C. N. SOWDEN.

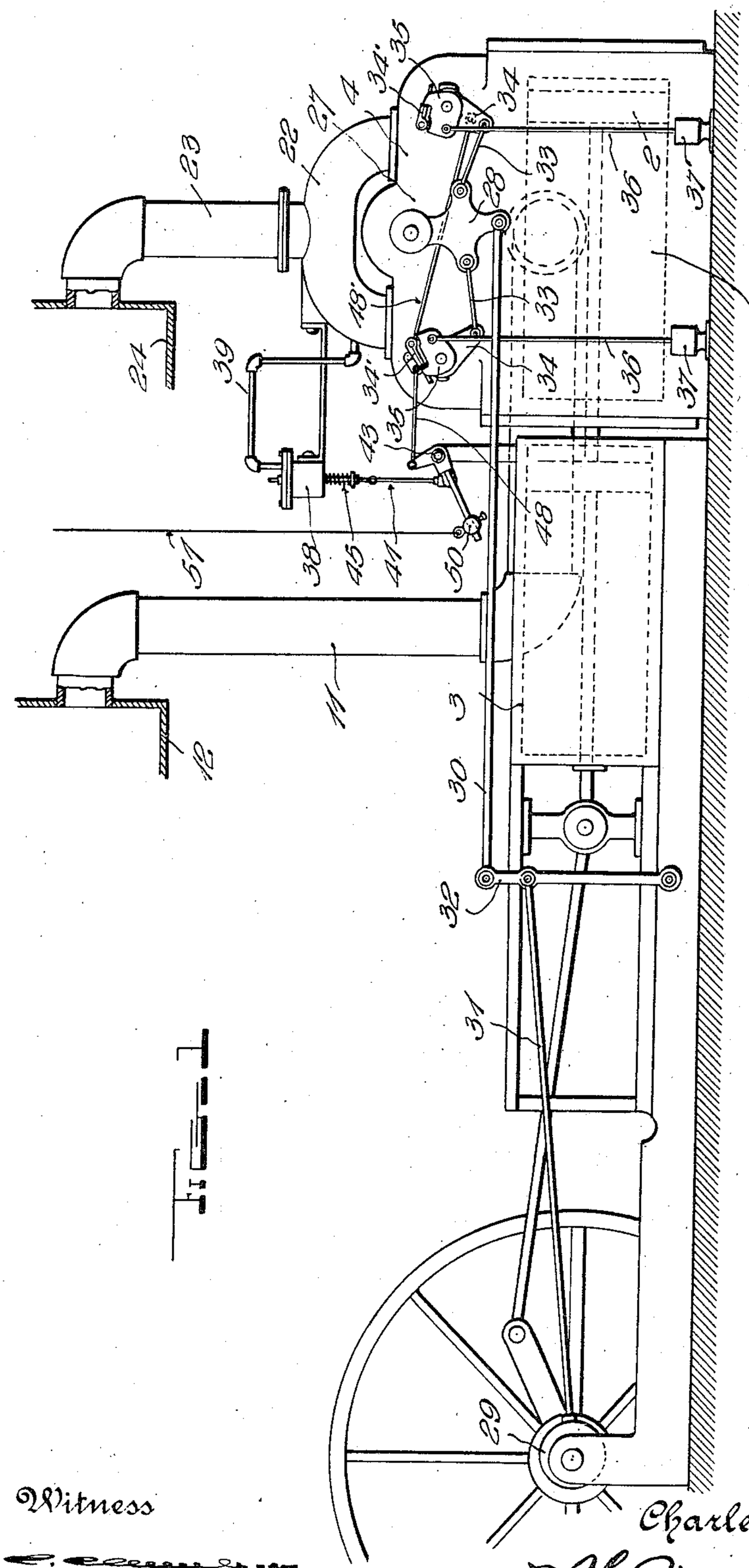
VACUUM PUMP.

APPLICATION FILED FEB. 18, 1918.

1,298,111.

Patented Mar. 25, 1919.

4 SHEETS—SHEET 1.



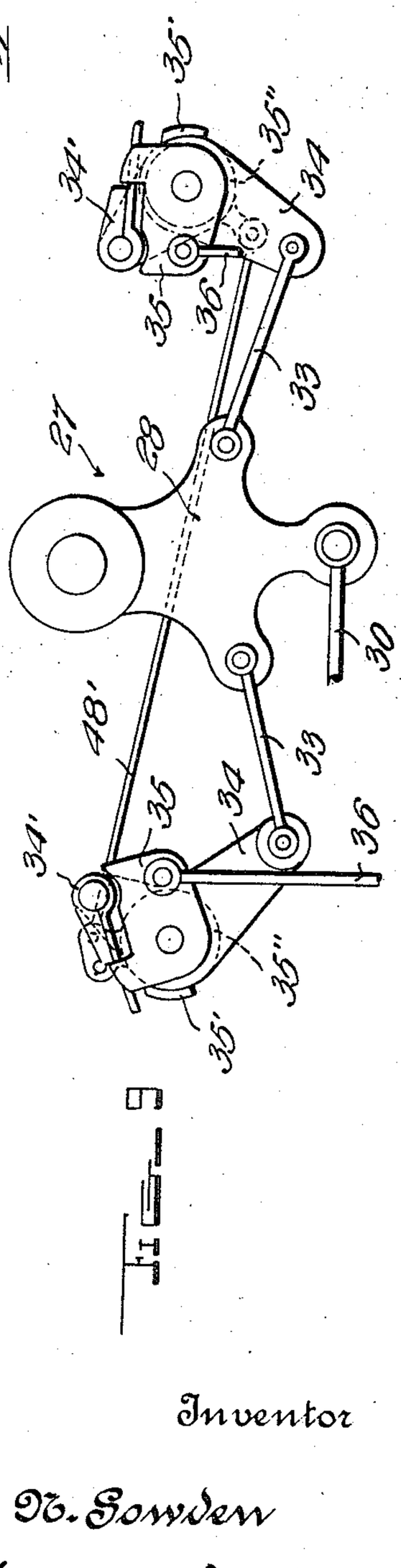


FIG. 1.

FIG. 6.

Witness

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4 SHEETS—SHEET 2.

