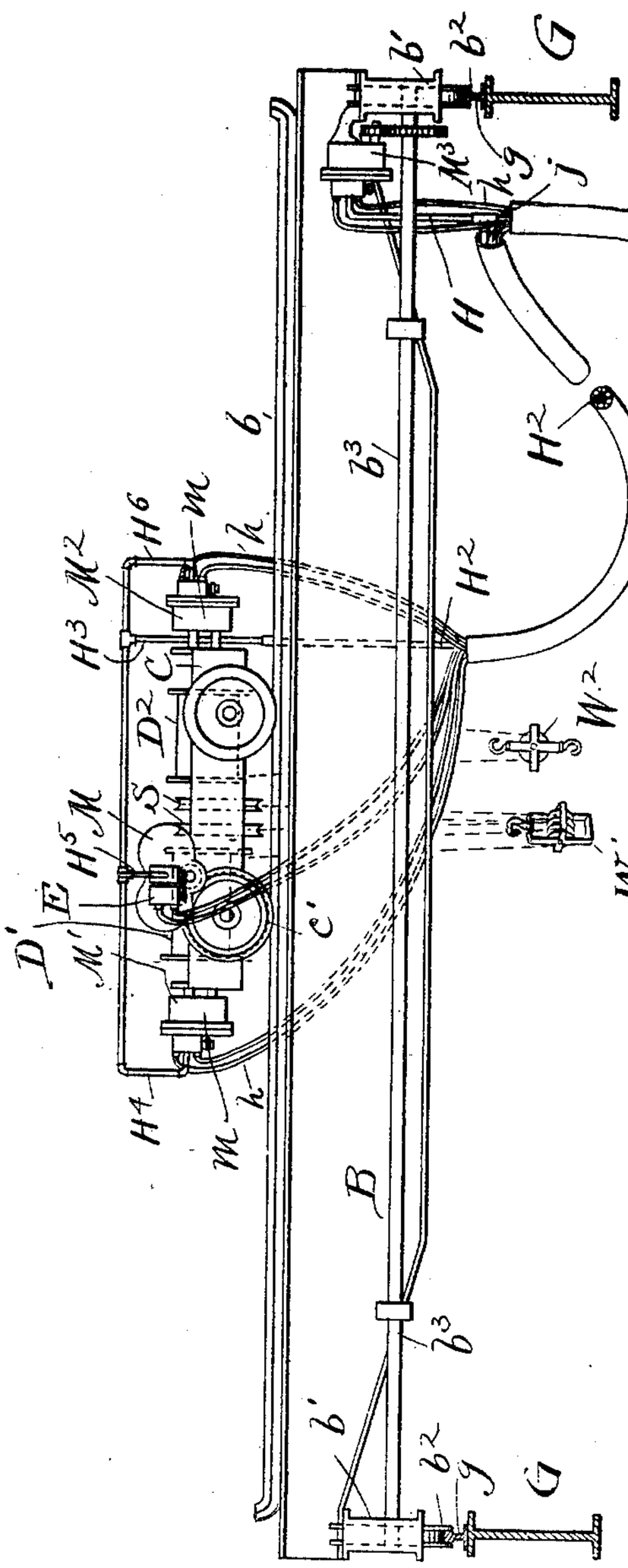
No. 679,534. Patented July 30, 1901.

E. Y. MOORE.

SYSTEM OF CONTROLLING PNEUMATIC MOTORS OF CRANES, HOISTING MECHANISM, &c.

(No Model.) (Application filed May 15, 1901.) 3 Sheets—Sheet 1.



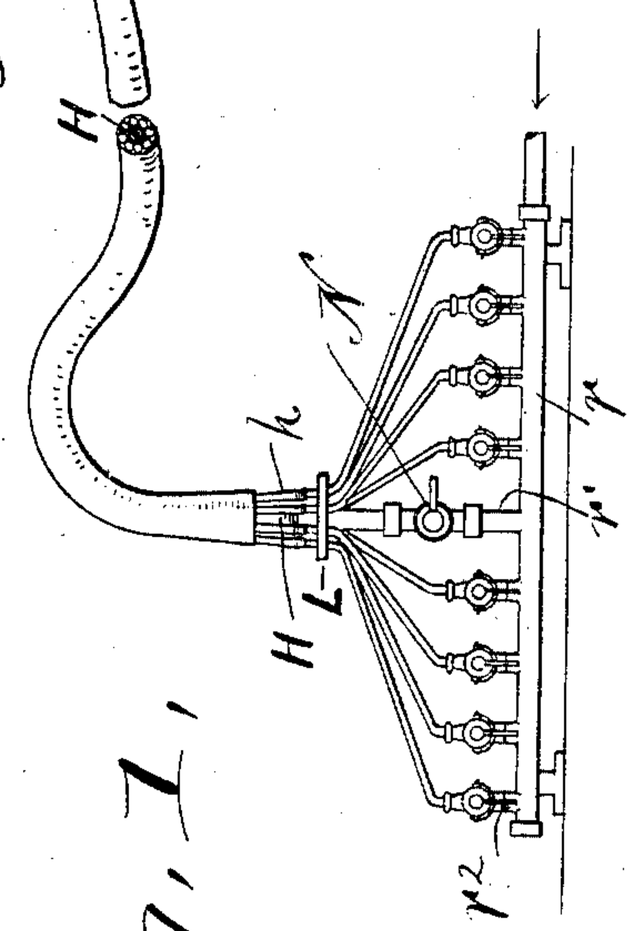


Fig. 1.

