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AUTOMATIC OIL BURNER.

APPLICATION FILED FEB. 19, 1909.

940,539.

Patented Nov. 16, 1909.

4 SHEETS—SHEET 1.

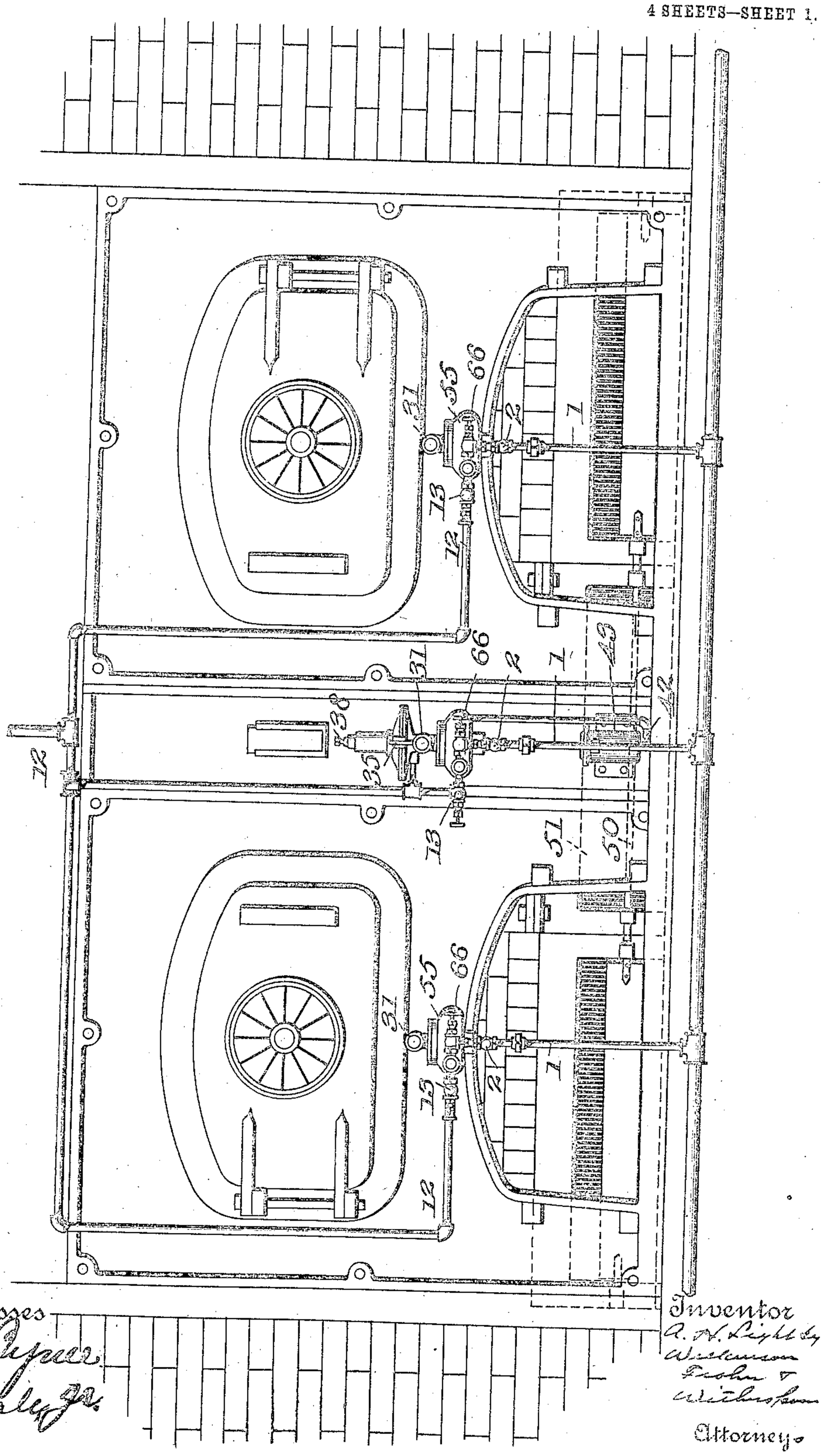

Fig. 1.

