July 28, 1931. A. W. MORRIS ET AL 1,816,491

CONTROL MECHANISM

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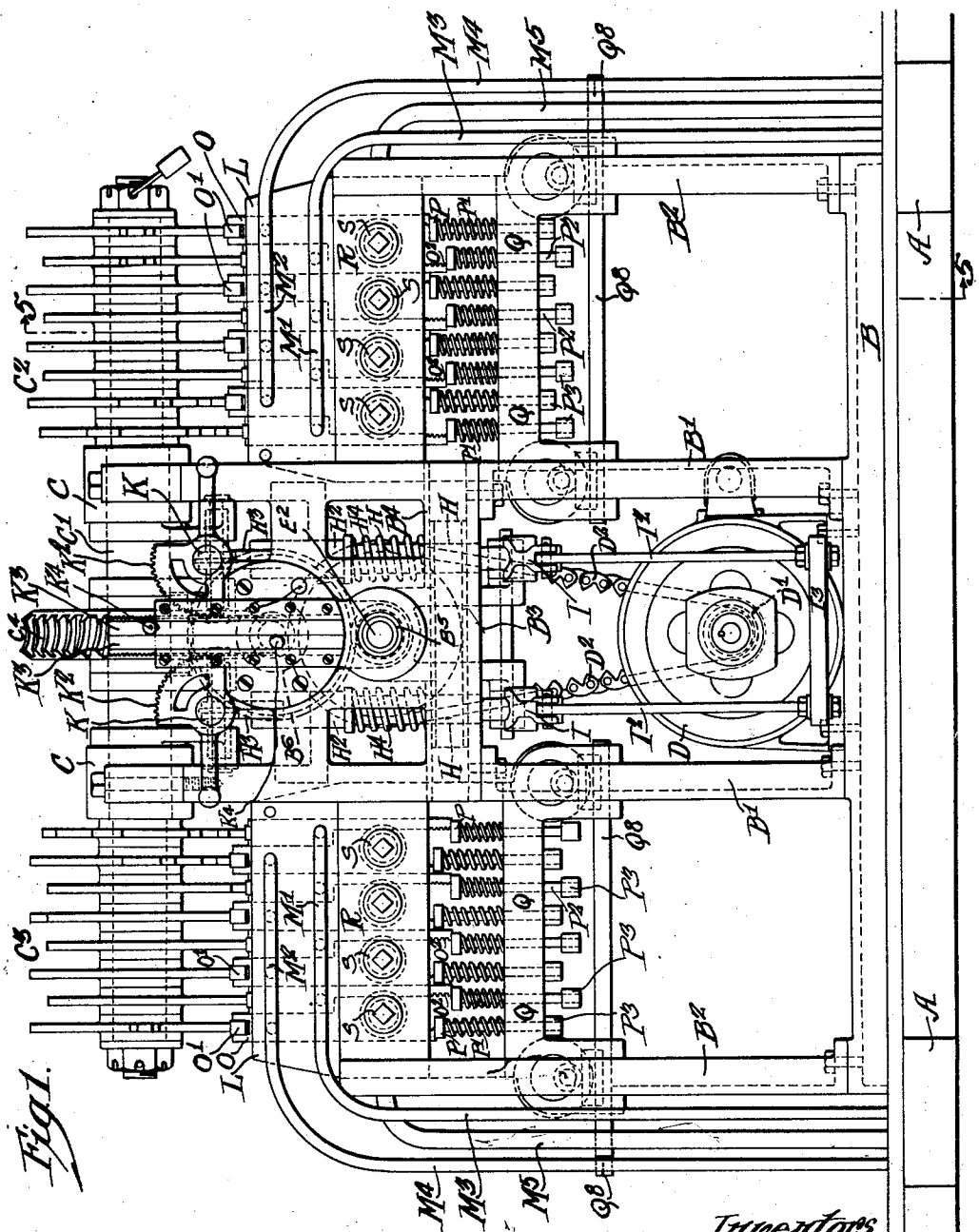


Fig 1.

Witness:
Walter Chamberlain

Inventors
Albert Wood Morris
and Samuel Price Wetherill
by Francis C. Lawrence
their Attorney

July 28, 1931. A. W. MORRIS ET AL 1,816,491

CONTROL MECHANISM

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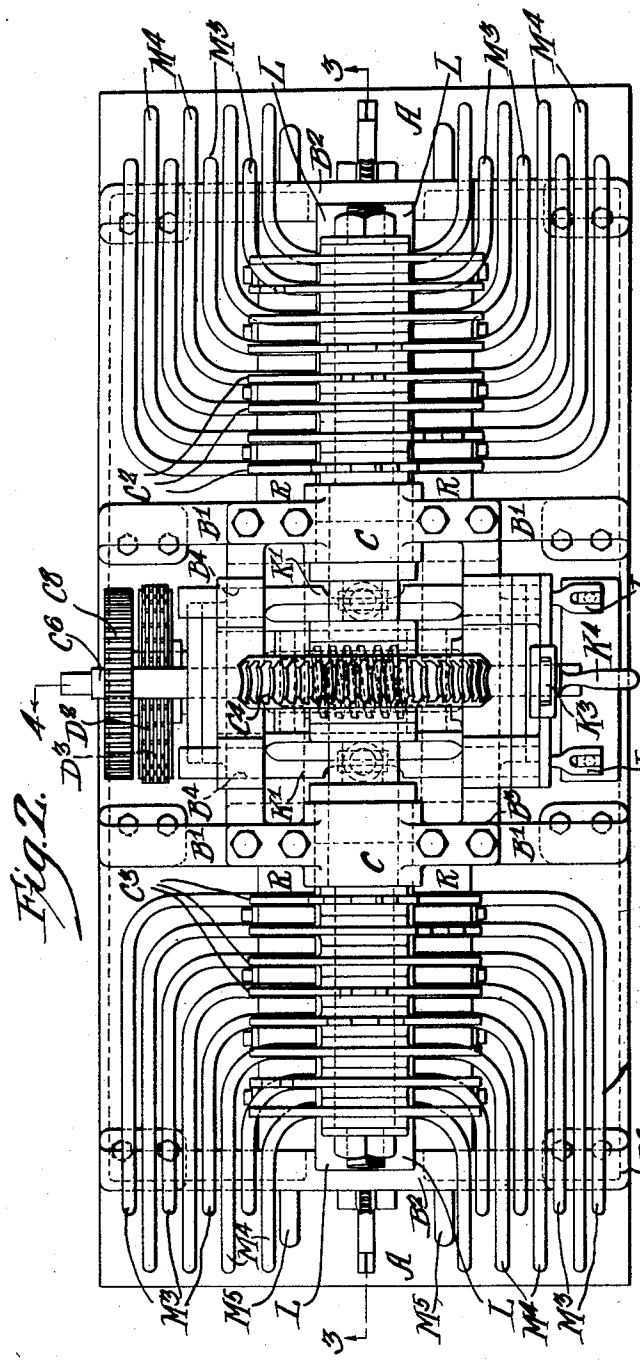


Fig. 2.

