W. R. BURROWS.

EXHAUSTING MACHINE.

APPLICATION FILED MAY 11, 1906.

973,625.

Patented Oct. 25, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

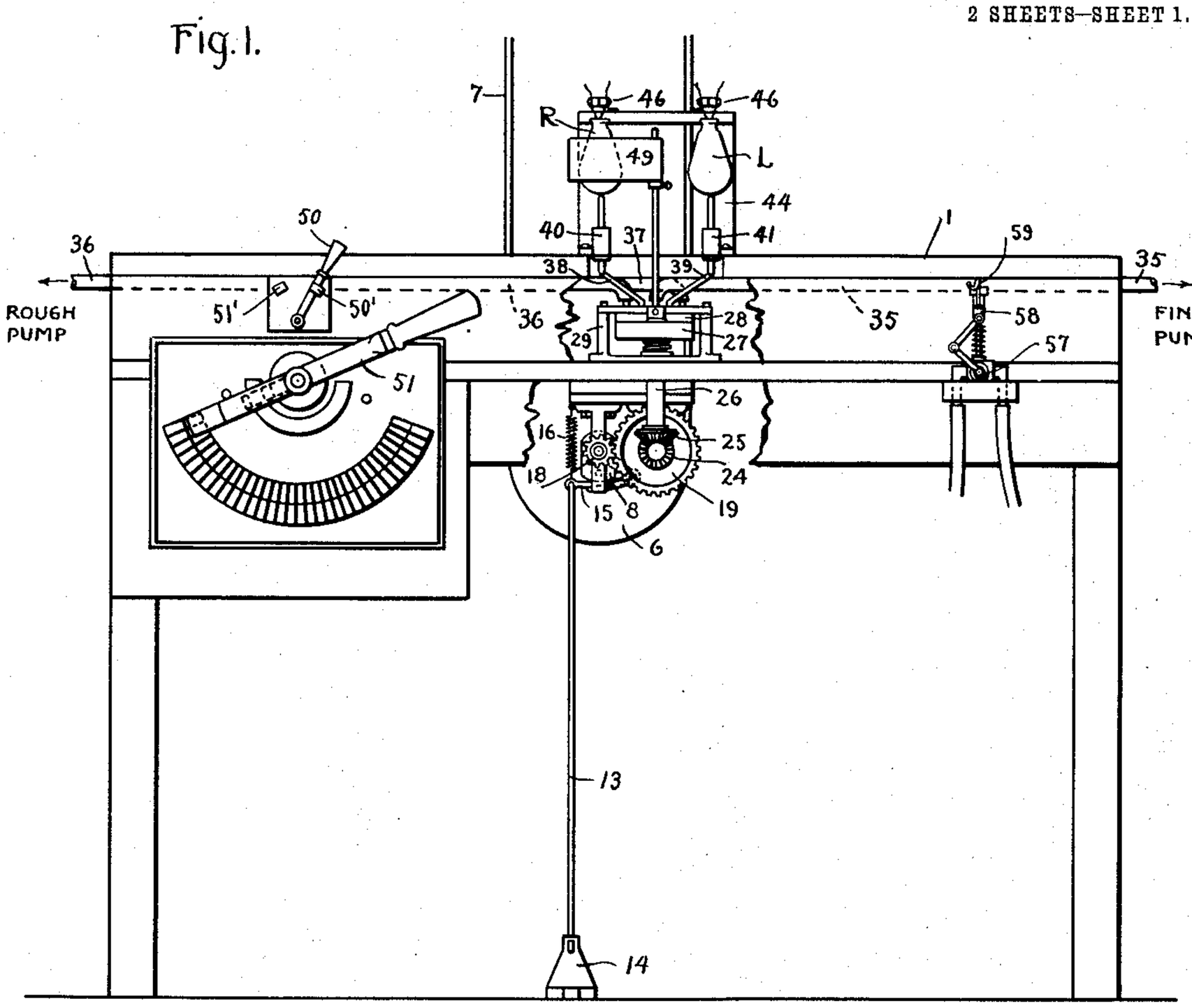


Fig. 2

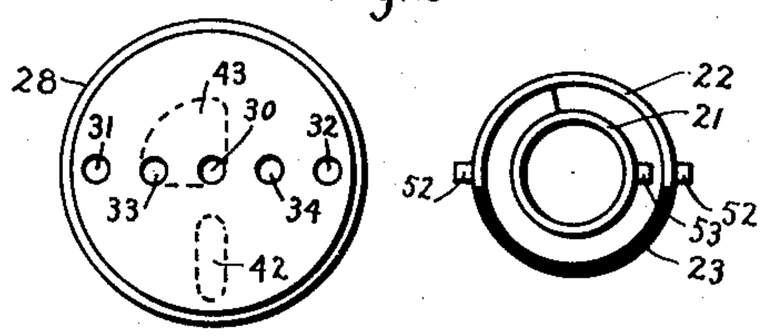