FIG. 2

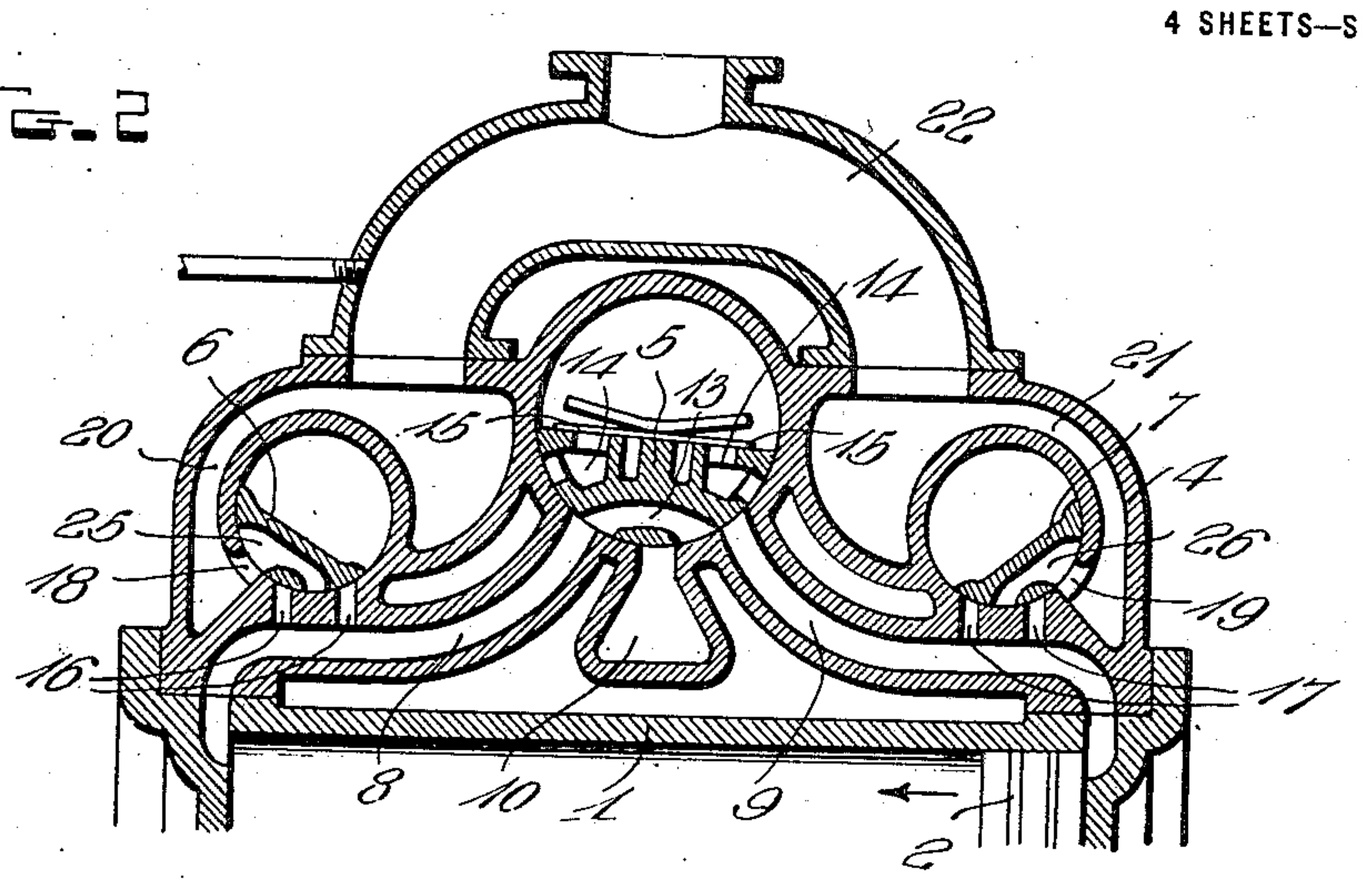


FIG. 3

