P. P. DEAN.

DRIVING MECHANISM FOR VALVES AND OTHER DEVICES.

APPLICATION FILED SEPT. 10, 1917.

1,325,005.

Patented Dec. 16, 1919.

3 SHEETS—SHEET 1.

Fig. 1.

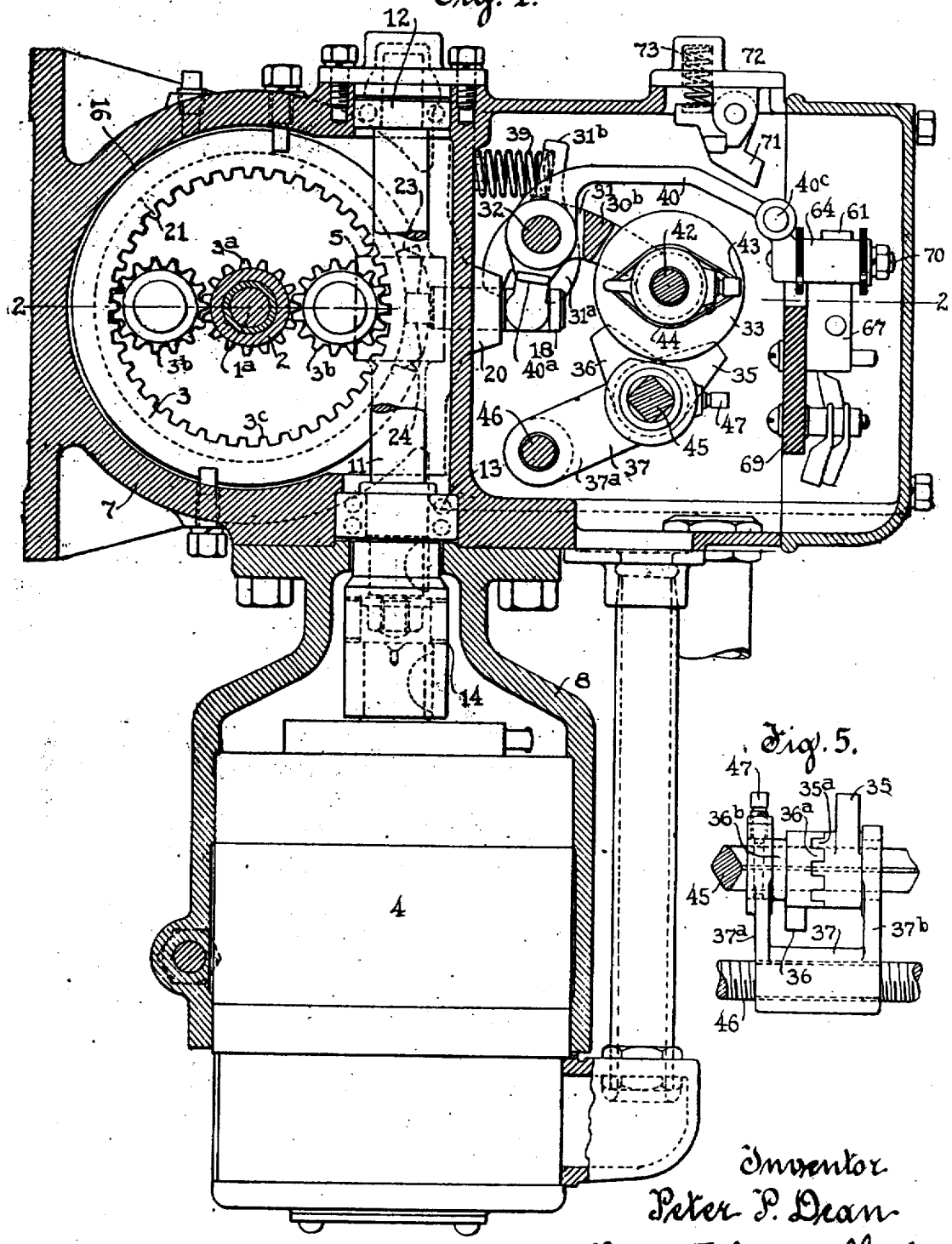


Fig. 5.

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3 SHEETS—SHEET 2.

Fig. 2.

