

Dec. 4, 1934.

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1,982,926

OPERATING MECHANISM FOR CLUTCHES AND THE LIKE

Original Filed April 24, 1930 5 Sheets-Sheet 1

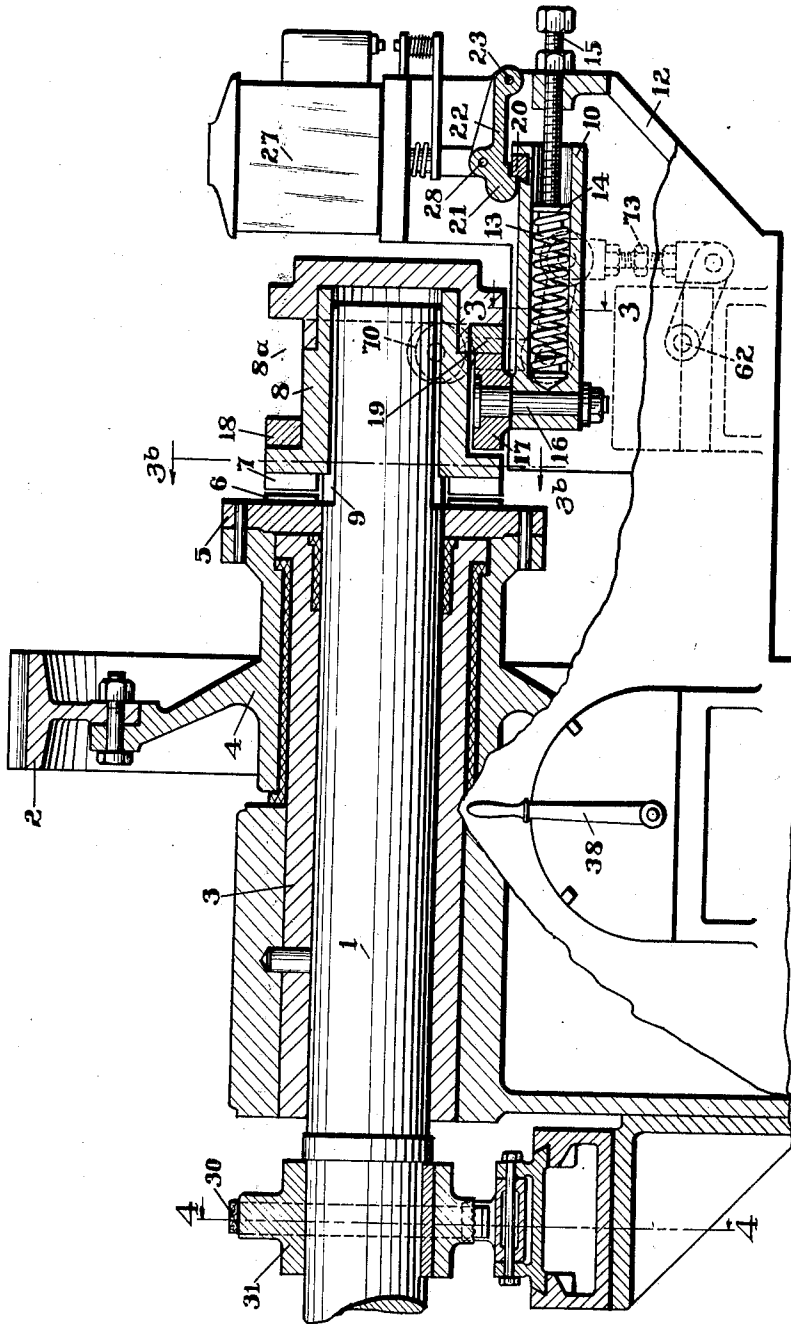


Fig. 1.

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Original Filed April 24, 1930 5 Sheets-Sheet 2

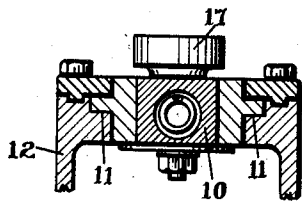


Fig. 3.

