June 19, 1923.

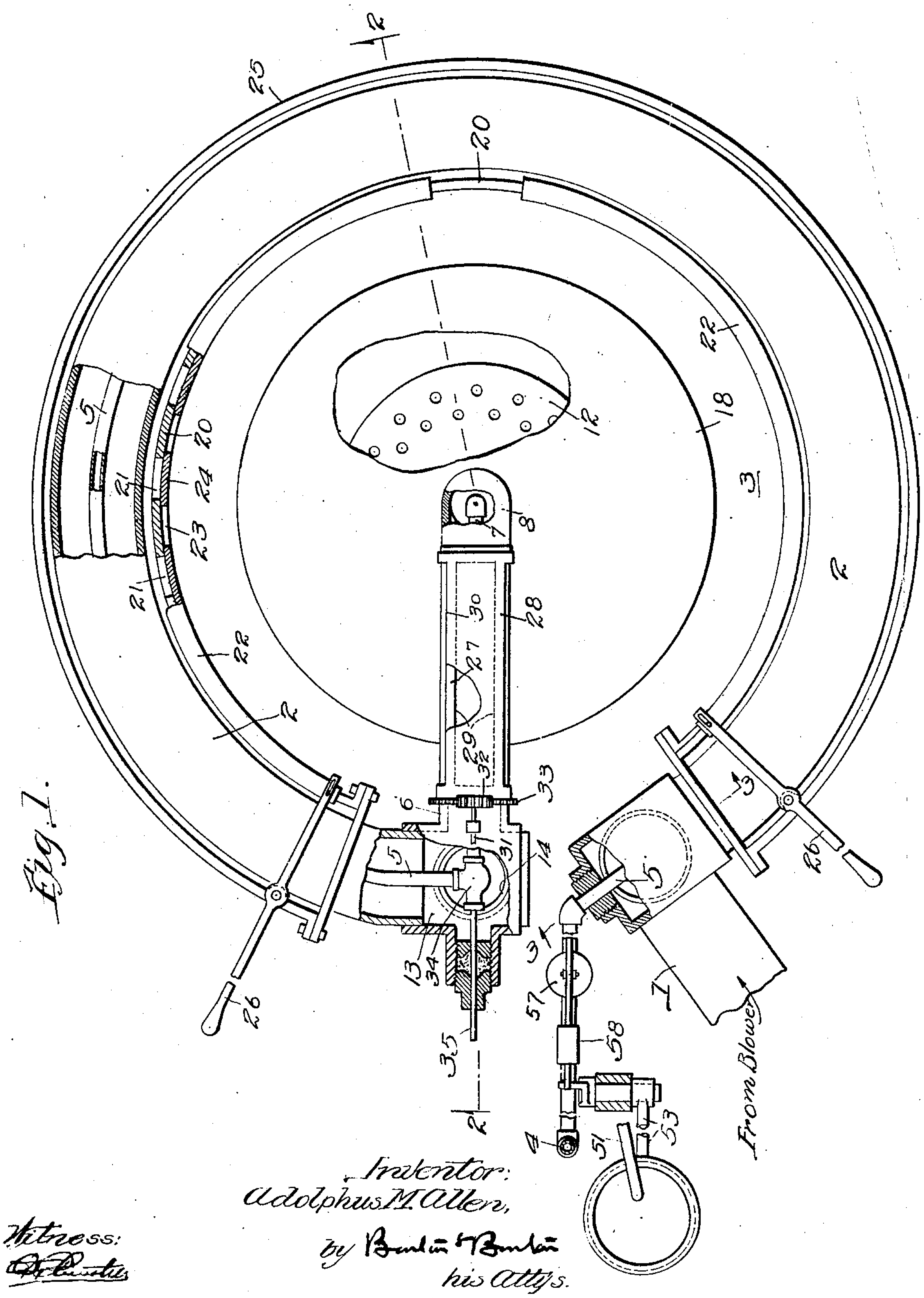
1,459,133

A. M. ALLEN

OIL BURNER

Filed Oct. 8, 1921

3 Sheets-Sheet 1



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Witness:

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Filed Oct. 8, 1921 3 Sheets-Sheet 2