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3 Sheets—Sheet 2.

Fig. 3.

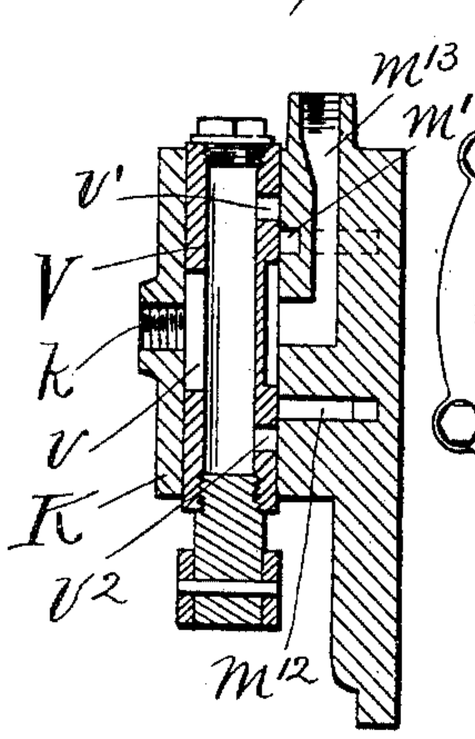

Fig. 2.

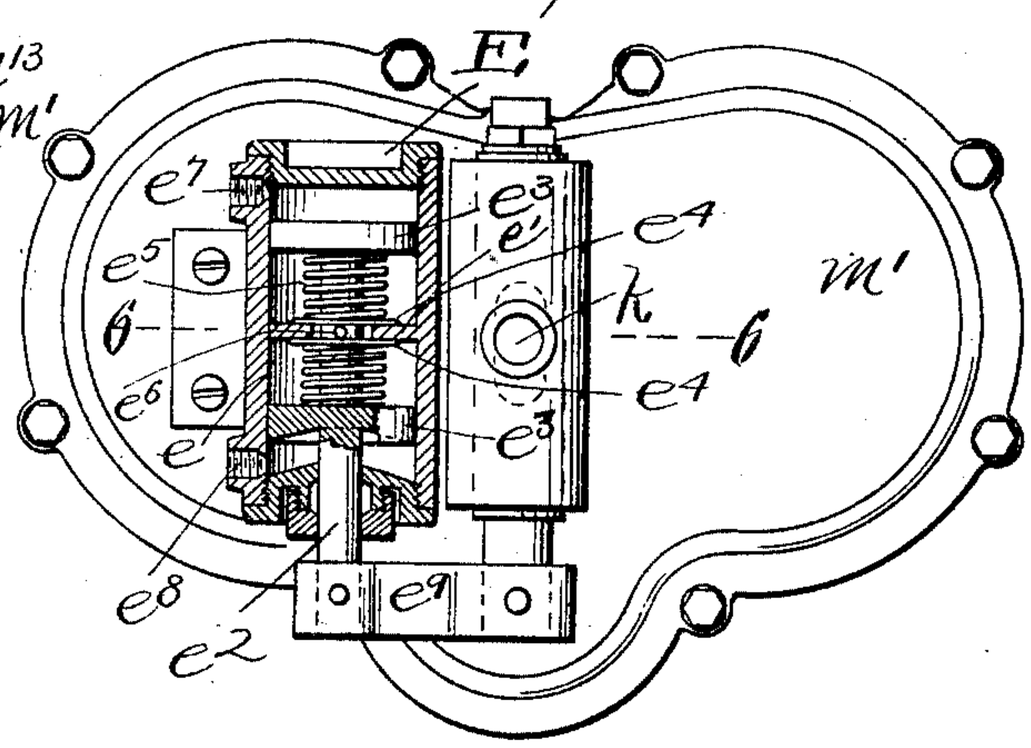

Fig. 4.

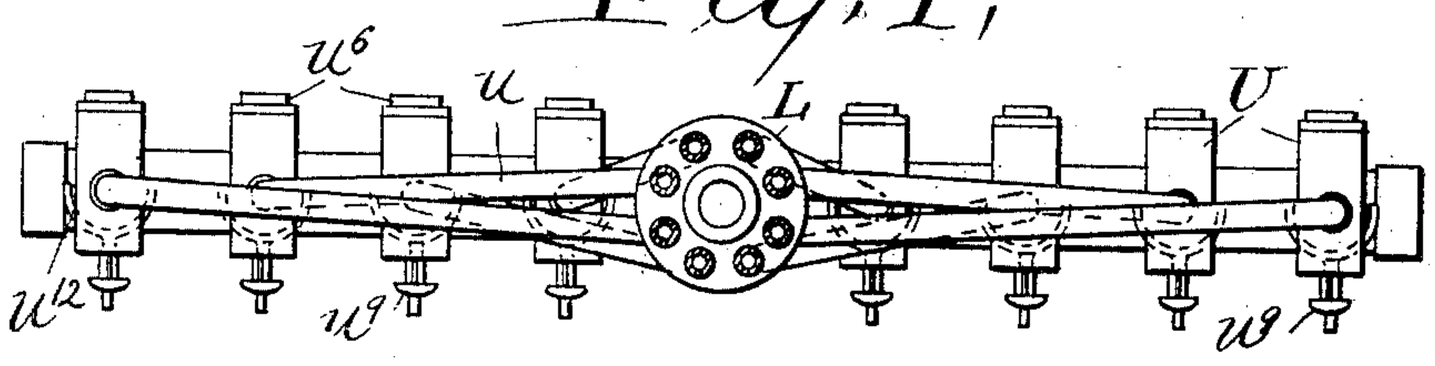

Fig. 5.