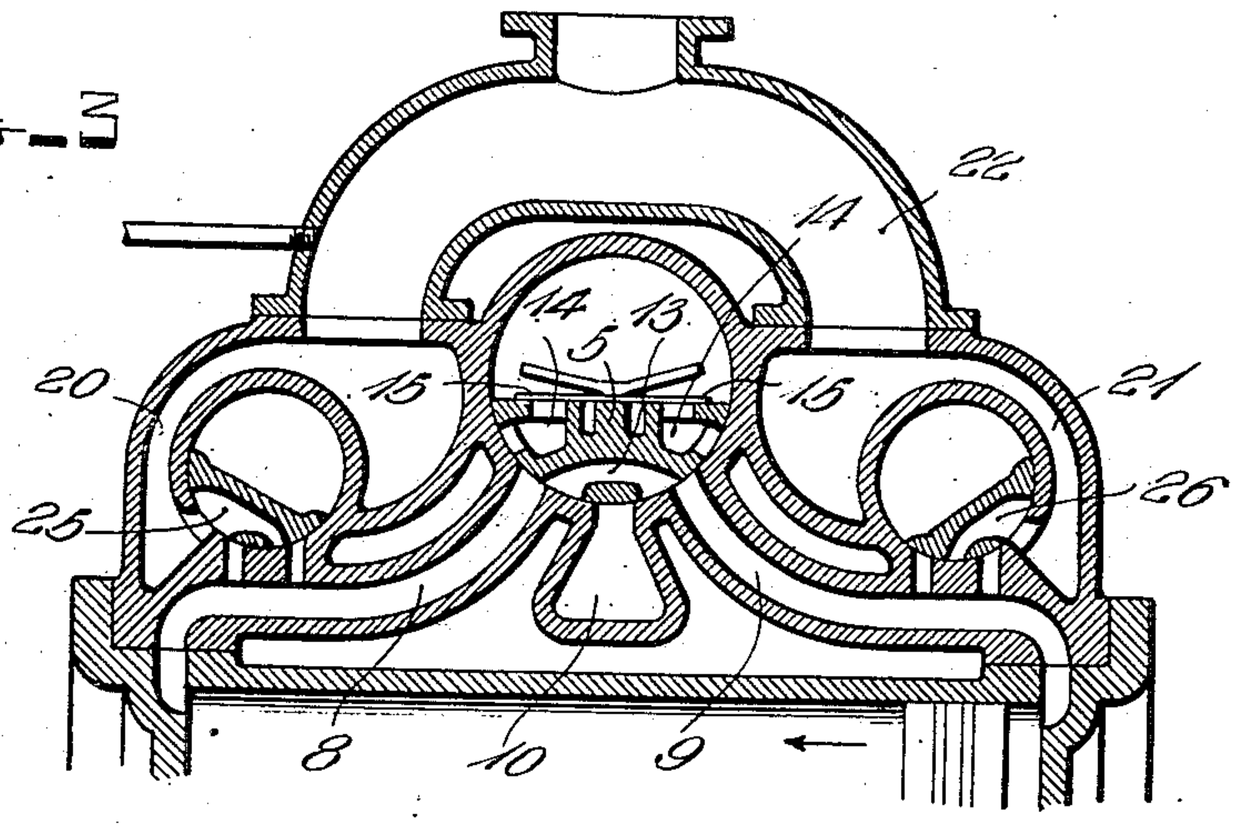
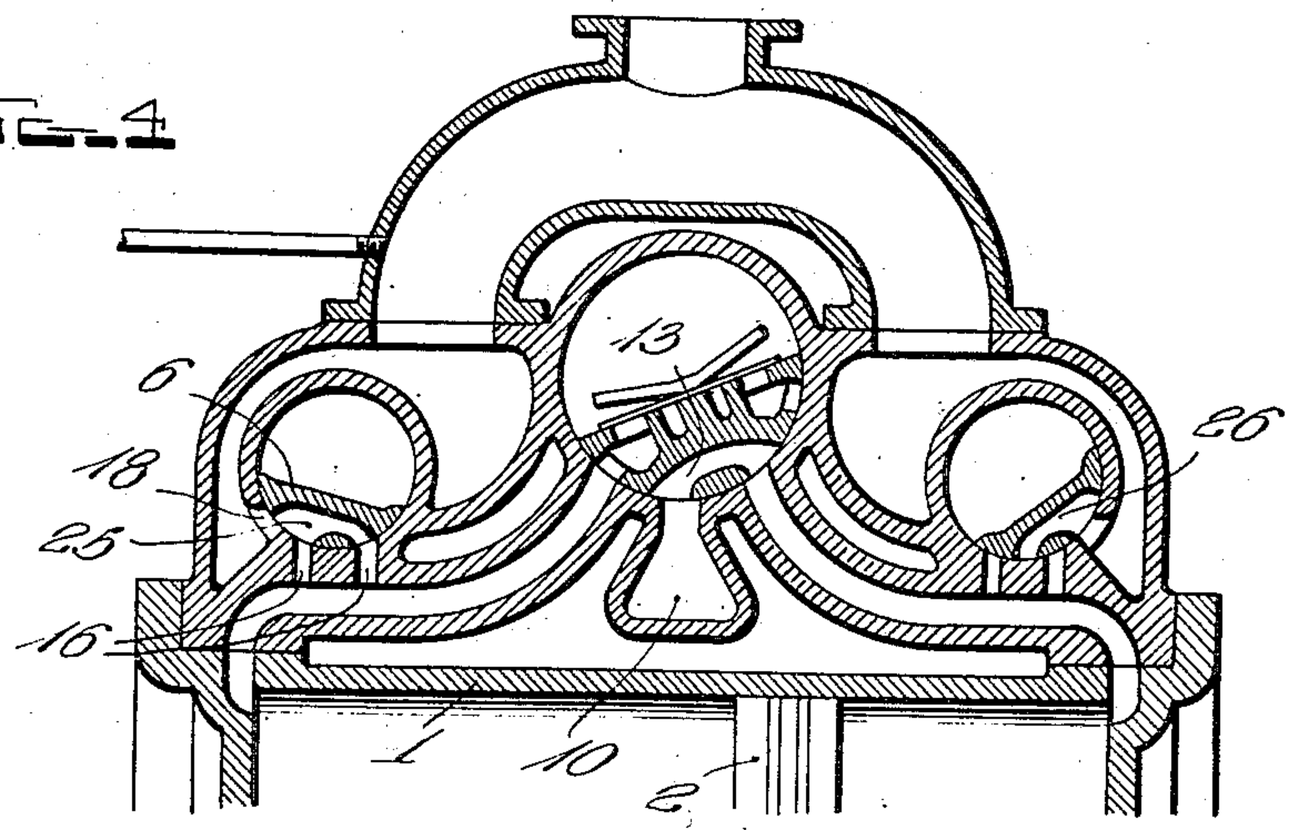