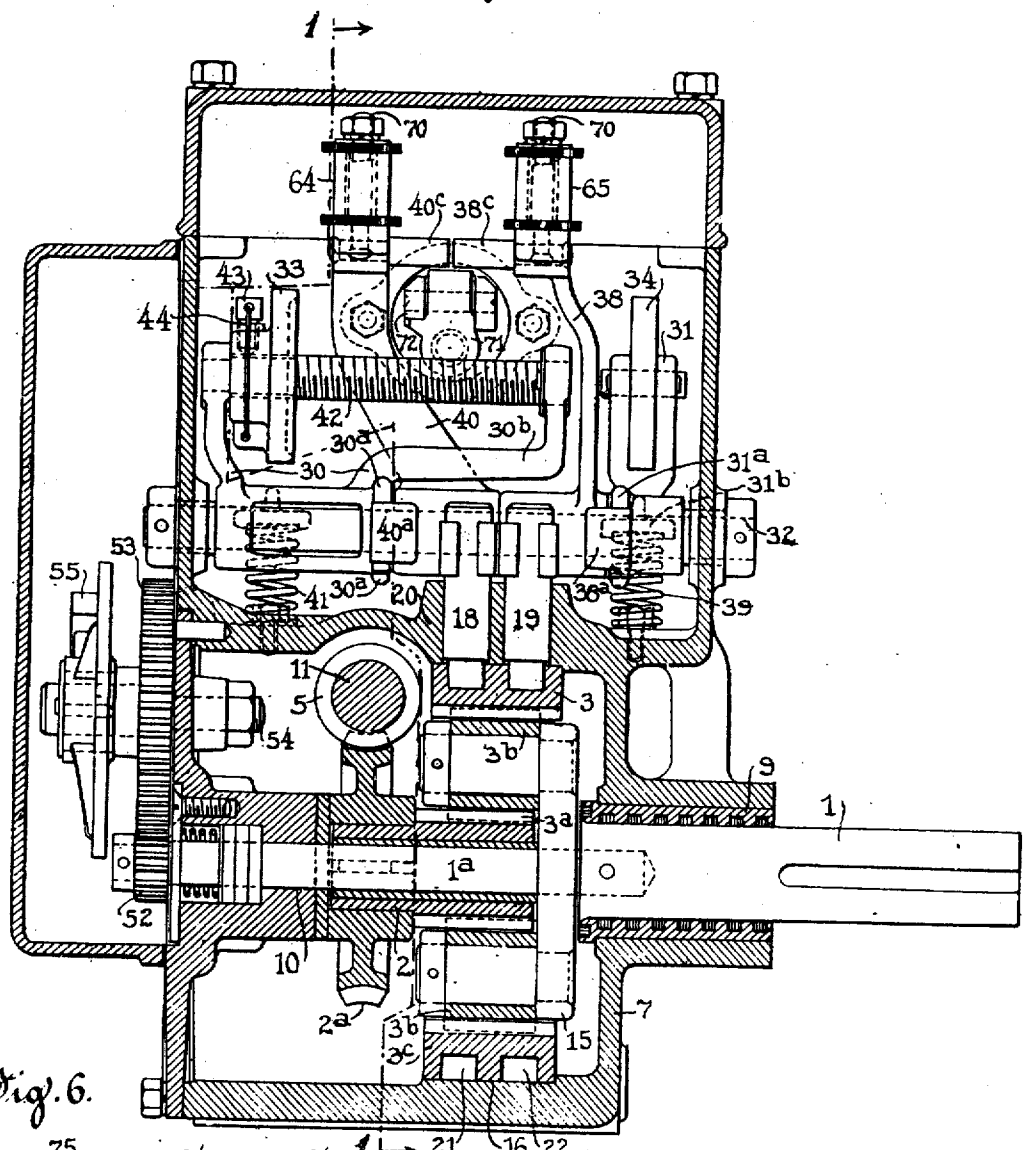
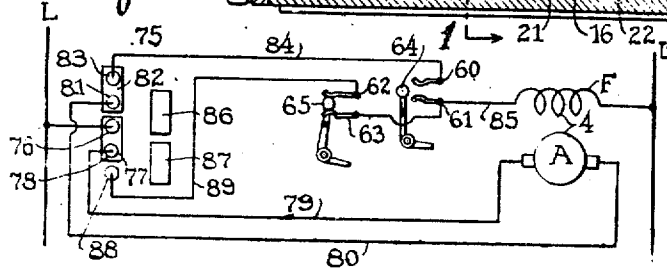


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 3.

