatively actuable assemblages, one of the further assemblages having a group of contact members and the other further assemblage being constituted of a single contact member, means for electrically connecting the single contact member with one of the first-named groups of contact members, and means for relatively actuating the assemblages.

9. An electric system having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly the contact members of the other group, a further contact member, and means for connecting the further contact member to one of the groups of contact members.

10. An electric system having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, two further relatively actuable assemblages, one of the further assemblages having a group of contact members and the other further assemblage being constituted of a single contact member, means for electrically connecting the single contact member with one of the first-named groups of contact members, means for relatively actuating the assemblages, a further contact member, and means for connecting the further contact member with the last-named one of the first-named group of contact members.

11. An electric system having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, two further relatively actuable assemblages, one of the further assemblages having a group of contact members, and the other further assemblage being constituted of a single contact member, means for electrically connecting the single contact member with one of the first-named groups of contact members, means for relatively actuating the assemblages, a further contact member, means for connecting the further contact member with the last-named one of the first-named group of contact members, and means for connecting the further contact member with the single contact member.

12. An electric system having, in combination, a rotatable disc having a group of substantially equally spaced contact members, a group of cooperating substantially equally spaced contact members, one of the groups having one more contact member than the other group, a second rotatable disc having a contact member, a group of contact members cooperating with the contact member of the second rotatable disc, means for electrically connecting the contact member of the second rotatable disc with the group of contact members of the first-named disc, means for rotating the discs to cause the contact members of the first-named disc to engage singly and successively the contact members of the group of contact members cooperating therewith and to cause the contact member of the second rotatable disc to engage successively the contact members with which it cooperates, a further contact member, and means for connecting the further contact member with the contact member of the second rotatable disc.

13. An electric system having, in combination, a plurality of units switches each adapted to occupy two positions, a plurality of multiples switches each adapted to occupy two positions, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having one more contact member than the other group, one of the groups having the same number of contact members as the number of units switches and respec-

tively connected to the respective units switches, a further group of contact members equal in number to the number of multiples switches and connected to the respective multiples switches, a contact member cooperative with the further group of contact members and connected with the group of contact members of the assemblage that does not have the same number of contact members as the number of units switches, means for actuating the said cooperative contact members and the assemblage of contact members connected therewith to cause the contact members of one of the first-named groups to engage successively and singly the contact members of the other first-named group and to cause the said cooperative contact member to engage successively the contact members of the further group, a further contact member, and means for connecting the further contact member to the assemblages.

14. A switch structure having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly the contact members of the other group, and means for controlling the actuating means to effect the said single engagement of the contact members at predetermined time intervals.

15. An electric system having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly the contact members of the other group, and means controlled by the contact members for controlling the actuating means.

16. A switch structure having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having one more contact member than the other group, means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly and successively the contact members of the other group, two further relatively actuable assemblages, one of the further assemblages having a group of contact members and the other further assemblage being constituted of a single contact member, means for relatively actuating the two further assemblages, and means for mechanically connecting one of the groups of contact members of one of the assemblages to one of the groups of contact members of the other assemblage.

17. A switch structure having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly the contact members of the other group, two further relatively actuable assemblages, one of the further assemblages having a group of contact members and the other further assemblage being constituted of a single contact member, and means for electrically connecting one of the groups of contact members of one of the first-named assemblages to one of the groups of contact members of the other assemblage.

18. A switch structure having, in combination, a rotatable disc having a group of substantially equally spaced contact members, a group of cooperating substantially equally spaced contact members, one of the groups having one more contact member than the other group, a second rotatable disc having a contact member, a group of contact members cooperating with the contact member of the second rotatable disc, and means for rotating the discs in synchronism to cause the contact members of the first-named disc to engage singly the contact members of the group of contact members cooperating therewith and to cause the contact member of the second rotatable disc to engage successively the contact members with which it cooperates.

19. An electric system having, in combination, a plurality of first switches, a plurality of second switches, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having one more contact member than the other group, one of the groups having the same number of contact members as the number of first switches and respectively connected to the respective first switches, a further group of contact members equal in number to the number of second switches and connected to the respective second switches, a contact member cooperative with the further group of contact members and connected with the group of contact members of the assemblage that does not have the same number of contact members as the number of first switches, and means for actuating the said cooperative contact members and the assemblage of contact members connected therewith to cause the contact members of one of the first-named groups to engage singly the contact members of the other first-named group and to cause the said cooperative contact member to engage successively the contact members of the further group.

20. A switch structure having, in combination, a plurality of units switches each adapted to occupy two positions, a plurality of multiples switches each adapted to occupy two positions, a rotatable disc having a plurality of substantially equally spaced contact members, a plurality of substantially equally spaced contact members cooperative therewith spaced along the circumference of the disc, a second rotatable disc having a contact member connected to the contact members of the first-named disc, a plurality of substantially equally spaced contact members connected to the contact members of the second disc, and means for actuating the discs to cause the contact members of the first-named disc to engage singly their cooperating contact members and the said one contact member to engage successively its cooperating contact members.

21. An electric system having, in combination, a plurality of units switches each adapted to occupy two positions, a plurality of multiples switches each adapted to occupy two positions, a plurality of units contact members cooperative with the units switches in one of their positions, a plurality of multiples contact members cooperative with the multiples switches in one of their positions, and means controlled by one of the units switches in the said one of its positions and with all except one of the multiples

switches in the said one of their positions for controlling a count determined by the said one units switch and the said one multiples switch.