FIG. 4



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4 SHEETS—SHEET 3.

FIG. 5

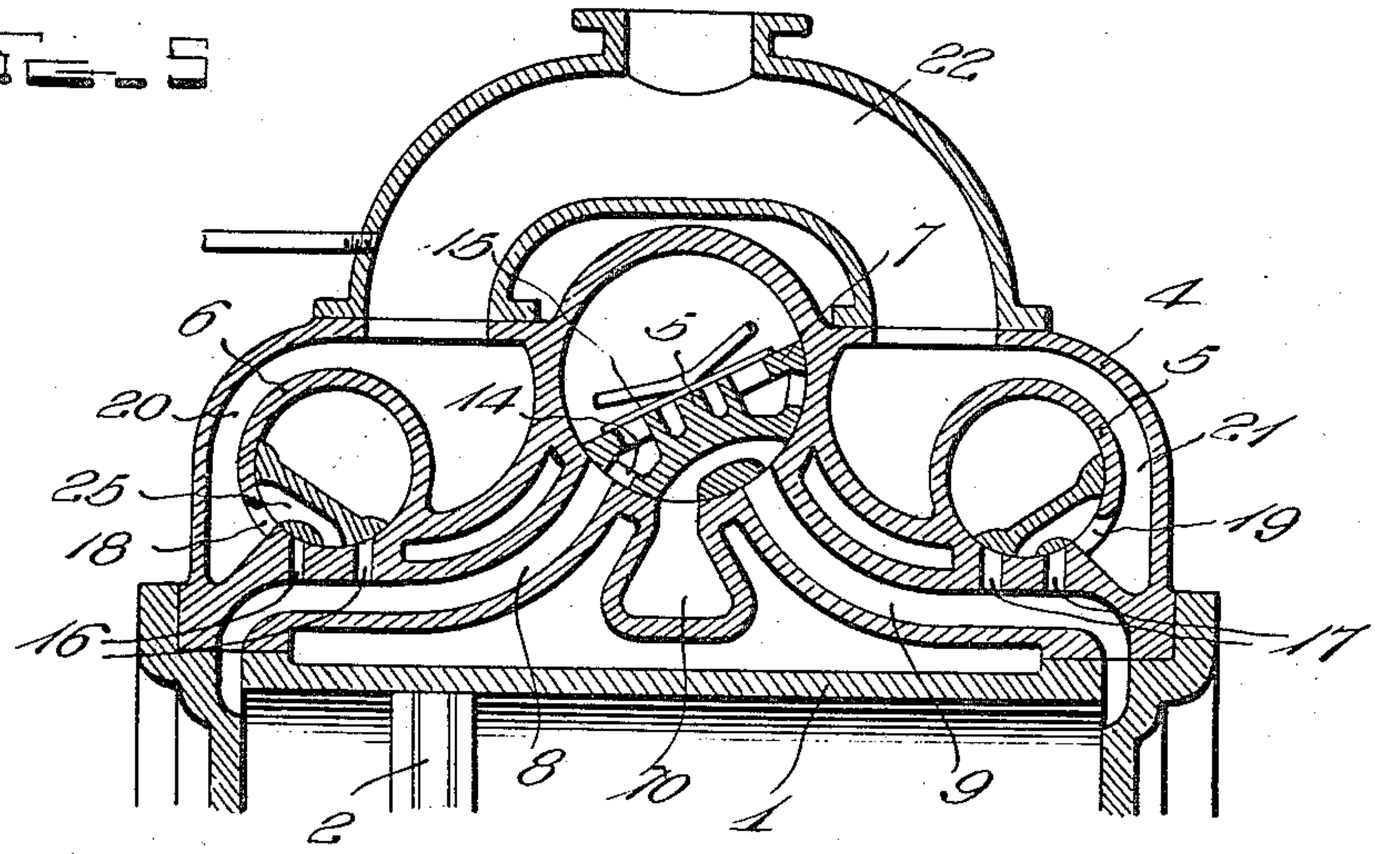

FIG. 7

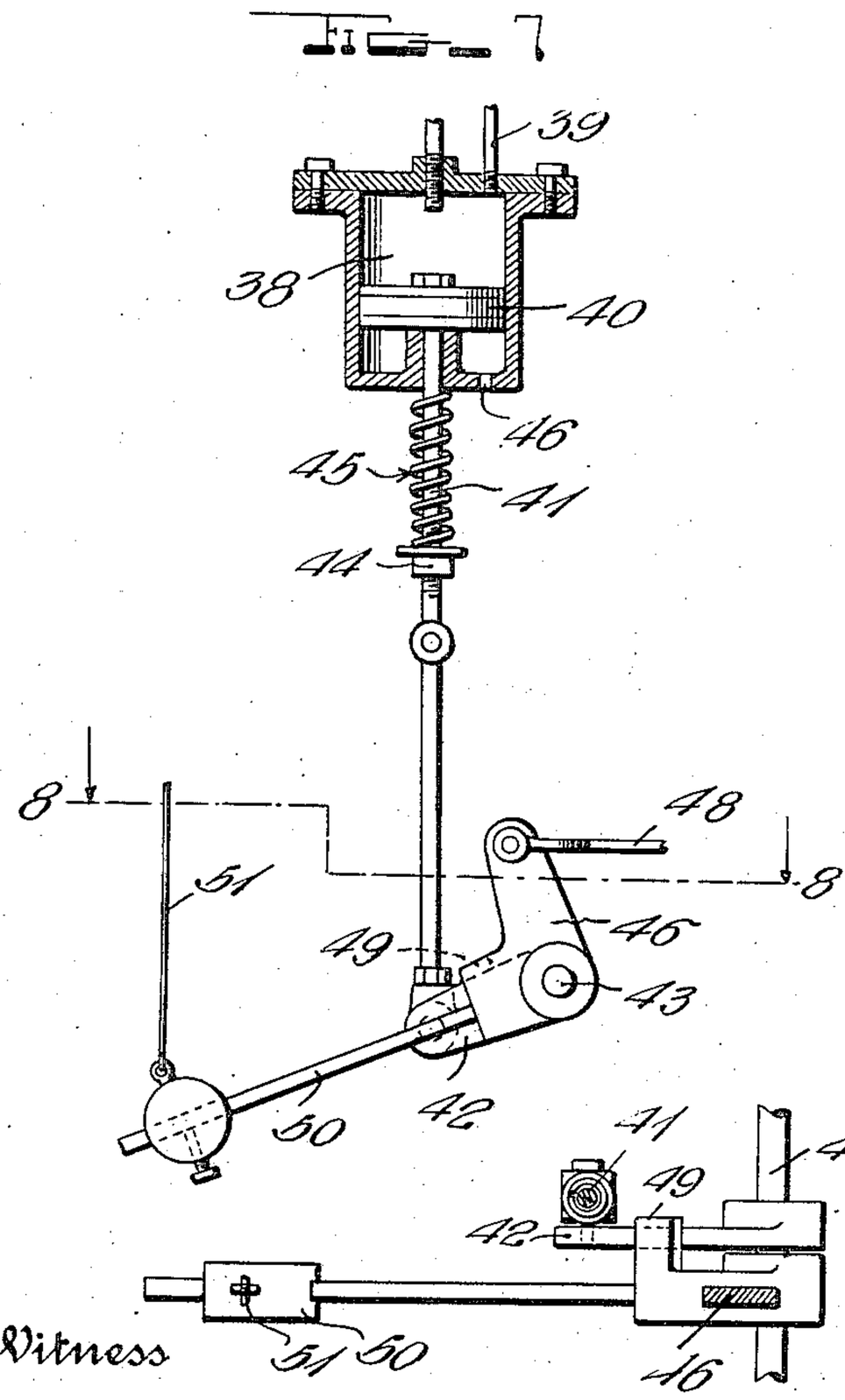

FIG. 6

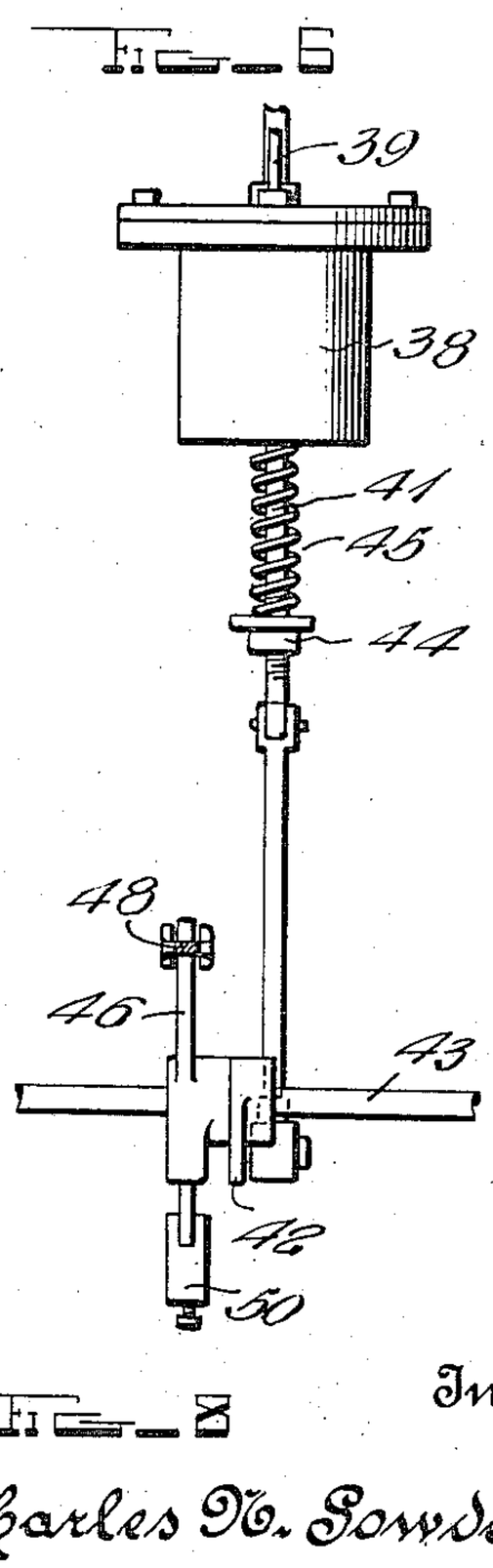

FIG. 8

Witness

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4 SHEETS—SHEET 4.