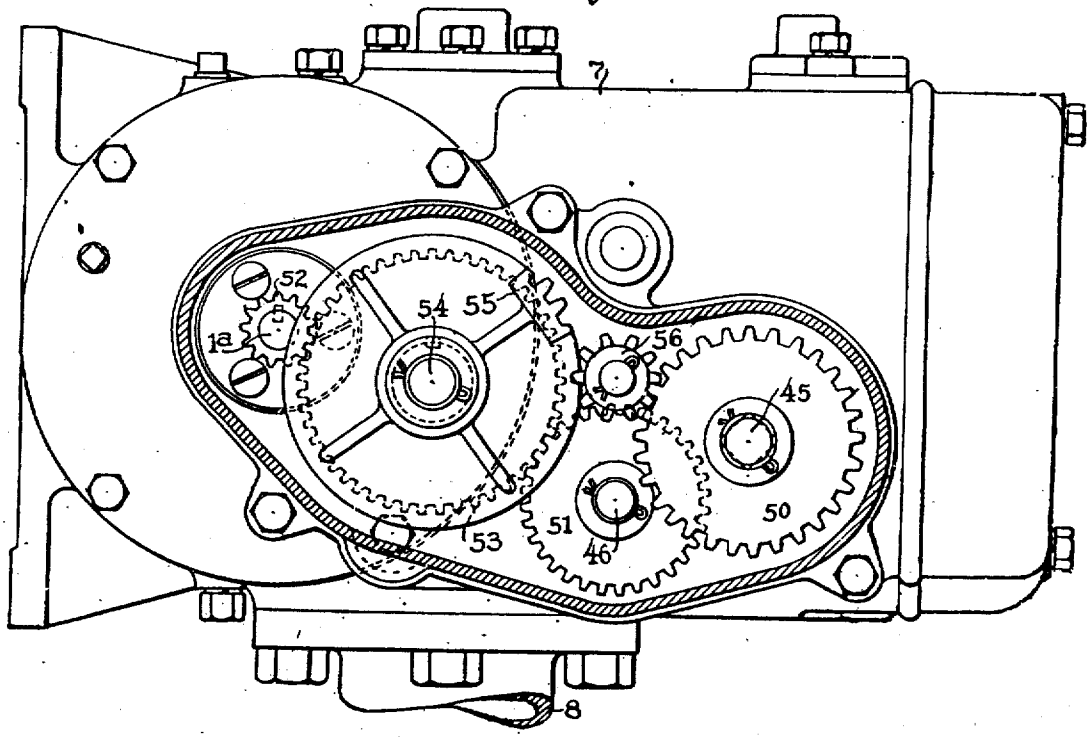
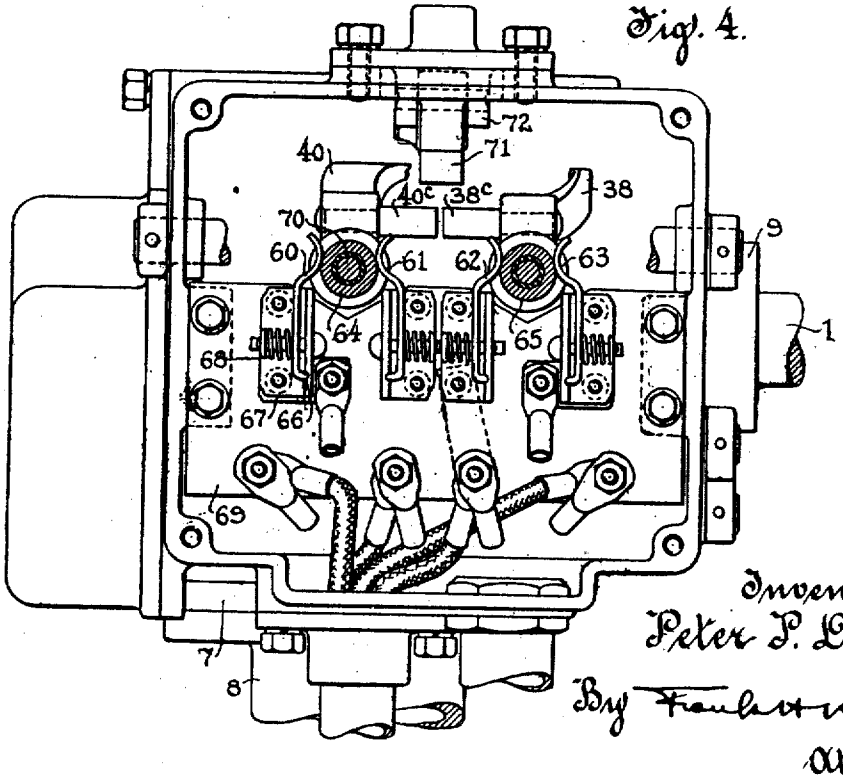


Fig. 4.



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UNITED STATES PATENT OFFICE.

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DRIVING MECHANISM FOR VALVES AND OTHER DEVICES.

1,325,005. Specification of Letters Patent. Patented Dec. 16, 1919.

Application filed September 10, 1917. Serial No. 190,507.

To all whom it may concern:

Be it known that I, PETER P. DEAN, a subject of the King of England, residing at New York city, in the county of New York and State of New York, have invented new and useful Improvements in Driving Mechanism for Valves and other Devices, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing forming a part of this specification.

This invention relates to driving mechanism for valves and other devices.

