Feb. 16, 1932. J. N. MACRAE ET AL 1,845,028

OIL BURNER

Filed Dec. 20, 1928 4 Sheets-Sheet 1

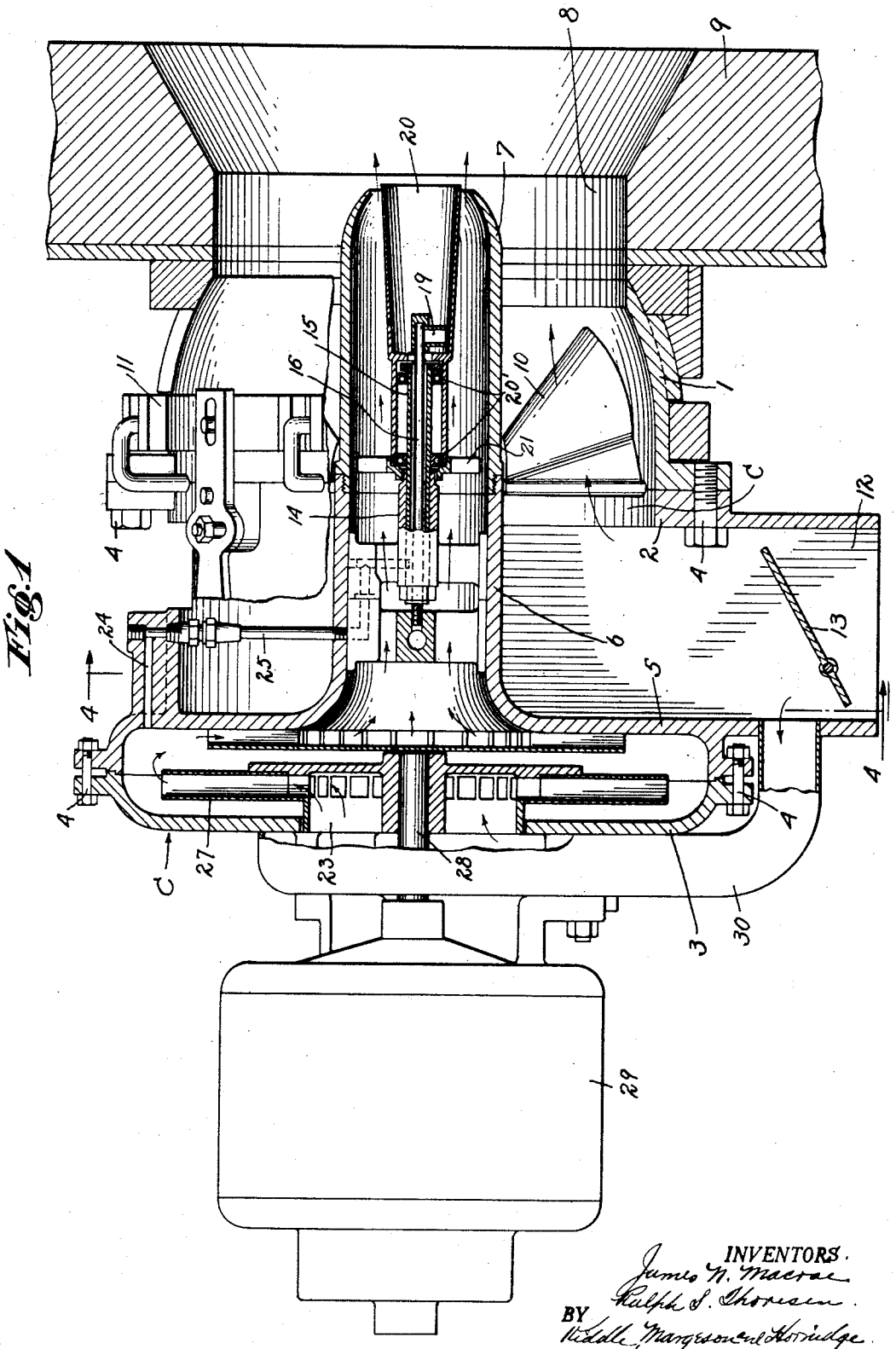


Fig. 1

INVENTORS.
James N. Macrae
Ralph S. Thoresen.
BY
Liddle, Margeson and Partridge
ATTORNEYS.

