April 21, 1931. R. A. BLOOD 1,801,654

OPERATING MECHANISM FOR CONTROLLING MOVEMENT OF ELEMENTS IN SEQUENCE

Filed May 17, 1929 3 Sheets-Sheet 1

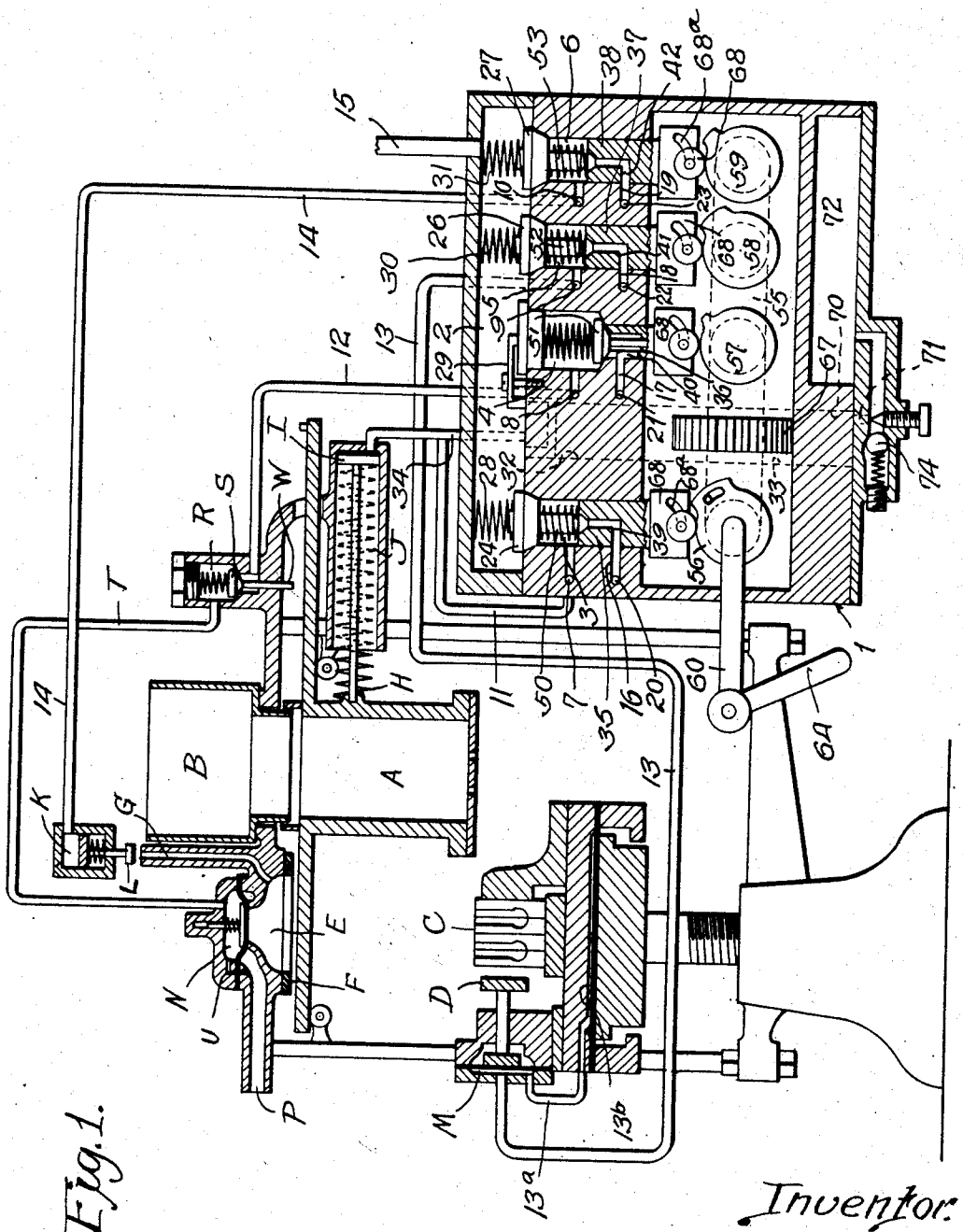


Fig. 1.