In my prior Patent No. 1,245,574, granted Nov. 6, 1917, there is disclosed a driving mechanism of such character including a normally restrained member releasable to effect substantially instantaneous release of the driven member from the driving member, and the present invention has among its objects to provide improved control means for said restrainable member.

Another object is to provide improved limit means whereby the power supplied to the drving motor of such a mechanism will be terminated substantially simultaneously with the release of said normally restrained member.

Another object is to provide limit means which will miminize the operation of the driven member incident to resetting of said means, for a purpose hereinafter described.

Other objects and advantages of the invention will hereinafter appear, and it is to be understood that certain features of the invention may be advantageously employed in other relations.

The accompanying drawing illustrates one embodiment of the invention and the same will now be described, it being understood that the embodiment illustrated is susceptible of various modifications without departing from the scope of the appended claims.

In the drawings,

Figure 1 is a horizontal sectional view of the mechanism taken on line 1—1 of Fig. 2.

Fig. 2, is a sectional view, taken substantially on line 2—2 of Fig. 1;

Fig. 3 is a top plan view of Fig. 1, exclusive of the driving motor and with a part of the casing broken away;

Fig. 4 is a right hand side elevation of Fig. 1, exclusive of the driving motor and with the casing cover removed;

Fig. 5 is a detail view of parts shown in Fig. 1; and,

Fig. 6 is a diagram of one circuit arrangement for the driving motor.

Referring to Figs. 1 and 2, and first to the latter figure, the mechanism includes a driven shaft 1, a driving member 2 (Fig. 2) a planetary speed reducing gear 3 for connecting the same, and a relatively small high speed motor 4 (Fig. 1) operatively connected to the driving member 2 through a worm wheel 2^a and worm 5. These parts are all mounted in a casing 7 and the motor 4 is connected in an extension 8 of the said casing.

The driven shaft 1 is mounted in a bearing 9 (Fig. 2) in one wall of casing 7 and has an extension 1^a upon which the driving member 2 is rotatably mounted, said extension projecting through and having a bearing 10 in the opposite wall of said casing. The worm wheel 2^a is fixed to the driving member 2 while the worm 5 is fixed to a shaft 11 having suitable bearings 12 and 13 (Fig. 1) in opposite walls of the casing and connected through a suitable coupling 14 to the shaft of the motor. The planetary gear 3 includes a pinion 3^a, fixed to the driving member 2, a plurality of pinions 3^b carried by a disk 15 (Fig. 2) fixed to driven shaft 1 and an internally toothed ring 3^c, the pinions 3^b being arranged between and in mesh with the pinion 3^a and toothed ring 3^c. The toothed ring 3^c is revolubly mounted in a bearing 16 (Fig. 2) provided within the casing and forms the aforesaid restrainable and releasable member. And as will be apparent, restraint of the ring will render the planetary gear effective as a driving connection between the driving member 2 and driven shaft 1 whereas release of said ring will allow rotary play thereof for release of the driven shaft from the driving member.

In the respects above noted, the driving mechanism is substantially the same as that shown in my prior application, aforesaid.

The means employed in this instance to restrain the ring 3^c of the planetary gear, includes two plugs 18 and 19 (Fig. 2) reciprocably mounted in an intermediate wall 20 of casing 7. These plugs are arranged side by side directly above the ring 3^c and said ring is provided with peripheral grooves 21 and 22 to respectively receive said plugs and

with blocks 23 and 24 (Fig. 1) within the grooves 21 and 22 respectively to abut said plugs. Each block has sheer ends and a peaked upper surface, providing a cam for a purpose hereinafter set forth, and said blocks are oppositely disposed and so spaced on the periphery of the ring as to lock said ring against rotation in either direction when both plugs are projected into the space between said blocks. On the other hand, the arrangement is such that assuming operation of the motor tending to rotate the ring in a counter-clockwise direction (Fig. 1) retraction of the plug 19 will free said ring for rotation in such a direction, whereas the block 23 will upon slightly less than one revolution of said ring, abut the plug 18 to again arrest said ring. Conversely, assuming operation of the motor tending to rotate the ring in a clockwise direction, retraction of the plug 18 will free said ring for rotation in such direction, whereas the block 24 will upon slightly less than one revolution of said ring abut plug 19 to again arrest the said ring.

Thus assuming projection of both plugs into their respective grooves the planetary gear will operatively connect the driven shaft to the driving member for operation of the former by the latter in either direction and without play. Then if the plug restraining the ring be withdrawn it will release the driven shaft from the driving member and permit the ring to revolve until checked by the other plug. Then if the drive be reversed without reinsertion of the withdrawn plug, the ring will be permitted unrestrained rotation until the last acting block abuts the opposite side of the inserted plug thereby effecting reconnection of the driven shaft with the driving member and with a hammer blow to the former. Hence assuming drive of a valve, the mechanism described provides for quick release thereof when seated and for unseating of the same with a hammer blow and as will be described, means are provided for automatically and selectively withdrawing the plugs at given limits, and terminating the power supply to the driving motor.