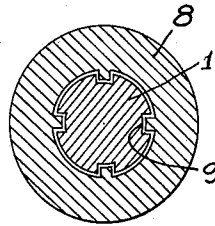


Fig. 3b

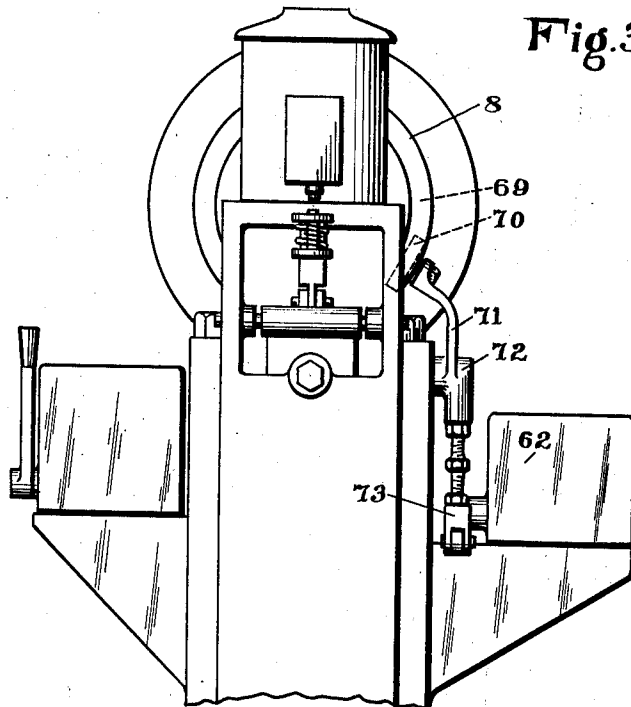


Fig. 2.

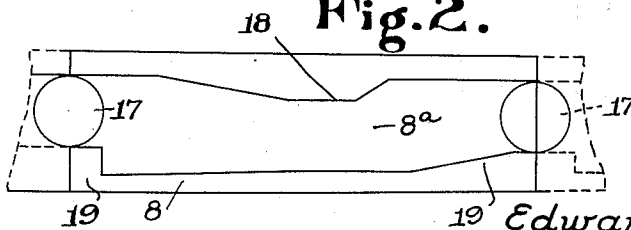


Fig. 3^a

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OPERATING MECHANISM FOR CLUTCHES AND THE LIKE

Original Filed April 24, 1930 5 Sheets-Sheet 3

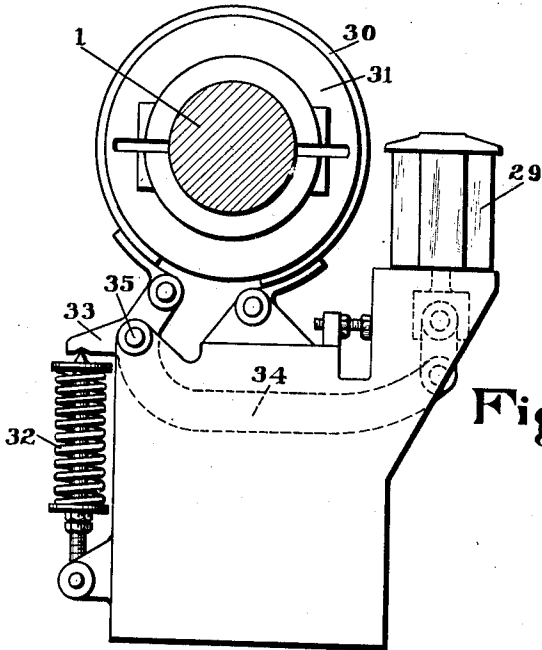


Fig. 4.

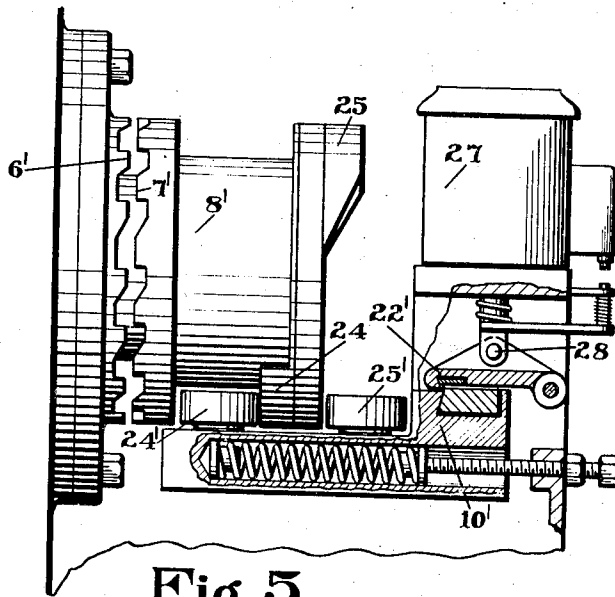


Fig. 5.