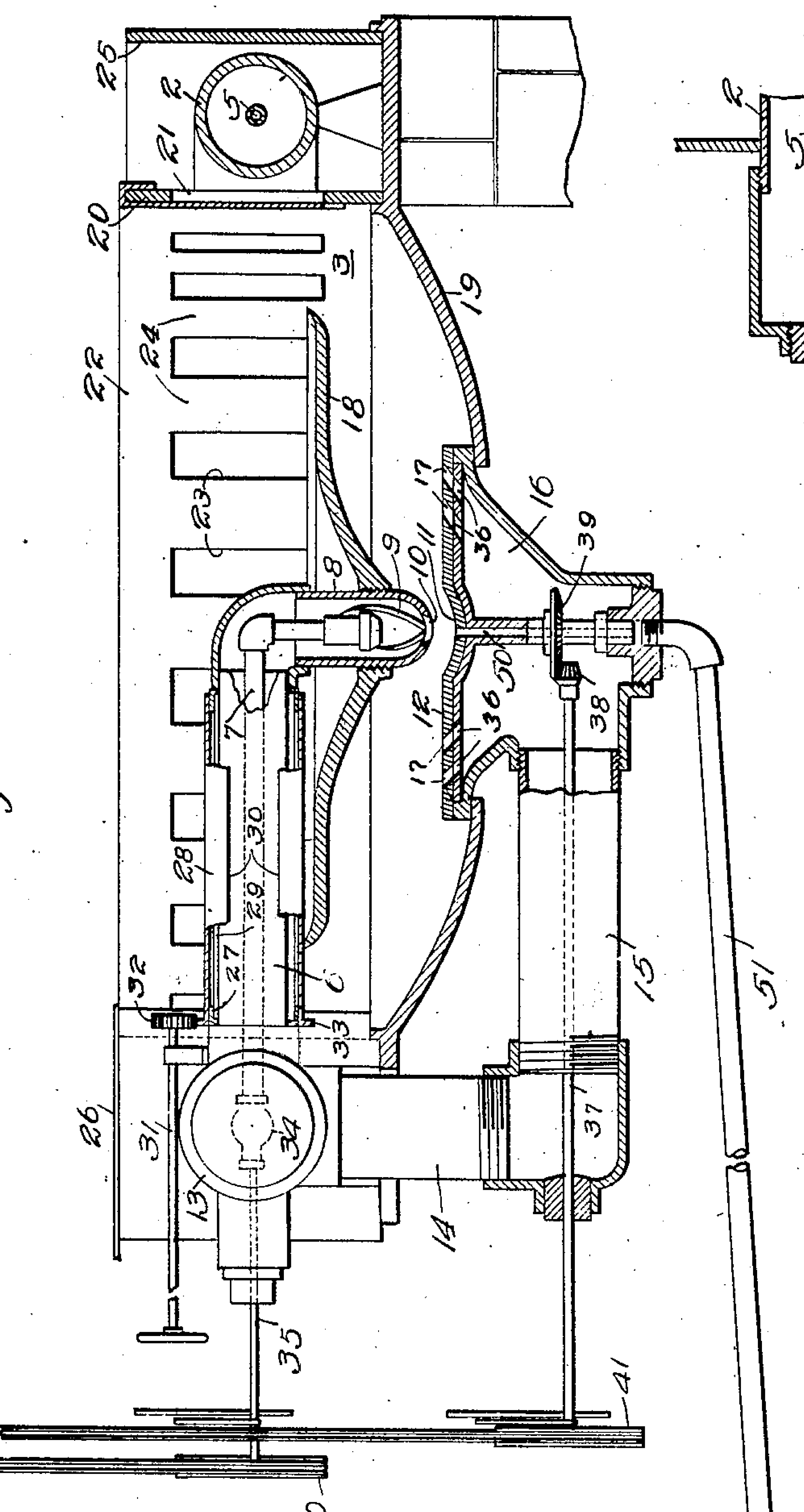

Fig. 2

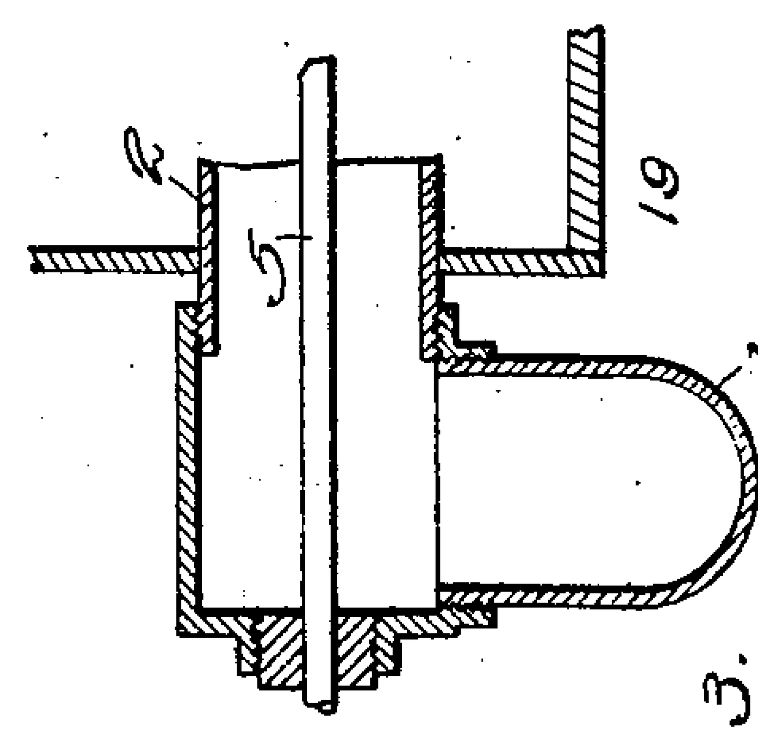

Fig. 3.

