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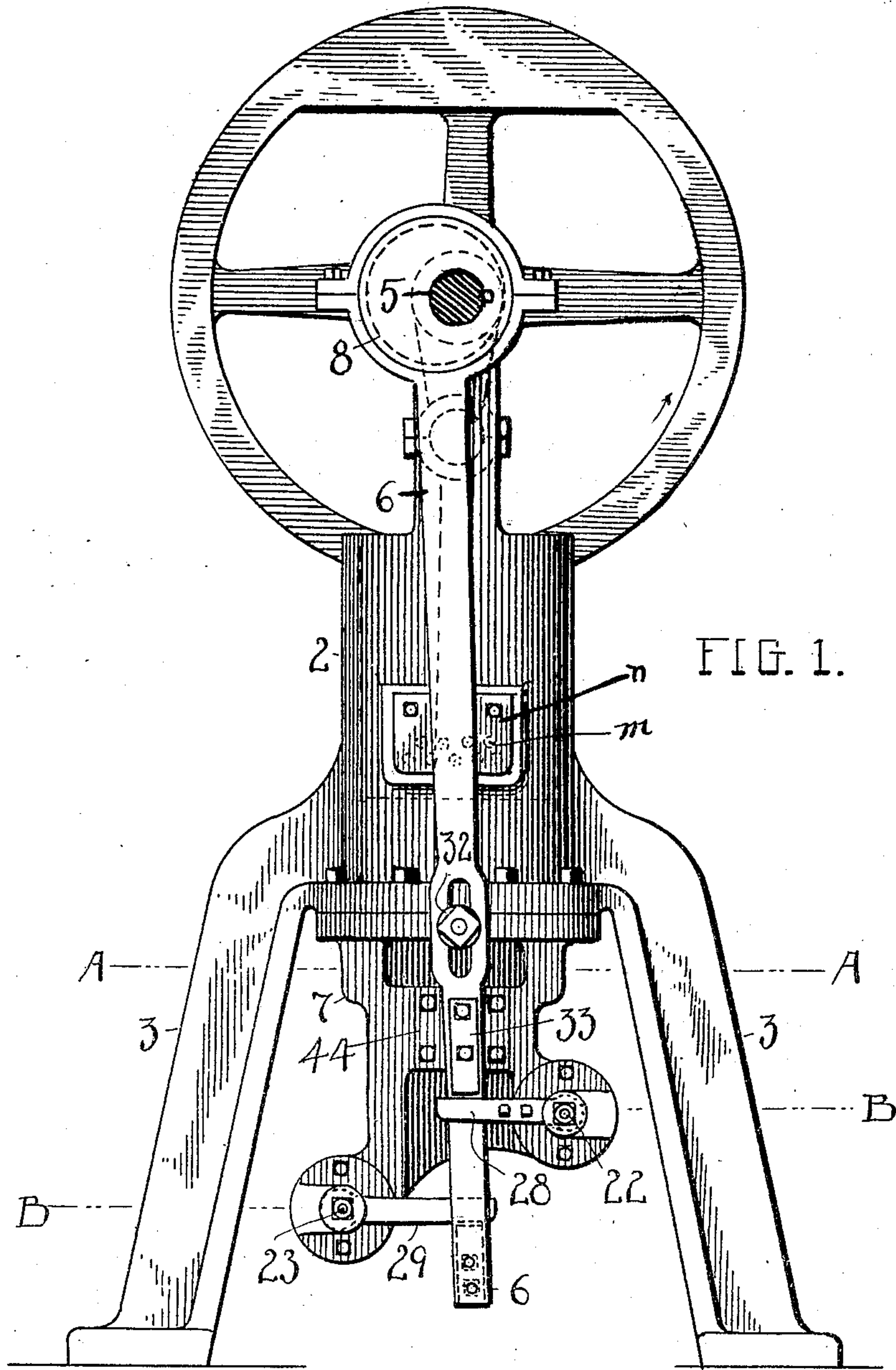
PATENTED NOV. 8, 1904.

M. A. YEAKLEY.
COMBINED COMPRESSION AND EXHAUSTION PUMP.

APPLICATION FILED OCT. 12, 1900.

NO MODEL.

4 SHEETS—SHEET 1.



ATTEST.