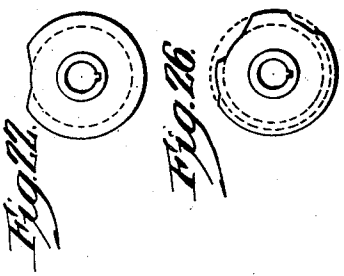


Fig. 22. Fig. 26.

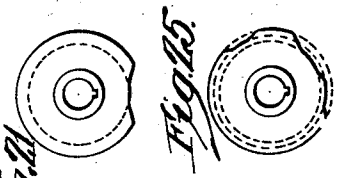


Fig. 21. Fig. 25.

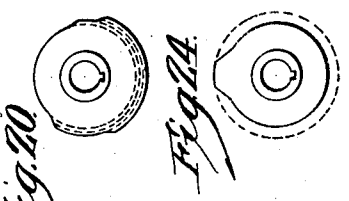


Fig. 20. Fig. 24.

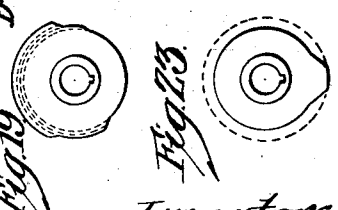


Fig. 19. Fig. 23.

Witness:

Inventors
Albert Wood Morris
and Samuel Price Metheritt
by Francis J. Chamberlain
their Attorney

July 28, 1931. A. W. MORRIS ET AL 1,816,491

CONTROL MECHANISM

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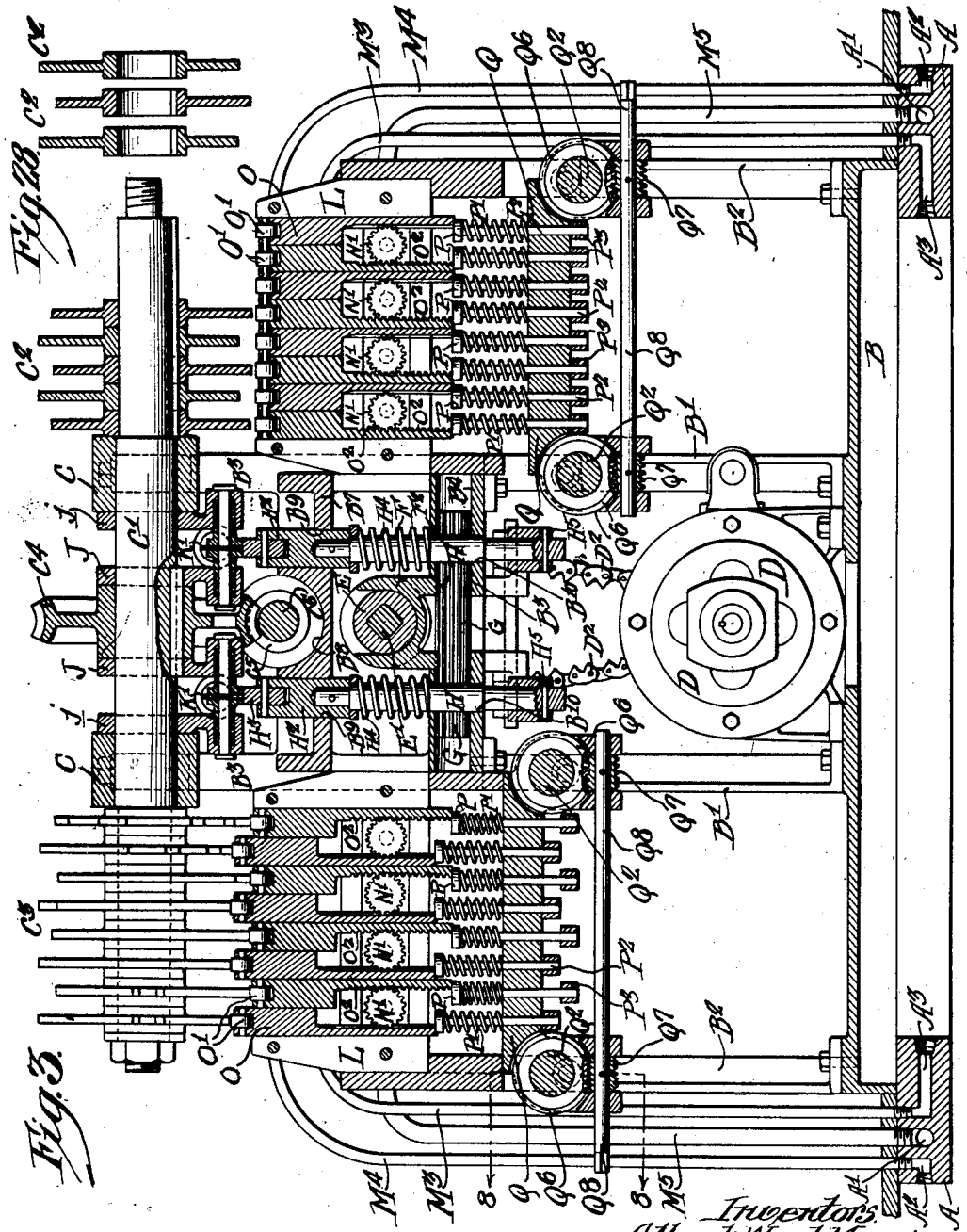


Fig. 3.

Witness:
Walter Chamberlain

Inventors:
Albert Wood Morris
and Samuel Price Wetherill
by Francis D. Chamberlain
their Attorney

July 28, 1931. A. W. MORRIS ET AL 1,816,491

CONTROL MECHANISM

Filed Dec. 11, 1928 8 Sheets-Sheet 4

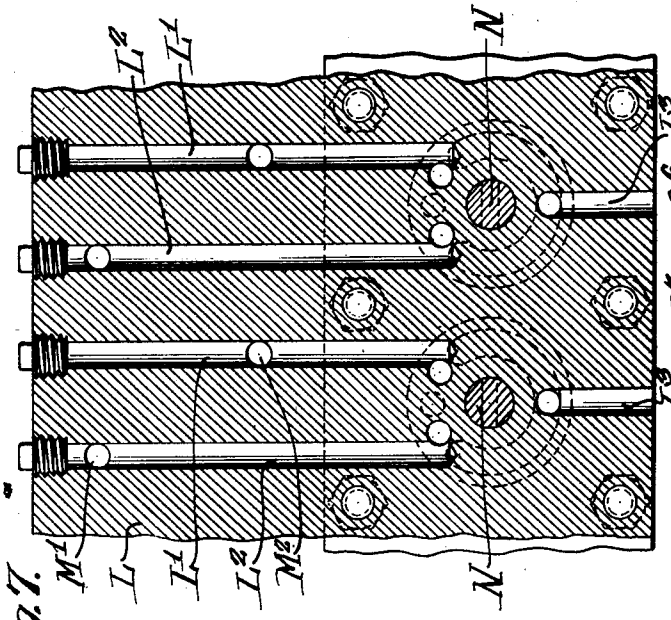


Fig. 7.