Fig. 3.

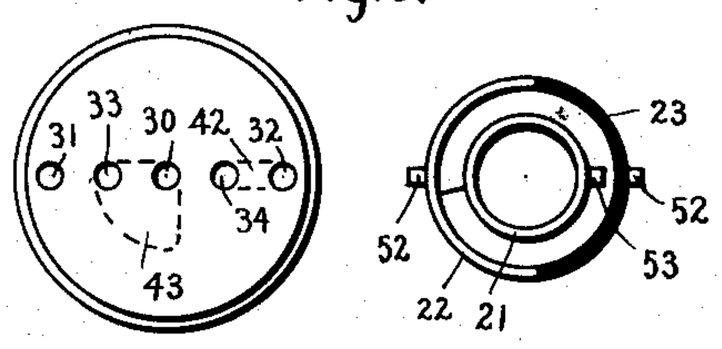


Fig. 4

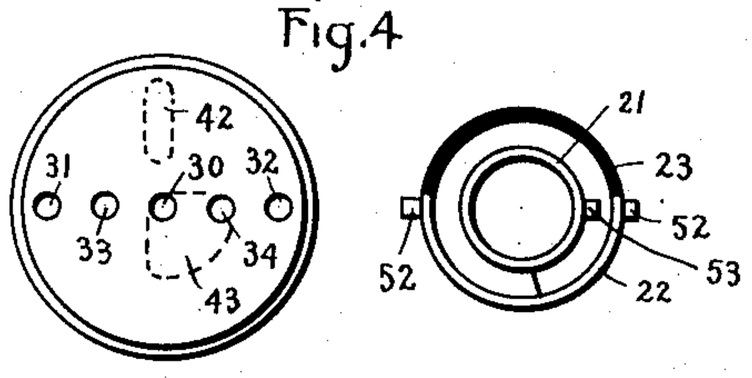
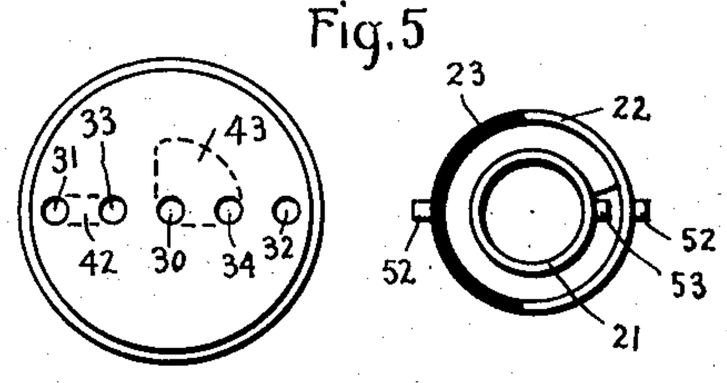


Fig. 5



Witnesses

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2 SHEETS—SHEET 2.