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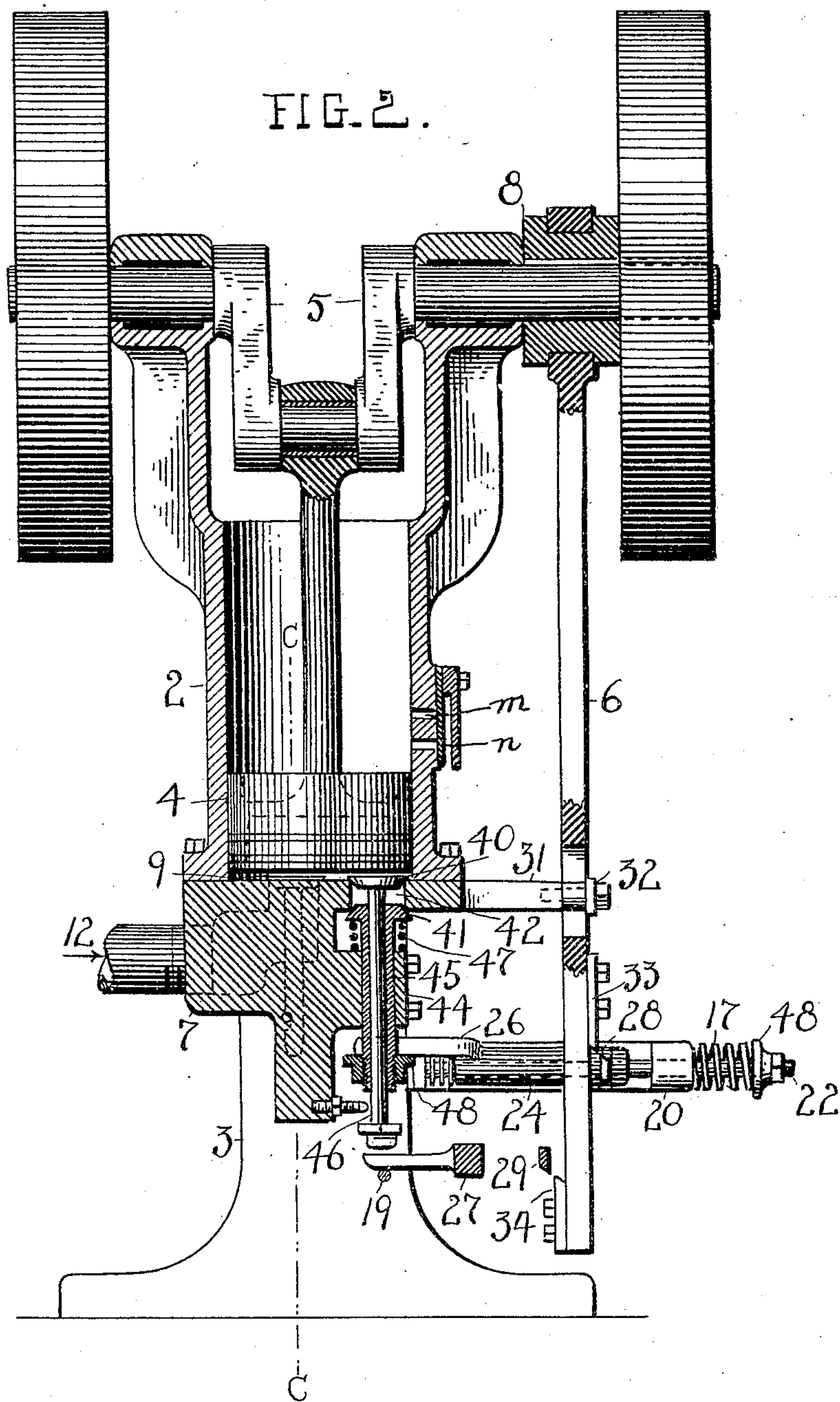
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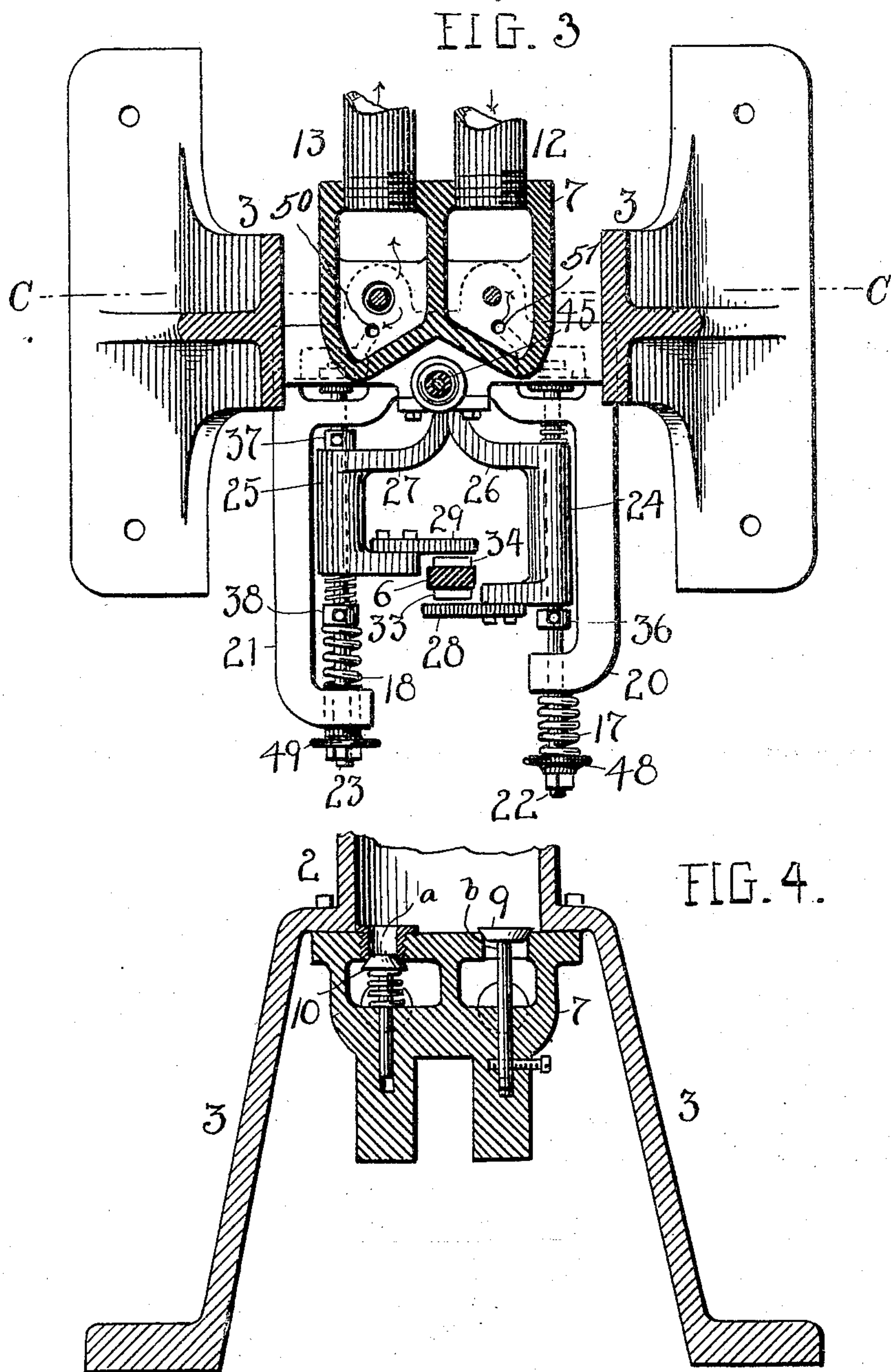