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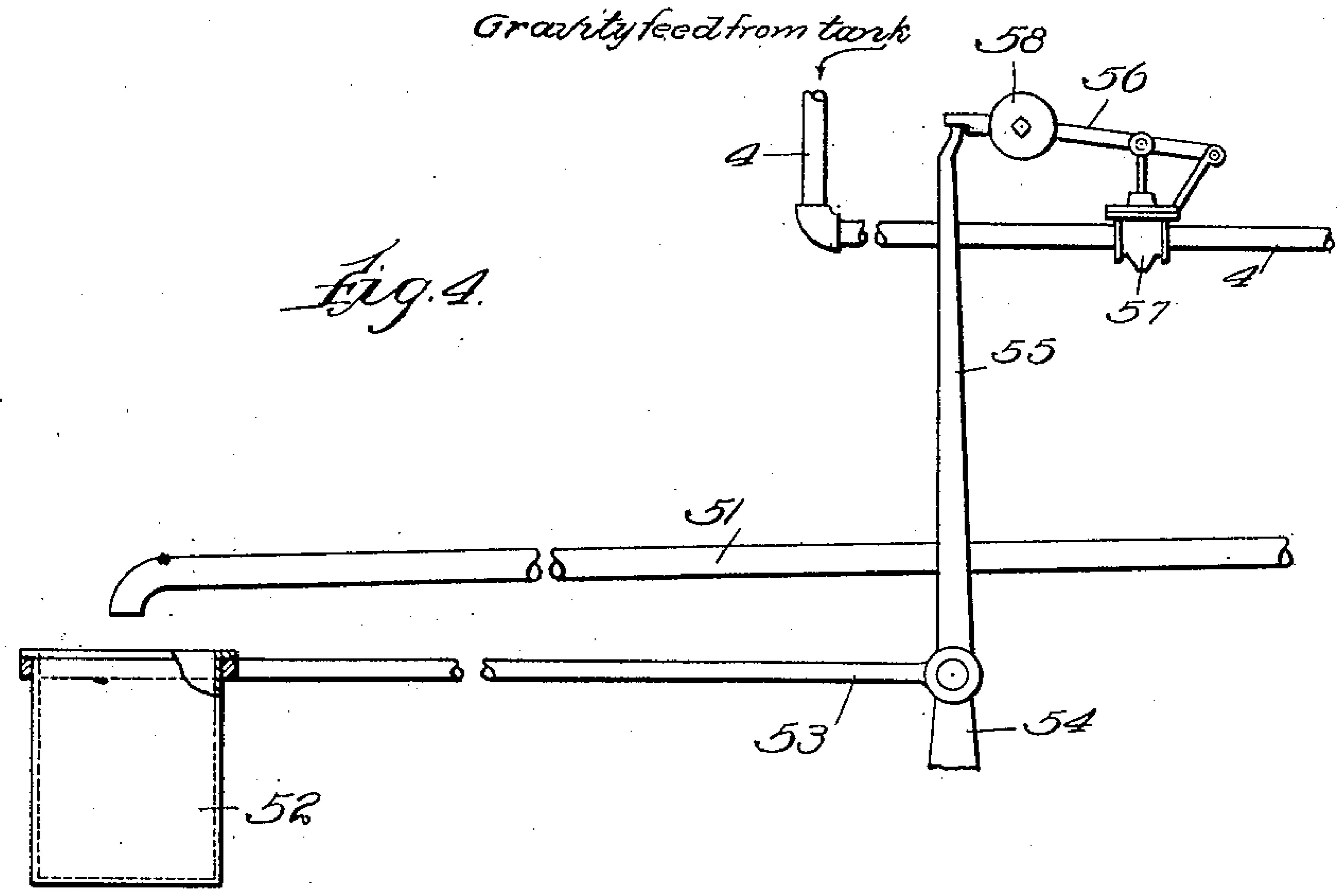

Fig. 4.