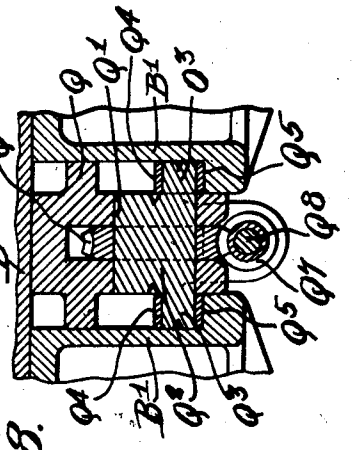


Fig. 8.

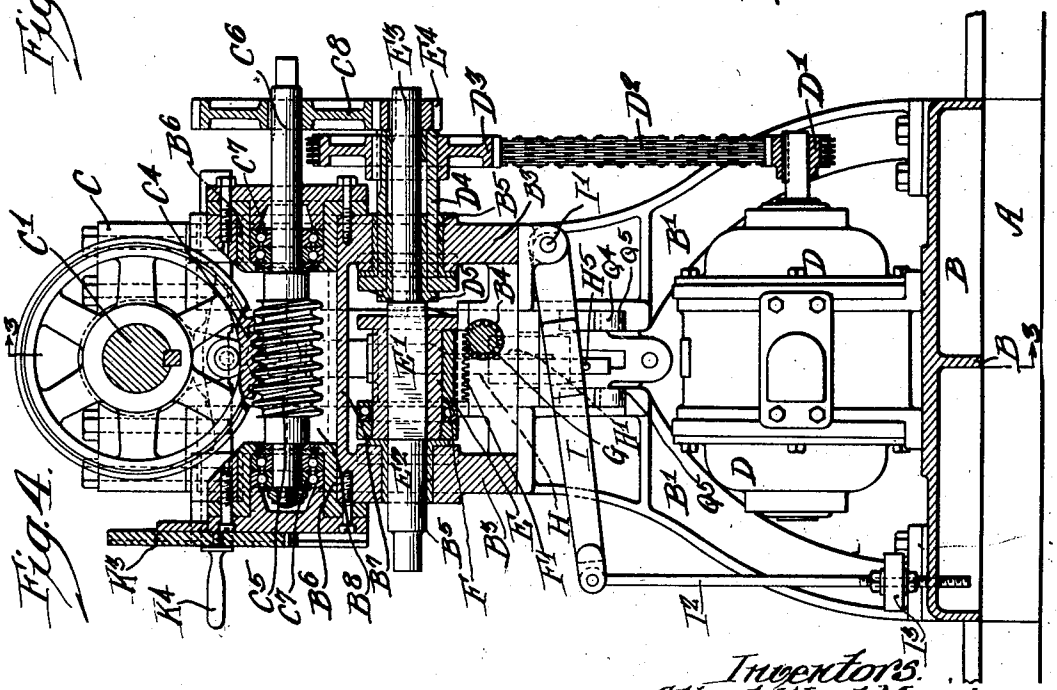


Fig. 4.

Witness:
Walter Thorn.

Inventors:
Albert Wood Morris
and Samuel Price Wetherill
by Francis J. Chambers
their Attorney.

July 28, 1931. A. W. MORRIS ET AL 1,816,491

CONTROL MECHANISM

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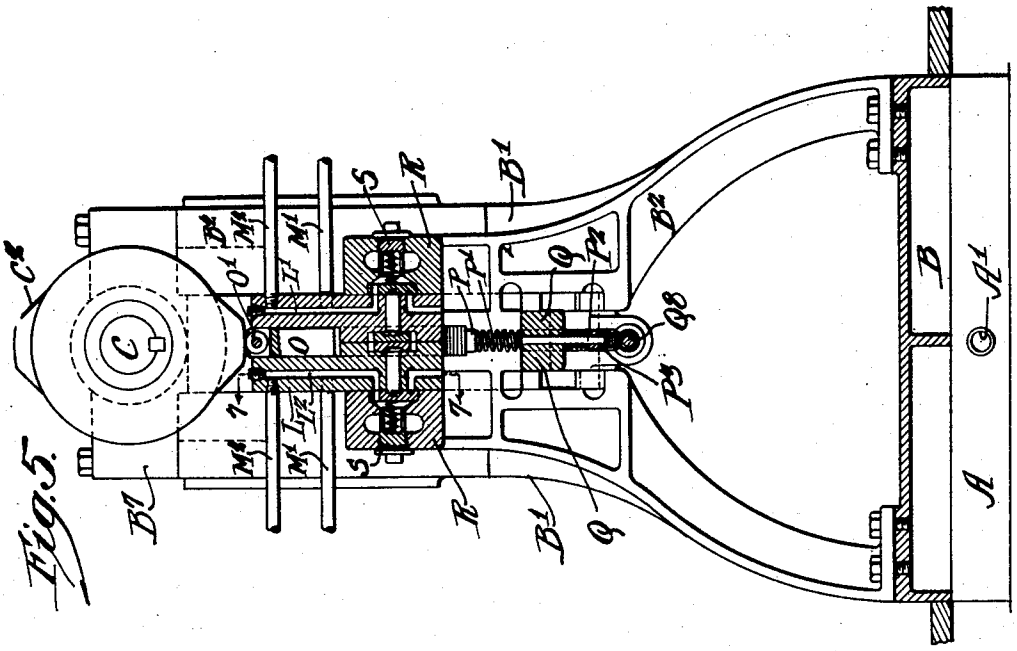


Fig. 5.