The limit means for withdrawing the plugs includes an operating lever 30 (Fig. 2) for the plug 18 and an operating lever 31 (Figs. 1 and 2) for the plug 19, both of said levers being fulcrumed upon a shaft 32 extending through the casing 7, and supported in opposite walls of the latter. These levers, as will hereinafter appear, have lost motion connections with the plugs and are respectively provided with rollers 33 and 34 to be respectively engaged by the cams 35 and 36 of a traveling device 37 (Figs. 1 and 5) connected with the driven shaft 1. Also, as will appear, the cams while moving rectilinearly with the traveling device, are subjected to a rotary movement and in given positions of said device said cams rotate against their respective rollers for selectively rocking the levers 30 and 31 for selective withdrawal of the plugs.

The lever 31 (Fig. 1) has a bifurcated extension 31^a and on the shaft 32 is mounted a bell crank lever 38 having a lateral lug 38^a projecting into such bifurcated portion of lever 31 and also having a forked extremity operatively engaging the plug 19. The lug 38^a is of such size as to permit a play thereof in the bifurcated portion of lever 31, thus providing a lost motion connection between said levers and a spring 39 is interposed between a part of the casing and a lug 31^b on lever 31 to bias the latter to the position shown in Fig. 1. In other words, the spring 39 biases the lever 31 in a direction to project the roller into the path of the traveling device and to force the plug downwardly into engagement with the ring. Thus when the lever 31 is actuated by the traveling device it first takes up the play between the same and the lever 38 and then lifts the plug to clear the sheer end of the block 24 for release of the ring, whereupon the play between levers 31 and 38 permits a limited upward movement of the latter independently of the former for a purpose hereinafter set forth. The lever 30 (Fig. 2) has a similar bifurcated portion 30^a and an associated bell crank lever 40 operatively connected to plug 18 and provided with a lateral lug 40^a projecting into the bifurcated portion 30^a. Also lever 30 is provided with a spring 41 corresponding to spring 39 to bias said lever in the same manner and for the same purposes as in the case of lever 31. Further, the lever 30 is provided with an elongated threaded spindle 42 (Fig. 2), for its roller 33, said spindle being revolubly carried by and between said lever and a bracket arm 30^b projecting from the hub of said lever. The roller 33 is threaded on spindle 42 and thus as will appear, is adjustable relatively to the roller 34 for varying the range of operation of the driven shaft, said roller 33 being lockable in adjusted position by a set screw 43 adapted to be secured against turning by a wire 44.

The cams 35 and 36 (Figs. 1 and 5) are slidingly mounted upon a square shaft 45 and are confined between arms 37^a and 37^b of the traveling device 37, which comprises a yoke threaded onto a shank 46. The cam 35 fits the shaft 45 to rotate therewith, while the cam 36 is rotatably mounted upon said shaft and provided with teeth 36^a to interlock with teeth 35^a on the cam 35. Also, the cam 36 is provided with a peripherally grooved hub, 36^b, having a bearing in the arm 37^a of the traveling device, the arrangement being such that said cam may be disengaged from the cam 35, then rotated for

adjustment relative thereto and then reëngaged therewith. This adjustment, as will appear, also provides for variation of the range of operation of the driven member and for retaining the cams in the desired interlocked relation the traveling device is provided with a set screw 47 adapted to be set into the peripheral groove in the hub 36b. Thus, as will be apparent, the screw shaft 46 provides for movement of the device 37 to push the cams along the square shaft 45 while the latter shaft provides for rotation of the cams during their rectilinear movement.

Both shafts 45 and 46, have bearings in opposite walls of the casing and the upper extremities of the two shafts project through the casing as shown in Fig. 3, and as shown in the same figure, the shaft 45 has fixed thereto a gear 50, while the shaft 46 has fixed thereto a gear 51, the former to be driven intermittently by the driven shaft 1 and the latter to be driven continuously by said driven shaft. More specifically, the gear 51, is driven by a pinion 52 (Figs. 2 and 3) fixed to the extension 1a of the driven shaft 1, through the medium of an idler 53 mounted upon a stud 54 fixed to the wall of the casing while the gear 50 is driven by the same pinion through the medium of an interrupted gear 55 fixed to the hub of said idler and meshing with a second idler 56 which meshes with gear 50. Thus, as before stated, the screw shaft 46 will be continuously driven by the shaft 1 at a speed determined by the relative sizes of the gear 51 and pinion 52 while the shaft 45 carrying the cams will only be operated intermittently, or in other words, in a step by step manner, each step of rotation being dependent upon a given angular movement or a given number of revolutions of the shaft 1 according to the gear ratio. As shown the interrupted gear has but two teeth and the idler 53 is of greater diameter than pinion 52 whereby shaft 45 will make only a partial revolution to a number of revolutions of the driven shaft.