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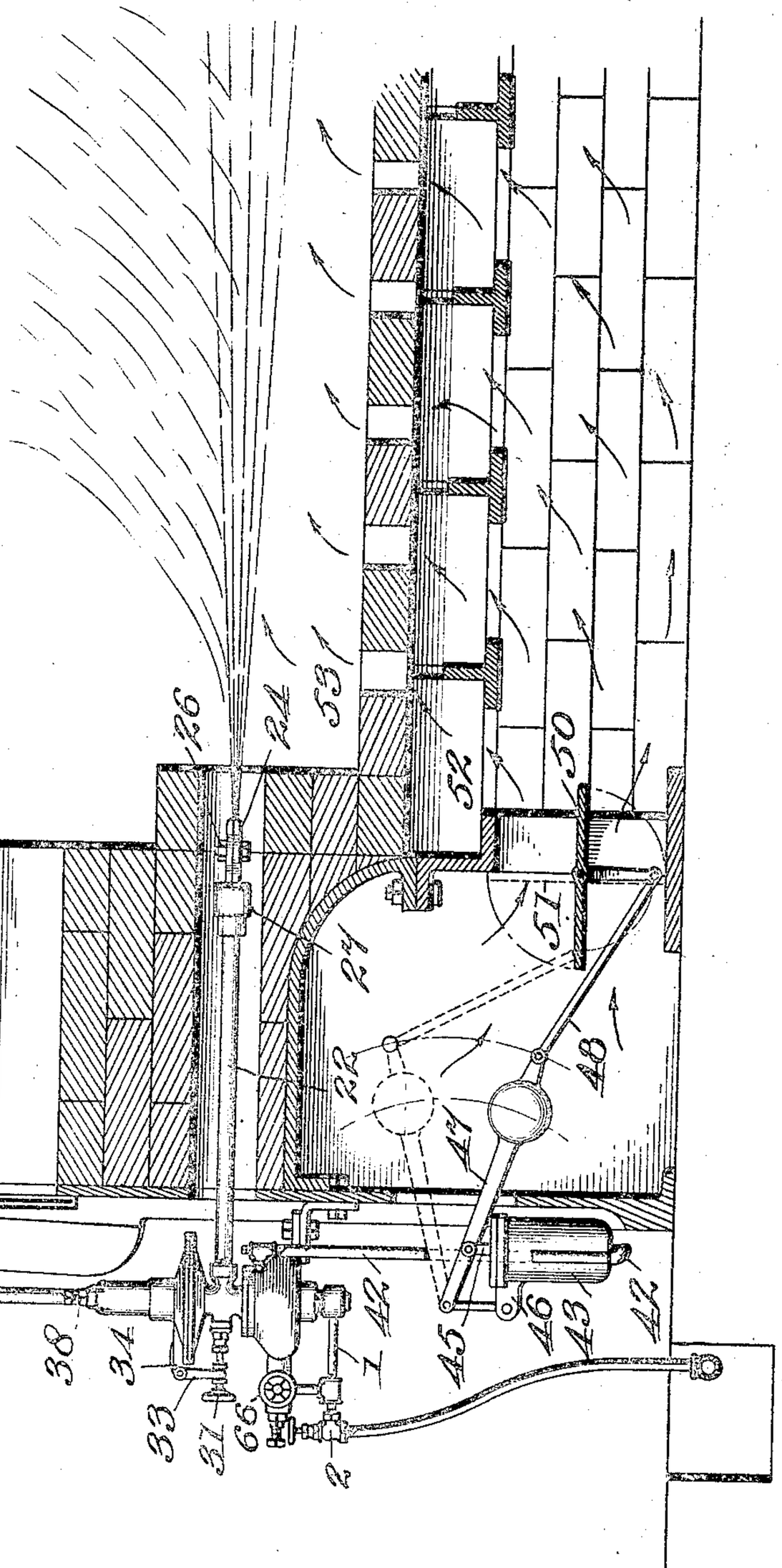
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