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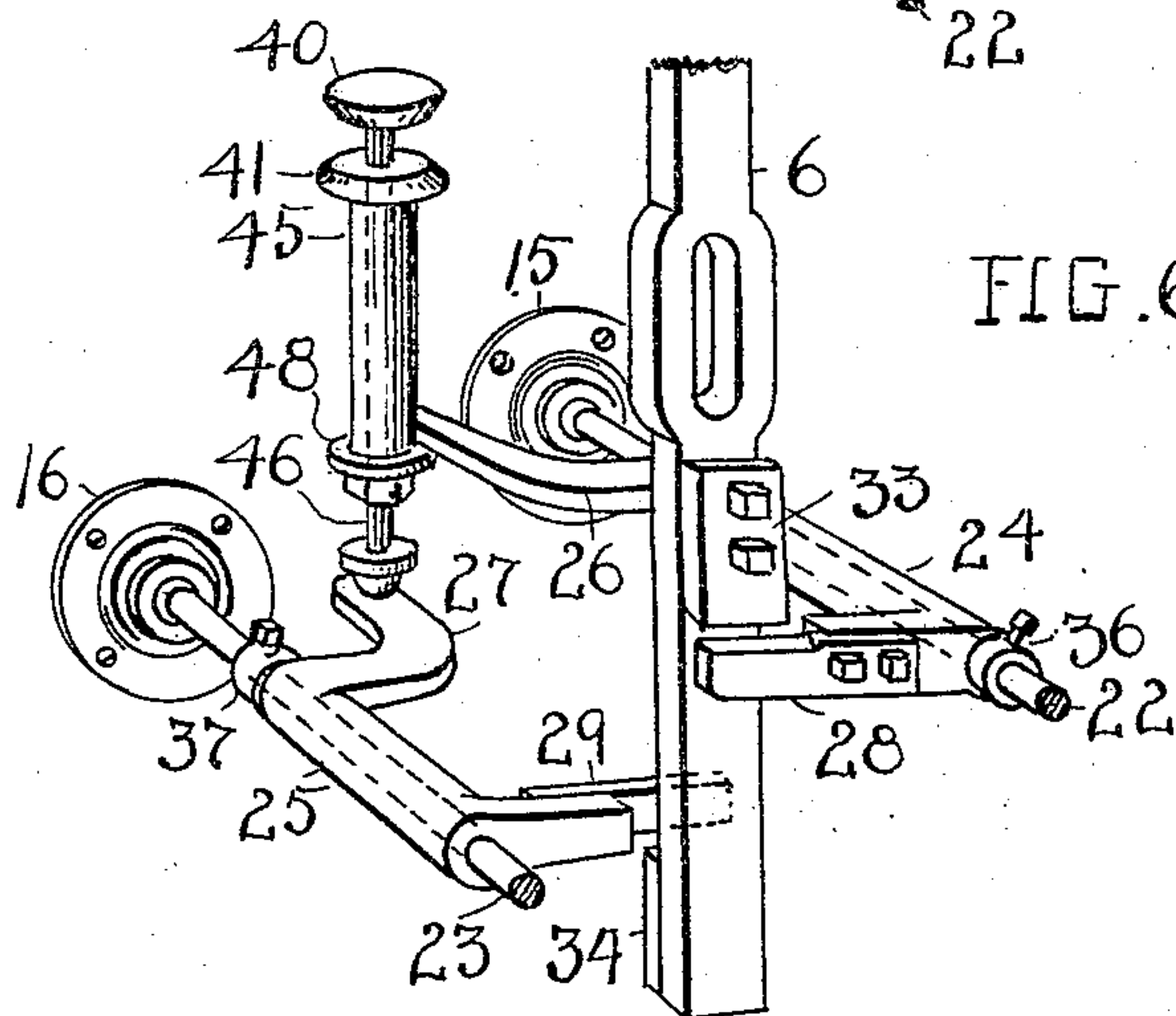
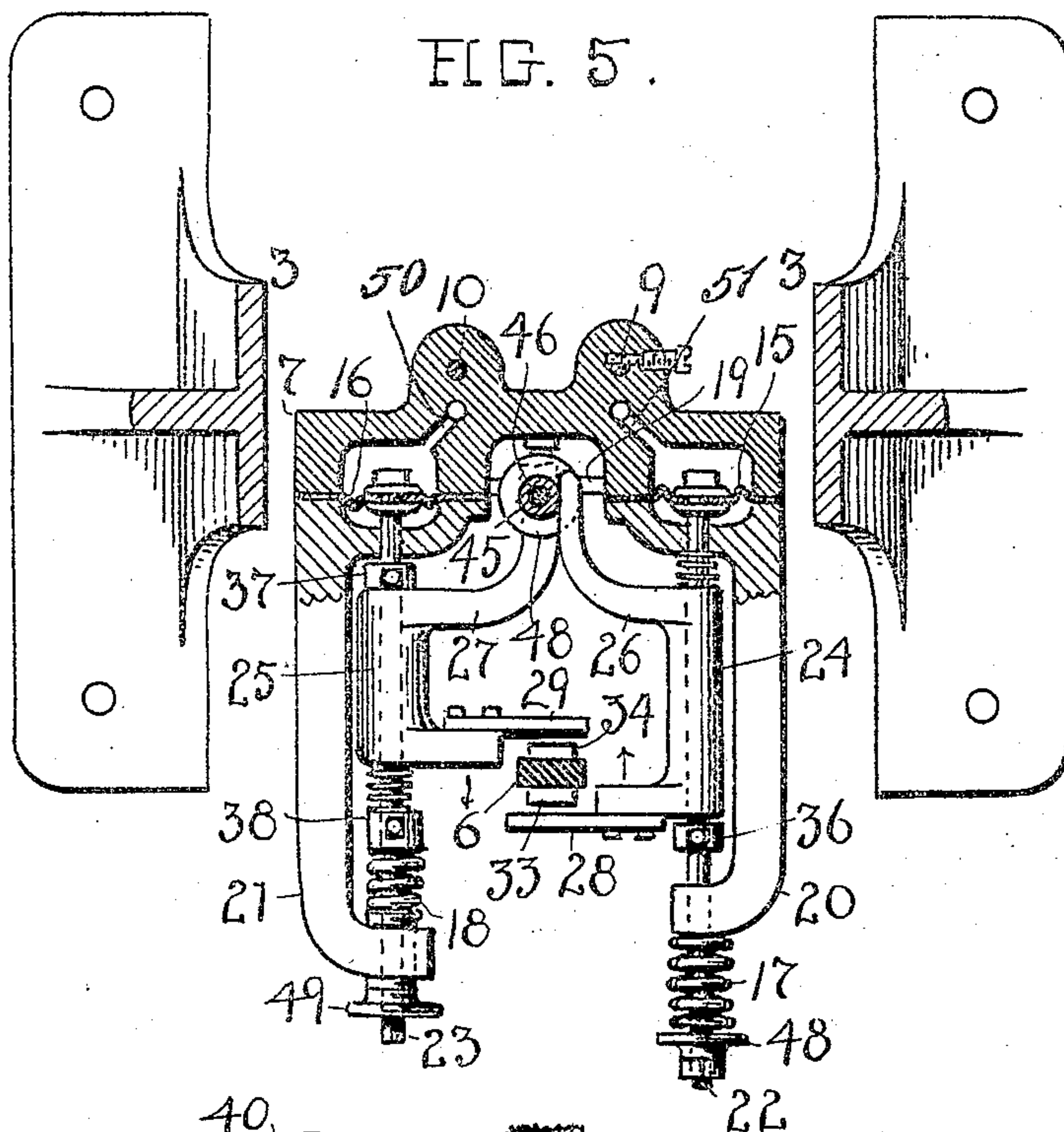
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ATTEST
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MELVIN A. YEAKLEY, OF CLEVELAND, OHIO, ASSIGNOR TO WILLIAMS, WHITE & CO., OF MOLINE, ILLINOIS.