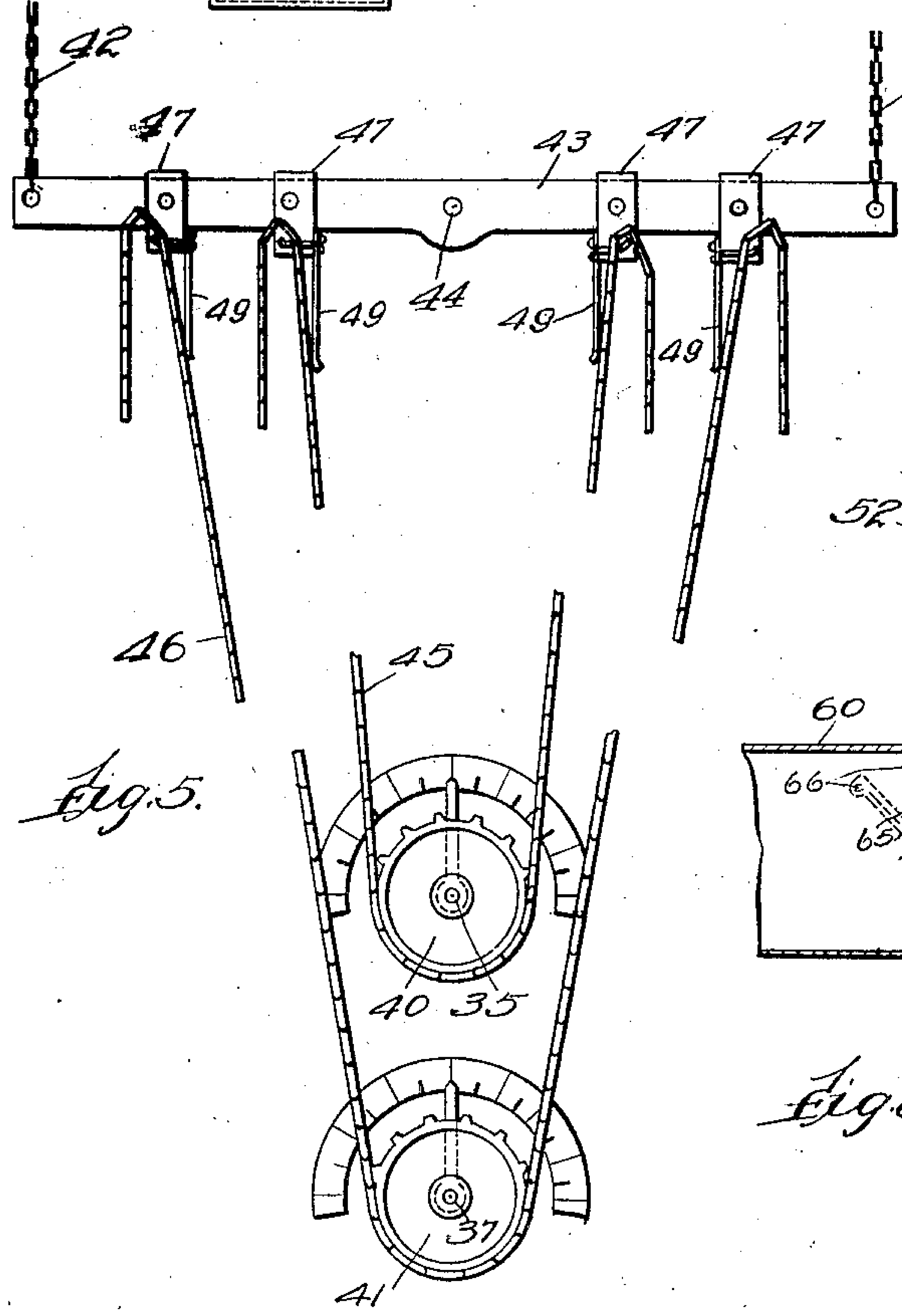

Fig. 5.