Hence in operation the traveling device by its rectilinear movement, provides for alining the cams with their respective rollers upon given operations of the driven shaft, while the rotation of the cams when so alined with their rollers provides for actuation of the levers carrying said rollers, and hence for withdrawal of the corresponding plugs. Obviously, therefore, the intermittent rotation of the cams enables the mechanism to be readily designed for insuring effective alinement of the cams with their rollers prior to their rotation thereagainst, while the aforesaid adjustments of the roller 33 and cam 36 provide for variation of the limits at which the plugs are withdrawn and through a considerable range.

The means controlling the power supply to the motor, as best illustrated in Fig. 4, comprises two pairs of stationary contacts 60—61 and 62—63, a bridging contact 64 for the former and a bridging contact 65 for the latter. Each of said stationary contacts has an open pivotal bearing 66 upon a right angle bearing plate 67 and a spring pressure device 68, to yieldingly hold the same against said plate and in the path of its respective coöperating contact, the bearing plates of all of said contacts being fixed to an insulating block 69. The insulating block 69 is mounted in a rectangular chamber provided at the side of casing 7 (Fig. 3) and is provided with binding posts for all necessary connections of the contacts. The bridging contacts 64 and 65, on the other hand, are respectively mounted upon the upright arms of the bell crank levers 40 and 38 which as before described, directly engage the plugs 18 and 19 respectively. As best shown in Figs. 2 and 4, each of the bridging contacts comprises a cylinder secured by an insulated bolt 70 to the extremity of its respective lever and as shown in Fig. 1, each of these contacts engages and bridges its respective stationary contacts in the normal position of its supporting lever, *i. e.*, the position of said lever insuring depression of the corresponding plug.

Thus when either plug is retracted as above described, its respective actuating lever also tends to withdraw the contact carried thereby from engagement with its respective stationary contacts but the latter are arranged to maintain circuit throughout such movement of the lever. On the other hand, each movable contact is arranged to be disengaged from its respective stationary contacts upon a slight additional movement of its respective lever and the aforesaid peaked surfaces of the blocks 23 and 24 carried by the ring 3e provide for such additional movement of the levers. For example, assuming a tendency of the ring 3e to rotate in a counter-clockwise direction and further assuming retraction of the plug 19, as above described, the block 24 of said ring will pass beneath said plug and through the medium of its peaked surface lift the same for additional movement of bell crank lever 38. Again assuming a tendency of the ring 3e to rotate in a clockwise direction, and further assuming retraction of the plug 18, said ring will rotate to force the block 23 beneath said plug, and through the medium of its peaked surface, lift the same for additional movement of its bell crank lever. And since the lost motion connection between each pair of levers 38—31 and 40—30, leaves the first mentioned lever of each pair free for movement independently of the other following retraction of the plugs by the traveling device, the further movement

of levers 38 and 40 for disengagement of the contact carried thereby from their respective contacts will be unopposed save by the friction of the parts. Also since the ring 3^c when released will accelerate very rapidly the peaked blocks of said ring will effect quick actuation of the plugs and hence quick actuation of the movable contacts for disengagement from the stationary contacts, and with the levers 38 and 40 designed as illustrated, a slight movement thereof by the plugs will effect a relatively wide break between the contacts.

With the circuit arrangement hereinafter described, it is desirable upon opening of either limit switch, to insure against reclosure thereof, pending reverse operation of the motor, whereas the actuating means specified tends to release said switches for reclosure thereof, as soon as the ring rotates sufficiently to remove the blocks 23 and 24 from beneath their respective plugs. To insure such desired result, the levers 38 and 40 are respectively provided with laterally projecting pins 38^c and 40^c (Figs. 2 and 4) while a latching pawl 71 (Figs. 1 and 4) for said pins is pivotally mounted upon a bracket 72 within the casing and biased to latching position by a spring 73. And the arrangement is such that opening of either switch engages its respective pin with said pawl for retention of the actuated switch in open position whereas the pawl is so formed as to release the retained switch when subjected to the bias of its return spring 39 or 41, following withdrawal of the traveling device from the path of its respective lever by reverse operation of the driving motor.