Fig. 10

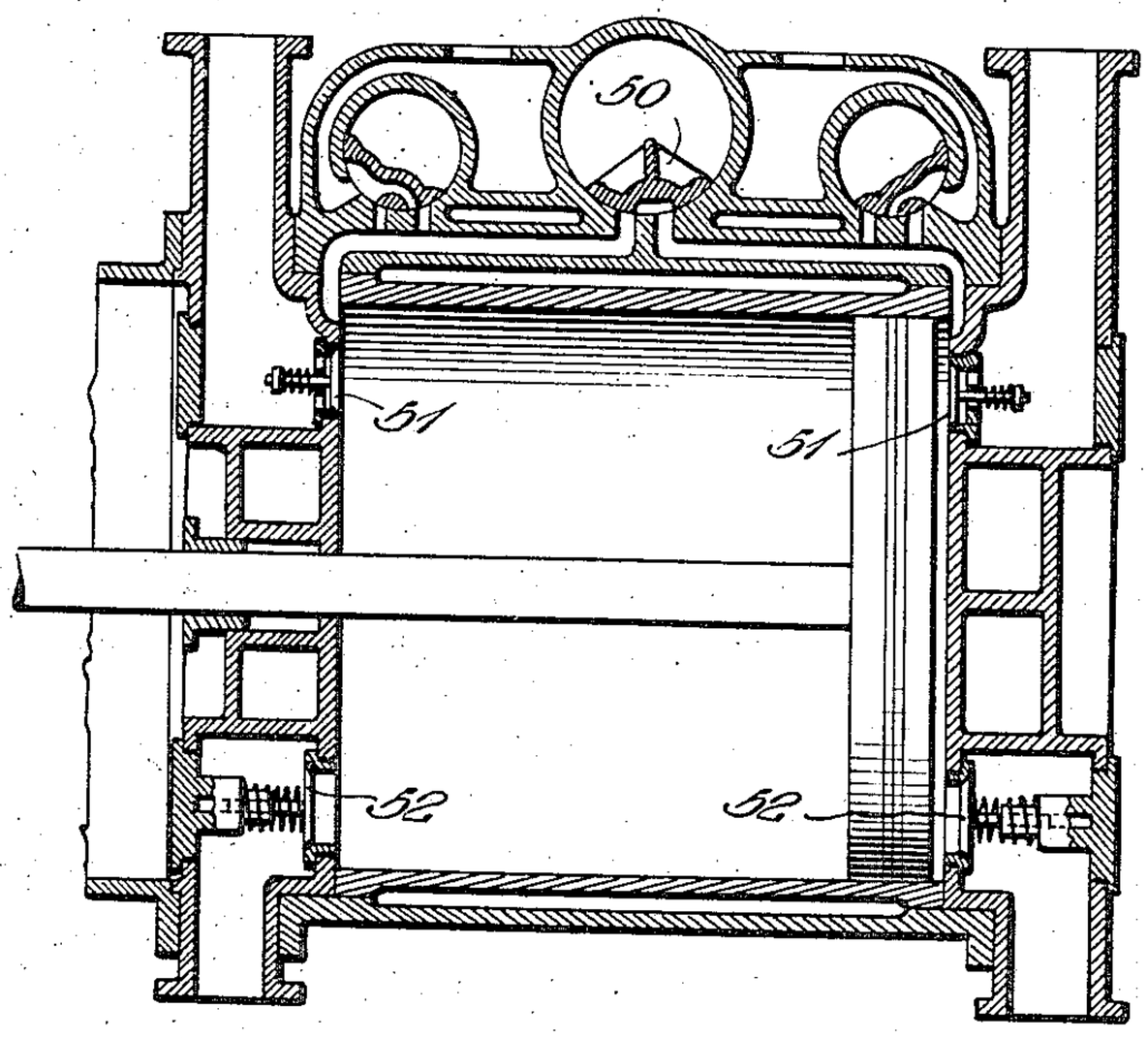
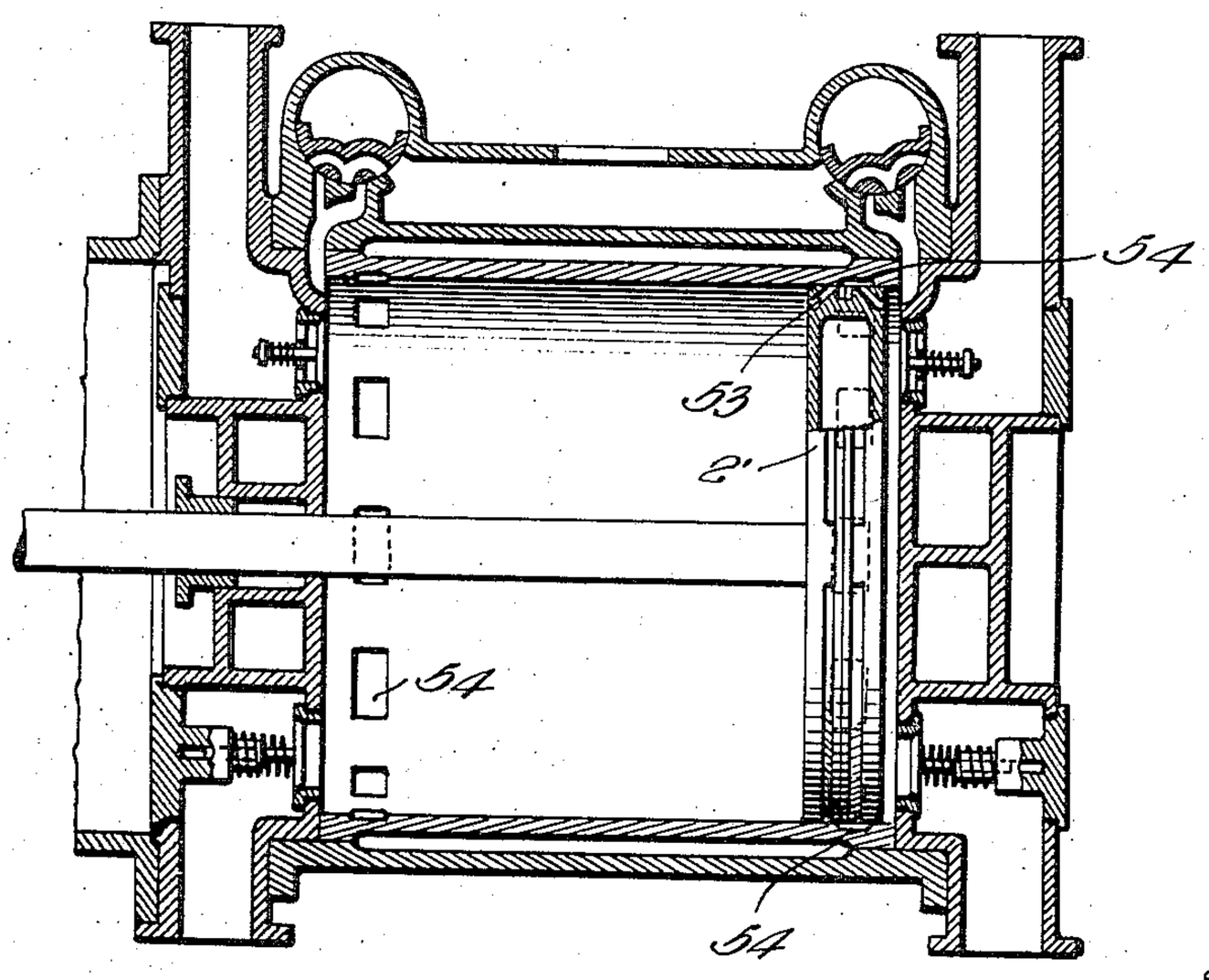


Fig. 11



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UNITED STATES PATENT OFFICE.