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Fig. 2.

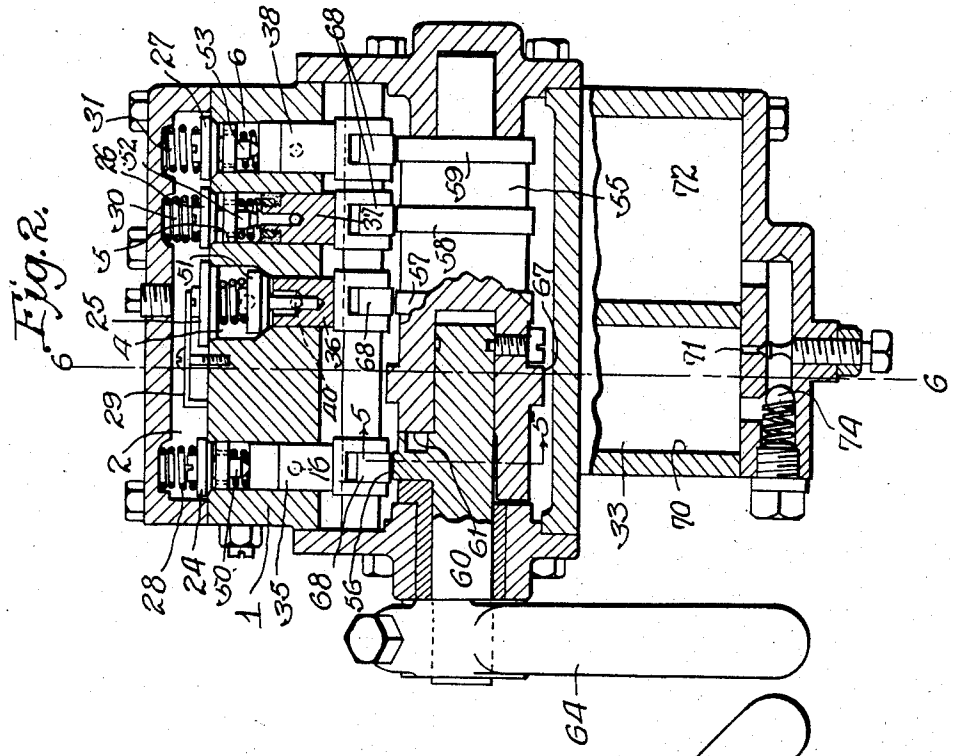
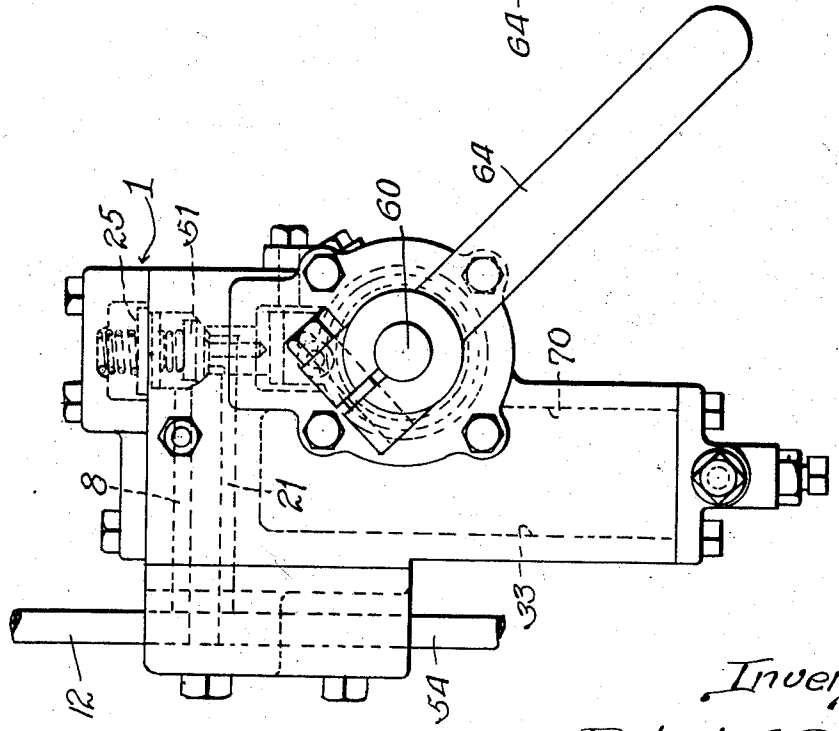