Referring to Fig. 6, the same diagrammatically shows the motor 4 as having an armature A and series field winding F and further shows schematically the limit switches above described and a drum controller 75 for completing the motor circuit through the limit switches and reversing the flow of current through the motor armature. Both limit switches are included in series with the motor, one being included in the motor connections for forward operation and the other being included in the motor connections for reverse operation. More specifically with the drum controller in the position illustrated circuit is traceable from the line L to and through contacts 76, 77 and 78 by conductor 79 through armature A from left to right by conductor 80 to and through contacts 81, 82 and 83 by conductor 84 through contacts 60, 64 and 61 of one limit switch by conductor 85 to and through the motor field winding F to line L. On the other hand with the drum controller in its other position circuit is traceable from line L to and through contacts 76, 86 and 81 by conductor 80 through the motor armature from right to left by conductor 79 to and through contacts 78, 87 and 88 by conductors 89 to and through contacts 62, 65 and 63 of the other limit switch and thence through the motor field winding to line L′ as already described.

Thus the one limit switch serves to interrupt the motor circuit when the motor operates in a given direction while the other serves to interrupt the motor circuit when the motor operates in a reverse direction and the mechanism described provides for a quick operation of each limit switch for quick interruption of the motor circuit substantially simultaneously with the release of the ring 3^c for interruption of the driving connection. Accordingly, rotation of the ring 3^c and reëstablishment of the driving connection by rotation of said ring as above described, will be dependent upon the momentum of the motor reversal thereof, and as will be understood one or the other of the limit switches is always closed whereby the motor after being arrested may be started in a reverse direction.

Further, it will be observed that the limit mechanism described provides for resetting of the withdrawn plug and reclosure of the opened switch upon a relatively slight reverse operation of the traveling device of said mechanism whereby the driven device may be reversed at any point within a wide range between limits, which is frequently quite desirable.

What I claim as new and desire to secure by Letters Patent is:

1. In combination, driving and driven members, a driving connection therebetween including a part requiring restraint to render the same effective, a restraining element for said part and mechanical means subjecting said element to positive actuation by one of said members under given conditions to thereby release said driven member from said driving member.

2. In combination, driving and driven members, a driving connection therebetween including a part requiring restraint to render the same effective, a restraining element for said part and mechanical limit means to actuate said element for release of said members, including a cam connected to and positively operable by one of said members and a positive actuating member for said element arranged in the path of said cam.

3. In combination, driving and driven members, a driving connection therebetween including a part requiring restraint to render the same effective, a restraining element for said part having a projecting operating member connected thereto for positive operation thereof, a traveling device having a rotatable cam to be alined thereby with said operating member and then rotated thereagainst for actuation of said element and means providing for drive of said traveling

device by said driven member and for rotation of said cam but subject to arrest for alinement with said operating member.

4. In combination, driving and driven members, a driving connection therebetween including a part requiring restraint to render the same effective, a reciprocable element operable to restrain and release said part, a lever connected to said element for positive actuation thereof to release said part and a traveling device connected to and operable by one of said members to positively actuate said lever.

5. In combination, driving and driven members, a driving connection therebetween including a part requiring restraint to render the same effective, a reciprocable element operable to restrain and release said part, a lever connected to said element for positive actuation thereof to release said part and a traveling device connected to and operable by one of said members, said device having a rotatable cam to engage and actuate said lever, said cam being driven for rotation thereof intermittently.

6. In combination, a driving motor, a driven member, a driving connection therebetween including a part subject to operation by said motor and restrainable and releasable to respectively render said connection effective and ineffective and a switch subject to operation by said part when released, to interrupt the power supply to said motor.

7. In combination, a driving motor, a driven member, a driving connection therebetween including a part subject to operation by said motor and restrainable and releasable to respectively render said connection effective and ineffective, restraining means for said part responsive to movement of said driven member to release said part at a predetermined limit of said member and a switch subject to operation by said part when released, to interrupt the power supply to said motor.

8. In combination, a driving motor, a driven member, a driving connection therebetween including a part subject to operation by said motor and restrainable and releasable to respectively render said connection effective and ineffective, a restraining element for said part operable to release the same and further operable by said part upon movement of the latter and a switch responsive to such further operation of said element to interrupt the power supply to said motor.

9. In combination, a driving motor, a driven member, a driving connection therebetween including a part subject to operation by said motor and restrainable and releasable to respectively render said connection effective and ineffective, a restraining element for said part operable to release the same and further operable by said part upon movement of the latter following its release, a switch responsive to such further operation of said element to terminate the power supply to said motor and means responsive to movement of said driven member to operate said element for release of said part at a given limit of said driven member.

10. In combination, a driving motor, a driven member, a driving connection therebetween including a rotatable part subject to operation by said motor and restrainable and releasable to respectively render said connection effective and ineffective, a restraining element for said part operable to release the same, means to effect such operation of said element at a given limit of said driven member, said part having a cam surface for further operating said element upon release and rotation of said part and a limit switch for said motor operable by said part through the medium of said element.