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OPERATING MECHANISM FOR CLUTCHES AND THE LIKE

Original Filed April 24, 1930 5 Sheets-Sheet 4

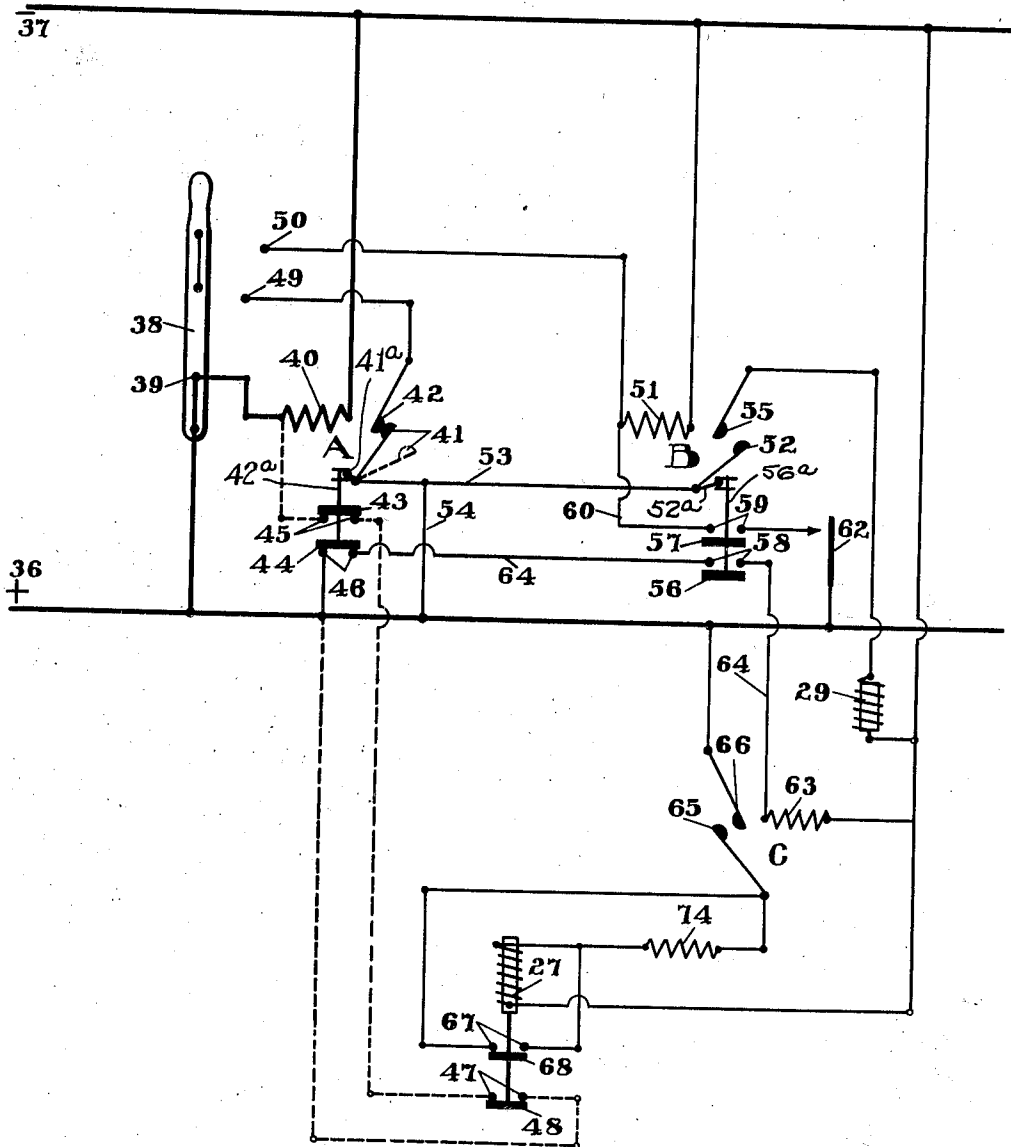


Fig. 6.