Fig. 4.



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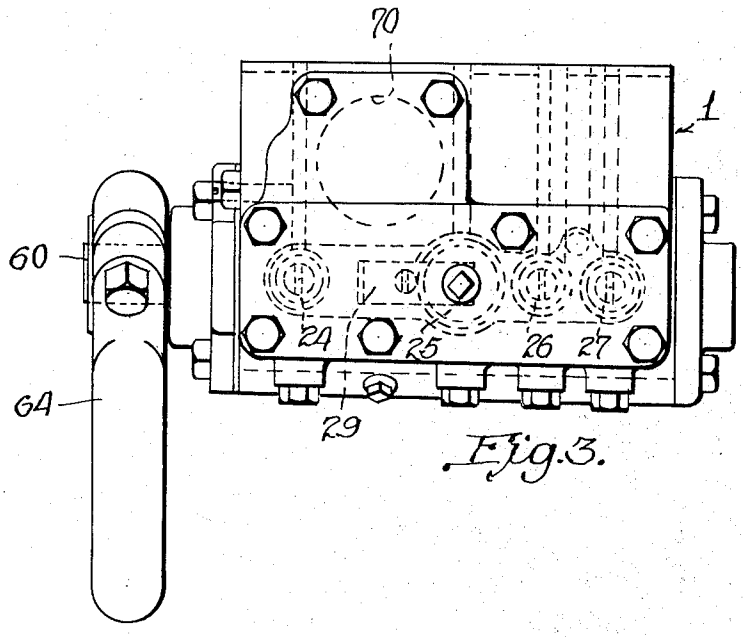


Fig. 3.

Fig. 6.

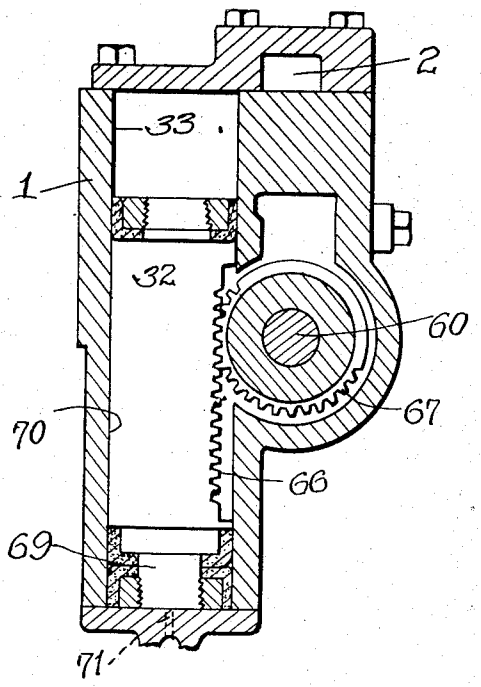
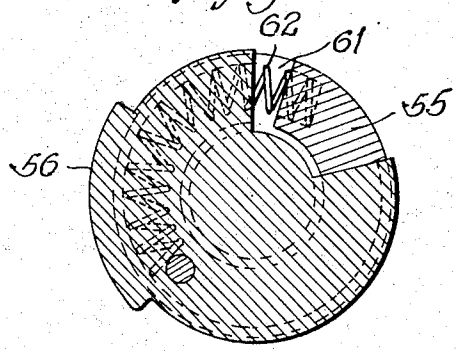


Fig. 5.