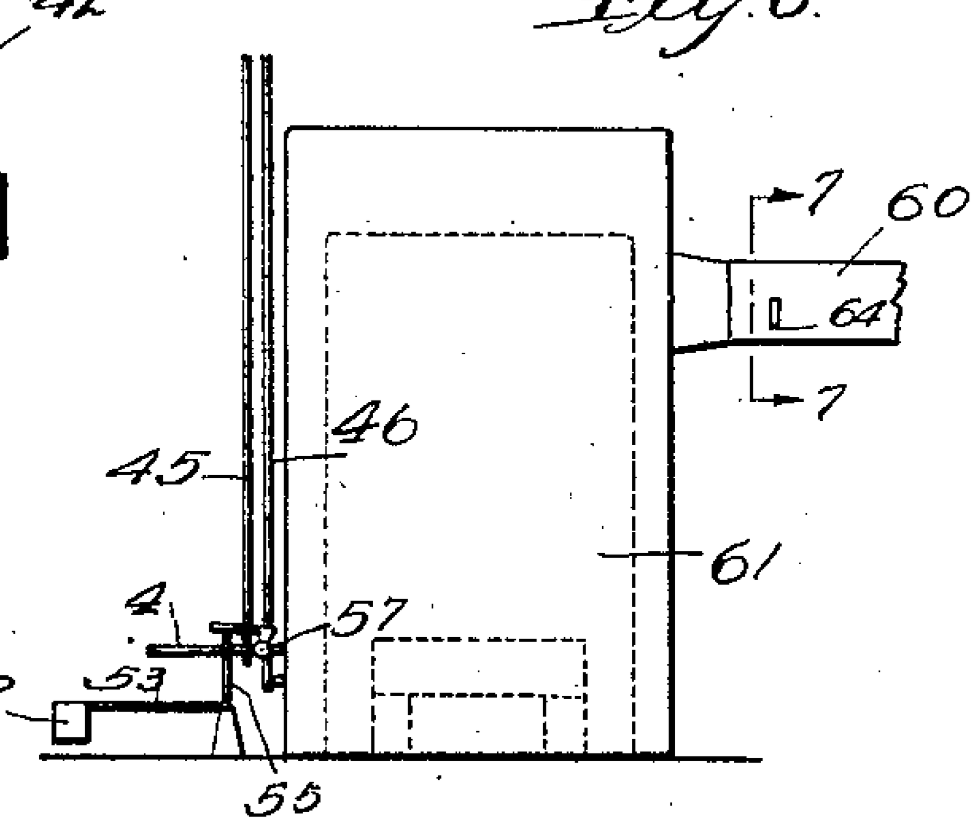

Fig. 6.

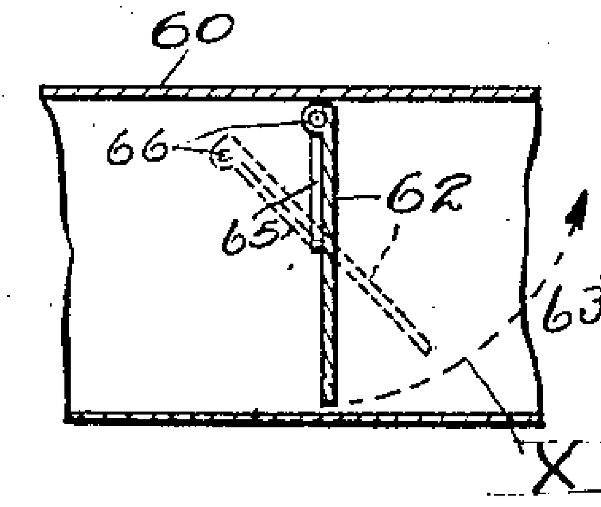

Fig. 8.

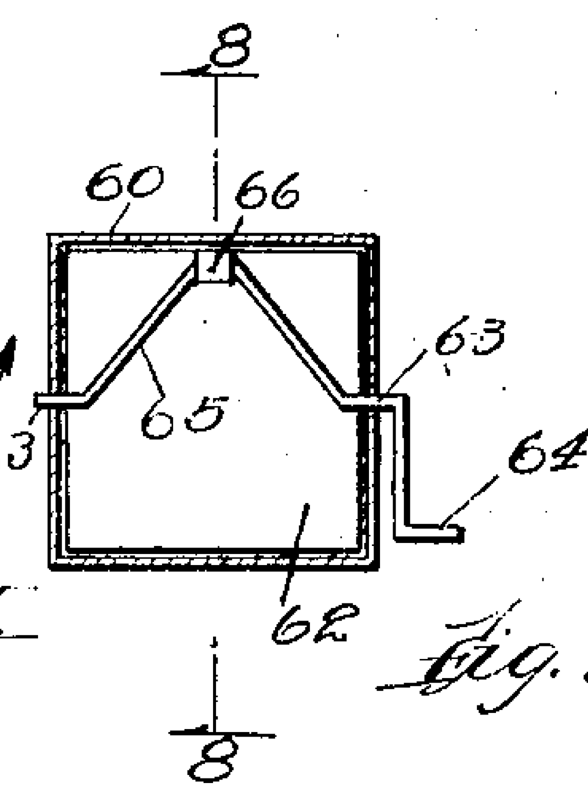

Fig. 7.

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Witness:
[signature]

Patented June 19, 1923. **1,459,133**

UNITED STATES PATENT OFFICE.

ADOLPHUS M. ALLEN, OF MINNEAPOLIS, MINNESOTA.

OIL BURNER.

Application filed October 8, 1921. Serial No. 506,436.

To all whom it may concern:

Be it known that I, ADOLPHUS M. ALLEN, a citizen of the United States, residing in the city of Minneapolis, in the county of Hennepin, in the State of Minnesota, have invented certain new and useful Improvements in Oil Burners, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide a burner adapted to use lquid hydrocarbon fuel such as the heavier fuel oil which results as a residue in the distillation of kerosene, gasoline and naphtha and the invention particularly involves means for preheating the oil and a quantity of air to be mixed therewith to such a degree that both the oil and air before contact with each will have attained approximately the temperature at which they will readily unite for complete combustion. The invention comprises various features and elements of construction hereinafter described and shown in the drawings as indicated by the claims.

In the drawings:

Figure 1 is a plan view of a burner embodying this invention.

Figure 2 is a sectional view taken as indicated at line 2—2 on Figure 1.

Figure 3 is a detail section taken as indicated at line 3—3 on Figure 1.

Figure 4 is a detail elevation of an oil shut-off device.

Figure 5 is an elevation of a valve-controlling gear.

Figure 6 is a side elevation of a furnace embodying an improved damper which is a feature of this invention.