COMBINED COMPRESSION AND EXHAUSTION PUMP.

SPECIFICATION forming part of Letters Patent No. 774,503, dated November 8, 1904.

Application filed October 12, 1900. Serial No. 32,834. (No model.)

To all whom it may concern:

Be it known that I, MELVIN A. YEAKLEY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in a Combined Compression and Exhaustion Pump; and I do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to a combined compression and exhaust pump and to certain balancing mechanism for controlling both compression and exhaust, all substantially as shown and described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is an elevation of my improved pump, showing it with the regulating rod or bar at the front. Fig. 2 is a sectional elevation of the pump at right angles to Fig. 1 and with the cylinder and valve mechanism at its bottom in vertical section parallel to the axis of the crank-shaft. Fig. 3 is a horizontal section looking down on line corresponding to A A, Fig. 1. Fig. 4 is a sectional elevation on line C C, Fig. 3, showing especially the valves governing the pressure and exhaust passages in the base on the cylinder. Fig. 5 is a horizontal section looking down on line B B, Fig. 1. Fig. 6 is a perspective elevation of certain of the automatic valve-controlling parts, as hereinafter fully described.

In the pump and associated mechanism thus shown I am enabled by a single cylinder and power-driven piston to work or produce both atmospheric compression and exhaust or vacuum in the same operation or time or either independently of the other and while one or the other is not working and to govern the condition of both, so that excessive pressure above a predetermined point and undue exhaust or vacuum below a certain point will be prevented and the relative conditions harmonized. Both compression and exhaust can be regulated at will, and excess of either is provided against in the valve-controlling mechanism hereinafter described; but one

may be relatively much in excess of the other, as also will hereinafter appear.

In the drawings, 2 represents a stationary pump-cylinder, supported in this instance on its rests or legs 3. The piston 4 is actuated by crank power-shaft 5, and the valve mechanism below is operated by equalizing-rod 6, having its head working upon eccentric 8 or its equivalent on the main shaft 5.