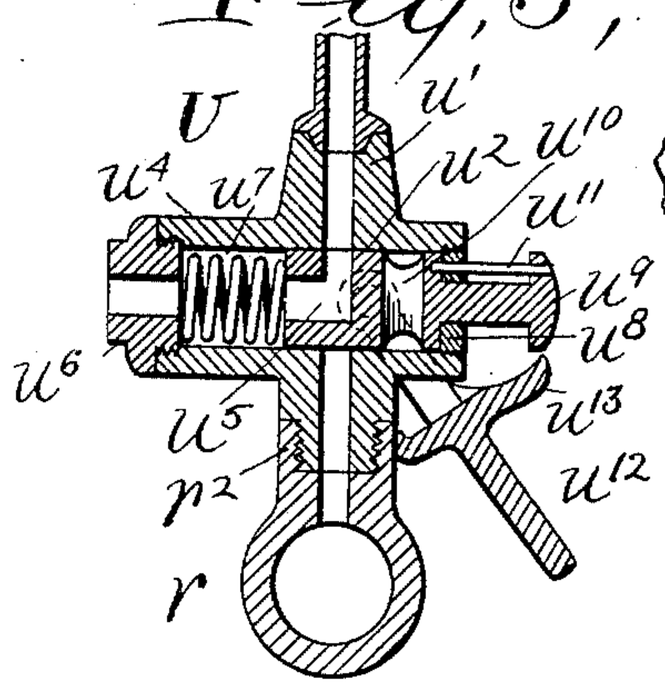

Fig. 6.

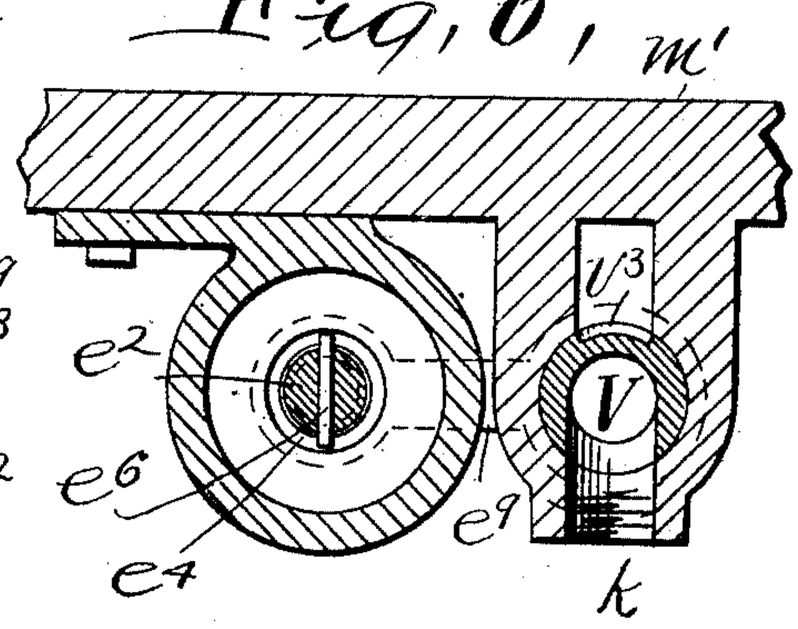

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Fig. 7.

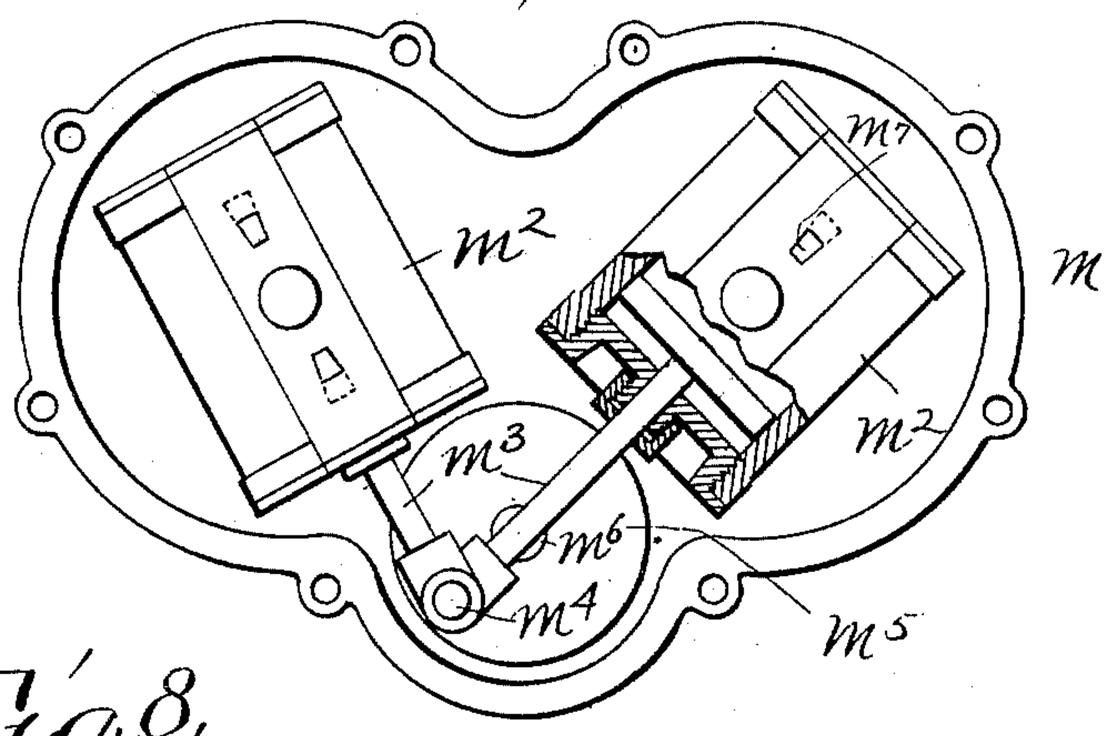


Fig. 8.