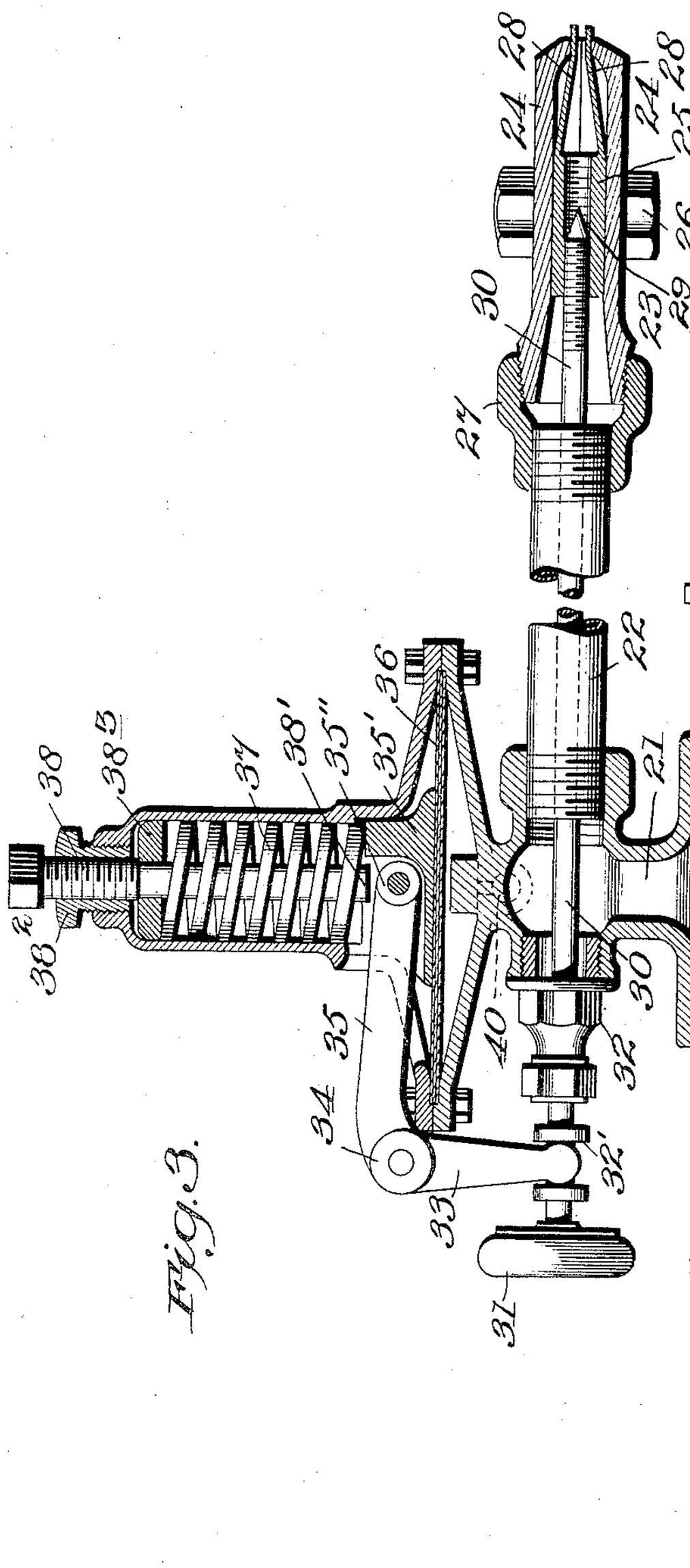

Fig. 3.

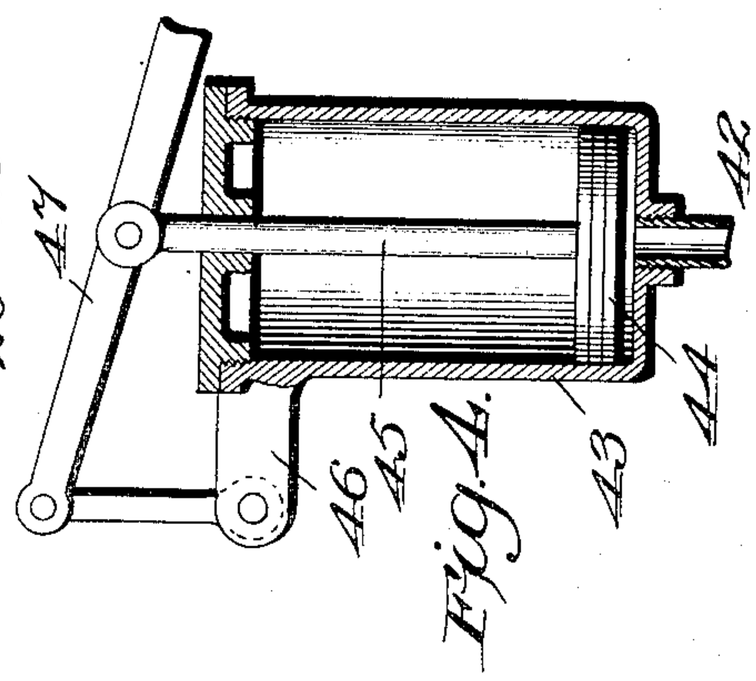

Fig. 4.