CHARLES NEVILLE SOWDEN, OF CENTRAL CARACAS, CUBA.

VACUUM-PUMP.

1,298,111. Specification of Letters Patent. Patented Mar. 25, 1919.

Application filed February 18, 1918. Serial No. 217,912.

To all whom it may concern:

Be it known that I, CHARLES N. SOWDEN, a subject of the King of Great Britain, residing at Central Caracas, Cuba, have invented certain new and useful Improvements in Vacuum-Pumps; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to certain new and useful improvements in vacuum pumps to be used particularly in connection with sugar refining.

One object of the invention is to provide a vacuum pump which, during its stroke, can form two independent vacuums of predetermined pressures; this object being attained by bringing into communication with the cylinder, different vacuums at predetermined points of the voluminal displacement of the piston during its stroke in the cylinder.

Another object of the invention is to provide a double-acting pump of this character having a main valve controlling the communication of the main suction with the cylinder, two auxiliary valves controlling the communication of the secondary suction with the cylinder, and automatic means for throwing the auxiliary valves out of operation when the vacuum in the secondary suction has reached a predetermined point.

A further object of the invention is to provide a vacuum pump of this class which will be comparatively simple, strong, durable and inexpensive in construction, efficient and reliable in operation and well adapted to the purpose for which it is designed.

With these and other objects in view, the invention consists of certain novel features of construction and the combination and arrangement of parts as will be hereinafter fully described and claimed.

In the accompanying drawings in which similar reference characters are used to designate like parts throughout the several views:

Figure 1 is a front elevation of a pump constructed in accordance with this invention;

Figs. 2, 3, 4 and 5 are longitudinal sectional views through the valve chest and a portion of the cylinder of the pump, showing the positions of the piston and valves at different stages of the stroke of the piston;

Fig. 6 is an elevation of a portion of the means for automatically throwing the auxiliary valves into closed and inoperative positions when the vacuum in the secondary suction has reached a predetermined point;

Fig. 7 is a vertical sectional view through the cylinder of the above referred to means, the piston and parts connected to the same being shown in elevation;

Fig. 8 is a horizontal sectional view taken substantially on the line 8—8 of Fig. 7;

Fig. 9 is an enlarged front view of a portion of the valve gear; and,

Figs. 10 and 11 are longitudinal sectional views, similar to Figs. 2–5, of modified forms of pumps.

Referring more particularly to the drawings, the numeral 1 designates the cylinder of the pump, 2 the piston which works within the cylinder and which is connected to and operated by an engine 3, and 4 a chest fastened in any suitable manner upon one side of the cylinder and containing the oscillating valves 5, 6 and 7. The valve 5, being what may be termed the "main valve" because it controls the main suction, is dispased between the auxiliary valves 6 and 7 which control the secondary suction.

Ports 8 and 9 lead through the chest 4 from the ends of the cylinder 1 to the casing for the valve 5, and disposed between these ports 8 and 9 is a central port 10 which also leads to and through the casing for said valve 5. The port 10 is connected by means of a pipe 11 to a receptacle 12 in which the vacuum is to be about 27 inches.

The valve 5 is provided with a bypassage 13 by which communication is established between the ports 8 and 9 and the port 10 with either of the ports 8 and 9, and passages 14 having outwardly opening flap valves 15 therein. These passages 14 are adapted to register with the ports 8 and 9 and permit the air contained therein to pass through them and the valves 15 to the interior of the casing of the valve 5, and thence to the atmosphere.

A pair of apertures 16 lead from the port 8 to and through the casing to the valve 6, and another pair of apertures 17 lead

imilarly from the port 9 to and through the casing of the valve 7. The casings of these valves 6 and 7 are respectively provided with ports 18 and 19 which lead into the hollow portions 20 and 21 respectively of the chest 4, and these hollow portions 20 and 21 communicate with a manifold 22 attached to the chest 4 and to which is connected a pipe 23 leading to a receptacle 24 in which the vacuum is to be a few inches lower than 27 inches.

The valve 6 is provided with a bypassage 25 which is adapted to register with the apertures 16 and the port 18, and the valve 7 has a similar bypassage 26 to control the communication of the apertures 17 with the port 19.

The valves 5, 6 and 7 are operated by the engine 3 through the medium of a simple form of the well known Corliss type of valve gear 27, the wrist plate 28 of which is connected to the eccentric 29 by means of the rods 30 and 31 and the rocker arm 32. The plate 28 is carried by the valve 5 so that an oscillating motion is imparted to the latter. Rods 33 connect the wrist plate 28 to the arms 34 which carry latches 34′ to engage and turn on the arms 35 carried by the valves 6 and 7 to open these valves and lift the rods 36 connected to the dash pots 37. These dash pots quickly close the valves when the latches 34′ are moved out of engagement with the arms 34 by engagement of the cams 35′ carried by collars 35″ with lugs carried by said latches. The construction and operation of the valve gear 27 is well known so that further illustration and description of the same is unnecessary.

The numeral 38 represents a cylinder which is supported adjacent the pump in any suitable manner and which has communication with the manifold 22 by means of a pipe 39, the latter entering the cylinder 38 at the upper end of the same. The piston 40 which works vertically within the cylinder 38 has its rod 41 extending through the lower end of the same and connected at its lower end to an arm 42 pivoted upon a shaft 43. Surrounding the rod 41 and disposed between an adjustable nut 44 on the same and the lower end of the cylinder 38 is a coiled spring 45, the pressure of which acting upon the nut 44 tends to normally maintain the piston 40 at the lower end of the cylinder 38. Atmospheric air passes into the cylinder 38 beneath the piston 40 through an opening 46, and this air acts upon the lower side of the piston to raise the same when a predetermined vacuum exists in the manifold 22 and consequently the receptacle 24.

Pivoted to the shaft 43 is a bell crank 46, one of the arms of which is connected to a rod 48 which in turn is connected to the collar 35″ of the valve 6. This collar is connected to the collar 35″ of the valve 7 by a rod 48′ so that when the collars are turned, their cams will throw the latches and allow the valves 6 and 7 to close. The other arm of the bell crank 46 is provided with a laterally extending lug 49 which rests upon the upper edge of the arm 42 so that when the rod 41 is raised and swings the arm 42 upwardly, the bell crank 46 will be rocked so as to release the valves 6 and 7 and cause them to be closed. The closing of the valves 6 and 7 obviously takes place automatically when a predetermined vacuum is formed in the secondary suction. To operate these valves 6 and 7 manually, the last named arm of the bell crank 46 is provided with a weighted extension 50, and to this is fastened an operation cord or cable 51.