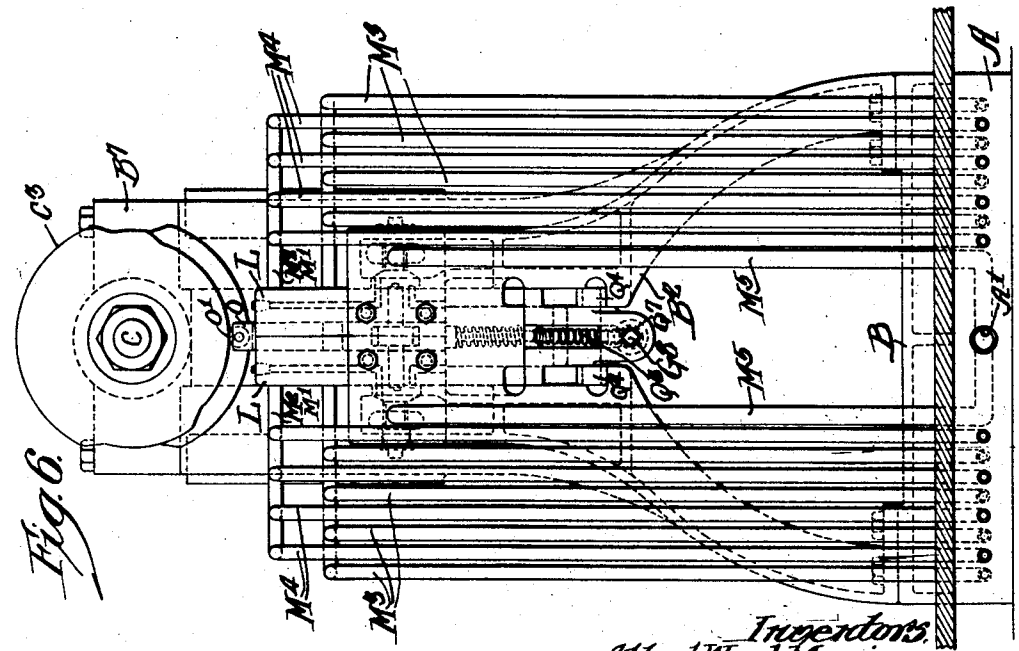


Fig. 6.

Witness:
Walter Chamberlain

Inventors:
Albert Wood Morris
and Samuel Price Wetherill Jr.
by Francis P. Chamberlain
their Attorney

July 28, 1931. A. W. MORRIS ET AL 1,816,491

CONTROL MECHANISM

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Fig. 9.

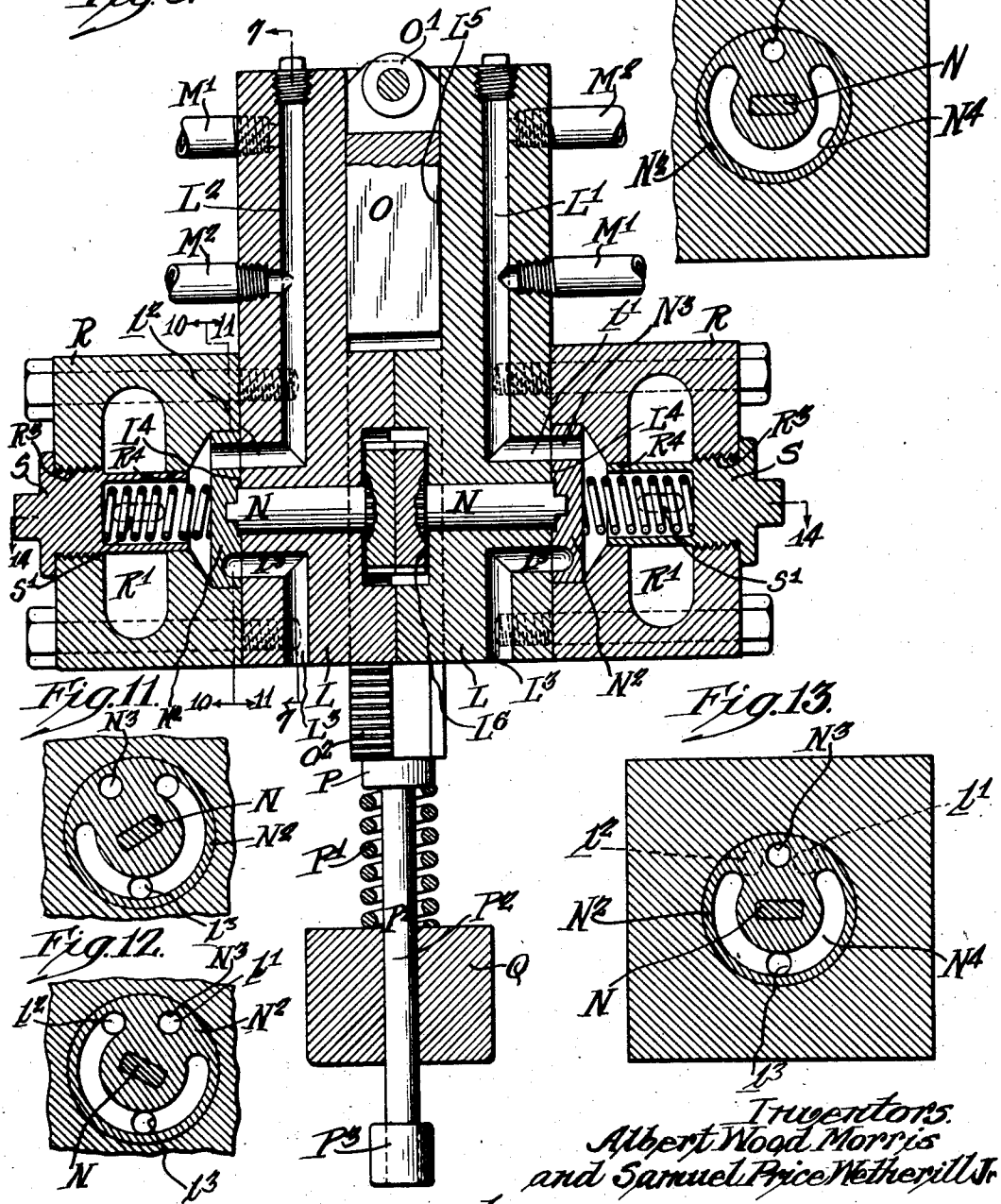


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Inventors.
Albert Wood Morris
and Samuel Price Wetherill Jr.
by Francis J. Chamberlain
their Attorney

Witness:
Walter Chism.

July 28, 1931. A. W. MORRIS ET AL 1,816,491

CONTROL MECHANISM

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Fig. 14.

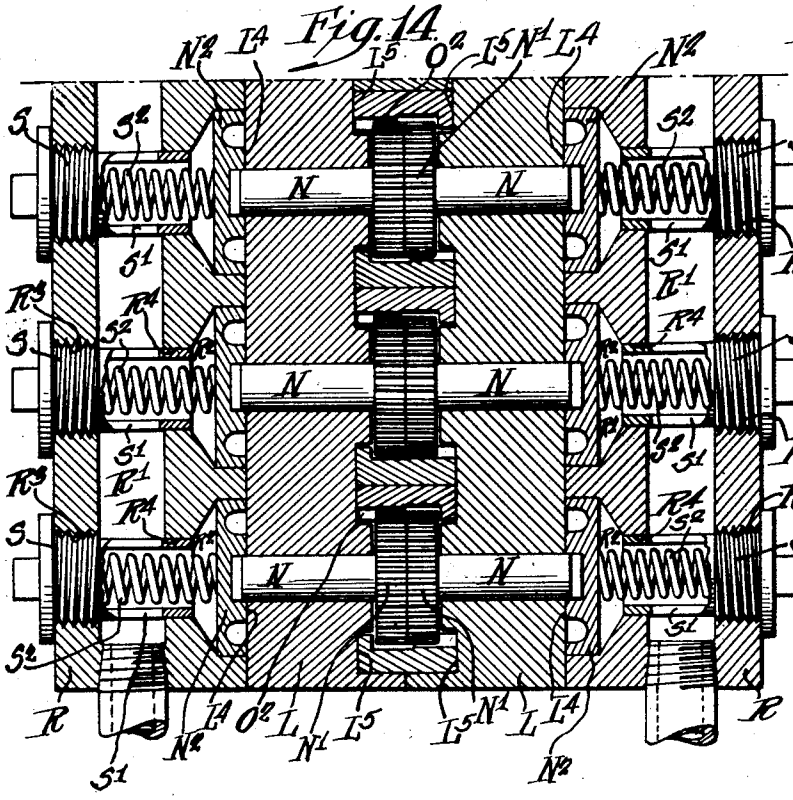


Fig. 15.