The cylinder-head 7 on the bottom is a separate piece bolted to a flange about the bottom of said cylinder and in addition to serving as a head answers for other purposes, as will now appear. Thus the said cylinder has inlet and outlet passages *a* and *b*, controlled by valves 9 and 10, Fig. 4, and the spaces immediately below said valves have pipes 12 and 13 openly connected therewith and which presumably are connected with separate pressure and exhaust chambers or spaces or serve themselves as such chambers or spaces, if large enough, and they are understood to be large enough in this instance. Valve 9 is seated from above and controls the exhaust-passage opening into the pump-cylinder, and valve 10 is seated from below and spring-pressed upward and controls the pressure or outlet passage therefrom to compression-space outside thereof and including all the inclosed space directly open to said valve. In these operations it is to be understood that an exhaust-chamber is necessarily within the system and which is exhausted through pipe 12 up past valve 9 into the pump-cylinder. This also in turn becomes the chief source of supply of air for compression; but when the exhaust from said space is stopped a supply of air enters the cylinder through the passage to the atmosphere, as hereinafter fully described.

It may be here stated that the pressure and vacuum respectively created by this pump can be used for independent or different purposes, as may be desired, or conjunctly in any kind of machine, apparatus, or process adapted therefor.

I have not shown special outside chambers or spaces for either the pressure or the exhaust, because large pipes like those shown, if they have length enough, will serve my purpose,

and no other chambers or operating-spaces as such are needed. In case the pressure is at normal and the exhaust not, air will exhaust into the cylinder by valve 9 and discharge from the cylinder to the atmosphere by valves 40 and 41. It may be noted, however, in this connection that under certain conditions the pressure getting normal does not have anything to do with the exhaust and the exhaust getting normal does not have anything to do with the pressure, valves 40 and 41 cutting them completely in two except when the two are being replenished approximately at the same time, when the air is withdrawn from the vacuum-space and forced backward to the compression-space. The atmospheric pressure to the exhaust can be used for a wholly independent purpose from the pressure and the pressure can be used independently also, and both may be used at the same time or one at a time.

The pressure and exhaust regulating device on the respective pressure and exhaust spaces is to stop the pump from working on either when the uses of the pressures are stopped for intervals and when used to throw the pump to work the instant either pressure is used or utilized. When these pressures are not utilized, the pump is running idle and power saved. This also dispenses with pressure and exhaust tanks. The pressure is created the instant pressure is used and stopped whenever the use is stopped. Were there no regulating means with these chambers, the pressure would run too high and the exhaust too low. To prevent either becoming excessive or beyond a predetermined point, I have provided automatically-operated mechanism having two controlling movable walls 15 and 16, Fig. 5. These movable walls are located in open atmospheric relation to or with the exhaust and pressure spaces and are exposed on their opposite sides to the outside atmosphere about stems 22 and 23. The said movable wall-stems 22 and 23 are provided with springs 17 and 18, respectively, pressing in opposite directions on said walls, and said stems are supported by laterally-extending arms 20 and 21 on head 7, Fig. 5. The said wall-stems rest at their outer ends in these arms, and spring 17 crowds or counterbalances wall 15 outward against the pressure of the atmosphere to the exhaust-space, while spring 18 bears or counterbalances wall 16 inward against the compression-pressure.

Each wall-stem has sleeved upon it a member 24 and 25, respectively, having inwardly-extending arms 26 and 27 at one end and inwardly-extending fingers 28 and 29, respectively, at the other end. The said arms and fingers project toward each other in different horizontal planes, and the said fingers are arranged on opposite sides of the suspended regulating-rod 6. Rod 19, Fig. 2, holds the arm 27 and fingers 29 up at the right eleva-

tion, which are integral with sleeve 25, that is sectioned away in this figure, so as not to break the view of the said arm 27 and finger 29. Said parts are shown integral in Fig. 5, and adjustable collars 36 and 37 fix both members on their spindles relatively to the other parts. Stem 23 has also a collar 38, which confines one end of spring 18.

The rod or bar 6 is slidably supported or stayed by an arm or projection 31, whereon it is engaged by a headed screw 32, passing through a slot in the said rod and serving to hold the rod loosely on said arm. Thus the rod 6 is adapted to move up and down under actuation by eccentric 8 and runs continually while the pump is at work.

Normally fingers 28 and 29 are held laterally apart from the shoulders 33 and 34 on rod 6, as seen in Figs. 3 and 6, and this occurs when proper working conditions exist in the pressure and exhaust passages. Then the controlling-walls 15 and 16 sustain the relations relatively, as shown in Fig. 5; but when, say, compression becomes excessive the effect of the pressure on controlling-wall 16 is to overcome the normally-sustained push of spring 18 and crowd said controlling-wall outward. This carries stem 23 outward also and moves finger 29 into the path of shoulder 34 on rod 6, to be engaged thereby. Then as rod 6 is raised the effect through finger 29 will be to rotate the part 25 and correspondingly raise arm 27.