Figure 7 is a section taken as indicated at line 7—7 on Figure 6.

Figure 8 is a section taken as indicated at line 8—8 on Figure 7.

In the burning of fuel oil in relatively large furnaces lined with fire brick which tends to hold a high temperature for some time, it is possible to secure a fairly high efficiency of combustion but when such fuel is employed in small furnaces such as domestic heating plants the problem is not so simple. In such outfits it is usual to regulate the heat by means of a thermostatic device located in a room or space at some distance from the furnace and arranged to shut off the fire at intervals when the room temperature has reached the desired maximum,—the fire being relighted and allowed to burn intensely for a time when the temperature of the rooms falls below a predetermined minimum. Under these conditions it has heretofore been difficult to secure complete combustion of the fuel. As is well understood the carbon which is the principal element of fuel oil will combine with the oxygen of the air either as carbon monoxide or as carbon dioxide. In the former instance the combustion process is incomplete, the resulting carbon monoxide is a poisonous gas and only a part of the available heat units are liberated. But when carbon dioxide is formed the maximum quantity of heat units is set free and the resulting gas is non-poisonous in character. Usually where the combustion is incomplete and carbon monoxide is formed a portion of the carbon in the fuel oil is merely deposited as soot settling in the flues and on the walls of the furnace and acting as a rather effective heat insulator to prevent the transmission of much of the heat produced in the fire box and thus seriously impairing the efficiency of the plant.

Assuming that an adequate quantity of air is supplied for admixture with the fuel oil the resulting product of the combustion will depend upon the temperature at which the air and oil are brought together; the present invention provides means for raising the temperature of both the air and oil sufficiently so that when they are brought together the resulting chemical reaction will consist principally in the formation of carbon dioxide,—in other words, complete combustion.

As indicated in Figure 1, the air is supplied at the intake, 1, from a blower, not shown, and flows through a circularly arranged pipe or conduit, 2, which extends around and adjacent the zone of combustion represented by the annular space, 3. The oil may be understood as feeding by gravity from any suitable supply tank to a pipe, 4, connected with a relatively small pipe or conduit, 5, which is supported within the air conduit, 2, so that it is also subject to the heat of the fire at the zone, 3. The conduits, 2 and 5, form slightly less than a complete circle and continue radially inward in portions, 6 and 7, respectively, terminating in a downwardly discharging nozzle, 8, arranged as shown in Figure 2 with spiral vanes, 9, causing a whirl in the air current which assists in breaking up or atomizing the oil and entraining it for discharge in a cloud or vapor at the orifice, 10, of the nozzle. The effect of the whirl thus produced is to discharge the vapor in a hollow cone so that it strikes the concave surface, 11, of an opposing reflector plate, 12, and is thrown off outwardly in all directions therefrom.

The air conduit, 2, is branched at the fitting, 13, from which the portion, 6, extends and a second branch, 14, leads downwardly to a horizontal portion, 15, arranged to discharge into a chamber, 16, and therefrom through upwardly and outwardly inclined openings or tuyères, 17. The additional air thus fed to the fire flows outwardly and mixes with the vapor discharged from the nozzle, 8, and reflected from the plate, 12. The outward direction of flow of the air and oil may be further controlled by mounting a deflector plate, 18, on the nozzle, 8, so that it shall extend outward therefrom toward the air conduit, 2, but stopping short of it to leave the annular space, 3, heretofore referred to as the combustion zone. Preferably a bottom wall, 19, is provided extending outwardly from the plate, 12, for reflecting the heat upwardly and also for supporting the air conduit, 15, and the distributing chamber, 16, in which it terminates.

The oil and air mixture being initially ignited in any convenient manner and the flow of air being maintained at a sufficient rate by means of the blower, not shown, it will be seen that combustion will continue at the zone, 3, as long as the oil supply is also maintained.

The incoming oil and air flowing through the pipes, 5 and 2, respectively, will absorb heat from the zone, 3, sufficient to raise their temperature to that at which they will readily combine for complete combustion when they are brought together in the fire pot. But to control the quantity of heat absorbed by the incoming elements from the combustion zone, I prefer to provide a wall or baffle, 20, interposed between the conduit, 2, and the nozzle, 8, and just outside the annular space, 3, which encircles the deflector plate, 18. Said wall, 20, is formed with a series of openings, 21, and these are controlled by one or more slidably mounted closure plates or dampers, 22, having similar openings, 23, which may be moved into registration with the openings, 21, for admitting heat from the zone, 3, to the oil and air conduits or which may be moved out of such registration so that the intermediate portions, 24, of the plates, 22, will cover the openings, 21, and shield the oil and air conduits from the heat radiated at the combustion zone. Preferably the space above the conduits, 2 and 5, is upwardly open but since the heated gases at the combustion zone, 3, will tend always to rise, there will be only a comparatively small quantity of heat radiated downwardly from them upon the conduits. If desired an outer wall, 25, may be positioned so as to enclose the conduits and shield them from cold air currents which may result from leakage of the main housing of the furnace. As shown the closures, 22, are made simply in two sections, each controlling about one-half of the length of the wall or baffle, 20, and each arranged for adjustment by means of a lever, 26, fulcrumed on the opposite wall, 25, as seen in Figure 1.