Fig. 8

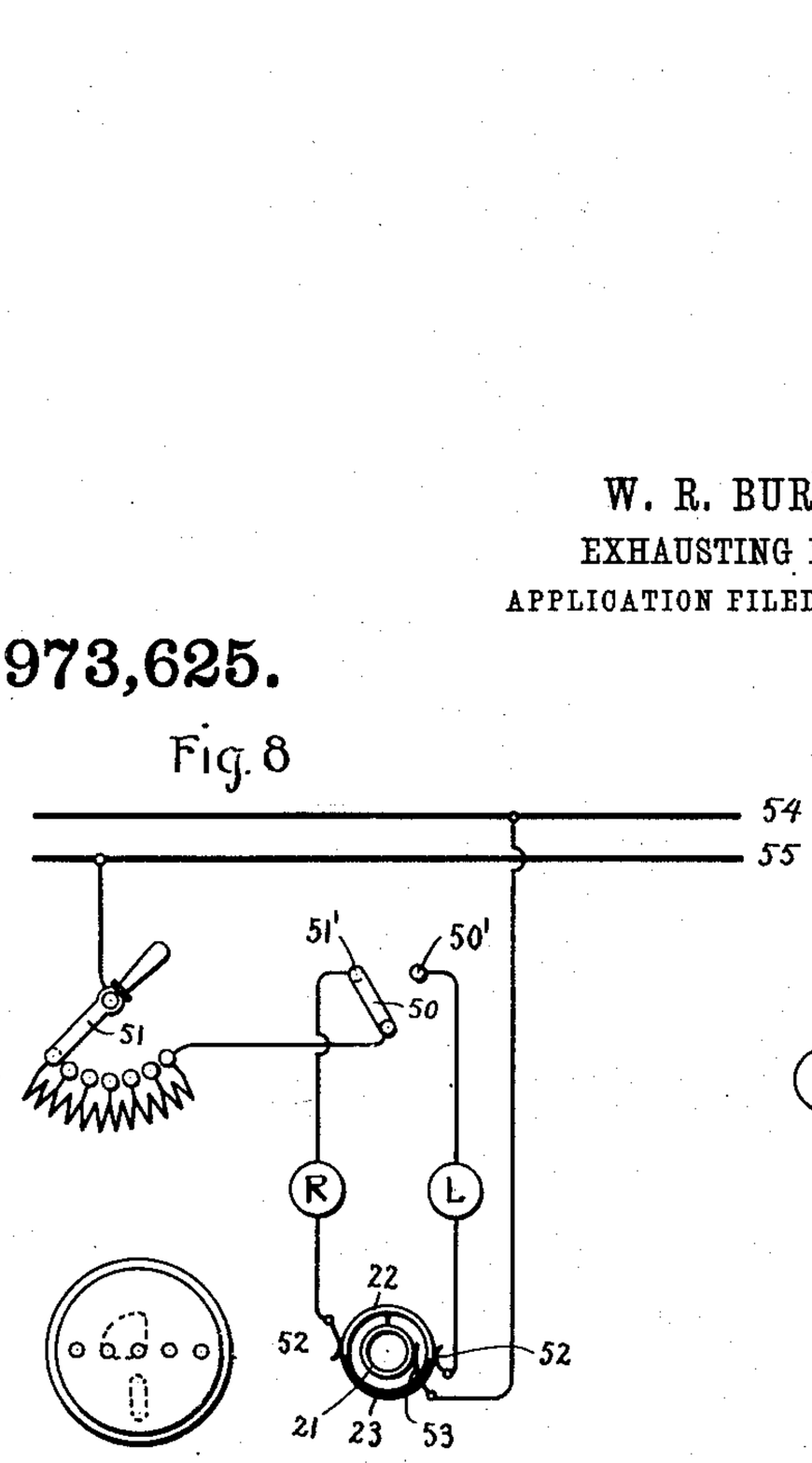


Fig. 6.