Two relief-valves 40 and 41 come into view now. The pump-head 7, forming the bottom of cylinder 2, has an opening 42, which enters the cylinder from the outside air. Valve 40 seats from above on said opening and valve 41 from below. Valve 41 has a tubular stem 45, adapted to slide in supporting arm or projection 44, rigid with head 7, and valve 40 has a rod-stem 46 extending down through tubular stem 45 and some distance beneath its lower extremity. Spring 47, resting on projection 44, bears against the bottom valve 41 and holds it to its seat. Tubular valve-stem 45 has a collar or flange 48 on its lower end, adapted to be engaged by arm 26 in certain contingencies and pressed downward, thereby opening valve 42, while arm 27 bears against the lower end of stem 46 and in certain contingencies lifts said stem and valve 40.

Now returning to the former description, where pressure is become excessive, spring 18 is overcome, finger 29 is carried outward into engagement with shoulder or catch 34, and when rod 6 rises sleeve 25 is rotated, arm 27 is lifted, which lifts valve 40 and opens passage 42 outward. This possible opening is timed to occur when piston 4 is descending, so that the air which otherwise would be compressed and forced forward to increase the accumulated pressure beyond valve 10 is, in fact, allowed to escape past valve 40, now open, and of course past valve 41 as well, to the atmosphere. An engagement between arm 130

29 and rod 6 having once been made, it continues until the accumulated pressure in the system has been so far reduced that the pressure of spring 18 is found to be stronger than the pressure against controlling-wall 16 and the parts assume their former positions. This of course liberates arm 29 again and allows rod 6 to run free, and the air is being compressed again. If, on the other hand, the exhaust becomes excessive on the exhaust side of the pump, controlling-wall 15 overcomes the back-holding tension of spring 17, carries finger 28 inward beneath shoulder or catch 33 on rod 6, and said finger is depressed. This carries arm 26 downward and bearing on collar 48 of valve-stem 45 perforce moves valve 41 from its seat and allows the air to pass by valve 41 and also by valve 42 from the atmosphere to the cylinder. The time of movement, of course, is when pump-piston 4 is rising and otherwise would draw exclusively from the exhaust-passage past valve 9; but by opening inlet-valve 41 a volume of air is admitted and exhaust from the exhaustion-space in the system suspended, and this likewise will continue until the former conditions are automatically reestablished, as before. When the atmosphere-pressure is used and discharged into the exhaust-space, it weakens the atmospheric pressure to said exhaust-space under its set pressure, and spring 17 crowds controlling-wall 15 toward the atmosphere and disengages finger 23 and allows the pump to exhaust again from said exhaustion-space. Then rod 6 is again free to run alone, and this continues until right working conditions reappear and rebalancing occurs automatically. This mechanism is very sensitive, and the rebalancing will take place when the difference is comparatively slight. The springs 17 and 18 are adapted to be tightened or loosened by nuts 48 and 49, and thus vary the pressure from above atmosphere to any point desired in the compression-space and the atmospheric pressure to the exhaust at any point desired within its limits.

The parts 15 and 16 are shown here as controlling-walls of the diaphragm type, suitably packed; but they might be of another type and serve the same purpose. If said walls were located in some other portion of the pump in open exposure to the compression and exhaust spaces, they would serve as well, provided the associated mechanism were changed to correspond. This obviously could be done without departing from the spirit of the invention, the idea being to have the said walls exposed and subject to the atmospheric conditions in said spaces, which show the state of compression or exhaust therein, thus serving to tell what the conditions are, especially when the ether becomes excessive, as hereinbefore described. Open channels or ducts 50 and 51 lie between the air-passages in front of the walls 15 and 16, embodying a part of

the spaces and openly exposing the said walls to their spaces, respectively, and making them sensitively responsive to the pressure on one side and the exhaust on the other.

The compression and exhaust spaces referred to herein are understood to comprise the space embraced in one or more of the chambers of this construction or pipes openly connected therewith, so that the term is designed to be somewhat flexible and comprehensive and need not be definitely located.

It will be noticed in both Figs. 1 and 2 that there are perforations or openings *m* in the side of said cylinder near its lower end and just above piston A, as seen in Fig. 2, which are covered by a flap-valve *n*, which is adapted to prevent more air than part of a cylinderful being compressed. Thus the air is allowed to escape on the compression-stroke until the piston descends opposite said perforations and until the same are closed by the piston.