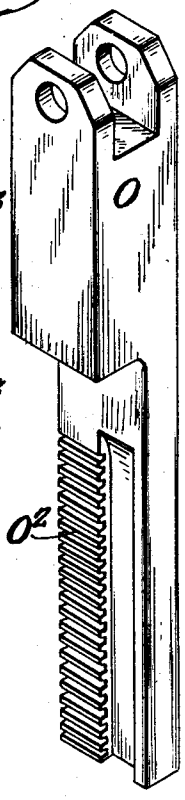
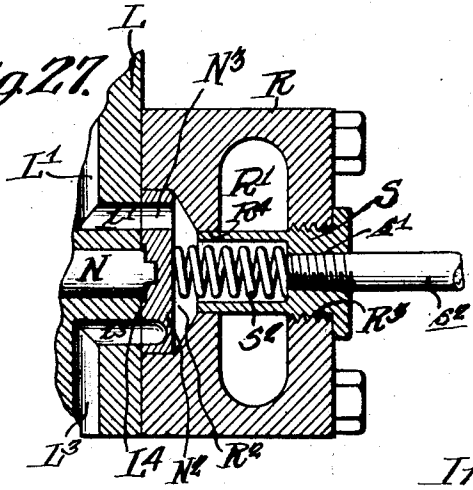


Fig. 27.



Inventors.
Albert Wood Morris
and Samuel Price Wetherill.
by Francis D. Chamberlain
their Attorney.

Witness:
Walter Chamberlain.

July 28, 1931. A. W. MORRIS ET AL 1,816,491

CONTROL MECHANISM

Filed Dec. 11, 1928 8 Sheets-Sheet 8

Fig. 16.

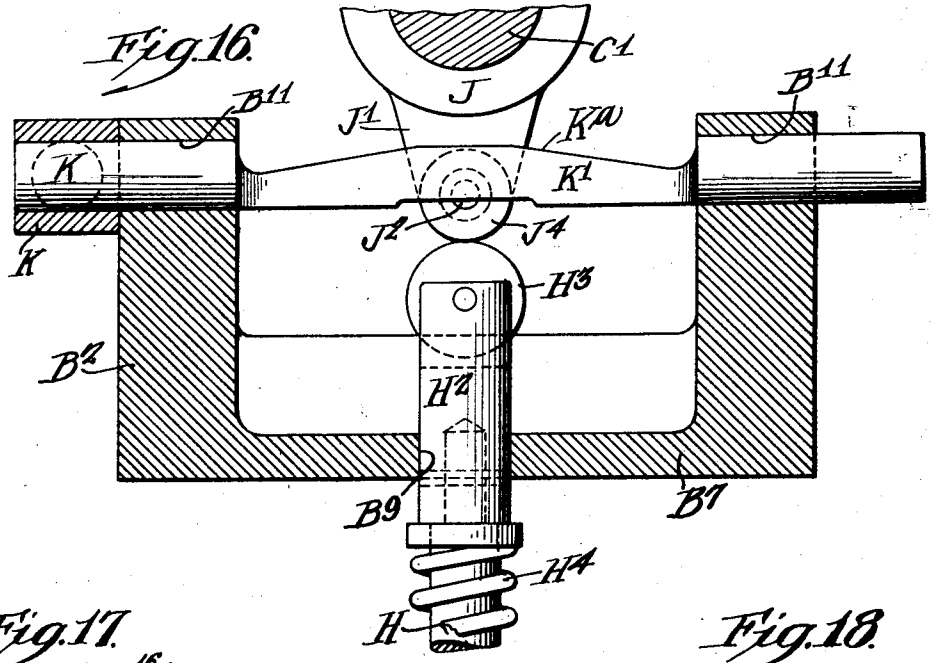


Fig. 17.

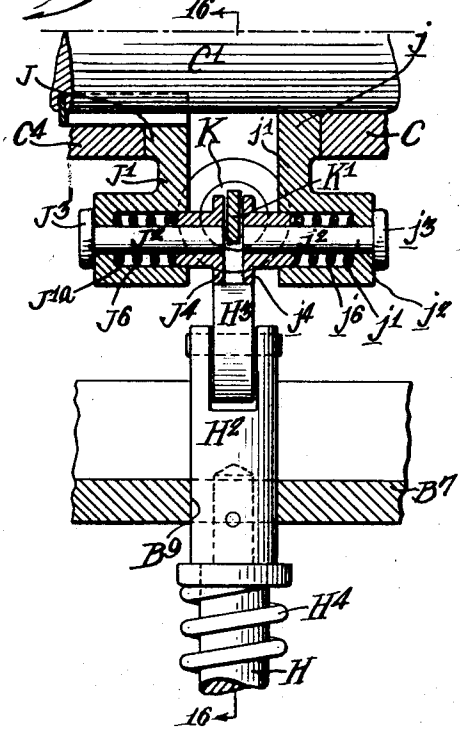
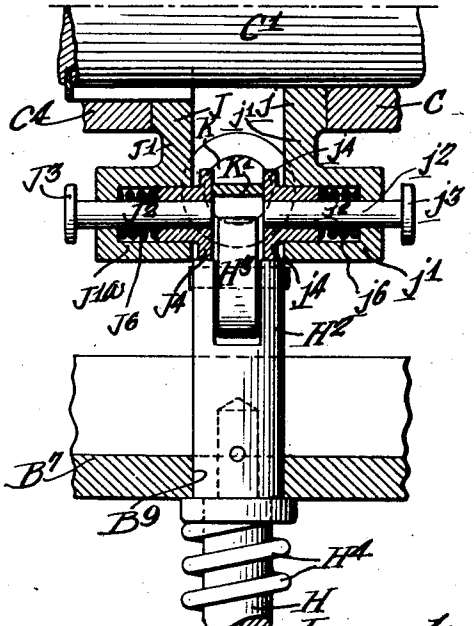


Fig. 18.