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Patented Apr. 21, 1931 1,801,654

UNITED STATES PATENT OFFICE

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OPERATING MECHANISM FOR CONTROLLING MOVEMENT OF ELEMENTS IN SEQUENCE

Application filed May 17, 1929. Serial No. 363,974.

This invention relates to an operating mechanism for controlling the movements of a plurality of elements in a certain sequence, similar to that described in my application Sr. No. 118.651 since abandoned, and has for its object a particularly simple, compact and easily operable mechanism by which a plurality of mechanical movements or a plurality of movements or operations are brought about in a certain sequence, by power.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings in which like characters designate corresponding parts in all the views.

Figure 1 is a diagrammatic view of this operating mechanism, the same being shown as applied to a molding machine.

Figure 2 is a detail sectional view of the controlling mechanism.

Figures 3 and 4 are respectively a plan view and a side elevation of the parts seen in Figure 2.

Figure 5 is a sectional view on line 5—5, Figure 2.

Figure 6 is a sectional view on the plane of line 6—6, Figure 2.

This operating mechanism for controlling the movements of a plurality of elements having relative movement in a certain sequence comprises generally, an air pressure chamber, a plurality of outlets from said chamber to said elements respectively, an air motor, normally closed valves for controlling the outlets, one of the outlets leading to the motor, a single member having means for operating the valves in sequence, the motor being connected to said member to actuate it and a manual for initially opening the valve which normally closes the air outlet to the motor.

The invention further includes valves which normally permit the air to exhaust from the air outlets back through the outlet pipes controlled by the valves, that is, the invention further includes normally open exhaust valves, and the single member operates to first close these valves before opening the control valves.

The plurality of elements having relative movement in a certain sequence are here shown as the elements of a core making machine or what is called a pneumatic core machine.

This machine consists of a sand chamber A shiftable into and out of position to receive sand from a sand hopper B, a core box C arranged to receive sand from the chamber A when the sand chamber is out of registration with the sand hopper B, this core box having a movement toward and from the end of the sand chamber, a core box clamp D for clamping it tightly at a right angle to its movement toward and from the bottom of the same chamber and a stationary top or dome E for the sand chamber when it is in register with the core box C.

This dome E has means at F for forming an air tight joint or seal when the sand chamber A is under the dome E. The dome also has an air inlet and an air outlet. The sand chamber A has a movement with the core box toward and from the dome E. The sand chamber A, core box C, and core box clamp D may be considered movable elements as well as the diaphragm in the diaphragm chamber N which controls the air to the dome E. Although the dome E is not movable, it receives air to compress the sand in the sand chamber. The air for effecting the movements of the sand chamber A, core box C, core box clamp D and for effecting the flow of air into the dome E and sand chamber A and out through the exhaust G of the sand chamber, is controlled by the operating mechanism forming the subject matter of this invention.

This operating mechanism as here shown includes a suitable casing or block 1 formed with an air pressure chamber 2 having a plurality of passages 3, 5, 6 leading therefrom or opening through one wall thereof, the passages being formed with outlet ports 7, 9, 10 which are connected through outlet pipes 11, 13, 14 to various elements, A, C, E. The chamber is connected to a suitable

source of compressed air or other motive fluid through a pipe 15.

A passage 4 in the block is disconnected from the chamber 2 and is formed with a port 8 connected by a pipe 12 to a normally closed valve chamber to be presently described. This controls the operation of an element E.

In this embodiment of my invention, the air from the various elements to which it is supplied exhausts through the pipes 11, 12, 13 and 14 into the passages 3, 4, 5 and 6 and out through exhaust ports 16, 17, 18 and 19, these being connected through passages 20, 21, 22, 23 to a common exhaust pipe.