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OPERATING MECHANISM FOR CLUTCHES AND THE LIKE

Original Filed April 24, 1930 5 Sheets-Sheet 5

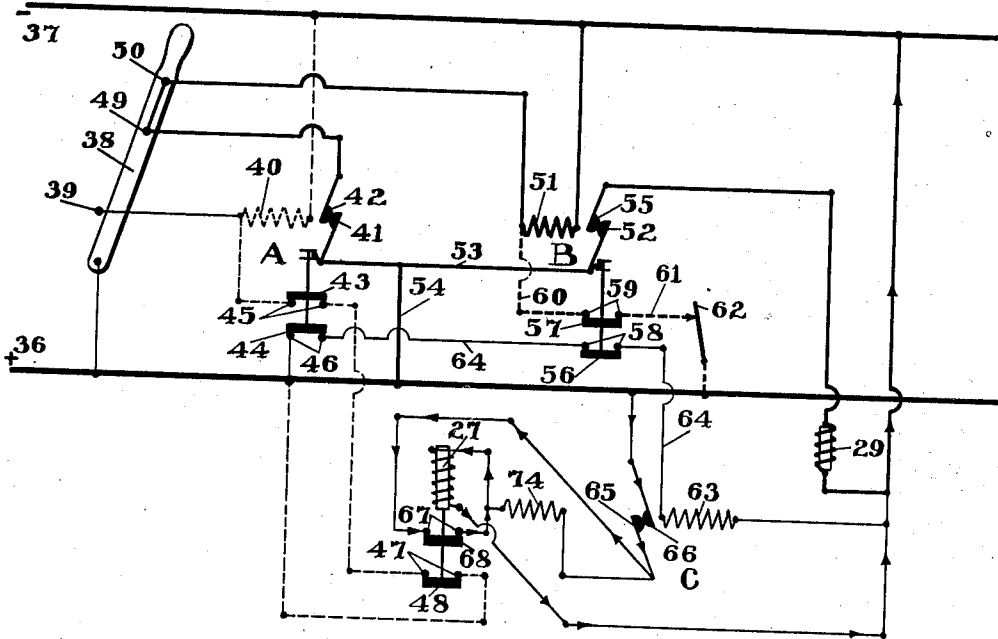


Fig. 7.

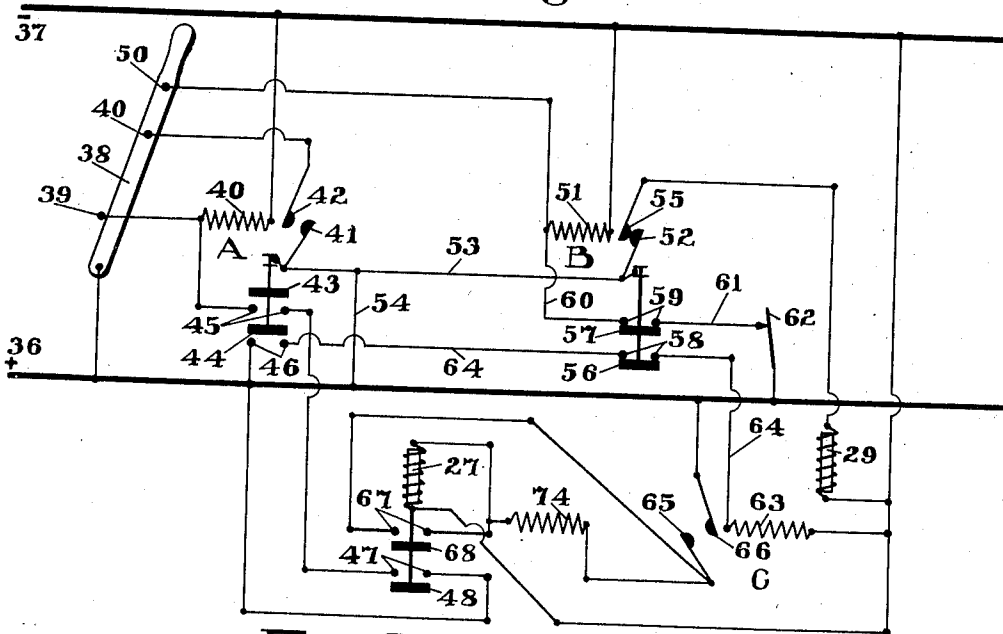


Fig. 8.

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UNITED STATES PATENT OFFICE

1,982,926

OPERATING MECHANISM FOR CLUTCHES AND THE LIKE

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Original application April 24, 1930, Serial No.
446,901. Divided and this application October
1, 1931, Serial No. 566,339

8 Claims. (Cl. 192—144)

The present invention relates to operating mechanism for clutches, and is adapted particularly for use with clutches in which the clutching elements are intermittently engaged and disengaged, to procure predetermined angular movements of a driven member, from a constantly rotating driving member. The present application is a division of my copending application Serial No. 446,901, filed April 24, 1930.

The invention resides in an automatic electric control for the clutching devices, arranged in proper interlocking relation to the application and release of a braking member for the intermittently driven machine. Other and further objects and advantages of the invention will be made apparent in the following detailed description thereof, in connection with which reference is had to the accompanying drawings, wherein—

Fig. 1 is a vertical sectional view illustrating the application of my invention to the intermittent drive of an actuating shaft for a shear or the like.

Fig. 2 is an end elevation of the mechanism shown in Fig. 1.

Fig. 3 is a large scale sectional view on the line 3—3 of Fig. 1.

Fig. 3a is a developed view of the cam members shown in Fig. 1.

Fig. 3b is a fragmentary sectional view on the line 3b—3b of Fig. 1.