Witness:
Walter Clunn

Inventors
Albert Wood Morris
and Samuel Price Wetherill
by Francis Chambers
their Attorney

Patented July 28, 1931 1,816,491

UNITED STATES PATENT OFFICE

ALBERT WOOD MORRIS, OF DREXEL HILL, AND SAMUEL PRICE WETHERILL, JR., OF HAVERFORD, PENNSYLVANIA, ASSIGNORS TO WETHERILL-MORRIS ENGINEERING COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF DELAWARE

CONTROL MECHANISM

Application filed December 11, 1928. Serial No. 325,364.

Our invention relates to control mechanism adapted for use in the ordered opening and closing of a series of valves whereby the admission and exhaust of pressure fluid to actuating mechanism of any kind is regulated in determined sequence. The object of our invention is, generally speaking, to compact and improve the construction of actuating mechanism of the kind mentioned and to provide efficient and reliable means for practically arresting the motion of the mechanism when desired.

The nature of our improvements will be best understood as described in connection with the drawings in which they are illustrated and which illustrate the machine embodying our improvements in what we believe to be their best and most available form.

In the drawings:

Figure 1 is a side elevation of our improved machine.

Figure 2, a plan view.

Figure 3, a sectional elevation on the line 3—3 of Fig. 4.

Figure 4, a cross sectional elevation on the line 4—4 of Fig. 2.

Figure 5, a cross sectional elevation on the line 5—5 of Fig. 1.

Figure 6 is an end elevation of the machine.

Figure 7 is a sectional elevation taken through one of the blocks on which the valve seats are formed as on the line 7—7 of Fig. 9.

Figure 8 is a cross section taken as on the line 8—8 of Fig. 3, showing a detail of construction.

Figure 9 is an enlarged scale sectional view of certain mechanism shown in Fig. 5.

Figure 10 is a cross sectional view on the line 10—10 of Fig. 9.

Figures 11, 12, and 13 are views similar to Fig. 10, showing the valve in the different positions it assumes during the operation of the machine.

Figure 14 is a cross sectional view on the line 14—14 of Fig. 9.

Figure 15, a perspective view of one of the slide racks by means of which the valves are operated.

Figure 16 is a sectional elevation taken as on the line 16—16 of Fig. 17.

Figure 17 is an enlarged scale detail of portions of the mechanism shown in smaller scale in Fig. 3, the portions of the mechanism shown in this figure being those which operate upon the vertically movable plungers H.

Figure 18 is a view similar to Fig. 17 but showing the devices which bring about the stoppage of the machine in non-operative positions.

Figures 19 to 26 inclusive are views showing different forms of cams such as are intended for use in my control mechanism, and

Figure 27 is a sectional view of a detail showing the modified construction as contrasted with similar details in Fig. 14.

Figure 28 is a sectional view of certain of the detachable cams shown as keyed to the shaft C in Fig. 3.

A indicates the base of the machine which, as shown, is formed with fluid conduit passages in which the one marked A^1 leads from a source of fluid under pressure, not shown, and those indicated at A^2 and A^3 are connected with various utilizing devices not shown. Supported on the base A is a frame or base indicated at B, upon which in turn are supported the frames B^1, B^1, and B^2, B^2, which support the control mechanism to be described, the frames B^1, which are the inner frames, having extensions B^3 formed with passage openings indicated at B^5 to support the bearings for the clutch mechanism by which the cam shaft is actuated and also passage openings B^6 in which are supported the bearings of the worm wheel which directly drives the cam shaft and the frames B^1 further serve to support the bearing B^4 in which is located the gear wheel indicated at G. In the portion B^7 of the frames B^1 are formed the guideways B^9 for the plunger extensions indicated at H^2 and the oil receptacle indicated at B^8 in which the worm wheel lies, further guides for the plungers H being indicated at B^{10}.

C, C, are bearings for the cam shaft supported on the frames B^3, C^1 indicating the came shaft; C^2 and C^3 groups of cams supported on the ends of the shaft and C^4 a worm wheel secured to the shaft and driven by the worm C^5 secured to the shaft C^6 supported in ball bearings, as indicated at C^7, and actuated through the gear wheel C^8, driven through a detachable member, in this case a clutch, from a motor indicated at D through sprocket wheel D^1, chain D^2 and sprocket wheel D^3, which last mentioned sprocket wheel is attached to a sleeve D^4, the end D^5 of which forms one jaw of a clutch projecting from the end of which is one jaw of a clutch indicated at D^5. The inner portion of the sleeve D^4 serves as a bearing for the shaft E^3, to which is attached the gear wheel E^4 which engages and drives the gear wheel C^8. E is a longitudinally movable clutch member adapted to engage with the jaw D^5 of the sleeve D^4 and move toward it. E^1 is the squared portion of the shaft, the ends of which are indicated at E^2 and E^3, which shaft is driven through the clutch when in engagement with the sleeve D^4; reciprocating movement is given to the clutch member E by the cradle like structure indicated at F, the lower portion of which is formed into a rack or, as shown, a double rack indicated at F^2. This rack lies in contact with the upper face of the elongated gear wheel G by the rotation of which in opposite directions the clutch is engaged and disengaged and the cam shaft put in operation or brought to a standstill. The gear wheel G is operated through racks formed on the vertically movable plungers H, H, of which the portions indicated at H^2 form in effect extensions and support at their upper ends contact faces here indicated as contact rollers indicated at H^3. Springs indicated at H^4 tend to move and hold the plungers to their uppermost position. The lower ends H^5 of the plungers are engaged with the levers indicated at I, pivoted at I^1 and having their free ends operated through rods I^2 by a treadle indicated at I^3.

J, J, are hubs keyed to the shaft C^1 on each side of the head of the worm wheel C^4, said hubs having projecting arms indicated at J^1 formed with spring holding pockets indicated at J^{1a} and supporting longitudinally movable shafts J^2 which extend through openings in the pocket and are formed with head J^3, said shaft supporting rollers indicated at J^4 which are held but not otherwise controlled in the position shown in Fig. 17, by means of the spring J^6. In this position it will be observed that the rollers J^4 will move over and contact with the roll H^3 of the plunger H^4. *j*, *j*, are arms secured to the bearings C having spring holding pockets j^1 which in turn support the shafts j^2 having heads j^3 and contact rolls j^4, held normally in extended position by the action of the springs j^6. These devices do not rotate with the shaft as do the similar device previously described.

Supported on the portions of the framing indicated at B^2 are the shaft portions indicated at K, K, best shown in Fig. 16, which in turn support the wide and thin bars indicated at K^1, one side of this bar having the cam like conformation indicated at K^a and the bar being so shaped that when turned from the vertical position indicated in Fig. 17 to the horizontal position indicated in Fig. 18, it will, by its contact with the faces of the rolls J^4 and j^4, force them outward to positions where they will not contact with the contact member H^3. K^2, K^2, best shown in Fig. 1, are toothed segments attached to one end of the shaft K, K and engaged each one by one of two vertically movable racks indicated at K^3, K^3, each rack having a handle K^4 by which it can be manually operated.