Feb. 16, 1932. J. N. MACRAE ET AL 1,845,028

OIL BURNER

Filed Dec. 20, 1928 4 Sheets-Sheet 2

Fig. 4

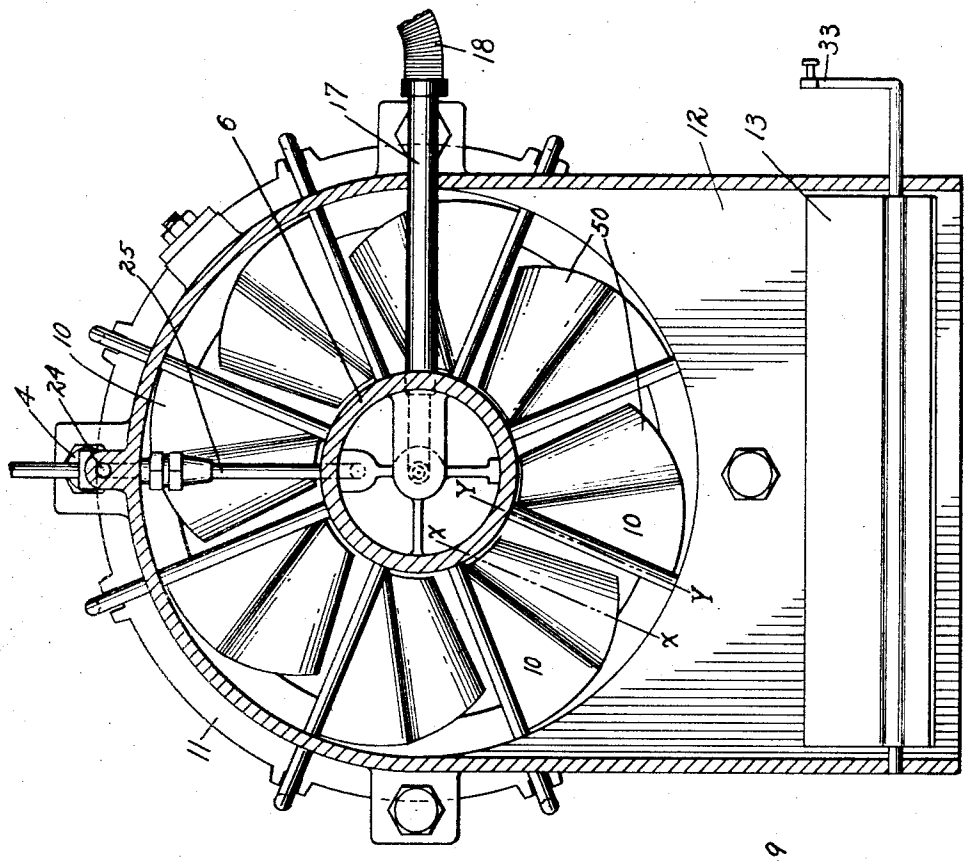


Fig. 2

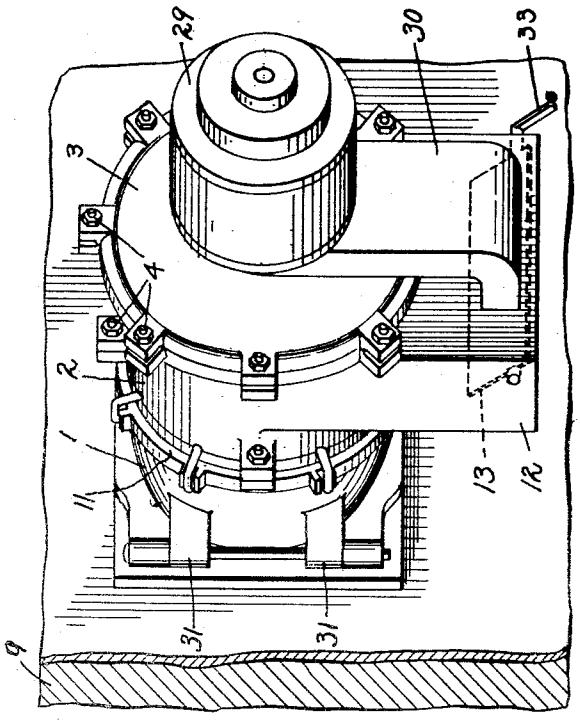
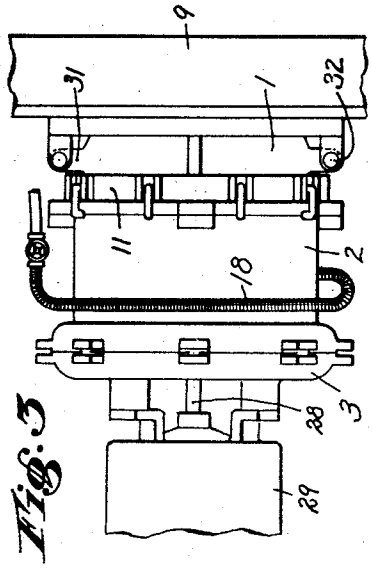


Fig. 3



INVENTORS.
James N. Macrae.
Ralph A. Thoresen.
BY
Riddle, Marqueson & Kenidge
ATTORNEYS.