Fig. 4 is a large scale sectional view on the line 4—4 of Fig. 1.

Fig. 5 is a fragmentary sectional view similar to Fig. 1, illustrating a modified form of the invention.

Fig. 6 is a wiring diagram, illustrating the electrical connections by which the operations of the clutching and braking solenoids are secured.

Figs. 7 and 8 are views similar to Fig. 6, showing different conditions of the electrical apparatus.

Like reference characters refer to like parts in the different figures.

For purposes of illustration, I have shown the clutching devices which are operated by the invention as applied to the intermittent rotation of a driven shaft 1, which may be employed, for example, to operate a metal cutting shear or the like, not shown,—it being the function of the clutch to impart, at intervals, a predetermined angular movement to said shaft, for the purpose of procuring a single operation of the shear or other devices, and then to disconnect said shaft from the driving power, until another operation is desired. The driving power in the present instance is shown in the form of a continuously rotating gear 2 which receives its rotation from

any suitable source of power, not shown, said driving member 2 being journaled on a stationary quill or sleeve 3, concentric with the driven member 1. The constantly rotating gear 2 has secured to its hub 4 a clutching member 5, providing a series of clutch teeth 6 which are adapted to cooperate with a similar series of clutch teeth 7 on a sliding collar 8. The latter is mounted for sliding movement on the projecting end of driven shaft 1, said projecting end being squared or grooved as shown at 9, Fig. 3b to prevent relative rotation between said collar 8 and the shaft 1. In the normal non-operative position of the parts, the collar 8 occupies the position shown in Fig. 1, with its clutch teeth 7 out of engagement with the rotating teeth 6 of driving member 2,—the driven shaft 1 under these conditions being stationary. When the collar 8 is moved to the left, Fig. 1, the clutch teeth 6 and 7 are engaged, resulting in the rotation of shaft 1 from the continuously rotating gear 2.

The mechanism for securing the movement of collar 8, to engage and disengage the clutch, is here shown as embodying a slidable member 10. As shown in Figs. 1 and 3, said member 10 is mounted for sliding movement, in a direction parallel to the axis of shaft 1, in suitable guide-ways 11, 11 provided by the frame bracket 12. The member 10 is constantly urged to the left, Fig. 1, by the expansive action of spring 13, the latter, as here shown, being contained within a lengthwise recess of said member 10, so as to press at one end against said member; at the other end, said spring is seated on a relatively stationary abutment 14, which is carried by a screw 15 adjustable in the frame bracket 12. By means of said screw, the member 14 is movable in and out, to vary, as desired, the expansive force of spring 13, by which the member 10 is urged to the left in Fig. 1.

The slidable member 10 carries a pin 16, whereon is journaled a roller 17 received in a circumferential groove 8a of clutch collar 8. The sides of said groove are in the form of cam surfaces 18 and 19, as hereinafter described, for cooperation with roller 17 to obtain the engaging and disengaging movements of the clutch collar 8. The normal position of member 10, when the clutch is disengaged, is shown in Fig. 1 as involving a retraction of said member to the right, far enough to dispose a shoulder 20 thereof behind the hooked end 21 of a latch member 22, which is pivoted as shown at 23. When said latch member 22 is lifted clear of the shoulder 20, the expansive force of spring 13 will drive the

member 10 sharply to the left, and the roller 17 being then opposed to the left hand wall of groove 8a, at a point angularly removed from the raised cam surface 18, will shift the collar 6 to the left, to engage its teeth 7 with the teeth 6 of driving member 2. Thereupon, the rotation of collar 8 and with it the driven shaft 1 is inaugurated; such rotation in due time brings into play against the roller 17 the raised cam surface 18, whereby a retraction of member 10 to its original latched position is obtained. Thereafter, just before the collar 8 and shaft 1 complete a single revolution, the raised cam surface 19 approaches the position shown in Fig. 1, and since the roller 17 has been locked by latch 22 against left hand movement, the reaction between roller 17 and cam 19 will effect the right hand movement of collar 8 that is necessary to carry the teeth 7 out of engagement with the driver teeth 6.

Referring now to Fig. 5, I have shown a somewhat modified construction of the clutching and unclutching mechanism, as embodied in a slidable collar 8', which provides a pair of cam surfaces 24 and 25, and an operating member 10' which carries, for coaction with the respective cams, the two rollers 24' and 25'. When the latch 22' is raised to release said member 10' for its left hand movement, the engagement of roller 25' with the end of the collar 8', shifts the latter into clutching position,—this occurring when the effective surface of cam 25 is angularly displaced from said roller 25'; the ensuing rotation engages cam 25 with said roller 25' and thereby returns the member 10' to its latched position. Thereafter, just before a single revolution of the shaft 1 has been completed, the effective portion of cam 24 arrives opposite the roller 24', and since said roller is locked against left hand movement, a right hand movement of the collar 8' must take place to disengage the clutch teeth 6' and 7'.