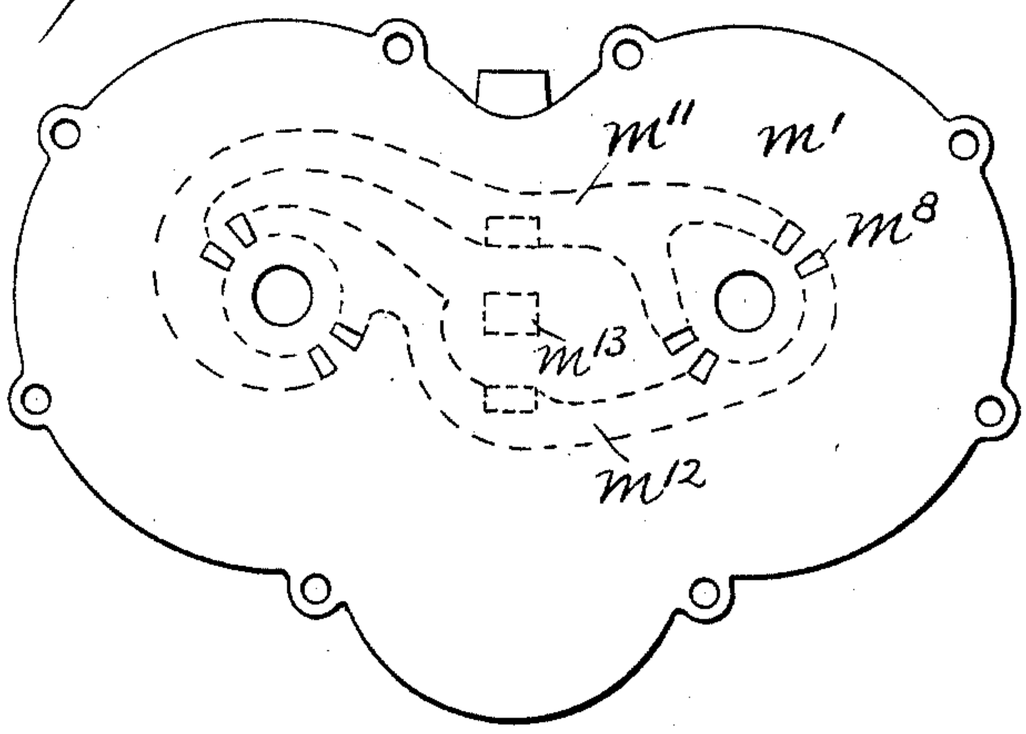
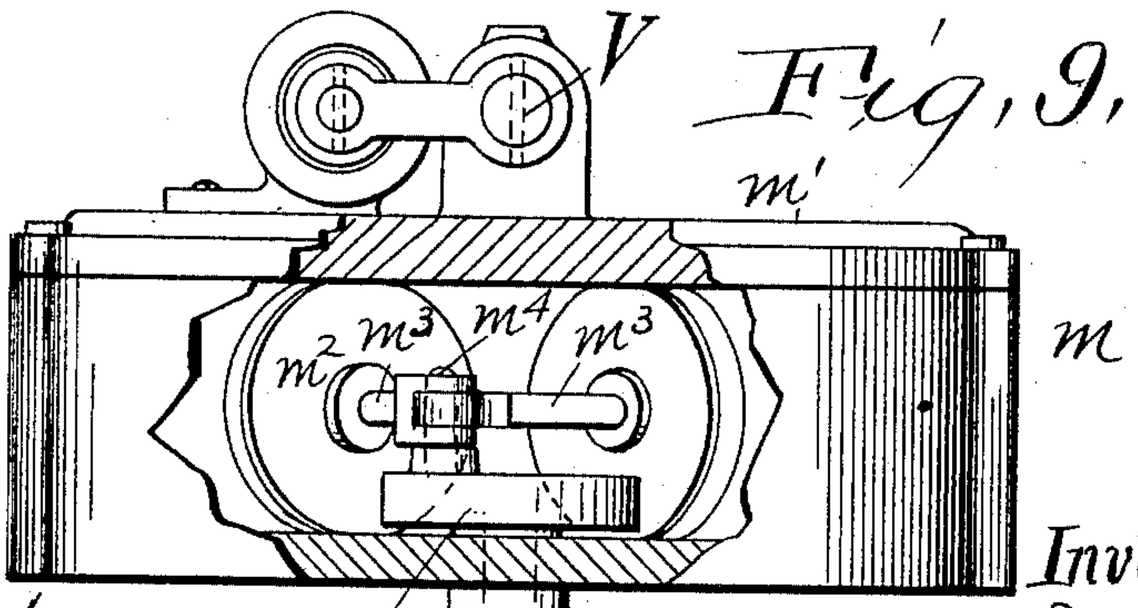


Fig. 9.