Feb. 16, 1932. J. N. MACRAE ET AL 1,845,028

OIL BURNER

Filed Dec. 20, 1928 4 Sheets-Sheet 3

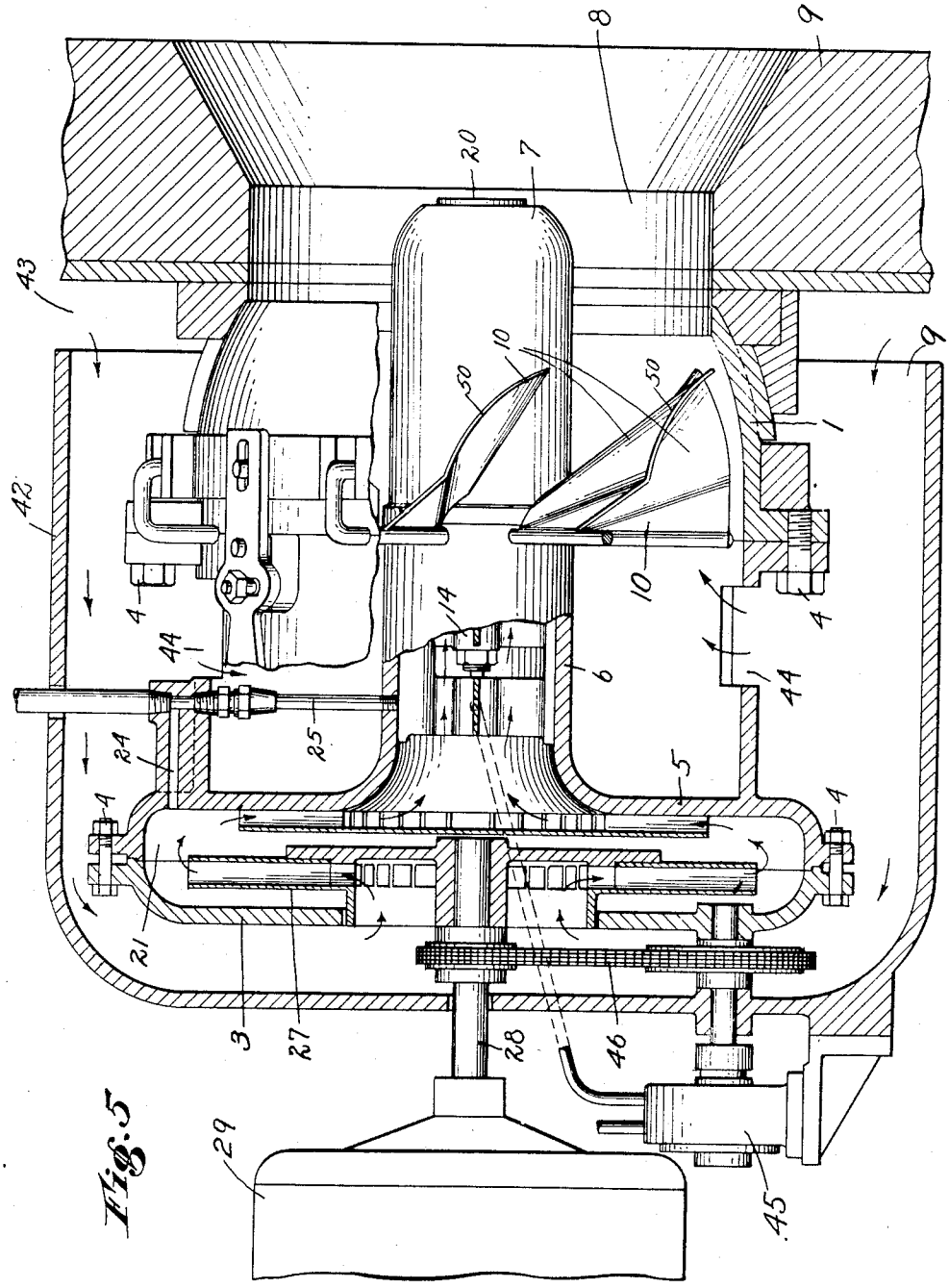


Fig. 5

INVENTOR.
James N. Macrae.
Ralph S. Thoreen.
BY
Kiddle, Margeson & Hornidge.
ATTORNEYS.