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4 SHEETS—SHEET 4.

Fig. 5.

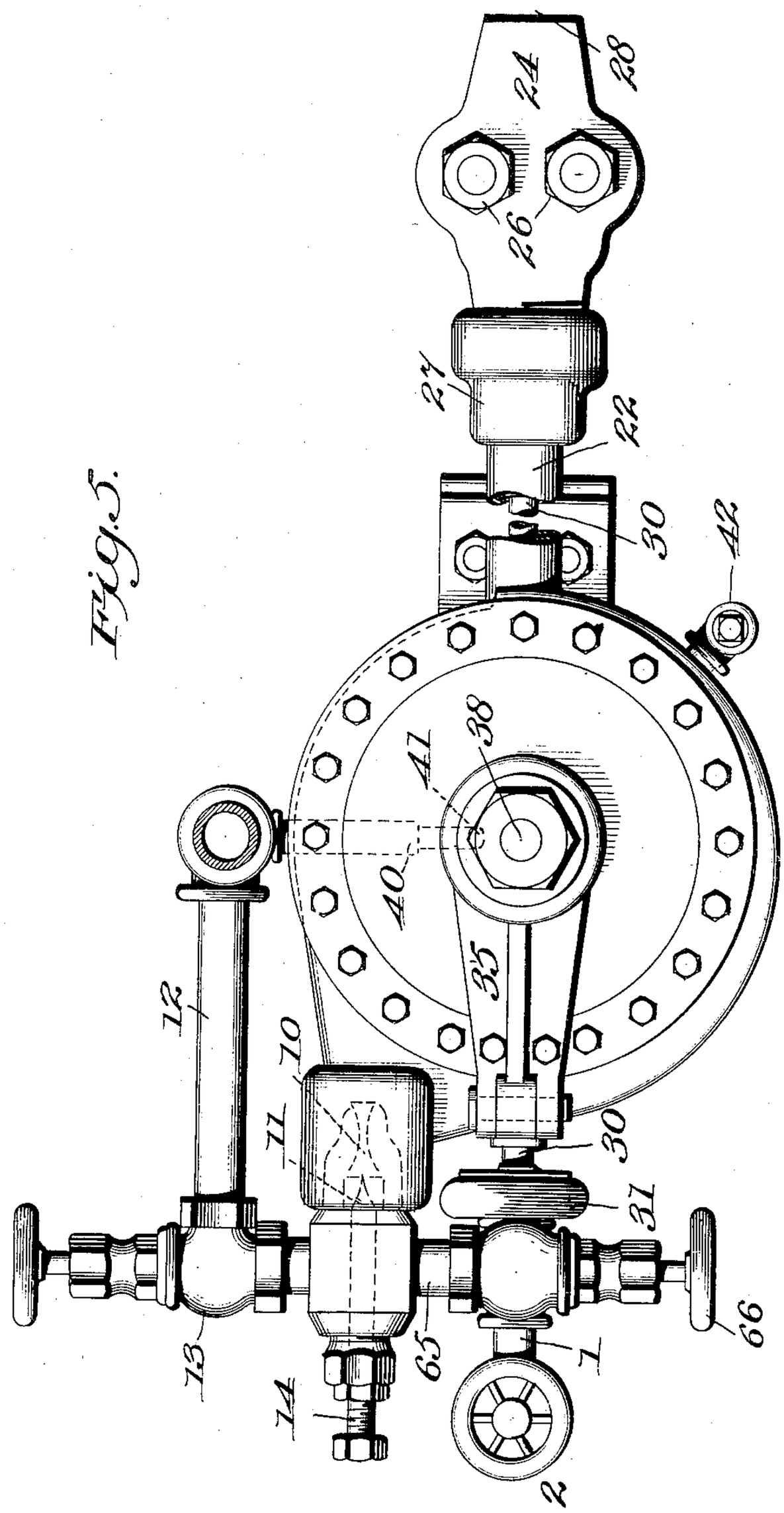
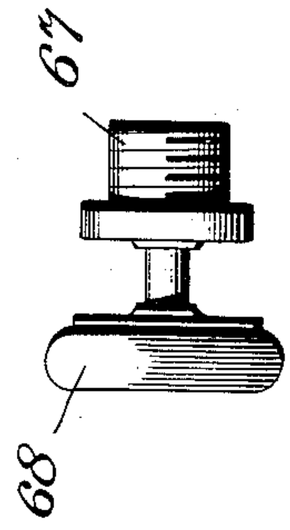


Fig. 6.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC OIL-BURNER.