22. An electric system having, in combination, a plurality of switches, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, one of the groups having the same number of contact members as the number of switches and respectively connected to the respective switches, a further switch in circuit with each contact member of the said one group and the switch connected thereto, means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly and successively the contact members of the other group, and means in circuit with each said contact member of the said one group and the said switch connected thereto for controlling the further switch.

23. An electric system having, in combination, a plurality of switches, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, one of the groups having the same number of contact members as the number of switches and respectively connected to the respective switches, a further switch in circuit with each contact member of the said one group and the switch connected thereto, means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly and successively the contact members of the other group, and means in circuit with each said contact member of the said one group and the said switch connected thereto for controlling the further switch and the actuating means.

24. An electric system having, in combination, a plurality of switches, two relatively actuable assemblages each having a group of contact members, the contact members of one of the groups being equal in number to the number of switches and being respectively connected to the respective switches, one of the groups having more contact members than the other group, means for relatively actuating the assemblages, and means in circuit with each contact member of the said one assemblage and the switch connected thereto for controlling the actuating means.

25. An electric system having, in combination, a plurality of switches, two relatively actuable assemblages, one of the assemblages having a group of contact members equal in number to the number of switches and respectively connected to the respective switches, the other assemblage being constituted of a single contact member, means for relatively actuating the assemblages, and means in circuit with each contact member of the said one assemblage and the switch connected thereto for controlling the actuating means.

26. An electric system having, in combination, a plurality of switches, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, one of the groups having the same number of contact members as the number of switches and respectively connected to the respective switches, a further switch having a normal position in which it is normally in circuit with each contact member of the said one group and the switch connected thereto, means for relatively actuating the assemblages to cause the contact members of one of the groups to engage singly and successively the contact members of the other group, means in circuit with each said contact member of the said one group and the said switch connected thereto for actuating the further switch out of the normal position, and means for thereafter restoring the further switch to the normal position.

27. An electric system having, in combination, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equally spaced distances, one of the groups having more contact members than the other group, two further relatively actuable assemblages, one of the further assemblages having a group of contact members and the other further assemblage being constituted of a single contact member, means for relatively actuating the assemblages, a normally closed switch for controlling the actuating means, means controlled by the first-named assemblages for opening the normally closed switch, and means controlled by the further assemblages for closing the normally closed switch.

28. An electric system having, in combination, a rotatable disc having a group of substantially equally spaced contact members, a group of cooperating substantially equally spaced contact members, one of the groups having one more contact member than the other group, a second rotatable disc, two further groups of contact members one of which is provided on the second rotatable disc, one of the two further groups being constituted of a single contact member cooperating with the contact members of the other further group of contact members, means for rotating the discs to cause the contact members of one of the first-named groups to engage singly and successively the contact members of the other first-named group and the single contact member to engage successively the contact members of the said further group, the single contact member being adapted to engage one of each of the contact members of the said other further group of contact members throughout the single and successive engagement of the contact members of the first-named groups of contact members, a normally closed switch for controlling the rotating means, means controlled by the first-named rotatable disc for opening the normally closed switch, and means controlled by the second rotatable disc for closing the normally closed switch.

29. An electric system having, in combination, a plurality of units switches each adapted to occupy two positions, a plurality of multiples switches each adapted to occupy two positions, two relatively actuable assemblages each having a group of substantially equally spaced contact members extending over substantially equal distances, one of the groups having more contact members than the other group, the contact members of one of the groups being the same in number as the number of units switches and being respectively connected to the respective units switches, a normally closed switch in circuit with each units switch and the contact member connected thereto, a further group of contact members equal in number to the number of multiples switches and connected to the respective multiples switches, a contact member cooperative with

the further group of contact members and connected with the group of contact members of the assemblage that does not have the same number of contact members as the number of units switches, means for actuating the said cooperative contact members and the assemblage of contact members connected therewith to cause the contact members of one of the first-named groups to engage singly and successively the contact members of the other first-named group and to cause the said cooperative contact member to engage successively the contact members of the further group, means controlled by a predetermined units switch for opening the normally closed switch, and means connected in circuit with each multiples switch and the contact member connected thereto for closing the normally closed switch.

30. An electric system having, in combination, a plurality of units switches each adapted to occupy two positions, a plurality of multiples switches each adapted to occupy two positions, a rotatable disc having a plurality of substantially equally spaced contact members one less in number than the number of units switches, a plurality of substantially equally spaced contact members cooperative therewith spaced along the circumference of the disc and respectively connected to the respective units switches, a further switch in circuit with each units switch and the contact member connected thereto, a second rotatable disc having a contact member connected to the contact members of the first-named disc, a plurality of substantially equally spaced contact members connected to the contact members of the second disc equal in number to the number of multiples switches and connected to the respective multiples switches, means for actuating the discs to cause the contact members of the first-named disc to engage singly and successively their cooperating contact members and the said one contact member to engage successively its cooperating contact members, the said one contact member being adapted to engage one of each of its cooperating contact members throughout the single and successive engagement of the contact members of the first-named disc with their cooperating contact members, means controlled by a predetermined units switch for opening the normally closed switch, and means connected in circuit with each multiples switch and the contact member connected thereto for closing the normally closed switch.

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