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H. W. Hiss.

Inventor,
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UNITED STATES PATENT OFFICE.

EDWARD Y. MOORE, OF CLEVELAND, OHIO, ASSIGNOR TO THE CHISHOLM AND MOORE MANUFACTURING COMPANY, OF SAME PLACE.

SYSTEM OF CONTROLLING PNEUMATIC MOTORS OF CRANES, HOISTING MECHANISM, &c.

SPECIFICATION forming part of Letters Patent No. 679,534, dated July 30, 1901.

Application filed May 15, 1901. Serial No. 60,321. (No model.)

To all whom it may concern:

Be it known that I, EDWARD Y. MOORE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Systems of Controlling Pneumatic Motors of Cranes, Hoisting Mechanism, &c., of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The primary object of this invention is to provide an efficient system of distantly controlling pneumatic motors. In applying such system to the motors of hoisting mechanism, and more particularly to cranes, various cooperating subordinate inventions have been devised, which are included herein.

Economy and freedom of operation of the crane result from my system, as well as the practical advantage of controlling the crane from a fixed operating position.

My system is particularly applicable to traveling cranes of the type illustrated in the drawings.

The invention consists in the means I employ to secure the objects sought, residing especially in the apparatus for controlling the motor-valves and the arrangements of the piping or ducts of such apparatus. I also make certain adaptations of the hoisting-tackle which coöperates with the controlling mechanism to facilitate the handling of a variety of loads without loss in efficiency.

In the drawings which clearly illustrate my invention, Figure 1 is in the nature of a diagram representing a front elevation of a traveling crane to which my invention has been applied. Fig. 2 is a front elevation of the motor I prefer to use in connection with my invention, the valve-shifter chamber being there shown in central longitudinal section; and Fig. 3 represents a central longitudinal section through the reversing-valve at right angles to Fig. 2. Fig. 4 is a plan of the gang of valves whereby the system is controlled, showing in section the air-tubes leading therefrom. Fig. 5 is a central section through one of the controlling-valves. Fig. 6 is a cross-section of a valve-shifter and motor-reversing valve, taken on the line 6 6 of Fig. 2. The remaining figures illustrate the motor I prefer to employ, Fig. 7 being a side elevation with the cover-plate removed, Fig. 8 an elevation of the inner side of the cover-plate, and Fig. 9 a bottom view of the motor, partly broken away.

Referring to the parts by letters, B represents the bridge of a crane; C, a carriage adapted to travel to and fro upon the track *b* on the bridge. At the ends of the bridge B are trucks *b'*, which carry wheels b^2, running on the track *g*, supported by the girders G.

Two hoisting-drums D' and D^2 are mounted upon the carriage C, which drums are driven, respectively, by the air-motors M' M^2, also secured to the carriage. Another motor M, which is preferably of the same type as the motors M' M^2, previously referred to, is secured to the side of the carriage and is adapted to shift it back and forth upon its track *b*, being geared to one of the axles of said carriage—as, for illustration, by a pinion on the motor-shaft meshing with a gear *c'* on the axle. Likewise a motor M^3 is fastened at one end of the bridge and is geared to a through-axle b^3 of the wheels b^2, moving the bridge B along its track *g*.

Between the two hoisting-drums are two loose sheaves S S, which may coöperate with the hoisting-tackle of either of the drums. Thus the block W' may be suspended from the drum D by a number of strands, the hoisting-tackle in this case being carried over the sheaves S S to adapt it to raise heavy weights at a low speed. The other drum and tackle are adapted to raise relatively light weights, wherefore there need not be more than one loop through the block W^2. Now with this arrangement the motors M' and M^2 may turn their drums at the same speed and operate to move the block W^2 at a higher speed than the block W', which conduces to great economy of air as well as despatch in handling light loads. The motors may be of any approved form. They include suitable driving mechanism and automatically-operated valves for controlling them. If desired, the motors may be such as shown in my prior patent, No. 669,587, granted March 12, 1901, where the automatic valves comprise the cooperating relatively-movable ports in the

cover-plate and the side face of the cylinders. Figs. 7, 8, and 9 illustrate such a motor. It comprises within the box formed by the casing m and cover-plate m' a pair of oscillating cylinders m^2, having pistons, the rods m^3 of which take onto the same crank-pin m^4, extending from a suitable crank m^5 on the shaft m^6. The side faces of the cylinders are flattened and have port-openings m^7, which form valves with the corresponding port-openings m^8 in the cover-plate, across which they oscillate. These latter openings are connected in groups by the passage-ways m^{11} m^{12}, as shown in dotted lines in Fig. 8. Either of these passage-ways is adapted to be connected with the admission for compressed air and the other with the exhaust-passage m^{13} by means of the reversing-valve, to be hereinafter described.