940,539. Specification of Letters Patent. Patented Nov. 16, 1909.

Application filed February 19, 1909. Serial No. 478,844.

To all whom it may concern:

Be it known that I, ARTHUR H. LIGHT, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Automatic Oil-Burners; and I do hereby 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.

My invention relates to automatic oil burners, and has for its object the production of an efficient and inexpensive burner, which will automatically control the intensity of the fire, and therefore will regulate the pressure of the steam in the boiler; will automatically control the air supply to the furnace; will utilize a maximum amount of the energy in the steam in atomizing the oil; and one that will atomize the oil to a greater degree than any heretofore proposed.

With these and other objects in view my invention consists in the novel combination of parts and in the details of construction more fully hereinafter disclosed and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification in which like numerals refer to like parts in all the views:—Figure 1 is an elevational view showing my invention applied to a furnace along with another form of burner; Fig. 2 is a partly sectional view showing a damper regulating attachment; Fig. 3 is a sectional view of my automatic burner detached; Fig. 4 is a sectional detail of the damper operating cylinder; Fig. 5 is a plan view of the burner shown in Fig. 3, and Fig. 6 is a view of a plug used when cleaning the parts.

1 indicates an oil supply controlled by the valve 2, and leading to the space 3, connected with the ports 4 of the check valve 5, having a rim 6 and a seat 7. The space 8 between the said rim and seat leads into the mixing chamber 9, which I term a cyclone mixing chamber, owing to the cyclonic action that takes place in the same, as will appear below.

Owing to the pressure that exists in the chamber 9, when the burner is in action, as will be more fully explained below, the valve 5 is pressed downwardly toward its seat 7, and the oil under pressure in pipe 1, escapes upwardly through the space 8 in a thin film; and should the space 8 become choked, the pressure of said oil will accumulate and raise the valve 5 higher, so as to cause said space to be cleared. If, however, for any reason the valve should not thus automatically clear itself, steam may be admitted through pipe 1, and clear the valve, as will appear more fully hereinafter.

Steam flows through the pipe 12, Fig. 5, controlled by the valve 13, through the passage 10, controlled by the needle valve 11, and into the mixing chamber 9. The needle valve is adjusted by its screw threaded stem 14, and the tips 15 containing the passage 10 are readily renewable.

After entering the mixing chamber 9, the steam which before entering is preferably kept at full boiler pressure, circulates around said chamber, and expands therein as fully illustrated and described in my copending case Serial No. 477200 filed Feby. 10, 1909, for oil burners, and subdivides the oil to an extent not heretofore possible; and this for the reason that the exit end 16 of the tip 15 is so designed as to permit the steam or other fluid to attain its highest velocity in the mixing chamber, in order that the mixture of oil and steam may have imparted to it a very high rotation in said chamber. And for the further reason that the mixing chamber 9 is provided with an additional outer chamber or annular passage 18, connected to said mixing chamber by the restricted passage 19. The structure is such as fully disclosed in my co-pending application above that as the mixture of oil and steam circulates around the cyclone mixing chamber 9, any unatomized particles, which of course are heavier than the others, will be thrown out to the rim of said chamber by centrifugal action. They will be likewise forced through the passage 19 into the chamber 18, where they will be caught and carried back to the tip 15 and there again subjected to the rotary cyclonic action of the jet issuing from said tip 15. It is evident that these unatomized particles will be thus resubjected to the subdividing effect

of the steam jet so long as they exist as such; and since the only escape from chamber 9 is upwardly through the restricted centrally located passage 21, which said unatomized particles cannot reach owing to the centrifugal force which keeps them near the outer rim of the chamber 9, it is evident that said unatomized particles will in time all be automatically subdivided before they leave the mixing chamber. It is also obvious that by simply increasing the pressure of the steam, and decreasing the thickness of the film of oil delivered through the space 8, that any degree of subdivision desired can be attained, even up to reaching a point where the oil is practically all in a state of vapor.