Feb. 16, 1932. J. N. MACRAE ET AL 1,845,028

OIL BURNER

Filed Dec. 20, 1928 4 Sheets-Sheet 4

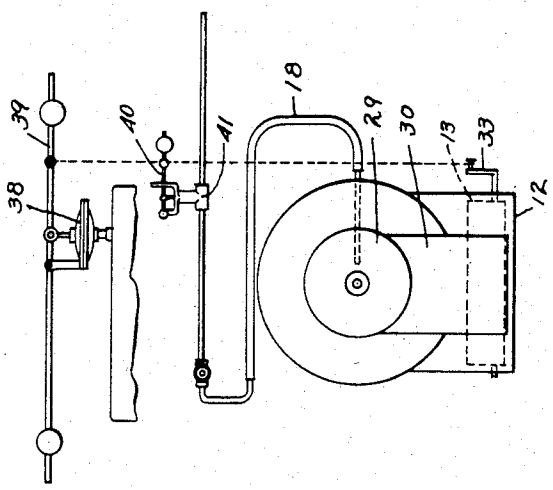


Fig. 8

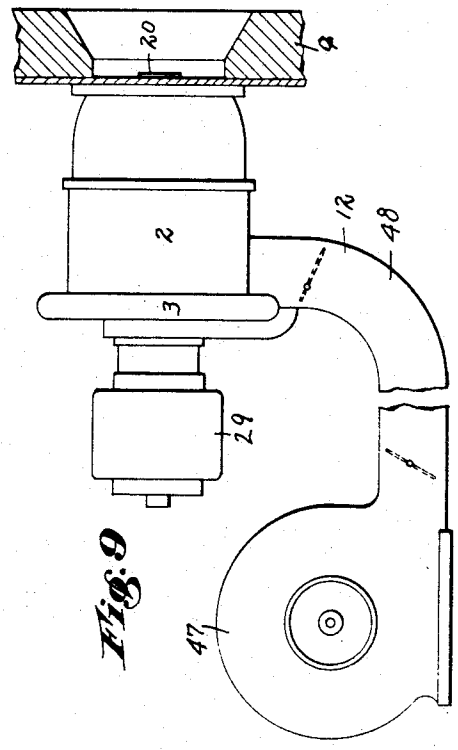


Fig. 9

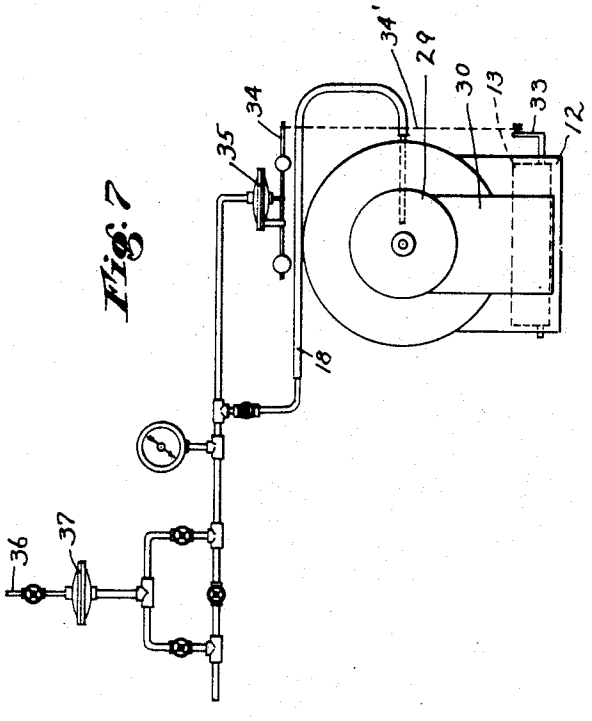


Fig. 7

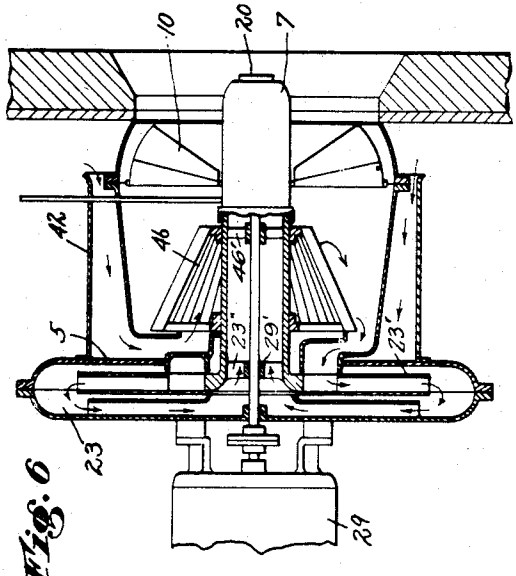


Fig. 6

INVENTORS.
James N. Macrae
Ralph S. Thoreau.
BY
Liddle Margeson and Hornidge,
ATTORNEYS.

Patented Feb. 16, 1932 1,845,028

UNITED STATES PATENT OFFICE

JAMES N. MACRAE AND RALPH S. THORESEN, OF STAMFORD, CONNECTICUT, ASSIGNORS TO PETROLEUM HEAT AND POWER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

OIL BURNER

Application filed December 20, 1928. Serial No. 327,221.

This invention relates to an improvement in oil burners and among the objects of our invention is the provision of an oil burner structure in which the driving motor no matter what the type is mounted in line with the atomizer and in which the various parts making up the burner, as for example the atomizer, nozzle, air register, fan, etc. are all mounted on the one support in the furnace front. This support also carries a pump for drawing oil from a supply tank and delivering the same to the burner, the pump being connected to the oil supply by a flexible connection to permit of the entire burner as a unit being swung away from the furnace front about a hinge at one side of the burner to permit of inspection, repair, etc.