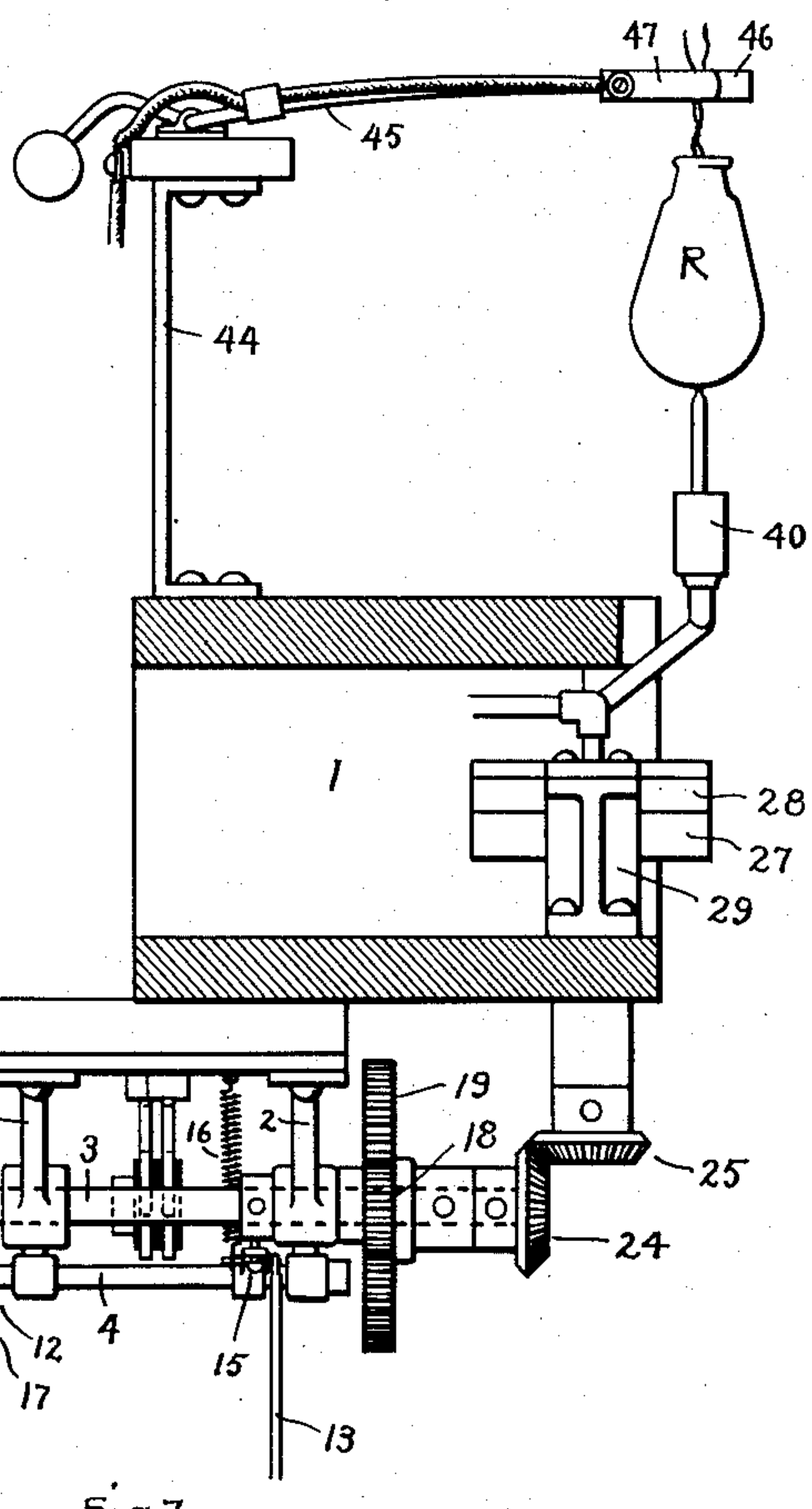


Fig. 9

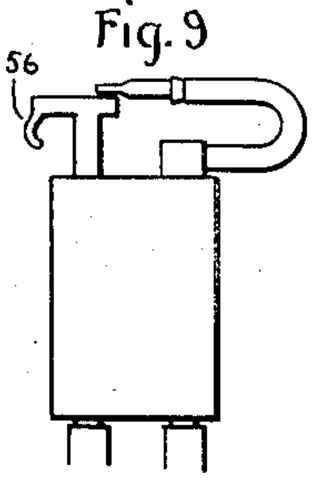


Fig. 10

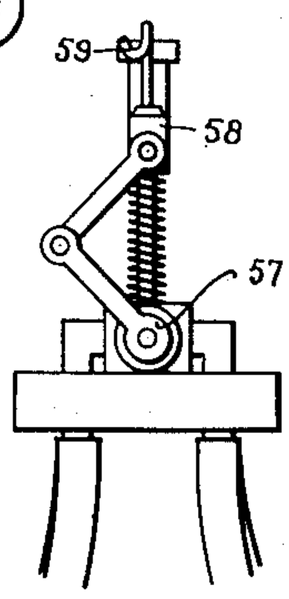


Fig. 11.