The steam and atomized oil in an extremely finely divided state passes up through the passage 21, along the pipe 22 to the nozzle 23, and of course the mixture exerts pressure to seat the valve 5, and to thereby keep the oil entering the chamber under pressure in a very thin film.

The nozzle or tip 23 is preferably located just inside the front wall of the furnace, and consists of the two halves 24, and the block 25. The halves 24 are secured together steam tight by suitable fastenings 26, and are suitably joined to the pipe 22, as by the coupling 27.

The block or plug 25, is provided with the resilient tongues or lips 28, and is screw threaded at 29. The screw threaded rod 30 fits the screw threads 29, is provided with the hand wheel 31, and passes through the stuffing box 32. It is evident that any movement of the hand wheel 31 will cause the inclined resilient tongues 28 to be adjusted toward or from each other, and therefore will close or open the orifice through which the atomized oil and steam escapes from the nozzle 23. These tongues are made to fit the inner surfaces of the halves 24, as shown, and their own resiliency at all times insures a tight joint with said surfaces. The longitudinally sliding rod 30 is also provided with a pair of collars 32′, between which fits one end 33 of a bell crank lever 34, the other end 35 of which is secured to a block 35′ resting on a diaphragm 36, controlled by a spring 37, the tension of which is capable of adjustment through the screw threaded nut 38^2, and disk 38^3. Passing through the said nut 38^2 is a bolt 38, the end 38′ of which extends down to a point slightly above the extreme end 35″ of the lever 34, and therefore may limit the upward movement of the latter; and the adjustment of the disk 38^3 by the nut 38^2 readily controls the tension of the spring 37 on the diaphragm 36.

Leading from the steam pipe 12 is a pipe 40 which delivers steam from the boiler through a port 41 beneath the diaphragm 36; and leading from the chamber 9 is a pipe 42 which enters a cylinder 43 provided with a piston 44, a piston rod 45, a bracket 46, and a weighted lever 47 pivoted to said bracket and piston rod as shown. The lever 47 is connected by a link 48 to the damper 50, controlling the air passage 51 to the space 52 under the combustion chamber 53.

The operation of my burner is as follows:—Suppose the boiler pressure is 140 pounds and the safety valves are so set that they will open at 145 pounds; the tension on the spring 37 will be so adjusted that the diaphragm 36 will rise when, say 142 pounds is reached. And suppose that the discharge opening between the lips 28 of the nozzle or tip 23 has been so adjusted by the rod 30, that 55 pounds is maintained in the cyclone mixing chamber 9. If the valve 13 be left open and the passage 10 be controlled by the needle valve, steam will expand in said chamber 9 from 140 pounds, its boiler pressure to 55 pounds, the mixing chamber pressure; and this will cause a rotation of the mixture in said chamber of several hundred revolutions per second. Now suppose the pressure maintained on the oil supply is 65 pounds, upon opening the cock 2 slightly the oil will lift the valve 5, and flow into the chamber, owing to its excess of pressure over that in said chamber. The entering oil in a very thin film is caught by the rapidly rotating steam entering the chamber in a tangential direction, and it is thoroughly atomized. The heavier particles by centrifugal action are forced out through the restricted passage 19 into the passage or chamber 18 and immediately returned to the steam jet for a complete atomization. The more finely divided particles, having less weight, will have a tendency to rise, and when their subdivision is sufficient to so lessen their weights as to permit their rising, they will pass upward out of the chamber 9 through the passage 21 and pipe 22 to the tip 23 and into the furnace.

It is evident that any initial diminution of the area of the discharge opening of the tip 23, will bring about an increase of pressure in the chamber 9, and therefore a thinner oil film and a more finely divided state of the oil; and if said diminution is continued the said pressure in the chamber 9 may equal that on the oil supply, when the oil film will be stopped altogether. This, however, would cause the steam pressure to fall, the spring 37 to force the diaphragm down, and the bell crank 34 to move the rod 30 to open the discharge orifice of the tip 23; thereby lowering the pressure in chamber 9 and restoring the oil supply. Likewise any initial increase in the area of the discharge opening in the tip 23 will decrease the pres-

sure in the chamber 9, and will cause the oil film to become thicker, thereby causing more unatomized particles to be thrown into the chamber 18 and resubjected to the atomizing action. An increased area will also cause the fire to receive more fuel, the steam pressure to rise and the diaphragm 36 to so actuate the rod 30, as to close the discharge orifice in the tip, and therefore the oil supply to be again diminished through the increased pressure in the chamber 9 as above stated.