A further object of our invention is the provision of a burner of the character above indicated in which the secondary air for combustion and the primary air for driving the atomizer when an air driven atomizer is employed is taken into the apparatus through a damper controlled inlet, the secondary air passing through a register directly into the furnace, the primary air being taken into the compressor compartment where it is compressed to the desired degree and discharged into the burner nozzle into contact with the atomizer turbine to drive the same. This greatly reduces air noises and hence makes for a quiet operating apparatus, which is very desirable in oil burning installations. The intaking of the air through a single damper controlled inlet provides a construction whereby the air supplied to the compressor for driving the burner turbine and for atomizing the fuel and for combustion purposes will vary in accordance with changing rates of fuel consumption.

A still further object of our invention is the provision of a burner structure of the general type above described in which a casing completely surrounds and encloses the air register to prevent transfer of reflex heat from the furnace to the boiler room, and to prevent injury to an operator in the event of a blowback.

The present invention also provides for automatic control of the air damper above referred to, this automatic control regulating the air supply so as to insure the supplying of the proper amount of air to the apparatus in synchronism with varying rates of combustion, thereby promoting complete and efficient combustion.

The present apparatus also provides not only for the automatic control of the air damper as just mentioned but also for the automatic control of the oil or fuel supply valve to maintain constant the steam or vapor pressure temperature of the liquid or substance in the heated vessel, such as the boiler of a furnace.

It has been mentioned above that the primary and secondary air are damper controlled and taken into the compressor direct through the same inlet, compressed, and then fed to the burner. The present invention provides also an arrangement whereby this construction may be varied, if desired, a low pressure fan exterior of the apparatus supplying secondary air to the burner direct, through a damper controlled inlet, this low pressure fan also supplying air to a compressor which delivers primary air to the burner at a higher pressure for atomization.

A still further object of our invention is the provision of an oil burner structure in which the heat of the furnace front is utilized for preheating the air drawn into the burner. This applies to both the primary and secondary air and will promote combustion through better atomization of the oil. We have found also that this construction will reduce combustion noises appreciably.

Various other objects of the present invention will appear in the description to follow.

In the drawings accompanying this application,

Fig. 1 shows one embodiment of our invention in sectional elevation;

Fig. 2 is a perspective of the apparatus as installed;

Fig. 3 is a plan view of the apparatus of Figs. 1 and 2;

Fig. 4 is a section on the line 4—4 of Fig. 1;

Fig. 5 is a modification showing the burner so arranged that the air for supporting com-

bustion, etc. is preheated by passing the same along the furnace front;

Fig. 6 is a view of a still further modification along the lines of the apparatus of Fig. 5;

Fig. 7 is a more or less diagrammatic view of an arrangement for automatically controlling the air damper in synchronism with varying rates of combustion;

Fig. 8 is a diagrammatic view showing means for automatically controlling not only the air damper but the oil supply valve as well; and

Fig. 9 is an elevational view of a still further modification of our invention in which the secondary air is supplied by a low pressure fan exterior of the apparatus, this fan also supplying primary air to a compressor which in turn supplies it to the burner.

Referring first of all to Figs. 1, 2, 3, 4, 7 and 8, our improved burner construction here comprises a casing C completely enclosing the entire burner structure with the exception of the fan or compressor motor, the casing being made up of three parts designated 1, 2 and 3 bolted together as indicated at 4. This casing as will be hereinafter pointed out contains the air register, the burner and the atomizing cup, the turbine for driving the cup, if turbine drive is employed, and the fan for compressing the primary air employed for driving the turbine.

The rear wall 5 of the central section 2 of the burner casing C is provided with a tubular portion 6 extending toward the front of the burner. Screwed upon the tubular portion 6 is the burner tube or nozzle 7, this nozzle, as shown on Fig. 1, when in firing position extending into the opening 8 in the front wall 9 of a furnace to which the burner is applied.