24, 25, 26 and 27 are controlling valves for the passages 3, 4, 5 and 6 respectively, these valves being normally held closed or against their seats by springs 28, 29, 30 and 31 and being operated off their seats as will be hereinafter described.

32 is a movable member of a pressure operated motor as a piston movable in a passage 33 formed in the case or block 1. All of the passages 3, 4, 5, 6 and 33 are preferably parallel and 3, 4, 5 and 6 arranged in a row.

The outlet pipe 11 controlled by the valve 24 has a branch 34 connecting it to the piston chamber 33.

Also, in the passages 3, 4, 5 and 6, are plungers 35, 36, 37 and 38 having ports 39, 40, 41 and 42 which register with the exhaust ports 16, 17, 18 and 19. The ports 39, 40, 41 and 42 opening through the upper ends of the plungers in position to coact with valves 50, 51, 52 and 53, the valves 50, 52, 53 being carried by the valves 24, 26 and 27, the valves 50, 52 and 53 being normally open and the valve 51 normally closed. Thus, normally, the air can exhaust back from the outlet pipes 11, 13 and 14 through the ports 7, 9 and 10 and the ports 39, 41 and 42 out through the exhaust pipes 16, 18 and 19, but not through the pipe 12, passage 4 and passage 40. These passages 16, 17, 18 and 19 are connected to a suitable common exhaust pipe 54.

The single member for operating the valves in sequence comprises a rotary member or shaft 55 having a plurality of cams 56, 57, 58 and 59 thereon, these cams coacting with the valves respectively or the plungers 35, 36, 37 and 38 associated with each of the control valves 24, 25, 26 and 27. The cams 57, 58 and 59 are fixed to the rotary member 55 while the cam 56 which acts to open the valve 24 has a movement relative to the member 55 and is connected thereto by a lost motion connection.

As here shown, the cam 56 is mounted upon a shaft 60 extending coaxially of the member 55 and rotatable therein, the cam working in a radial slot 61 in the member 55 against the action of the spring 62, the slot forming a lost motion connection, as when the shaft 60 is rotated to rotate the cam 56, the cam 56 will be rotated until a shoulder thereon engages the end of the slot in the member 55. A handle 64 is mounted on the shaft 60 to initially actuate it.

The plunger or piston 32 is connected to the member 55 to actuate it after the valve 24 has been opened by the manually operated cam 56 and as here illustrated, the plunger is formed with a rack 66 meshing with the gear teeth 67 on the periphery of the member 55. At the end of each operation, the member 55 is reset to its starting position by the movement of the operating handle 64 in a retrograde or clockwise direction and in order to permit a retrograde movement of the cams 56, 57, 58 and 59 without actuating the valves 24, 25, 26 and 27 or the plungers 35, 36, 37 and 38, means is provided for permitting a ratcheting action between the cams and the plungers with which they coact.

As here shown, each of the plungers is provided with a follower in the form of a roller 68, this roller having an axle movable in an angular slot 68^a having an upwardly extending portion. Movement in the forward direction tends to move the roller and its axle to the lower end of the slot and movement of the member 55 in a retrograde direction permits the roller 68 and its axle to move upwardly in the slot without actuating the plunger 35, 36, 37 or 38.

The movement of the motor or piston 32 under the air pressure is retarded and regulated by a dash pot, and as here shown, the lower end of this piston 32 constitutes the plunger 69 movable into a dash pot or oil chamber 70 formed in the casing or block 1. The chamber 70 communicates through a small needle valve controlled passage 71 with an oil reservoir 72. Also, a spring pressed check valve 74 is located between the dash pot chamber 70 and the reservoir 72, which check valve permits the oil to flow freely into the dash pot chamber during upward and retrograde movement of the piston 32. As the operation of dash pots are well known, further description is thought to be unnecessary.