To readily understand the operation of the pump, it must be borne in mind that the highest vacuum of about 27 inches is created first in the main suction and then the vacuum in the secondary suction depends upon the vacuum which has been created in the main suction. It must also be remembered that the pump is double acting so that during each stroke of the piston the vacuum in both suctions will be raised.

With the above facts in mind, attention is directed to Fig. 2 of the drawing in which the piston is at the end of its stroke so that the discharge (right hand) side has just been cut off from the atmosphere and the suction (left hand) side has just been cut off from the main suction and the vacuum in the cylinder is about 27 inches. As the piston begins its next stroke and has moved to the position shown in Fig. 3, the valve 5 will have been turned so as to bring the two ends of the cylinder into communication with each other by means of the ports 8 and 9 and the bypassage 13 in said valve. This causes an equilibrium between the two ends of the cylinder to be established which results in the lowering of the vacuum therein to somewhat below 27 inches.

The relative positions of the parts at the next stage of the stroke is shown in Fig. 4. The valve has been further turned so that its bypassage 13 has brought the port 10 into communication with the port 9 and the vacuum in the main suction is consequently being raised. The auxiliary valve 6 has also been turned to establish communication between the now discharge side of the cylinder and the secondary suction through the port 8, apertures 16, bypassage 25 and the port 18. Since the vacuum of the secondary suction is below that in the discharge side of the cylinder, the equilibrium will take place resulting in the raising of the vacuum in the secondary suction. The vacuum in the secondary suction thus depends upon the vacuum which had been created in the main

suction on the preceding stroke of the piston.

The valve gear 27 is so timed that when the last mentioned state of equilibrium has been reached, the valve 6 will be quickly closed. The parts are then in the position shown in Fig. 5 and as the piston completes its stroke the air contained in the compression or discharge side of the same will be forced through the port 8 and adjacent passage 14 in the valve 5 to the hollow of the casing of said valve and thence to the atmosphere. In passing out of the passage 14 the flap valve 15 will be forced open.

The valve 7 remains closed during this entire stroke of the piston. During the next or return stroke of the piston a similar action of the pump will take place, the valve 6, however, remaining inoperative while the valve 7 operates.

When the vacuum in the secondary chamber 24 has reached a predetermined point depending upon the area of the piston 40 and the strength of the spring 45, the atmospheric air acting upon the lower side of the piston 40 will raise the same, and this causes the bell crank 46 to be rocked so as to release the auxiliary valves 6 and 7 and permit them to be closed and remain closed. Also rocking of the bell crank 46 by the hand means would cause them to be closed. The valve 5 will continue to operate to further raise the vacuum in the main suction, but this will obviously have no effect upon the secondary suction.

Fig. 10 illustrates a modified form of pump in which the centrally disposed oscillating valve 50 merely opens the two ends of the cylinder into communication with each other at the ends of the stroke, and hence does not contain any discharge nor does it control the communication of the main suction with the cylinder. The latter is accomplished by inwardly opening spring pressed valves 51 suitably arranged at the ends of the cylinder, while the discharge is also at the ends of the cylinder, being in the form of outwardly opening spring pressed valves 52.

In the further modification of the invention shown in Fig. 11, the main suction inlets and the discharge are the same as the form shown in Fig. 10, but this form contains no oscillating valve for bringing the two ends of the cylinder into communication with each other at the ends of the stroke. Instead, the piston 2′ is provided at its periphery with by-passages 53 which communicate with recesses 54 arranged in the walls of the cylinder near the ends of the same. Obviously since there is no centrally disposed oscillating valve in this type of pump, the wrist plate 28 of the valve gear must be pivoted in any convenient manner to the side of the steam chest.

From the foregoing description, taken in connection with the accompanying drawings, the construction, use and operation of the device will be readily understood without a more extended explanation.

As various changes in form, proportion, and the minor details of construction may be resorted to without departing from the spirit of this invention it is to be understood that I do not wish to be limited to the construction herein shown and described other than as claimed.

I claim:

1. In a vacuum pump for creating relatively high and low vacuums simultaneously, a cylinder and a piston therein, a main valve casing and secondary valve casings on opposite sides thereof, main ports leading from the ends of the cylinder to said main valve casing, a main oscillating valve in said main casing for establishing communication between the ends of the cylinder as the piston reaches the ends of its strokes, secondary ports from said main ports to said secondary valve casings, secondary suction inlet means opening into said secondary valve casings, secondary oscillating valves in said secondary valve casings for controlling communication between said secondary suction inlet means and said secondary ports, main valve-controlled suction inlet means for alternate communication with the opposite ends of said cylinder, and valve-controlled exhaust means for similar communication with the cylinder ends.

2. In a vacuum pump for creating relatively high and low vacuums simultaneously, a cylinder and a piston therein, a main valve casing and secondary valve casings on opposite sides thereof, main ports leading from the ends of the cylinder to said main valve casing, a main oscillating valve in said main casing for establishing communication between the ends of the cylinder as the piston reaches the ends of its strokes, secondary ports from said main ports to said secondary valve casings, main suction inlet means opening into said main valve casing, a main oscillating valve in said main casing for placing said main ports in communication as the piston reaches the ends of its strokes, for alternately placing said main ports in communication with said main suction inlet means and for controlling communication between said main ports and the interior of said main valve casing, the latter having an exhaust outlet from its interior, secondary suction inlet means opening into said secondary valve casings, and secondary oscillating valves in said secondary casings for controlling communication between said secondary ports and said secondary suction inlet means.

3. In a vacuum pump for creating relatively high and low vacuums simultane-

ously, a cylinder and a piston therein, a main valve and ports for placing the two ends of the cylinder in communication as the piston reaches the ends of its strokes, main valve-controlled suction inlet means for alternate communication with the two ends of the cylinder, a valve-controlled exhaust for similar communication with said cylinder ends, a secondary suction inlet, secondary valves separate from said main valve for controlling communication of said secondary suction inlet with the ends of the cylinder, and means for operating said main and secondary valves, including means for throwing said secondary valves automatically out of play when their respective vacuum has been raised to the required strength.

4. In a vacuum pump for creating relatively high and low vacuums simultaneously, a cylinder and a piston therein, a main valve and ports for placing the two ends of the cylinder in communication as the piston reaches the ends of its strokes, main valve-controlled suction inlet means for alternate communication with the two ends of the cylinder, a valve-controlled exhaust for similar communication with said cylinder ends, a secondary suction inlet, secondary valves separate from said main valve for controlling communication of said secondary suction inlet with the ends of the cylinder, means for operating said main valve at a uniform rate of speed, and means for opening said secondary valves slowly and closing them quickly.