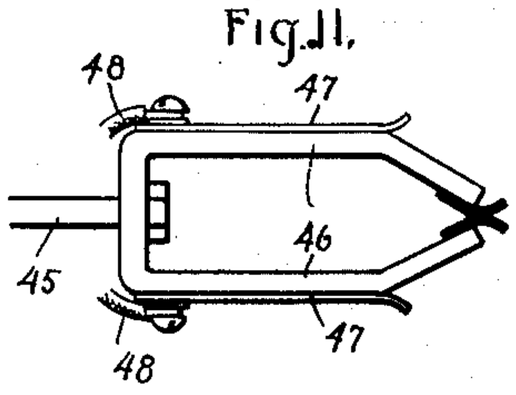
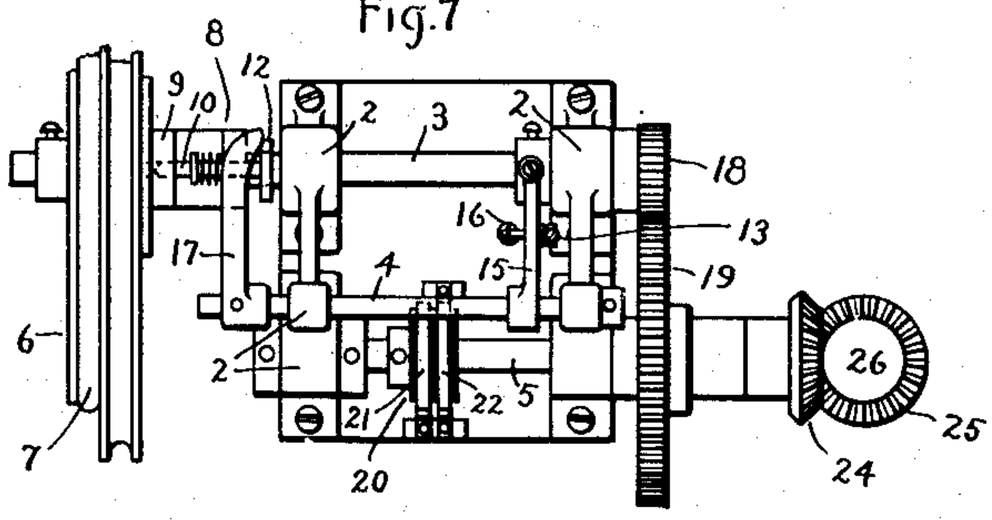


Fig. 7



Witnesses

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UNITED STATES PATENT OFFICE.

WILLIAM R. BURROWS, OF NEWARK, NEW JERSEY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

EXHAUSTING-MACHINE.

973,625. Specification of Letters Patent. Patented Oct. 25, 1910.

Application filed May 11, 1906. Serial No. 316,255.

To all whom it may concern:

Be it known that I, WILLIAM R. BURROWS, a citizen of the United States, residing at Newark, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Exhausting-Machines, of which the following is a specification.

This invention relates to machines for use in the manufacture of incandescent lamps, and more particularly to machines of the type known as "exhausting machines," with which the exhaustion of the lamp bulbs is effected by mechanical pumps and also by the chemical process and the connection to the bulb through which the air was exhausted is sealed.

The object of the invention is to provide a machine by which these operations can be performed more quickly than they have been heretofore so that the number of bulbs completed in a given time per operator is greatly increased and the cost of producing the lamps correspondingly reduced.

In machines of this type it has been common heretofore to use two pumps, one called the "rough" pump, for effecting a coarse preliminary exhaustion of the bulb, and another called the "final" pump, by which a more complete exhaustion is obtained. I prefer to employ two such pumps, and in combination therewith, I use a valve having a movable member which is actuated by suitable power-driven devices to make the proper connections between the pumps and bulbs. Preferably the movable member of the valve is rotatable and is turned intermittently, on the pressure of a button or treadle by the operator, to connect first the rough pump and then the final pump to each of a plurality of bulbs, and after the final pump has been disconnected from a bulb, the vacuum may be perfected by the chemical process, and the connection to the bulb sealed off. I also employ a circuit-controlling device the movable member of which is actuated when the movable valve-member is turned and which controls the circuit of the filament in each bulb which is being exhausted. This device is so arranged that it prevents closure of the circuit of a filament while the bulb inclosing that filament is connected to the rough pump, as the filament might be destroyed if it were brought up to incandescence before most of the oxygen was withdrawn from the bulb.