Each of the motors M M' M^2 M^3 is provided (in addition to its automatic valve or valves) with a governing-valve V, which I shall call a "reversing-valve," because its position determines also the direction of rotation of the motor. The reversing-valve shown, which is admirably adapted for this purpose, is not individually of my invention, however, being the invention of Thomas Barrow and shown, described, and claimed in his Patent No. 673,573, granted May 7, 1901. The valve V consists of a tubular body of suitable material having a suitable inlet and otherwise closed, except as to its ports. As shown, each end is closed and the inlet v is through the cylindrical wall, communicating with an opening k through the wall of the guide K, carried by the motor-cover m. On the side facing the motor are provided passages v' and v^2 through the valve-wall, and located between them is a recess v^3. If the passage v' and the admission-port p' are brought into communication, the motor is forwardly driven, for example, and the recess v^3 will in that position of the valve connect the port p^2 with the exhaust-outlet p^3. If the valve is moved so that the passages v^2 and p^2 communicate, the motor is of course reversed. Each of these reversing-valves has associated with it mechanism for moving it, which I call the "valve-shifter." This shifter (designated E) is preferably located at the side of the valve and coupled with it. It consists, as shown, of a cylinder e, having a central transverse diaphragm e'. A piston-rod e^2 passes through the diaphragm and rigidly carries the two piston-heads e^2. Washers e^4 take over the piston-rod e^2 on each side of the diaphragm e', resting against the same and against an intermediate pin e^6 on the rod e^2, which is short enough to pass through the opening of the diaphragm. Helical springs e^5, surrounding the piston-rod, exert a thrust against the piston-heads e^3 and the washers. This construction normally holds the double piston in mid-position—that is, as shown in Fig. 2. If the double piston is moved in either direction from mid-position, one spring is compressed, tending to return the piston, but the other is not extended, for the pin and one of the washers e^4 prevent its elongation. Thus the force tending to return the plunger to mid-position is not the difference between the two springs, (which is a variable quantity,) but is the full force of one spring alone. The present adaptation and embodiment of this principle is a part of this invention.

At the ends of the cylinders e are provided openings e^7 e^8, to which air-hose can be attached, and it will readily appear that if air under pressure be admitted at one end only of this cylinder the double piston or valve will be moved toward the opposite end. A yoke e^9 connects the piston-rod e^2 with the lower end of the valve V, being rigidly pinned to the two, whereby the movement of the valve-shifter is directly communicated to the valve V. There are flexible air-hose h in connection with each of the openings e^7 and e^8, before referred to, on all of the motors and a flexible main air-hose H, which brings air to the valve V, and I control the flow of air therein by means to be later described. This main air-hose H connects with a pipe H' at some point, as j, which connects with the motor M^3. Another flexible section H^2 leads from the point j and connects with the pipe H^3, which pipe in turn feeds the main motor-pipes H^4 H^5 H^6. The flexible air-hose are of sufficient length to allow the carriage to run to its farthest position on the bridge and also to allow the bridge to run to the extreme end of its track, as will be readily understood, the hose being supported as desired parallel with the bridge and parallel with the girder G, whereupon it does not extend diagonally across the shop in the way, as would be the case if it ran from a fixed point directly to the carriage.

At some suitable point is placed the gang or series of controlling-valves R. As shown, this consists of a tubular body r, having a plurality of nipples r^2, which form outlets from the body, to which nipples are connected individual valves U. A branch r' of the pipe or body r preferably rises centrally for connection with the main hose H. Each of the valves U has a pipe connection u, which inclines upwardly and leads through an opening in the disk L, which is placed centrally, surrounding and supported by the branch r', and has equally-spaced holes for receiving the pipes u. Above the disk L each pipe u forms a junction with the corresponding air-hose h. These valves U control the flow of air in the hose h. Their internal construction is shown in Fig. 5. They consist of a body u', having a vertical passage u^3, which communicates through the nipple r^2 into the interior of the pipe r and forms a connection at its upper extremity with a pipe u. A gate u^2, which is slidably mounted in an intersecting bore u^4 of the body U, normally closes communication through the passage u^3. The gate is provided with a bent passage u^5, which normally main-

tains communication between the pipe u and the bore u^4. A tubular plug u^6, screwing into the end of the bore u^4, affords a backing for a helical spring u^7, which spring normally holds the said gate u^2 in the position in which it is shown in Fig. 5, the plug having a central opening which connects the bore u^4 with the outer air. Thus each end of the cylinder e is normally in open communication with the outer air. The gate u^2 has a shank which projects through a plug (closing the front end of the bore u^4) and is provided with a knob u^9. When this button is pressed, the gate moves inward until the bent passage u^5 is closed at its side by the wall of the bore u^4. Then the peripheral groove u^{10} in the gate u^2 opens communication from the nipple r^2 through the passage u^3. A pin u^{11}, fixed in the body of the gate u^2 and its head u^9, slides through a hole in the plug u^8 and serves to keep the gate u^2 from turning in the bore u^4. A keeper u^{12} carries a yoke, through the ends of which it is pivoted to the body of the valve, and it is also provided with a cam-plate u^{13}, which when the keeper is raised presses the knob in and holds it in this position. The friction under the force of the spring u^7 is sufficient to hold the keeper elevated. Thus whenever the gate is pressed inward (by the operator's thumb on the knob u^9 for momentary use or by raising the keeper u^{13}) the corresponding end of the proper valve-shifter E is connected with the air under pressure within the pipe r, and the connected reversing-valve V is shifted accordingly. A stop-cock N on the branch r' affords means for letting the air into the main hose or for closing it off from the same. The body r connects with an air-supply at one end, and by opening the stop-cock N air is admitted through the hose H and H′ to all of the reversing-valves V. Each end of every valve-shifter E has a corresponding valve U, which admits air thereto, so that the motors are all under complete control from the operator's position at the gang of valves. The air-hose H and h make connection with the gang of valves R immediately above the disk L, and flexible coverings J J′ inclose them substantially throughout their length, binding all the small hose h around the larger central hose H and H′.