In operation, the parts of the core machine are in their position shown in Figure 1, but the cam is in its position in which it has been previously operated by the piston 32. The operator first resets the parts in their starting position by operating the handle in a retrograde or clockwise direction or to the right, Figure 1, thus bringing the cams of the operating mechanism in their position shown in Figure 1.

He then operates the handle 64 slightly in an anti-clockwise direction, thus turning the cam 56 relatively to the member 55 causing it to lift the plunger 35, close the ex-

haust port 16, open the control valve 24 so that the air passes from the chamber 2 through the passage 7, pipe 11 to a piston I in a piston chamber J, which piston is connected to the sand chamber A to actuate the sand chamber against the spring H, into a position where it is in register with the core box and the air dome E. Air also passes from the pipe 11 through the pipe 34 to the piston chamber 33 and actuates the piston, which through the rack 66 and the gear 67 turns the cam member 55, thus continuing to automatically rotate the member 55 and hence, the cam 56 and the cams 57, 58 and 59. The rotation of the cam 59 lifts the plunger 38, closes the exhaust passage 19 and valve 53 and opens the control valve 27 permitting air to pass from the chamber 2 through the passage 6, port 10, outlet pipe 14 to an exhaust valve chamber K which closes the exhaust valve L on the end of the exhaust pipe G from the air dome E, thus closing the air dome E against the outlet of air.

Movement of the cam 58 correspondingly actuates the plunger 37, closes the exhaust passage 18 and opens the control valve 26 permitting air to pass from the chamber 2, through the passage 5, outlet port 9 and outlet pipe 13 to an air motor as a diaphragm chamber M which actuates the core box clamp D and after actuating said diaphragm, the air passes from the diaphragm chamber through a pipe 13^a to a chamber 13^b under the core box and lifts the core box against the bottom of the sand chamber A and lifts the sand chamber against the air seal of the dome E.

Movement of the cam 57 actuates or lifts the plunger 36, and opens the valve 51 so that air can exhaust from pipe 12 from a valve chamber 2 having a normally closed spring pressed valve S therein. The valve chamber is connected by a pipe T to a diaphragm chamber N. The diaphragm is spring pressed and normally closes the entrance of air from a supply pipe to the dome E. The pipe P is connected to a suitable source of supply. There is a by-pass U around the diaphragm for the pipe P to the diaphragm chamber N, so that when the pipe 12 is closed, the pressure is equal on both sides of the diaphragm and it will be held closed by its spring and hence, cut off the air dome E from the pipe P. The port 40 in the plunger 36 is a slot so that the port 17 is always open and controlled only by the valve 51.

The movement of the core box upwardly by the air in the chamber 13^b also lifts the sand chamber against the air seal F and also actuates a rod W operating to open the valve S in the chamber R and hence, open the pipe 12. When this valve S is so opened, the pressure in the diaphragm chamber N collapses permitting the pressure in the pipe P to lift the diaphragm and permit air to enter the sand chamber and force the sand in the chamber into the core box to form the core. It will be borne in mind that this feature takes place when the plunger 36 and valve 51 are being held up by the cam 57.

The high points of the cams 56, 57, 58 and 59 are in such proportions and suitably timed as to bring about the operations in the proper sequence and for the desired length of time.

For instance, the high point of the cam 56 is long enough to hold the valve 24 open during all the time that the other cams 56, 57, 58 and 59 are operated, while the high point of the cam 57 is located and is of such extent as to open the pipe 12 only momentarily and then only while the sand chamber is registering with the dome E, while the high point of the cam 58 is long enough to hold the core box C and the sand chamber A elevated in air tight sealed relation with each other and with the dome E, while the sand chamber is under and air sealed to the dome E and the high point of the cam 59 is so located as to hold the exhaust valve L closed while the diaphragm valve N is open and air is entering the dome E and the sand chamber is in seated relation with the dome E.