11. In combination, a driving motor, a driven member, a driving connection therebetween including a part subject to operation by said motor, a restraining element for said part operable to release the same and further operable by said part upon movement of the latter following its release, a limit switch for said motor adapted to be tripped by said element but only upon full movement thereof and means for effecting operation of said element to release said part at a given limit of said driven member, said element having a play relative to said means to permit free movement of the former by said part.

12. In combination, a driving motor, a driven member, a driving connection therebetween including a part subject to operation by said motor, a restraining element for said part operable to release the same and further operable by said part upon movement of the latter following its release, a limit switch for said motor connected to said element to be opened and closed thereby but opened only upon full movement of said element, means biasing said element to a position to restrain said part and close said switch and means to effect operation of said element for release of said part at a given limit of said driven member and to release said element upon a relatively small movement of said member away from its limit.

13. In combination, a reversible driving motor, a driven member, a driving connection therebetween including a part subject to reverse operations by said motor according to the direction of operation of the latter, said part being restrainable and releasable to respectively render said connection effective and ineffective and reverse limit switches for said motor subject to operation selectively by said part when released.

14. In combination, a reversible driving

motor, a driven member, a driving connection therebetween including a part subject to reverse operations by said motor according to the direction of operation of the latter, said part being restrainable and releasable to render said connection effective and ineffective, restraining elements for said part operable selectively for release of the same according to the direction of operation of said motor, said part acting when so released to further operate the selected element and reverse limit switches for said motor operable selectively by said elements when so operated by said part.

15. In combination, a reversible driving motor, a driven member, a driving connection therebetween including a part subject to reverse operations by said motor according to the direction of operation of the latter, said part being restrainable and releasable to render said connection effective and ineffective, restraining elements for said part operable selectively for release of the same according to the direction of operation of said motor, said part acting when so released to further operate the selected element and reverse limit switches for said motor operable selectively by said elements when so operated by said part and means subjecting said elements to the aforesaid selective operation thereof at given limits of said driven member.

16. In combination, a reversible driving member, a driven member, a driving connection therebetween controllable for substantially instantaneous release of said driven member from said motor, reverse limit switches for said motor and means for effecting such release of said driven member at given limits thereof and also selective operation of said limit switches without interference with reverse operation of said motor and reverse drive of said member, said means also providing for control of said connection and limit switches whereby the said motor and driven member may be reversed between limits.

17. In combination, a reversible driving motor, a member to be driven thereby in reverse directions, a driving connection therebetween including a part restrainable and releasable to respectively render said connection effective and ineffective, means to restrain said part for reverse operations of said driven member between given limits and to release said part at such limits, said means further enabling reversals of the drive of said member when between limits and reverse limit switches for said motor automatically and selectively controlled by certain of the aforesaid elements for termination of the power supply to said motor upon release of said part and for permitting reversals of said motor between limits.

18. In combination, a reversible driving motor, a member to be driven thereby in reverse directions, a driving connection therebetween including a part subject to reverse operations by said motor according to the direction of operation of the latter, said part being restrainable and releasable to respectively render said connection effective and ineffective and a plurality of separately operable restraining elements for said part.

19. In combination, a reversible driving motor, a member to be driven thereby in reverse directions, a driving connection therebetween including a part subject to reverse operations by said motor according to the direction of operation of the latter, said part being restrainable and releasable to respectively render said connection effective and ineffective, a plurality of separately operable restraining elements for said part and means for effecting selective withdrawal of said elements from restraining relation with said part at given limits of said driven member.

20. In combination, a reversible driving motor, a member to be driven thereby in reverse directions, a driving connection therebetween including a rotatable part subject to reverse operations by said motor and restrainable and releasable to render said connection effective and ineffective and a plurality of separately operable restraining elements for said part, said part having a rotary play relative to each of said elements.

21. In combination, a reversible driving motor, a member to be driven thereby in reverse directions, a driving connection therebetween including a rotatable part subject to reverse operations by said motor and restrainable and releasable to render said connection effective and ineffective and a plurality of separately operable restraining elements for said part, said part having a rotary play relative to each of said elements, and being restrainable by said elements jointly in a rotary position from which it is movable in opposite directions upon selective withdrawal of said elements.

22. In combination, a reversible driving motor, a member to be driven thereby in reverse directions, a driving connection therebetween including a rotary part subject to reverse operations by said motor, separately operable restraining elements for said rotary part, said part having a rotary play relative to each and being restrainable by the same jointly in a position from which it is movable in opposite directions upon release by said elements selectively and means for selectively operating said elements for release of said part at given limits of said driven member.

In witness whereof, I have hereunto subscribed my name.

PETER P. DEAN.