Passing next to the valve and valve actuating mechanism controlled by the cams on the shaft C^1, L, L, are blocks, two such blocks set face to face being supported at each side of the machine, the outer faces of the blocks forming valve seats, as indicated at L^4, for the disc valves and the blocks having formed in them ports or conduits L^1, L^2, communicating with the valve seat, as indicated at l^1, l^2 and with the pipe system by which the pressure fluid is conducted to the points of use through pipes as indicated at M^1 and M^2. L^3 indicates the exhaust passage also formed in the block L and communicating with the valve seat through a port indicated at l^3. The inner abutting faces of the blocks L, L, are recessed, as indicated at L^5 and L^6, to form vertical guideways for racks and chambers in which are located the gear wheels actuated by the racks and in turn actuating the valves. The valves which are indicated at N^2 are loosely engaged with the shafts N extending through the blocks L and having secured to their inner ends the gear wheels N^1 erected in pairs, as shown. In the construction illustrated, see Figs. 7, 9, and 10 to 13, each valve seat is provided with two inlet ports l^1, l^2, and an outlet or exhaust port l^3 and the valve N^2 seated on the port is provided with a port N^3 extending through it through which pressure fluid can be delivered to either of the ports l^1 or l^2 when the port in the valve registers with either one of the ports in the seat. The valve is also provided with a port N^4 by means of which either of the ports l^1 and l^2 can be placed in communication with the exhaust port l^3. It will be observed that the valve N^2 is held to its seat by the pressure of the fluid on its outer face and is free to adjust itself to this

seat by reason of its loose engagement with the operating shaft N. These gear wheels are each engaged by one of the racks O arranged in pairs, as shown, in the guideways L^5 and supporting at their upper ends contact rollers, indicated at O^1, which are in operative relation to the cams on the cam shaft. The rack portions are indicated at O^2 and the bottom of each rack rests upon the head P of a plunger P^2 which plunger passes through a bar Q and is provided with a lower head indicated at P^3. The plunger is normally pressed upward by a spring indicated at P^1. The bars Q are vertically adjustable, their normal working position being elevated, as indicated in Fig. 1, their adjustment being effected by the mechanism best shown in Figures 1 and 8. The ends of the bar Q which extend downward, as indicated in Fig. 1, have formed in them bearings Q^1 for a stud shaft Q^2, having eccentrically placed pins Q^3 extending from its sides and carrying rollers Q^4 which rest on ledges Q^5 of the supporting frames. The worm wheel Q^6 is secured on the side shaft, as shown in Fig. 8, and is in engagement with a worm wheel Q^7 secured to a shaft Q^8. It will be understood that devices as shown in Fig. 8 are secured to each end of the block Q and it will be obvious that by turning the shaft Q^8 the bar Q will be raised or lowered.

The valves seated on the blocks L are enclosed in a housing also fitted against the face of the blocks L and indicated at R, R, these housings also serving as conduits for the admission of pressure fluid to the valves, as shown, and, as preferably constructed, the housings R embody a fluid conduit indicated at R^1 and a series of valve chambers indicated at R^2 also being provided for each valve. R^3 indicates threaded perforations formed through the face of the housing R, opposite to each valve chamber and in line with a passage R^4, connecting the conduit R^1 with each valve chamber. As shown in Figs. 9 and 14, thimbles S screw into the perforations R^3 and fit into the perforations R^4, these thimbles being formed with openings S^1 by which the air or other fluid in the conduit R^1 is freely admitted to the valve chamber. Springs S^2 located in the thimbles are provided to hold the valve seated.

In the modification illustrated in Fig. 27, the thimble, here indicated at *s*, is formed with the openings s^1 so that it serves to close the conduit R^1 or the valve chamber R^2. In this construction a separate pipe, indicated at s^2, enters through the head of the former so as to supply any selected valve chamber with pressure fluid at a different pressure from that contained in the conduit R^1.

The pressure fluid in the construction illustrated in the drawings, enters through the ports A^1 in the base A and is delivered through the pipe, indicated at M^5, to the header conduit R^1, the ports L^1 L^2 formed in the blocks L connect through a series of pipes indicated at M^1 and M^2 through downwardly turned portions of these pipes, as indicated at M^3 and M^4, with the passages A^2 and A^3 formed in the base A and through these passages are led to the devices to be actuated by the pressure fluid. The exhaust from the valve chambers is through the ports indicated at L^3.

The operation of our improved mechanism can be readily followed. The motor D, through its sprocket wheel D^1, sprocket chain D^2 and sprocket wheel D^3, rotates the sleeve D^4 having a clutch member D^5 secured to its end and when the sleeve is engaged by the co-acting clutch member E, which has a rectangular perforation as shown in Fig. 3, the shaft E^1, E^2, E^3, is rotated and through its gear wheel E^4 transmits motion through the gear C^8 to the shaft C^6 rotating in the ball bearing C^7 and having formed on it the worm C^5 which drives the worm wheel C^4 and through it the cam shaft C^1. This cam shaft has laterally extending free ends beyond its bearings C, C, and on the free ends are adjusted and keyed the cams indicated at C^3 and C^2.

Of course, the motion of the cam shaft is arrested where an adjustable element, here consisting of the longitudinally movable clutch member E, is shifted to disengage it with the sleeve D^4 and this is effected by the longitudinal movement of the cradle F carrying the racks indicated at F^1 which engage the gear wheel G. This gear wheel in turn is rotated by the racks formed on the plungers H, H, which plungers are constantly pressed upward by the springs H^4 so that when not depressed they hold the gear wheel G in the position in which the clutch members are engaged with each other. The plungers H can be drawn downward and the clutch disengaged at any time by pressing down the treadle I^3 and through it depressing the lever I which is connected with the bottom of the plungers. The release of the treadle at once permits the plungers to move back to the position in which they would insure the engagement of the clutch. Another means which we have provided for depressing the plungers and holding them located in depressed positions, are the rollers J^4 and j^4. The rollers J^4, when in the position shown in Fig. 17, will, as they revolve with the shaft C^1, contact with the roller H^3 at the top of the plunger section H^2 and depress it and the connected plunger, thus releasing the clutch and the roller j^4 when in the position shown in Fig. 17, lies over the roller H^3 and serves as a latch holding it in depressed position. Under normal working conditions neither of

these rolls contact with the roller H^3, being held away from the roller by the wide and thin bar K^1 which is turned to horizontal position, as shown in Fig. 18, pressing the latch roll j^4 back to a point where it does not contact with the roller H^3 and guiding the roller J^4 in each revolution by means of its cam shaped surface K^a so that it is pressed back in passing the contact end of the plunger, as indicated at Fig. 18, to stop the machine, it is only necessary to rotate the shaft K through ninety degrees bringing the bar K^1 to the position shown in Fig. 17; this is effected in our machine through the slide racks K^3, K^3, independently slidable and manually operative through their knobs or handles indicated at K^4, K^4. These racks engage the segments K^2 which are attached to the shafts K so that if either or both slides are actuated the machine is brought to a rest.