At the end of each operation, the valves owing to their springs restore themselves to their normal position and hence, at the end of each operation, the air can exhaust from the various lines and all parts are in their normal positions except the member 55 and the piston 32. Hence, at the start of each operation, the handle 64 must be first operated in a retrograde or clockwise direction to restore the cams to their starting position and during such retrograde movement of the cams, the followers 68 coacting with the cams are free to ratchet relatively to the plungers 35, 36, 37 and 38.

Although this valve mechanism is shown as applied to effect a certain sequence of movement in a core making machine, evidently it can be applied to effect sequence of movement in any kind of a machine.

What I claim is:

1. The combination with a plurality of elements having a relative movement in a certain sequence, of an operating mechanism for controlling such movements comprising an air chamber having a plurality of outlets leading to said elements respectively, a second chamber having a movable pressure operated element therein, one of the outlets leading to the second chamber, normally closed valves for controlling the outlets, a rotary controller member having cams for opening the valves in sequence, the cam coacting with the valve which normally closes the air outlet leading to the second

chamber being mounted to move relatively to the rotary controller member, and a manual for initially moving said cam relatively to the rotary controller member.

2. The combination with a plurality of elements having a relative movement in a certain sequence, of an operating mechanism for controlling such movements comprising an air chamber having a plurality of outlets leading to said elements respectively, a second chamber having a movable pressure operated element therein, one of the outlets leading to the second chamber, normally closed valves for controlling the outlets, a rotary controller member having cams for opening the valves in sequence, the cam coacting with the valve which normally closes the air outlet leading to the second chamber being mounted to move relatively to the rotary controller member and connected thereto by a lost motion connection, and a manual for initially moving said cam relatively to the rotary member.

3. The combination with a plurality of elements having a relative movement in a certain sequence, of an operating mechanism for controlling such movements comprising an air chamber having a plurality of outlets leading to said elements respectively, a second chamber having a movable pressure operated element therein, one of the outlets leading to the second chamber, normally closed valves for controlling the outlets, a rotary controller member having cams for opening the valves in sequence, the cam coacting with the valve which normally closes the air outlet leading to the second chamber being mounted to move relatively to the rotary controller member and connected thereto by a lost motion connection, and a manual for initially moving said cam relatively to the rotary member and to reset the controller member in a retrograde direction, the valves having means coacting with the cams to have a ratcheting movement during the rotrograde movement of the cam.

4. An operating mechanism of the class described comprising an air supply chamber having an outlet leading therefrom, a second chamber having a movable pressure operated element therein, a normally closed valve for controlling the outlet, a rotatable cam member having means for holding said valve open after it has been initially opened, motion transmitting means between said element and the controller member to actuate the latter, and a manual for initially opening the valve.

5. The combination with a plurality of elements having relative movement in a certain sequence, of an operating mechanism for controlling said movements, comprising a plurality of pipes for a motive fluid, normally closed valves for controlling said pipes, a pressure operated member and the chamber in which it is located, one of said pipes leading to said chamber, and a rotatable cam member having means for operating the valves in sequence, motion transmitting means between the movable pressure operated element and said member, and a manual for initially opening the valve which controls the pipe leading to the chamber in which the pressure operated element is located.

6. The combination with a plurality of elements having relative movement in a certain sequence comprising an air supply chamber, a plurality of outlets leading from said chamber to said elements respectively, normally closed valves for controlling the outlets, a second chamber having a pressure operated element therein, one of the outlets leading to the second chamber, a rotatable cam member having means for operating the valves in sequence, motion transmitting means between the movable pressure operated element and said member, and a manual for initially opening the valve which normally closes the outlet to the second chamber in which the movable pressure operated element is located.

In testimony whereof, I have hereunto signed my name, at Syracuse, in the county of Onondaga and State of New York, this 30th day of April, 1929.

ROBERT A. BLOOD.