Intermediate the casing section walls and the tubular extension 6 and burner nozzle 7 is an air register, comprising a plurality of pivoted blades 10 having their outer ends pivoted in the wall of the casing section 2, for example, while their inner ends are pivoted in the extension 6. These blades are adjustable by ring 11 to vary their angularity and hence to vary the pitch of the secondary air for combustion passing between them.

The secondary air which passes through the air register is taken into the casing C back of the register through damper controlled intake 12, the damper controlling the same being designated 13, a portion of the air passing into the casing through this intake opening traveling direct to and between the blades 10 of the air register and from thence about the inner end of the burner, the air as it passes through the register being given a whirling motion, the pnitch of which depends upon the angular setting of the register blades. The blades 10 of the register are of special shape as will be explained hereinafter.

Mounted within the tubular extension 6 and burner tube 7 and spaced therefrom, and extending longitudinally of the burner is a fixed tube 14 within which is mounted a bearing tube 15. An oil tube 16 is mounted within the bearing tube and is in communication with an oil pipe 17, shown on Fig. 4. This pipe is connected by flexible pipe 18 to a suitable source of fuel supply, whereby oil is supplied to a nozzle 19 carried on the forward end of the oil tube. This nozzle is within a rotary atomizing cup 20, adjacent the bottom thereof. The atomizing cup is mounted for rotation on bearings 20′ on the bearing tube 15 above referred to. The cup carries an air turbine 21 located as found convenient, here shown adjacent the rear end of the cup about the rear bearings 20′ for the cup.

The air for effecting rotation of the turbine as well as for the atomization will be referred to hereinafter as primary air and is supplied from fan chamber 23, the air from this chamber flowing past the turbine to drive the same and out the end of the burner between the cup 20 and tube 7. 24 is a passageway or conduit leading from the fan chamber to lubricating oil pipe 25. The latter is for lubricating the cup bearings while the former is for the purpose of balancing the pressure in and around the bearings to permit of lubricating oil flow thereto.

Means are provided, therefore, for the direct supplying of secondary air for combustion, this air passing along the outside of the burner nozzle through the air register blades 10, and primary air under pressure for driving the turbine 20 and for atomization, the admission of both the primary and secondary air to the apparatus being damper controlled.

The fan chamber 23 above referred to is at the rear of the wall 5 of casing section 2, the rear wall of this chamber being provided by the casing section 3. The fan 27 in this chamber is directly mounted on the armature shaft 28 of an electric motor 29, this motor being supported by the casing C so that all of the parts which we have so far referred to go to make up a unitary structure adapted to be moved as a unit. To lessen the air noises in our improved burner we have provided for a muffling action of the air passing into the fan chamber 23, this muffler or muffle being in the form of a conduit 30 having its lower end as viewed in Fig. 1 opening into the air intake 12, while the upper portion of this muffle or muffler opens into the fan chamber.

The entire structure is mounted upon hinges 31, see Fig. 2, and held closed by a latch 32 of any suitable construction and diagrammatically illustrated in Fig. 3.

The unitary construction of the burner as above described, and the mounting of the same on hinges on the front wall of a furnace or other apparatus to be heated, permits

of the entire apparatus being swung out of firing position for the purposes of inspection, repair, etc. The provision of the flexible conduit 18 connected to the oil supply as above described permits of this swinging of the apparatus without disconnecting from the oil line. This flexible conduit connection also avoids the use of swiveled joints in a rigid pipe which is of advantage, such joints being a source of leakage, a dangerous condition in oil burning apparatus.

As above pointed out our completely enclosed and unitary burner structure possesses further advantages in that danger of fire in the boiler room or other place where such an installation may be made as well as danger of injury to an operator due to backfire is avoided inasmuch as any inflammable gases or flames are blocked off by the casing from the boiler room as well as from the operator.