I have illustrated the preferred embodiment of my invention in the accompanying drawings, in which—

Figure 1 is a front view of the machine; Figs. 2, 3, 4 and 5 are views showing the successive positions of the movable valve-member and the circuit-controlling device; Fig. 6 is a sectional elevation of the machine; Fig. 7 is a bottom view of the operating mechanism; Fig. 8 is a diagram of the circuits; Figs. 9 and 10 are detail views of the torch and support; and Fig. 11 is a detail view of one of the clips for connecting the filament of a bulb in circuit.

Referring first to Figs. 1, 6 and 7, 1 indicates a bench to which the parts of the machine are secured, and depending from the under side thereof are bearings 2 for three shafts, 3, 4 and 5. Shaft 3 is the power-shaft and loose thereon is a pulley 6 driven by means of a belt 7 from any suitable source of power. Keyed on shaft 3 is a member 8 having openings in arms 9 thereof, in which a pin 10 is movable parallel to shaft 3. In the side of the pulley 6 are a plurality of openings, into one of which the end of pin 10 is adapted to extend to lock pulley 6 and member 8 together and thereby cause shaft 3 to rotate with pulley 6. Pin 10 is pressed by a spring 11 into this locking position, but secured to the end thereof is an arm 12 by which the pin is withdrawn from and held out of engagement with pulley 6. Shaft 4 is arranged to control the movement of pin 10, and for that purpose has a rocking movement in its bearings, this movement being effected by a rod 13 connected at its lower end to a treadle 14 and at its upper end to an arm 15 which is secured on shaft 4 and which is normally held in the raised position by a spring 16 connecting its free end to the framework. This upward movement, however, is limited by the engagement of a set-screw in the end of arm 15 with some stationary part, as, for instance, one of the bearings for shaft 3.

Secured on shaft 4 is an arm 17, which at its end is bent so as to provide an inclined side adapted to coöperate with the arm 12. By means of this mechanism, when treadle 14 is depressed shaft 4 is rocked in its bearings and the free end of arm 17 depressed until it releases arm 12, and pin 10, being free then, is pressed by its spring to lock pulley 6 in driving relation to shaft 3.

Treadle 14 being immediately released, the free end of arm 17 is raised by spring 16, and as shaft 3 is nearing the completion of one revolution the end of arm 12 engages the inclined side of the free end of arm 17 and rides up the incline, thus withdrawing pin 10 from the opening in pulley 6 and bringing shaft 3 to rest after it has made one complete revolution.

Keyed on the end of shaft 3 is a pinion 18, which meshes with a gear 19 on shaft 5, gear 19 having four times as many teeth as pinion 18, so that each time treadle 14 is depressed shaft 5 makes one-quarter of a revolution. Secured on shaft 5 is a circuit-controlling device, consisting of a collar 20 of insulating material, on which is a ring 21 of conducting material and a ring consisting of a segment 22 of conducting material and a segment 23 of insulating material, the latter segment being slightly shorter than the former, as shown in Fig. 2. Stationary brushes are mounted in position to bear on these rings, as will be more fully explained hereinafter. On the end of shaft 5 is a bevel-gear 24 meshing with a similar gear 25 on a vertical shaft 26 carried by suitable bearings secured on the bench 1. The number of teeth on the gears 24 and 25 is the same, so that these two shafts turn in unison. Shaft 26 carries the movable member 27 of a valve, the stationary member 28 of which is carried by a suitable frame 29 secured on bench 1. The stationary member 28 of the valve has five ports therein, arranged in line with each other across a diameter of the member, as shown in Fig. 2. The middle port 30 is connected by a pipe 35 to the final pump, not shown in the drawings. The two outer ports, 31 and 32, are similarly connected by pipes 36 and 37 to the rough pump, not shown in the drawings. From the other ports, 33 and 34, pipes 38 and 39 extend upward to supports 40 and 41 secured on the top of bench 1 and having gaskets of rubber or other suitable material therein adapted to receive the tubulature of a lamp-bulb.