The operation of the latch 22 or 22', as the case may be, is preferably controlled, according to my invention, by a suitable solenoid, designated at 27 in Fig. 1 and also in Fig. 5,—the plunger of said solenoid being connected, as shown at 28, to the latch, so that when the solenoid is energized, the latch will be lifted to bring about an operation of the clutch, in the manner above described. Also, as best shown in Fig. 4, I employ a second solenoid 29 to effect, upon its energization, the release of a brake 30 which encircles a suitable drum 31 on the driven shaft 1, said brake being normally held contracted on said drum by a spring 32 acting through a lever 33. The plunger of solenoid 29 has a link connection 34 with the rock shaft 35, from which the lever 33 projects, so that when said solenoid is energized, the shaft 35 is rocked in such a direction as to overcome the force of spring 32, thereby permitting the brake 30 to expand on drum 31, to release the shaft 1 for free rotation. The control and operation of the solenoids 27 and 29 is effected, according to my invention, by the arrangement of electrical apparatus shown diagrammatically in Figs. 6, 7 and 8, to which reference is now directed for the purpose of setting forth in full detail the manner in which my improved clutch operating mechanism may be electrically actuated and controlled.

Referring to Fig. 6, I have shown diagrammatically the clutch solenoid 27 and the brake solenoid 29 in association with certain electric circuits,

hereinafter described, for which the current supplied may be furnished by the + and - bus leads 36 and 37 respectively. The apparatus includes a master switch 38, which, in the open or "off" position shown by Fig. 6, establishes, by its engagement with a stationary contact 39, a circuit (shown by heavy lines in Fig. 6) which includes the coil 40 of a movable contactor or relay device A, the latter comprising an arm 41 which, by the energization of coil 40, is moved from its broken line position to its full line position, where it engages, as shown, a fixed contact 42. This movement of contactor arm 41 also produces a circuit-closing movement of two bridging contacts 43 and 44, the former of which is operative with respect to a pair of fixed contacts 45, 45, while the latter is operative with respect to a similar pair of fixed contacts 46, 46. As shown in Fig. 6, the arm 41 has an integral arm 41a engaging with the upper end of a rod 43a to which the bridging contacts 43 and 44 are secure. By virtue of the connection thus made between the two contacts 45, 45, a holding circuit, to maintain the energization of contactor coil 40, notwithstanding a shift of the switch 38 to a different position, is established, and this holding circuit, as shown by the heavy broken lines in Fig. 6, includes the lead between the coil 40 and the bus lead 37, said coil, the joined connectors 45, 45, another pair of connectors 47, 47, joined by a connector 48, the latter being normally in the circuit closing position of Fig. 6, and the lead from the contact 47 to the bus lead 36. One of the contacts 45 is connected to one of the contacts 48 as indicated by the dotted line in Fig. 6. The connector 48 is associated with the movable member or plunger of the clutch solenoid 27 and is normally in circuit closing position when the solenoid 27 is deenergized.

When the master switch 38 is shifted clockwise, into the position represented by Fig. 7, engagement with stationary contact 39 is broken, thereby opening the direct circuit previously made by said switch through the contactor coil 40; however, the holding circuit above described is at this time undisturbed. In the position shown by Fig. 7, the master switch establishes electrical connection between two adjacent stationary contacts 49 and 50, the former being connected to the stationary contact 42, and the latter being connected to the coil 51 of a contactor or relay device B, the latter having a movable contact arm 52. Said arm 52 is electrically connected, as shown at 53, with the movable arm 41 of contactor device A, and the two arms 41 and 52 are electrically connected, as shown at 54, to the + side 36 of the supply line. In consequence of connecting the contacts 49 and 50 by the switch 38, as shown in Fig. 7, a circuit is established, as shown in full heavy lines, Fig. 7, through the coil 51 of contactor B, this circuit including the conductor 54, contacts 41, 42, 49 and 50, and the coil 51. This energization of coil 51 moves the contact arm 52 from the position shown in Fig. 6 to the position shown in Fig. 7, where the contact 52 engages a stationary contact 55 that is in circuit, as shown, with the brake solenoid 29. The engagement of the two contacts 52 and 55 completes a circuit through said brake solenoid,—this circuit including the conductors 54 and 53, the contacts 52 and 55, and the coil of solenoid 29, which is connected at one end to the - side 37 of the supply. The energization of solenoid 29 releases the brake 30 which is normally effective to hold the shaft 1 stationary; coincident with the establishment, as above described, of a circuit through

solenoid 29, a holding circuit for the contactor B is established, by reason of the fact that the