The initial changes in the opening of the tip 23, above described, could be made by moving the hand wheel 31, as well as by the automatic action of the diaphragm 36; and it is therefore evident that this automatic form of my burner can be used as well wherever hand operated burners are used; and in Fig. 1, I have shown hand operated burners 55 which are adapted to be used on furnaces in connection with my automatic burner and which are more fully disclosed in my pending application above.

It is sometimes desirable to limit the range of travel of the rod 30 in order to control the maximum and minimum intensity of fire. This is easily accomplished by adjusting the screw bolt 38 which passes through the tension nut 38^2, for by this means the diaphragm 36 is limited in its upward movement and rod 30 in its horizontal movement; consequently the increase or decrease of the discharge opening of the tip 23 is accurately governed, and by this regulation of said parts the fire may be entirely extinguished or not at the will of the attendant.

When both forms are used together, as illustrated in Fig. 1, which shows one automatic burner, with a hand operated burner 55 on each side of the same, it is best to have the automatic burner so adjusted as to enable it to extinguish the fire entirely, while the hand operated burners are so adjusted as not to permit the fire to be extinguished unless the attendant desires it.

If two non-automatic burners are used with an automatic burner in between, actual tests have shown that the automatic burner may by the means above described be regulated to carry 40 per cent. of the total load and thereby allow of a wide range of control of the steam pressure.

When upon an upward movement of the diaphragm 36 the pressure in chamber 9 is increased coincident with a decrease of the discharge opening of the tip, the piston 45 in the cylinder 43 will rise, thereupon lifting the weighted lever 47 and turning the damper 50 to a closed position which in turn will cut off the air supply. And when owing to a downward movement of said diaphragm 36 (caused by a decreased boiler pressure) said tip opening will be increased, and at the same time the pressure in chamber 9 will be lowered sufficiently to allow the piston 45 to descend and open the damper 50 thus restoring the air supply to that portion of the furnace controlled by said burner, and also restoring the intensity of the fire. When, however, two automatic burners are used it is preferred to so adjust the tensions of their springs 37 as will cause first the one and then the other to extinguish the fire, upon an increase of pressure, leaving the non-automatic burner alone to maintain the steam in the boiler. In such case, on a decrease in steam pressure, one automatic burner would come into action to cause said pressure to rise, and if it continued to decrease then the other would come in; this arrangement would be conducive to a high efficiency in those steam plants in which the pressure varied considerably.

It will be observed that in all cases, by simply raising or lowering the end 38′ of the screw 38, the rise and fall of the end 35″ of the lever 34, and therefore the play of the diaphragm 36, may be varied within wide limits. This means of controlling the movement of said diaphragm together with the independent adjustments of the tongues 28 through the hand wheel 31, allows of any maximum or minimum intensity of fire being maintained within very wide limits. It will, also, be observed that since the supply of carbon is cut off at the same time the air supply is cut off, when a fixed percentage of carbon dioxid in the products of combustion is once had, such percentage may be maintained notwithstanding the heat units delivered to the boiler may vary. In other words, if perfect combustion is once established I do not have to depart therefrom when increasing or diminishing my steam output. This is an important consideration in dealing with large plants.

It is often convenient to blow steam into the mixing chamber and out the nozzle 23 through the oil passages and valves, for the purpose of cleaning the parts; and to this end I have provided the connection 65 between the steam and oil supplies, and control the same by the valve 66. When blowing steam for cleaning purposes, it is often desirable to remove the rod 30 and its connections, and when this is done the plug 67 having the hand wheel 68 is screwed into the opening normally occupied by the stuffing box 32, in order to close the parts steam tight.

It will be observed that owing to the oil being subdivided to a state closely approaching that of vaporization, which is rendered possible by the peculiar action of my cyclone mxing chamber, I am enabled to con-

trol to a nicety the amount of heat entering the furnace, and therefore the pressure of the steam, which would not be the case were the oil not so finely divided.