The movable member 27 of the valve has two passageways formed therein arranged to make the necessary connections between the ports of valve-member 28. The passageway 42 is adapted to connect ports 31 and 32, leading to the rough pump, with ports 33 and 34 connected to the pipes leading to the supports 40 and 41 respectively. The passageway 43 is sector-shaped and is adapted to connect the central port 30 with one or the other of the ports 33 and 34, and the shape of this passageway is such that the connection is maintained while the valve is moved through a quarter of a revolution from one position to the next position.

Secured on the bench is a standard 44 (Fig. 6) on the top of which are pivoted two balanced arms 45, each carrying at its end a clip 46 (Fig. 11) having spring contact-plates 47 at its sides, to which are electrically connected wires 48. A lamp may be connected in circuit with the wires 48 by drawing the leading-in wires underneath the contact blades 47 as shown in Figs. 1 and 6 and thereby current may be passed through the lamp while it is being exhausted. A shield 49 may be pivoted in a convenient position, so that it may be swung around to cover one or the other of the bulbs held in the supports 40, 41. Secured on the front of the bench 1 are a double-throw switch 50 and an adjustable rheostat 51.

As shown in Fig. 8, each lamp is connected between one of the terminals of the double throw switch 50 and a brush 52 bearing on that ring of the circuit controlling device which has the insulating segment 23 therein, the points of contact of the brushes with the ring being diametrically opposite. The conducting segment 22 of this ring is connected to the conducting ring 21 on which bears the brush 53 connected to the main 54 of a circuit indicated by the positive and negative mains 54—55. The switch arm of the double throw switch 50 is connected to one terminal of a rheostat 51, the other side of which is connected to the main 55, and with the parts arranged as shown in Fig. 8, the current flows from the main 55 through the rheostat 51, the switch blade 50, the lamp R, the brush 52 and conducting rings 22 and 21 and thence through the brush 53 to the other main 54. By throwing the switch blade 50 into engagement with the contact 50′, the current can be passed through the lamp L.

Fig. 9 illustrates the torch, which may be used for volatilizing the chemical in the tubulature of the lamp and for effecting the seal. This is an ordinary Bunsen burner connected by flexible tubes to air and gas supply reservoirs and having a portion which may be grasped by the operator. The torch is provided with a hook 56 by which it may be supported when not in use. Fig. 10 shows a convenient support, which is arranged so that the act of placing the torch thereon operates a valve to reduce the supply of air and gas to the burner. In the connections feeding the burner, is a valve 57 operated by links connected to a spring-positioned sliding block 58 carrying a hook 59 which receives the hook 56 on the torch.

The bulbs to be exhausted have the filament mounted therein and the end to which the stem carrying the filament is joined is sealed, the leading-in wires extending through the stem to the exterior of the bulb. The tubulature, consisting of a short glass tube through which the air is exhausted, is connected to the opposite end of the bulb,

and on the inner walls of this tubulature is the chemical which is used to perfect the exhaustion. Before exhausting, it is common to put the bulbs for a few minutes in a suitable heater, so as to warm the glass somewhat.