Having described my invention, I claim—

1. In an air-controlled system, in combination, a motor including a valve actuated by the movement of the motor and in turn governing it to allow automatic consecutive operations thereof, a reversing-valve at the motor for governing it, a pneumatic valve-shifter mechanically connected with the reversing-valve, means for supplying air to the shifter to operate it, and means for controlling such supply, substantially as described.

2. In a controlling system, in combination, a motor including a valve actuated by the movement of the motor and in turn governing it to allow automatic consecutive operations thereof, a reversing-valve therefor, a cylinder, a piston connected with said reversing-valve, and means for admitting fluid on either side of said piston, substantially as described.

3. In a controlling system, in combination, a motor, a shaft driven by said motor, said motor including a valve actuated by the movement of the motor and in turn governing it to produce automatic consecutive revolutions of said shaft, a reversing-valve therefor, a cylinder, a piston connected with said reversing-valve, and means for admitting fluid on either side of said piston, substantially as described.

4. In a controlling system, in combination, a motor, a reversing-valve therefor, a cylinder, a piston therein, a cross-head connecting said reversing-valve to said piston, and means for admitting air on either side of said piston, substantially as described.

5. In a controlling system, in combination, a crane, air-motors adapted to operate the same and carried thereby, a valve on each of said motors adapted to admit operating fluid thereto, a system of flexible hose leading from said motors, and a system of valves adapted to control the valves of said motors, substantially as described.

6. In an air-controlled system, in combination, a motor including a valve actuated by the movement of the motor and in turn governing it to allow automatic consecutive operations thereof, a reversing-valve therefor, a pneumatic valve-shifter, two air-hose leading to said shifter, a connection between said shifter and said valve, and means for controlling the admission of air to said hose, substantially as described.

7. In an air-controlled system, hoisting mechanism, a motor adapted to actuate the same, said motor including a valve actuated by the movement of the motor and in turn governing it to allow automatic consecutive operations thereof, a reversing-valve at the motor adapted to govern it, a pneumatic valve-shifter also at the motor connected with the reversing-valve and adapted to operate it, and air-hose leading to the valve-shifter, substantially as described.

8. In an air-controlled system, in combination, hoisting mechanism, a motor adapted to actuate the same, said motor comprising a crank-shaft, driving mechanism therefor, and a valve actuated by the movement of the motor and in turn governing it to produce automatic consecutive revolutions of said crank-shaft, a reversing-valve at the motor adapted to govern it, a pneumatic valve-shifter also at the motor and connected with the reversing-valve and adapted to operate it, and air-hose leading to the valve-shifter, substantially as described.

9. In a crane-controlling system, a motor for operating the crane, said motor including a valve actuated by the movement of the motor and in turn governing it to allow automatic consecutive operations thereof, an air-operated reversing-valve for governing the

motor, combined with a system of pneumatic hose for leading compressed air to said motor for operating it and for leading compressed air to and from the reversing-valve for governing said motor, and means for controlling the admission of air to the hose and exhaust of air from them, substantially as described.

10. In a crane-controlling system, in combination, a crane, air-motors carried thereby and adapted to operate the same, an air-operated reversing-valve carried by each of said motors, a pair of flexible hose leading from each motor for governing the same and a main flexible hose for operating said motor, and valves for controlling the air in the governing-hose, substantially as described.

11. In a crane-controlling system, a crane, air-motors carried thereby and adapted to operate the same, a valve in each motor for admitting compressed air thereto, means for normally holding said valves in mid-position, mechanism for shifting the valve in either direction, flexible hose leading from said shifting mechanism, and pneumatic means for governing each of said valves therethrough, substantially as described.

12. In a crane-controlling system, a crane, air-motors carried thereby and adapted to operate the same, valves on said motors for admitting compressed air thereto, valve-shifters connected with said valves, and pneumatic means for operating said valve-shifters, substantially as described.

13. In a crane-controlling system, in combination, a crane, an air-motor carried thereby and adapted to operate the same, a valve on said motor adapted to govern said motor, a valve-shifter comprising a cylinder, a piston movable therein, springs normally constraining said piston to its mid-position, a connection between said piston and said valve, a flexible hose leading from said valve-shifter, and pneumatic means for governing said valve-shifter through said hose, substantially as described.

14. In a controlling system, the combination of a motor, a reversing-valve for said motor, a valve-shifter for operating said reversing-valve, said valve-shifter comprising a cylinder, a pair of piston-heads therein on the same piston-rod, port-openings into the cylinder on the outer side of said two piston-heads, a rigid support carried by the cylinder intermediate of said heads, a pair of springs surrounding the piston-rod between said heads and on opposite sides of said support, and a connection between said piston-rod and the reversing-valve, substantially as described.

15. In a controlling system, the combination of a motor, a reversing-valve for governing the motor, a valve-shifter carried by said motor consisting of a cylinder rigid therewith, and having in its interior a pair of piston-heads on a single piston-rod, a connection between said piston-rod and the reversing-valve, port-openings leading to the opposite ends of the valve-shifter, a rigid support within the shifter-cylinder intermediate of the piston-heads, springs surrounding said piston-rod intermediate of the piston-heads and on opposite sides of said rigid support, each spring being adapted to be compressed when the corresponding piston-head is moved toward said support, a projection carried by said piston-head adapted to hold the opposite spring from expanding into engagement with said support when the first spring mentioned is compressed, substantially as described.