The radial portion, 6, of the air conduit within which the radial portion, 7, of the oil conduit extends is also protected by a heat-regulating jacket comprising an inner sleeve, 27, spaced away from the conduit, 6, but encompassing it and an outer sleeve, 28, which is radially adjustable on the inner one. Said sleeves are provided with openings, 29 and 30, which may be brought into registration for admitting heat from the fire pot to the conduit, 6, and the oil pipe, 7, within it; by rotation of a shaft, 31, whose pinion, 32, meshes with gear teeth, 33, on the outer sleeve, 28, the latter may be rotated for closing the openings, 29 and 30, to exclude the heat as far as possible from the conduit, 6. While the baffle wall, 20, serves to exclude the heat of the combustion zone, 3, from the conduits, 2 and 5, when desired, it does tend to absorb a considerable amount of heat after the burner has been in operation for some time; thus, particularly upon changing the proportions of the oil and air, or upon starting the fire after a brief shut-down, the heat retained in this wall tends to assist combustion, or, upon shutting off the supply of fuel, the heated condition of the wall, 20, tends to complete the combustion of oil and fumes remaining in its vicinity.

The supply of oil to the nozzle through the pipe, 7, is controllable as by means of a needle valve, 34, having a stem, 35, extending from within the fitting, 13; and for regulating the supply of air to the tuyères, 17, the plate, 12, is provided with registering apertures, 36, and is mounted for rotation by means of a shaft or spindle, 37, and bevel gears, 38 and 39, so as to shift the apertures, 36, more or less out of registration with the tuyères, 17. For varying the effective size of these openings or for completely shutting off the openings if the oil valve, 34, and air supplying tuyères, 17, are to be thermostatically controlled, the shafts or spindles, 35 and 37, are provided with toothed wheels, 40 and 41, respectively, and the thermostat chains, 42, actuated in the usual way by a spring motor, not shown, are connected to the opposite ends of a beam or bar, 43, fulcrumed at 44 and connected to the toothed wheels, 40 and 41, by belts or bands, 45 and 46, respectively, which are preferably in the form of ladder chains. Said belts or bands each have their opposite ends attached to the bar, 43, at points equidistant from its fulcrum, 44, and at opposite sides thereof so that they depend from the bar in loops encircling the respective wheels, 40 and 41. Thus any movement of the thermostat chains, 42, such as will occur when a maximum or minimum room temperature is reached, will rock the bar, 43, about its fulcrum and shift the chains, 45 and 46, so as to rotate the toothed wheels, 40 and 41, which they engage and thus turn the valve spindles, 35 and 37. Preferably the chains are attached to the bar, 43, by hooks or fittings, 47, which are slidably adjustable on the bar so that within certain limits any desired amount of rotation of the valve spindles may be secured for a given angular motion of the bar, 43; furthermore the end of each of the two chains, 45 and 46, may be adjusted independently of each other so as to secure the desired relative movement of the two other spindles, 35 and 37. This permits varying the proportions or quantities of oil and air admitted to the fire pot for combustion so that the best mixture for a given fuel may be obtained by experiment and so that the maximum density of the fuel may be adjusted to general weather conditions at different seasons of the year.

In a heating plant of this type it is sometimes possible that owing to a break-down in the blowing apparatus or for some other reason the fire may go out although the liquid fuel oil will continue to feed by gravity to the nozzle. To avoid undue waste in such instances, I provide a drain opening, 50, leading from the center of the plate, 12, and downwardly through the hollow shaft of the gear, 39, for connection with the drain pipe, 51, which discharges into a receptacle, 52, on the end of the lever, 53, fulcrumed on a fixed bracket, 54. As shown in Figure 4, the lever, 53, is in the form of a bell-crank having its arm, 55, normally engaged on the weighted arm, 56, of the lever for actuating the oil supply valve, 57, in the pipe, 4, so that when a sufficient quantity of oil has drained through the opening, 50, into the receptacle, 52, the weight of the oil will tilt the lever arm, 55, out of contact with the lever, 56, allowing the counterweight, 58, thereon to close the valve, 57. Such occurrence will be comparatively infrequent and when it does happen will, of course, prevent the automatic renewal of the fire until the receptacle, 52, has been manually emptied and the lever, 56, has been reset to open the valve, 57.