In the operation of the machine, a bulb is taken from the heater and the end of its tubulature inserted in the gasket in one of the supports. This holds the bulb in place and the arm 45 is turned on its pivot and the leading-in wires of the bulb inserted under the contacts 47 of the clip carried by the arm. Each time treadle 14 is pressed, the movable members of the valve and circuit-controlling device make one-quarter of a revolution as above described to make the proper connections to the bulb. The cycle of operations will be best understood by reference to Figs. 2 to 5. With the valve and circuit-controller and the operating arms of switch 50 and rheostat 51 in the positions shown in Figs. 2 and 8, a bulb L is inserted in the support 41, the connection to which is, in this position, closed at the port 34. The operator then presses the treadle 14 and the valve and circuit-controller move to the positions shown in Fig. 3. In this position, port 34 is connected to port 32 by passageway 42, so that the bulb is connected to the rough pump. While in this position, the operator moves the end of arm 45 down and inserts the leading-in wires of bulb L under the clips 47 and throws the arm of switch 50 on to the stud 50′, but the circuit through the filament of the bulb is not completed, as the brush 52 to which the filament is connected is bearing upon the insulating segment 23 of the circuit-controller. The operator then presses the treadle again and the parts move to the positions indicated in Fig. 4. In doing so, the passageway 42 is moved away from port 34, and the passageway 43 is moved to the position to connect port 34 with port 30, thus connecting the bulb L to the final pump, and the conducting segment 22 of the circuit-controller is moved under the brush 52, so that the filament of the bulb in support 41 is connected in circuit from line 54 to brush 53, ring 21, segment 22, brush 52, through the filament to switch 50 and through the rheostat 51 to line 55. While in this position, the operator takes another bulb R from the heater and places it in the support 40, the connection to which is closed at post 33, and on again pressing the treadle the parts move to the positions shown in Fig. 5. In this position, the bulb R is connected to the rough pump by passageway 42 connecting ports 31 and 33 and the operator connects the leading-in wires of the bulb to the contacts of its clip 46. In moving to this position, the connection of the bulb L in support 41 to the final pump is not broken, on account of the shape of the passageway 43, and the action of the pump during this time has drawn most of the air from the bulb. The operator then turns the arm of the rheostat 51 to increase the current flowing through the filament in the bulb and cause the filament to glow above normal incandescence, and at the same time the pedal is again pressed, causing the valve to move a quarter turn, disconnecting the bulb L from the final pump, as shown in Fig. 2, and putting the bulb R on the final pump. While the bulb L is disconnected from the pump, the flame of the torch is first applied to the tubulature to volatilize the chemical therein and perfect the exhaustion of the bulb, and is then raised to the point of connection of the tubulature and the bulb, softening the glass, closing the opening in the bulb and cutting off the tubulature. The operator then cuts the coils of the rheostat into circuit again and throws the arm of the double-throw switch on the stud 51′ so that it will connect the filament in the bulb R in support 40 in circuit when the conducting segment 22 comes under the brush 52 which is connected to the filament. The finished bulb and the tubulature which was used therewith are then removed from the support and a new one put in its place. The operation proceeds in this manner continuously. With each movement of the valve, the condition of the bulbs in the two supports advances one step and, as the duties of the operator require no more time than is required by the pumps, the bulbs are completed very rapidly.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. An exhausting machine comprising a valve, means for supporting a bulb in communication with said valve, two pumps connected to said valve, driving means for actuating said valve to connect said bulb to said pumps in succession, and means controlled by said driving means for closing an electric circuit through the filament of the bulb while the bulb is connected to one of said pumps.

2. An exhausting machine comprising a valve having a movable member, a plurality of connections to said valve, means for supporting a plurality of bulbs each in communication with one of said connections, means for making electrical connection to the filaments in the bulbs in said supports, a plurality of pumps connected to said valve, mechanism for actuating said movable valve-member to connect said pumps successively to the bulbs in said supports, and means for closing the circuit of a filament while its bulb is connected to one of said pumps.

3. An exhausting machine comprising a seat with a plurality of ports, means for

connecting a bulb to one of said ports, two pumps connected to other ports in said valve seat, a valve mounted for step by step rotation on said valve seat, and coöperating with said ports to connect said bulb with one pump when in one position, and with the other pump when in the second position, and means actuated in definite relation to said valve to close a circuit through the filament of the bulb as said valve reaches the second position.

4. An exhausting machine comprising a valve, a bulb support arranged to maintain a bulb in communication with said valve, means for making electrical connection to the filament of a bulb in said bulb support, two pumps connected to said valve, means for actuating said valve to connect the bulb to said pumps in succession and a contact device controlled by said valve to close a circuit through the filament of the bulb while the bulb is connected to one of said pumps.

5. An exhausting machine comprising a valve, means for supporting a bulb in communication with said valve, two pumps connected to said valve, driving means for actuating said valve to alternately connect a bulb to said pumps in succession, and means controlled by said driving means for closing an electric circuit through the filament of each bulb while the bulb is connected to one of said pumps.

6. An exhausting machine comprising a valve seat having a plurality of ports, means for connecting a bulb to one of said ports, two pumps connected to other ports in said valve seat, a valve movable on said valve seat to connect said bulb to said pumps in succession, driving means for moving said valve, a stopping device controlled by said driving means to automatically stop said valve in a position to connect said bulb to one pump and means whereby said stopping device is manually controlled to cause said driving means to move the valve to connect the bulb to the other pump.

In witness whereof I have hereunto set my hand this ninth day of May, 1906.

WILLIAM R. BURROWS.

Witnesses:
GEO. V. DELANEY,
S. N. WHITEHEAD