16. In a crane-controlling system, in combination, a crane, air-motors adapted to operate the same, reversing-valves at the motors adapted to govern them, a series of controlling-valves for controlling said motors from one position and ducts connecting said reversing-valves with said series of controlling-valves, substantially as described.

17. In a crane-controlling system, in combination, a crane, air-motors carried thereby and adapted to operate the same, reversing-valves at the motors adapted to govern them, a series of controlling-valves for controlling all of said reversing-valves from one position, and flexible hose connecting said reversing-valves with said series of valves, substantially as described.

18. In a crane-controlling system, in combination, a crane, air-motors carried thereby and adapted to operate the same, a series of valves for controlling the different motors from one position, and air-ducts leading in pairs from valves of said series to said motors, substantially as described.

19. In a crane-controlling system, in combination, a crane, a plurality of air-motors carried thereby and adapted to operate the crane, an air-operated valve for governing each air-motor, a series of valves connected with an air-supply, there being two individual valves corresponding to each motor, and individual conveying-pipes leading from each individual valve to the corresponding motor, substantially as described.

20. In a crane-controlling system, in combination, a crane, a plurality of air-motors carried thereby and adapted to operate the same, a series of valves in the supply-main therefor, said series of valves comprising a valve governing the passage of air to drive said motors and valves for controlling the different motors, substantially as described.

21. In a crane-controlling system, in combination, a crane, air-motors carried thereby and adapted to operate the same, a series of valves in the supply-main therefor, a main air-duct leading from said series of valves and supplying the air that drives said motors, separate air-ducts also connecting said series of valves and said motors, said series of valves comprising a valve controlling said main duct and a plurality of valves controlling said separate ducts, substantially as described.

22. In a crane-controlling system, in com-

bination, a crane, air-motors for controlling the same, reversing-valves on each of said motors, valve-shifters adapted to operate said reversing-valves, a series of valves, a main air-pipe leading compressed air to said reversing-valves, auxiliary pipes leading from said series of valves to said valve-shifters, said series of valves comprising individual valves controlling said auxiliary pipes, substantially as described.

23. In a crane-controlling system, in combination, a crane, air-motors carried thereby, a reversing-valve for each air-motor, and a valve-shifter for operating it, flexible hose leading from the air-supply to the reversing-valve, a series of valves for controlling the valve-shifters, individual flexible hose leading from the series of valves to said valve-shifters, said individual hose being grouped about the main flexible hose and there retained, substantially as described.

24. In a crane-controlling system, in combination, a crane, air-motors carried thereby and adapted to operate the same, a series of valves for controlling the said motors, a flexible main air-hose connecting said motors with said series of valves, auxiliary hose grouped thereabout, and a flexible covering enveloping said composite hose, substantially as described.

25. In a crane-controlling system, in combination, a crane, a motor for operating it, an air-operated reversing-valve for governing said motor, a pair of conveying-pipes leading to said motor for operating said valve, valves for controlling said motor from a distance, said valves comprising a pair of individual valves each adapted to connect the corresponding conveying-pipe with the outer air or with a supply of compressed air, said individual valves being normally held in the first-mentioned position, substantially as described.

26. In a controlling system, in combination, a movable bridge, an air-motor adapted to move said bridge, a carriage traveling on said bridge, air-motors carried by said carriage, air-hose connecting said carriage with that end of the said bridge which carries its motor, and an air-supply for operating the same leading also from the motor of said bridge to the operator's position, and a series of valves connected therewith for operating said motors, substantially as described.

27. In a controlling system, in combination, two rotatable drums, independent air-motors adapted to drive the drums at substantially equal speed, hoisting-tackle connected with one of said drums whereby it may lift at a decreased speed, and means for controlling the movement of said motors from substantially the same distant point, substantially as described.

28. In a controlling system, in combination, two rotatable drums, independent air-motors adapted to drive the said drums at equal speeds, tackle connected with one of said drums whereby it may lift at a decreased speed, and pneumatic means for controlling the movement of said motors, substantially as described.

29. In a controlling system, in combination, two rotatable drums, an air-motor connected with each drum and adapted to drive the same, flexible air-hose leading from said motors to the operator's position, and means for controlling the movement of said motors from said position, substantially as described.

30. In a controlling system, the combination of a tubular body adapted to receive compressed air into its interior and having a plurality of outlets normally closed, individual valves for controlling said outlets, individual pipes leading from said valves and normally connected thereby with the outer air but adapted by the movement of said valves to be closed as to the outer air but connected with compressed air from the tubular body, substantially as described.

31. In a controlling system, the combination of a tubular body, valves controlling the outlets therefrom, air-tubes leading from said openings, gates in said valves normally keeping communication open between said tubes and the outer air, but closing said outlets, push-buttons operating said gates, and means for restraining said gates in position to hold the outlets open, substantially as described.

32. In a controlling system, in combination, a hollow body having a plurality of outlets, valves for controlling the same, a perforated holder supported by said body, and tubes leading from said valves and taking through the perforations of said holder, substantially as described.

33. In a controlling system, in combination, a tubular body, a branch rising therefrom, a stop-cock controlling the outlet thereto, said tubular body having a plurality of nipples having outlets therethrough, valves adapted to control the outlets through said nipples, a holder having a central opening taking over said branch, and holes clustered around said opening, tubes for conveying air from said valves and taking through said holes, substantially as described.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

EDWARD Y. MOORE.

Witnesses:
ALBERT H. BATES,
H. M. WISE.