In any furnace and particularly in a furnace of this type, it is desirable that the hot gases which are the products of combustion be retained in the furnace long enough to permit the absorption of as much heat as possible by the air, water or steam which is used as a vehicle for distributing the heat to the building. This may be accomplished by holding such gases within the furnace at a pressure somewhat higher than atmospheric pressure and for this purpose, I provide in the flue, 60, leading from the furnace, 61, a damper comprising a plate, 62, which fits loosely across the flue, 60, for normally closing it. For opening the damper a rocker member is mounted in the flue with its trunnions, 63, substantially at the middle thereof and with its operating arm and handle, 64, extending outside the flue, 60. Said rocker, however, is formed with a crank portion, 65, extending near the top of the flue, and loosely supporting the plates, 62, by a hinge connection at, 66, from which the plate depends against the crank, 65, at the side of the latter away from the furnace, 61, and its combustion chamber. Thus the weight of the plate, 62, will resist the tendency of the gases in the furnace to swing it upon its hinge, 66, but when the pressure of such gases becomes excessive the plate will yield outwardly as indicated by the dotted arc, X, and thus permit escape of the gases. When it is desired to open the damper the actuation of the handle, 64, will swing the parts to the position indicated in dotted lines in Figure 8.

I claim:—

1. The combination of a mixing device for oil and air with means producing an additional air discharge adjacent said mixing device but directed away from it toward a combustion zone, and a supply conduit for air extending to the mixing device and adjacent the combustion zone for preheating the air, means for controlling the quantity of heat absorbed by the air in said conduit from the combustion zone and means for supplying oil to the mixing device.

2. In the combination defined in claim 1, the oil-supplying means including a conduit also adjacent the combustion zone for absorbing heat therefrom.

3. The combination of a mixing device for oil and air with means producing an additional air discharge adjacent said mixing device, means directing the resultant inflammable mixture outwardly away from the mixing device to a combustion zone, supply conduits for oil and air extending adjacent each other and adjacent said zone for absorbing heat therefrom, together with means for controlling the quantity of heat absorbed by the oil and air in said conduits from the combustion zone.

4. In the combination defined in claim 3, means for varying the rates of flow of oil and air in said conduits respectively.

5. In the combination defined in claim 1, said controlling means comprising a wall standing between said air conduit and the mixing device and provided with openings adjacent the combustion zone, and means for varying the size of said openings.

6. In the combination defined in claim 1, said controlling means comprising a shielding member interposed between said air conduit and the mixing device at the combustion zone and movable to expose said conduit to the heat of said zone.

7. In the combination defined in claim 3, said oil conduit extending within the air conduit at a portion of the latter which is adjacent the combustion zone.

8. The combination of a mixing device for oil and air having a discharge nozzle, a plate opposing said nozzle in close proximity thereto for reflecting the mixture discharged against it and additional air supply openings in said plate disposed outside the area against which the nozzle plays and directed for discharging said additional air outwardly away from the nozzle, together with a deflector opposing said outlets of the plate and extending outwardly and upwardly from the nozzle for directing the vapor mixture outwardly still farther from the nozzle to a combustion zone.

9. The combination of a mixing device for oil and air with a downwardly discharging nozzle, means producing an additional air discharge upwardly adjacent said nozzle but directed away from it, means for preheating the oil and air supplies to the nozzle and said additional air comprising supply conduits for oil and air substantially encircling the nozzle at a distance therefrom, and a deflector plate extending outwardly from the nozzle above the additional air discharge toward the said supply conduits forming an annular space between the margin of said plate and said conduits to serve as a combustion zone for the gases flowing outwardly and upwardly past said deflector plate.

10. In the combination defined in claim 8, a drain opening within the reflecting area of said plate, a drain pipe leading therefrom and a movable receptacle into which said pipe discharges operatively connected with an oil supply valve through which the nozzle is fed, whereby the accumulation of liquid oil in said receptacle is adapted to close the valve.

11. In a mixing burner for oil and air, means for controlling the flow of oil, and means for controlling the admission of air, each including a rotatively adjustable spindle, said spindles extending parallel to each other, an adjusting bar fulcrumed at the middle, with a pair of belts or bands each having its ends attached to said bar at points equidistant from the fulcrum, and its middle portion depending in a loop, together with wheels on said controlling spindles respectively engaged by the respective belts or bands for actuation of the spindles by rocking of the bar.

12. In the combination defined in claim 11, attaching means for connecting the belts or bands to the bar, including yielding arms extending transversely from the bar and between said bands and the bar fulcrum for taking up slack in the bands at extreme positions of adjustment.

13. In the combination defined in claim 11, said belts or bands being adjustably attached to the bar to permit altering the distance of their points of attachment from its fulcrum.

14. In the combination defined in claim 1, means controlling the air supply, means controlling the oil supply, and actuating means connected to operate said controlling means simultaneously, said actuating means including connections adjustable for varying the rate of change of either supply independently of the other.

15. In the combination defined in claim 1, means controlling the air supply, means controlling the oil supply, and actuating means connected to operate said controlling means simultaneously, including connections adjustable at will for varying the ratio between the air and the oil.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 5th day of October, 1921.

ADOLPHUS M. ALLEN.