27 by the above described opening of the contacts 67, 67. On the part of the bridging member

movement of contactor arm 52 into the position of connector 48, the effect of such clutch sole-

shown in Fig. 7 is accompanied by movement of two bridging connectors 56 and 57, the former adapted to bridge a pair of stationary contacts 58, 58, and the latter adapted to bridge a pair of stationary contacts 59, 59. The connectors 56 and 57 are mounted on a rod 56a, the upper end of which engages an arm 52a integral with the arm 52. One of the contacts 59 is connected by a conductor 60 to the coil 51, and the other contact 59 is connected by a conductor 61 to a suitable limit switch 62. Thus, as shown by the heavy broken lines in Fig. 7, a holding circuit will be established through the contactor coil 51 if the switch 62 is closed, said circuit including switch 62, conductor 61, contacts 59, 59, connector 57, conductor 60, and coil 51.

The above described energization of coil 51 to move the contact arm 52, also produces the bridging of contacts 58, 58 by the connector 56, and this establishes another electric circuit which includes a coil 63 associated with a third contactor or relay device C,—said circuit, as shown in Fig. 7, being completed through the pairs of bridged contacts 58, 58 and 46, 46 which are connected by a conductor 64. The contactor device C provides a movable contact arm 65, which shifts from the position shown in Fig. 6 to the position shown in Fig. 7. When the coil 63 is energized, this movement engages arm 65 with a stationary contact 66, so that an electrical circuit, as shown by arrows in Fig. 7, is established through the clutch solenoid 27, this circuit including a pair of contacts 67, 67 which are normally bridged by a connector 68, in the same fashion as the associated contacts 47, 47 are normally bridged by the associated connector 48, said connector 68, as well as the connector 48, being associated with the plunger of the solenoid 27 for movement therewith. When this energization of solenoid 27 occurs, the latch 22 (or 22') is raised to release the member 10 (or 10'), thereby engaging the clutch in the manner above described. Since the brake solenoid 29 is energized at the time of the bridging of the contacts 58, 58 which control the relay device C, the latter operating to complete the circuit through the clutch solenoid 27, the clutch is not energized until after the brake 30 on the driven shaft 1 has been released, although the engagement of the clutch occurs a relatively short time after the release of the brake as determined by the setting of the relay device 63. The left hand movement of collar 8 engages a surface 69 thereof with a roller 70 which, as shown in Fig. 2, is carried by an arm 71 pivoted at 72. Through suitable linkage 73, the movement of arm 71 is communicated to the switch 62 to close the same, thus establishing the holding circuit above described for the coil 51 of contactor or relay device B.

Immediately upon the energization of the clutch solenoid 27, as above described, the cylinder of said solenoid moves downwardly, and there occurs an opening movement of the two normally closed connectors 48 and 68, which are connected to the plunger, from the position shown in Fig. 7 to the position shown in Fig. 8. The effect of this movement, on the part of the connector 68, is to break the primary circuit, above described, through the solenoid coil 27; thereafter, the only current flow through said coil 27 must pass through the relatively high resistance device 74, which is cut into series with said coil

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noid energization is to break the holding circuit shown in Fig. 6 for the coil 40 of contactor or relay device A; as a result of this, the contact arm 41 returns, as shown in Fig. 8, to normal position, whereupon the bridging members 43 and 44 are moved to open the respective pairs of contacts 45, 45 and 46, 46. The opening of the contacts 46, 46 breaks the circuit shown in Fig. 7 through the coil 63 of contactor or relay device C; this in turn allows the contact arm 65 to separate from the contact 66; thereby completely deenergizing the clutch solenoid 27. When this occurs, the bridging members 48 and 68 return to their normal closing positions with respect to the contacts 47, 47 and 67, 67, respectively, but there is no re-establishment at this time of any holding circuit through the coil 40, because the bridging member 43 is not in engagement with the contacts 45, 45.

These last-described operations, taking place while the master switch 38 still remains in the position shown in Fig. 7, result finally, as shown in Fig. 8, in the deenergization of the contactor or relay devices A and C, as well as of the clutch solenoid 27, after the latter has secured the release of the clutch operating member 10 (or 10'). The only coil that remains energized is the brake solenoid coil 29, this holding the brake 30 inoperative while the desired revolution of the driven member 1 is taking place. That is to say, although the separation of the contacts 41 and 42 in the circuit of coil 51 has already taken place, the holding circuit for the device B is still maintained through said coil, because the switch 62 is still closed; consequently, the contact arm 52 is maintained in engagement with the contact 55, as shown in Fig. 8, and the brake solenoid 29 is thus maintained in an operative condition for the duration of driving of member 1.