I have specifically described the mechanism shown in the drawings; but obviously this mechanism might be very considerably varied in form and serve the same purpose, so that my claims are to be understood as covering all equivalent mechanism.

The pump hereinbefore described is single-acting, or works on one side of the piston; but it is obvious that the foregoing mechanism will work on a double-acting pump, if constructed to work on both sides of the piston.

I claim—

1. In pumps, a pump-cylinder and piston, and separate pressure and vacuum spaces each provided with a valved passage leading to said cylinder, a movable determining-wall for each of said spaces with separate open connections leading to their respective spaces, and said walls exposed to the outer atmosphere at one side, and governing mechanism independently connected with each of said walls, substantially as described.

2. An air-pump cylinder, a reciprocating piston therein, separate valved vacuum and pressure passages at one end of said cylinder, a combined air inlet and outlet passage in the side of said cylinder open to the outer atmosphere, and an automatic valve adapted to close said passage upon the full outward or vacuum stroke of the piston and to open said passage to the outer atmosphere upon the initial and inward movement of said piston, substantially as described.

3. A pump-cylinder, separate exhaust and compression spaces and valve-controlled passages within said spaces and the pump-cylinder, movable pressure and vacuum regulating walls open to said spaces on one side, and to the outside air on the other side, a double-valved relief-opening to the said cylinder, and mechanism controlled by said walls to open said valves, substantially as described.

4. The pump-cylinder having separate in-

let and outlet pressure and vacuum passages and a separate air-space connected with each of said passages, a valve at the opening of each space from the pump and a movable wall
5 exposed to the atmosphere in each of said spaces, said cylinder having an opening and oppositely-seated valves in said opening, in combination with a power-operated bar provided with catches on its lower portion, and
10 mechanism operatively connecting both said movable walls and said valves with said bar, substantially as described.

5. An air-pump having inlet and outlet passages, in combination with two chambers, one
15 of which communicates with the inlet-passage of the pump, and the other with the outlet-passage thereof, a movable wall in each of said chambers, each wall being exposed on one side to the atmosphere and on the other side
20 to the pressure in the said chamber, relief-valves governing communication between the outside atmosphere and the pump, and connections between said valves and said movable walls, whereby one of the valves is opened
25 when the pressure in the inlet-passage falls below a certain limit and the other valve is opened when pressure in the outlet-passage rises above a certain limit, substantially as described.

30 6. A pump having inlet and outlet pressure and vacuum passages, respectively, and a separate relief-opening, a movable wall openly exposed in said pressure and vacuum passages on one side to the atmosphere therein and to
35 the outer atmosphere on the other, stems on said walls extending outside said passages, a rotatable member on each of said stems and a set of valves in the said relief-opening controlled by said rotatable members, in combination
40 with a power-operated device constructed to engage said rotatable members and thereby open one of said valves at a time according to the direction of rotation, substantially as described.

45 7. The pump and inlet and outlet pressure and vacuum passages, respectively, connected therewith, and movable walls openly exposed to atmospheric conditions in said passages and

to the outer atmosphere on opposite sides, and provided with operating - stems, said pump 50 having a relief-opening and oppositely-arranged valves with stems controlling said opening, in combination with arms rotatable on said movable wall-stems and in position to engage said valve-stems and open the valves, 55 substantially as described.

8. A pump-cylinder provided with a combined inlet and outlet relief opening and a set of valves on opposite sides of said openings, and air-pressure and vacuum space respectively connecting said pump, in combination
60 with a power-operated device and air-controlled intervening mechanism arranged to open one of said valves at a time, substantially as described. 65

9. A pump having a set of pressure and exhaust passages and a single combined inlet and outlet relief opening thereunto, a set of valves for said relief-opening and a movable wall
70 openly exposed to atmospheric conditions arising in each of said passages and to the outside atmosphere, said walls having stems exposed outside said passages, in combination with means connected with the stems of
75 said walls to operate said valves, according to the play of said walls, substantially as described.

10. A pump having pressure and exhaust passages entering the same and an inlet and outlet relief opening, a set of valves for said
80 opening and mechanism to open and close said valves comprising movable walls exposed to atmospheric vacuum or pressure in said passages, and stems on said walls, in combination
85 with a power-actuated device mechanism carried by said movable wall-stems adapted to be alternately engaged by said power-actuated device and means on said stems to open said valves, substantially as described.

Witness my hand to the foregoing specification this 26th day of September, 1900. 90

MELVIN A. YEAKLEY.

Witnesses:

R. B. MOSER,

H. T. FISHER.