It is evident that details in the arrangement and in the construction of parts may be varied by those skilled in the art without departing from the spirit of my invention, and therefore I do not wish to be limited to such details except as may be required by the claims.

What I claim is:—

1. In an automatic burner, the combination of a mixing chamber for hydrocarbon fuel; a cylinder; a damper; connections between said cylinder and said chamber; connections between said damper and said cylinder; a burner nozzle connected to said chamber; and means to control the outlet of said nozzle and thereby vary the pressure in said chamber and cylinder, substantially as described.

2. In an automatic burner, the combination of a chamber for mixed oil and steam; a cylinder; connections between the same and said chamber; a damper; connections between the same and said cylinder; and automatic means comprising a burner nozzle for controlling the pressure in said chamber and thereby automatically controlling said damper, substantially as described.

3. In an automatic burner, the combination of a chamber for mixed oil and steam; a nozzle; connections between said nozzle and chamber; a cylinder; connections between the same and said chamber; a damper; connections between the same and said cylinder; and automatic means for controlling the exit of said nozzle and the pressure in said chamber and thereby automatically controlling said damper, substantially as described.

4. In an automatic burner, the combination of a mixing chamber for fuel; a steam supply; an oil supply; a burner nozzle; connections between said nozzle and said chamber; means to vary the exit of said nozzle; a diaphragm adapted to be controlled from said steam supply; connections between said diaphragm and said nozzle controlling means; a damper; and means for controlling said damper from said chamber, substantially as described.

5. In an automatic burner, the combination of a mixing chamber for fuel; a steam supply; an oil supply; a burner nozzle; connections between said nozzle and said chamber; means to vary the exit of said nozzle; a diaphragm adapted to be controlled from said steam supply; connections between said diaphragm and said nozzle controlling means; an adjustable spring for controlling said diaphragm; a damper; and means for controlling said damper from said chamber, substantially as described.

6. In an oil burner, the combination of a mixing chamber for fuel; an oil supply; a valve governing the latter and adapted to be operated upon by a change of pressure in said chamber; a steam supply; a valve governing the said supply; a burner nozzle connected to said chamber; a damper, also, operatively connected to said chamber; and means for varying the exit of oil and steam through said nozzle and thereby operating said first mentioned valve and said damper, substantially as described.

7. In an oil burner, the combination of a fuel mixing chamber; a burner nozzle connected to the same; means comprising a rod governing the exit of said nozzle; a diaphragm; connections between said rod and said diaphragm comprising a lever; an oil supply means by which said supply is controlled from said nozzle; a steam supply; connections between said steam supply and said diaphragm; and a spring controlling said diaphragm, whereby a rise in pressure in said steam will operate to close the exit of said nozzle, substantially as described.

8. In an oil burner, the combination of an oil supply; a steam supply; a diaphragm; connections between said steam supply and said diaphragm; a spring controlling said diaphragm; adjustable means controlling the tension of said spring a rod having its end terminating near said diaphragm; a lever controlled by said diaphragm and limited in its movements by said rod; a nozzle connected to said oil supply; means for varying the exit of said nozzle; means for varying the oil supply when said exit is changed; and connections between said nozzle varying means and said lever, substantially as described.

9. In a burner, the combination of oil and steam supplies; a mixing chamber provided with means for preventing unatomized oil from escaping therefrom steam and oil supplies entering said chamber; a nozzle for burning the atomized oil; and means operated from said steam supply for controlling the exit of said nozzle, substantially as described.

10. In a burner, the combination of oil and steam supplies; a mixing chamber for said oil and steam provided with means for preventing unatomized oil from escaping therefrom; a nozzle for burning the atomized oil; means operated from said steam supply for controlling the exit of said nozzle; a damper; and connections between said chamber and damper adapted to operate the damper, when said exit is varied, substantially as described.

11. In a burner, the combination of oil and steam supplies; a mixing chamber adapted to utilize the expansive power of the steam in atomizing the oil and provided

with an outer chamber for receiving any unatomized particles of oil; a nozzle for burning the atomized oil; means for controlling the exit of the nozzle and the pressure in the chamber from the steam supply; means in the chamber adapted to change the quantity of oil admitted thereto when the nozzle exit is changed; a damper; and means to operate the same upon a change of pressure in said chamber, substantially as described.

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

ARTHUR H. LIGHT.

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