However, when the collar 8 (or 8') shifts to the right in the manner previously described, to disengage the clutch, the operating arm 71 of switch 62 is so moved by surface 69 as to open said switch, whereby the coil 51 is deenergized; this results of course, in the return of contact arm 52 from the position shown in Fig. 8 to the position shown in Fig. 6, in consequence of which the circuit of the brake solenoid 29 is broken, causing the brake 30 to be applied to the driven shaft 1 just as the latter completes its full revolution. Thus, notwithstanding the maintenance of the master switch 38 in the "on" position, as shown in Figs. 7 and 8, there is no repetition of the clutching operation which has been inaugurated by said master switch, because the completion of the cycle of operations above described automatically re-establishes the conditions illustrated in Fig. 6. In other words, it is impossible for another clutching operation to occur, except as the operator may set out deliberately to inaugurate such operation; to do this, the operator must first return the master switch 38 to the "off" position (Figs. 1 and 6), and then, when he desires the operation to occur, shift said master switch to the "on" position (Fig. 7).

I claim,

1. In mechanism of the class described, a clutch adapted to connect driving and driven members for predetermined movements in unison, a brake normally operative on said driven member, solenoids whose energization procure the release of said brake and the operation of said clutch, a

switch whose movement to "on" position procures energization of said solenoids, and means responsive to the ensuing operation of said driven member for de-energizing said solenoids, notwithstanding the maintenance of said switch in its "on" position.

2. In mechanism of the class described, a clutch adapted to connect driving and driven members for predetermined movements in unison, a brake normally operative on said driven member, solenoids whose energization procure the release of said brake and the operation of said clutch, a switch whose movement to "on" position procures energization of said solenoids, means responsive to the ensuing operation of said driven member for de-energizing said solenoids, notwithstanding the maintenance of said switch in its "on" position, and means operated by the return of said switch to "off" position for restoring the solenoid circuits to conditions that provide for energization thereof on the next movement of said switch to "on" position.

3. In mechanism of the class described, a clutch adapted to connect driving and driven members for predetermined movements in unison, a solenoid whose energization procures the operation of said clutch, a switch whose movement to "on" position procures energization of said solenoid, and means responsive to the ensuing operation of said driven member for de-energizing said solenoid, notwithstanding the maintenance of said switch in its "on" position.

4. In mechanism of the class described, a clutch adapted to connect driving and driven members for predetermined movements in unison, a solenoid whose energization procures the operation of said clutch, a switch whose movement to "on" position procures energization of said solenoid, means responsive to the ensuing operation of said driven member for de-energizing said solenoid, notwithstanding the maintenance of said switch in its "on" position, and means operated by the return of said switch to its "off" position for restoring the circuit of said solenoid to a condition which provides for its energization on the next movement of said switch to "on" position.

5. In mechanism of the class described, the combination with a constantly running driving member and an intermittently operated driven member, of a clutch operable to effect the connection and disconnection of said members, a control device movable in one direction by the operator to procure shifting of said clutch from

inoperative to operative position, for the connection of said members, means responsive to a predetermined rotation in unison of said members for shifting said clutch in the other direction to disconnect said members, and electrical connections between said control device and said clutch for preventing a subsequent shift of the latter to operative position until said control device is returned by the operator to its original position.

6. In mechanism of the class described, the combination with a constantly running driving member and an intermittently operated driven member, of a clutch operable to effect the connection and disconnection of said members, a control device movable in one direction by the operator to procure shifting of said clutch from inoperative to operative position, for the connection of said members, means responsive to a predetermined rotation in unison of said members for shifting said clutch in the other direction to disconnect said members, and means brought into action by said last-mentioned shift of said clutch for preventing a subsequent connection of said members thereby until after said control device has been moved by the operator in the opposite direction.

7. In mechanism of the class described, a one-revolution clutch for the intermittent connection of a driven member to a constantly running driving member, a brake for said driven member, a single control device adapted when moved in one direction by the operator to procure the release of said brake and the engagement of said clutch means for subsequently automatically disengaging the clutch and applying the brake independently of the position of the control device, and means providing for re-engagement of said clutch only after said control device has been moved in the opposite direction.

8. In mechanism of the class described, a clutch adapted to connect driving and driven members for predetermined movements in unison, a solenoid whose energization procures the operation of said clutch, a switch whose movement to "on" position procures energization of said solenoid, automatic control means for de-energizing said solenoid to provide for disengagement of the clutch while the switch is in "on" position, and means to provide for a second operation of said clutch only after the switch has been moved manually to its "off" position.

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