5. In a vacuum pump for creating relatively high and low vacuums simultaneously, a cylinder and a piston therein, a main valve and ports for placing the two ends of the cylinder in communication as the piston reaches the ends of its strokes, main valve-controlled suction inlet means for alternate communication with the two ends of the cylinder, a valve-controlled exhaust for similar communication with said cylinder ends, a secondary suction inlet, secondary valves separate from said main valve for controlling communication of said secondary suction inlet with the ends of the cylinder, means for operating said main valve at a uniform rate of speed, means controlled by the movement of said main valve for opening said secondary valves and then releasing them, and means for normally closing said secondary valves when released.

6. A double acting vacuum pump for creating two independent vacuums simultaneously; comprising a cylinder having a chest provided with two independent suction inlets, an exhaust, and ports leading from the two ends of said cylinder to said inlets and said exhaust; a piston within said cylinder; a main valve disposed within said chest for opening the suction end of said cylinder on both strokes of said piston into communication with one of said inlets for opening the discharge end of the cylinder into communication with said exhaust and for placing the two cylinder ends in communication as the piston reaches the ends of its strokes; a pair of auxiliary valves disposed within said chest and operating one at a time, one at each stroke of said piston, to open the discharge end of said cylinder into communication with the other inlet while said main valve is opening the suction end of said cylinder into communication with the first named inlet, and means synchronizing the movement of said piston and said valves.

7. A double acting vacuum pump for creating two independent vacuums simultaneously; comprising a cylinder having a chest provided with two independent suction inlets, an exhaust, and ports leading from the two ends of said cylinder to said inlets and said exhaust; a piston within said cylinder; an oscillating main valve disposed within said chest for openng the suction end of said cylinder on both strokes of said piston into communication with one of said inlets, for opening the discharge end of the cylinder into communication with said exhaust and for placing the two cylinder ends in communication as the piston reaches the ends of its strokes; a pair of oscillating auxiliary valves separate from said main valve disposed within said chest and operating one at a time, one on each stroke of said piston, to open the discharge end of said cylinder into communication with the other inlet while said main valve is opening the suction end of the same into communication with the first mentioned inlet; means for reciprocating said piston, a wrist plate carried by said main valve and operatively connected with said piston reciprocating means to be oscillated by the same; means controlled by the movement of said wrist plate for opening said auxiliary valves slowly and releasing them after they have moved a predetermined amount and means connected to said auxiliary valves for closing them quickly when they are released by the last mentioned means.

8. A double acting vacuum pump for creating two independent vacuums simultaneously; comprising a cylinder having a chest provided with two independent suction inlets, an exhaust outlet, and ports leading from the two ends of said cylinder to said inlets and said outlet; a piston within said cylinder; a main valve disposed within said chest and having a passage therein to first establish communication between said ports which lead to the two ends of said cylinder, and then to open the suction end of the latter on both strokes of said piston into communication with one of said inlets, said main valve having other passages therein provided with outwardly opening valves to open the

discharge end of said cylinder on both strokes of said piston into communication with said exhaust outlet; a pair of auxiliary valves separate from said main valve disposed within said chest and operating one at a time, one at each stroke of said piston, to open the discharge end of said cylinder into communication with the other inlet while said main valve is opening the suction end of the same into communication with the first named inlet; and means synchronizing the movement of said piston and said valves.

9. A double acting vacuum pump for creating two independent vacuums simultaneously; comprising a cylinder having a chest provided with two independent suction inlets, an exhaust outlet, a pair of ports leading from the two ends of said cylinder to one of said inlets and said outlet, and passages leading from said ports to the other inlet; a reciprocating piston within said cylinder; an oscillating main valve disposed within said chest and having a passage therein to first open communication between said ports and then to open the suction end of said cylinder on both strokes of said piston into communication with the first named inlet, said main valve having a pair of other passages therein provided with outwardly opening valves to open the discharge end of said cylinder on both strokes of said piston into communication with said exhaust outlet; a pair of oscillating auxiliary valves separate from said main valve disposed within said chest and having passages therein, said auxiliary valves operating one at a time, one at each stroke of said piston, to open the discharge end of said cylinder into communication with the other inlet while said main valve is opening the suction end of the same into communication with the first mentioned inlet; and means synchronizing the movement of said piston and said valves.

10. In combination, a pair of receptacles under different vacuum pressures, a vacuum pump, conduits connecting said receptacles with said pump, the latter including a cylinder, a piston in said cylinder, a valve for establishing communication between the two ends of said cylinder, a pair of valves for establishing communication between the ends of said cylinder and one of said conduits, mechanism synchronizing the movement of said piston and said valves, and means controlled by the vacuum in the receptacle to which the last mentioned conduit is connected and operatively connected with said mechanism for throwing said auxiliary valves out of operation when said vacuum has reached a predetermined strength.

11. In combination, a pair of receptacles under different vacuum pressures, a vacuum pump, conduits connecting said receptacles with said pump, the latter including a cylinder, a piston in said cylinder, a valve for establishing communication between the two ends of said cylinder, a pair of valves for establishing communication between the ends of said cylinder and one of said conduits, means for driving said piston, means connected with said piston driving means for operating the first named valve, means connected with the latter for opening said pair of valves and then releasing them after they have been opened a predetermined amount, means for quickly closing said pair of valves when released by the last mentioned means, and means controlled by the vacuum in the receptacle to which the last named conduit is connected and operatively connected with the valve opening and releasing means to throw this means out of operation when said vacuum has reached a predetermined strength.

12. In combination, a pair of receptacles under different vacuum pressures, a vacuum pump, conduits connecting said receptacles with said pump, the latter including a cylinder, a piston in said cylinder, a valve for establishing communication between the two ends of said cylinder, a pair of valves for establishing communication between the ends of said cylinder and one of said conduits, means for driving said piston, means connected to said piston driving means for operating the first mentioned valve, means controlled by the movement of the latter for opening said pair of valves and releasing them after they have moved a predetermined amount, means for quickly closing said pair of valves when released by the last mentioned means, a cylinder having one end in communication with the receptacle to which the last mentioned conduit is connected and the other end open to the atmosphere, a piston within said cylinder, a spring acting upon said piston to hold the latter in the last mentioned end of said cylinder, and connections between said piston and said valve opening and releasing means for throwing the same out of operation when said vacuum has reached a predetermined strength.

13. In combination with a vacuum chamber and a pump for maintaining a vacuum therein, said pump including a valve for controlling its communication with said chamber, means for operating said valve, a cylinder in communication at one end with said chamber, a piston in said cylinder, means constraining said piston to resist movement by the vacuum until the latter has reached a predetermined strength, and connecting means between said piston and said valve operating means for then throwing the latter out of play.

14. In a vacuum pump, a cylinder, main suction inlet means placed alternately in communication with the opposite ends of

said cylinder, a piston in said cylinder, an exhaust, provision being made for placing the ends of the cylinder in communication with each other as the piston reaches the ends of its strokes, and for permitting escape of the exhaust air to said exhaust, secondary suction inlet means, and a pair of independently operable oscillating valves for controlling communication between the ends of said cylinder and said secondary suction inlet means.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES NEVILLE SOWDEN.

Witnesses:

ALBERT F. NUFER,

LEOPOLD ROMAGOSA.