We have provided the above stopping mechanism in duplicate as a precautionary measure and we have made the shafts K independently movable through their separate slide racks K^3, K^3, so that both slide racks must be in proper position before the machine will start in operation. It is, of course, obvious that the machine is operative if only one of the described stopping devices is provided.

The valves N^2 are operated by the vertical movements of the racks O^2 on the slides O, each rack operating one of the valves through a gear wheel N^1 and shaft N. In normal operation the racks are pressed upward by the spring actuated plungers P and the contact rolls O^1 at the top of the slides rest in contact with the cams on the cam shaft each slide, of course, resting on a different cam so that the slides and the controlled valves are actuated in any desired sequence to admit and exhaust the pressure fluid from the cylinder or other device which is to be actuated by it. As shown in the drawings, with the exception of Fig. 27, each valve chamber on each side of a block L is in free communication with the fluid conduit R^1 but it is sometimes desirable that some specific valves and the source should be connected with the source of fluid pressure of higher pressure and this we provide for by the device shown in Fig. 27, in which the individual valve chamber is supplied with fluid through the pipe s^2 instead of through the column conduit R^1. The pressure of the spring actuated piston P on the slides O can be regulated by adjusting the bars Q and by a free adjustment of these bars through the desired mechanism. All pressure can be removed from the slides so that they are permitted to lose contact with the cams and this, of course, is desirable when it is necessary to remove and replace cams on the cam shaft.

It will be understood that there are two channels L^1 and L^2 connecting with ports l^1 l^2 on each valve seat and communicating through conduits indicated at M^1 and M^2 with cylinders or other devices to be actuated by the pressure fluid; also that there is an exhaust passage L^3 communicating with each valve seat through a port l^3. Fluid under pressure in the conduit R^1 is in free communication with the series of valve chambers R^2 and when the valve is in the position shown in Figs. 10 and 13 it closes both of the ports l^1 and l^2. When moved to position shown in Fig. 11 the port N^3 in the valve registers with the port l^2 in the valve seat so that pressure fluid can flow freely into the conduit L^2 and thence to a point of use while in the same position of the valve the port l^1 of the conduit L^1 registers with the channel N^2 in the valve and is then placed in connection with the exhaust port l^3. When the valve is shifted to the position shown in Fig. 12 the valve chamber is placed in communication with the port l^1 and the conduit L^1 leading from it while the port l^2 is brought to registration with the valve channel N^2 and then connected with the exhaust passage l^3 and the exhaust conduit L^3 leading therefrom.

The control apparatus above described is designed with special reference to its use as a control mechanism of a casting machine, the various movable parts of whcih are actuated by cylinders and pistons connected with the conduits L^1 and L^2. It is however obviously available as a control mechanism for any other machine in which pressure cylinders and pistons are utilized for the manipulation of its members.

Having now described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. Control mechanism comprising a rotatable cam shaft supporting a series of readily removable, and changeable spaced cams, means for operating the shaft including a detachable element by shifting which the actuating means is made inoperative, means for shifting the detachable element having a contact element disposed in the path of a revolving element secured to the cam shaft, resilient means acting to hold the shifting mechanism in operative position, a revolving element secured to the cam shaft laterally movable from a position in which it will contact with the contact element of the shifting mechanism to a position in which it will clear said element, a latch element laterally movable between positions in which it will engage and hold the contact element of the shifting mechanism in non-operative position and a non-engaging position and a manually operatable device normally holding the laterally movable rotating element and the

latch element out of contact with the contact element but shiftable to a position in which it permits said elements to engage the contact element.

2. A control mechanism having the features of claim 1, in which the shifting mechanism is provided with two contact elements and the devices acting on said contact elements are duplicated so that both manual controls must be in normal operative position to enable the detachable element to move to operative position.

3. Control mechanism having the features of claim 1, and having also independent means for shifting the detachable element.

4. Control mechanism having the features of claim 1, in which the detachable element consists of a clutch member having a rack secured to it and the shifting mechanism is made up of a gear wheel engaging said rack and actuated by a rack formed on a plunger, one portion of which serves as the contact member upon which the rotating and latch members act, said shifting mechanism further comprising resilient means normally holding the plunger in position to engage the clutch member.

5. Control mechanism as called for in claim 1, in which the manually controlled device for controlling the engagements of the rotating shaft actuated element and of the latch with the contact element consists of a wide and thin bar rotatively positioned in the machine above the contact element in position when turned laterally to engage the rotating and latch device and hold them out of contact with the contact element.

6. Control mechanism comprising a rotatable shaft carrying spaced cams in combination with two metal blocks adapted to be secured together at their inner faces and each having a series of valve seats formed on their outer faces, a series of gear chambers and rack guides formed on their inner faces and a series of valve shaft bearings extending from the valve seats to the gear chambers, a series of valve shafts extending from the valve seats to the gear chambers, gears secured to the ends of the shafts arranged two in each chamber, racks extending through the guideways of the abutted blocks, arranged in pairs and in engagement one with each gear, said racks being in operative contact with the cams, valves seated on the seats and operatively connected to the valve shafts and a housing and fluid conduit for the valves secured on the outer faces of the blocks.

7. Control mechanism comprising a rotatable shaft carrying spaced cams in combination with a metal block having a series of valve seats formed on its outer face, ports leading from said seats formed in the body of the block, a series of valve shaft bearings extending through the block from the centers of the valve seats and rack guides formed on its inner face, a series of valve shafts adapted to engage valves having gear wheels secured to their inner ends, a series of valves resting on the seats and engaged by the shaft ends, a series of racks engaged with the gear wheels of the valve shafts and held in contact with the cams by springs supported on a retractable bar, a housing and fluid supply conduit for the valves secured on the face of the valve seat block.

8. Mechanism as called for in claim 7 in which the retractable bar is positively interengaged with the ends of the rack bars so as to retract them from contact with the cams when the retractable bar is retracted.

9. Control mechanism comprising a rotatable shaft carrying spaced cams in combination with a metal block having a series of valve seats formed on its outer face, ports leading from said seats formed in the body of the block, a series of valve shaft bearings extending through the block from the centers of the valve seats and rack guides formed on its inner face, a series of valve shafts adapted to engage the valves having gear wheels secured to their inner ends, a series of valves resting on the seats and engaged by the shaft ends, a series of racks engaged with the gear wheels of the valve seats and disposed in operative relation with the cams, a valve housing secured on the face of the block formed with separate valve chambers and a common fluid supply conduit in combination with separate thimbles extending through the supply conduit into the valve chambers and by means of which said individual valve chambers can be connected to the common supply conduit or to individual sources of supply of fluid under pressure.

ALBERT WOOD MORRIS.
SAMUEL PRICE WETHERILL, JR.