We have also pointed out briefly that we have provided means for automatically controlling the damper 13 so as to supply the proper amount of air in synchronism with varying rates of combustion. We have also pointed out briefly that we have provided automatic control for both the air damper and the oil supply valve so as to maintain constant steam or vapor pressure in the vessel being heated. These features of our invention are illustrated diagrammatically in Figs. 7 and 8 to which reference will now be made.

With reference first of all to the automatic control of the air damper 13 alone, to supply the proper amount of air in synchronism with varying rates of combustion, it will be seen from an inspection of Fig. 7 that the damper is provided with an arm 33, this arm being attached to one end of a weighted lever 34 by a suitable connection 34′ such as a chain. The lever 34 is controlled by a diaphragm motor indicated diagrammatically at 35. From an inspection of Fig. 7 it will be seen that one side of this diaphragm motor is connected in the oil line. A pipe 36 is connected to the boiler or other apparatus being heated and the pressure generated therein is imposed upon a diaphragm valve motor 37 to control the rate of flow of oil to the burner.

It will be seen, therefore, that the pressure developed in the oil line will operate the air damper control diaphragm 35, this pressure varying in proportion to change in the rate of oil flow, to vary the setting of the air damper 13, so as to supply the correct amount of air to the apparatus in synchronism with varying rates of combustion.

Referring to Fig. 8 we provide for the automatic control of the air damper 13 and the oil supply valve so as to maintain constant steam pressure. In this instance a diaphragm 38 is connected to the boiler or other apparatus being heated and to a lever 39 connected to the arm 33 of the damper 13 by a chain or other suitable operating mechanism, as well as to a lever 40 in turn connected to oil supply valve 41. Variation in the steam pressure, therefore, will transmit motion to the levers 40 and 33 to adjust the oil supply valve 41 and damper 13, respectively, whereby automatic control of the oil supply valve and the air control damper is obtained for maintaining constant steam or vapor pressure.

As a modification of the burner above described we have shown in Fig. 5 a form of burner in which the casing C which as before is made up of sections 1, 2 and 3 is enclosed in an outer casing 42, closed at the rear, the forward end of this casing adjacent the furnace front being spaced as shown at 43 a short distance therefrom. As a consequence of this construction all air entering the apparatus is drawn along in front of and in contact with the furnace front to be thereby preheated, the air after traversing this wall passing into the casing 42. Some of this air passes through ports 44 provided for the purpose in the inner casing section 2 and from thence through the register 10. The remainder of the air is drawn into the fan 27 and discharged therefrom in the same manner as described in connection with Fig. 1.

In this modification also we have mounted the oil pump 45 on the casing 42, the pump shaft having a bearing in the casing and the rear wall of casing section 3. The pump is driven from the shaft of the motor 29 by a silent chain 46 for example within the casing 42.

So far as this embodiment of our invention is concerned, therefore, it comprises or embodies the advantageous features pointed out in connection with Fig. 1 so far as a unitary enclosed structure is concerned with the additional advantages afforded by preheating of the air, and novel pump mounting and drive therefor.

In the apparatus illustrated in Fig. 6 which is a still further modification of the constructions illustrated in Fig. 1 and Fig. 5, we provide for causing the air entering the burner structure to take a longer path than in the constructions of the other two figures just mentioned. This modification embodies the unitary feature of the other forms of the invention above described and also employs the enclosed feature of Fig. 1 and the outer casing feature of Fig. 5. The air entering the outer casing 42 is not drawn directly into the fan chamber, being prevented from so doing by the wall 5, but is drawn into and through blower 46, from which some of it is discharged through the register 10 to the discharge end of the burner for supporting combustion, while the remainder is drawn into the fan chamber 23 where it is compressed by vanes 23′ and discharged through outlet

23'' to the turbine and atomizing cup for driving the turbine and for atomization. The motor 29, that is to say, the shaft thereof is connected, as shown, to blower 46 and the fan blade 23' by spiders 46' and 29', respectively.

In all of the forms of our invention so far described in detail the air is taken directly from the boiler room into the burner. In the form of our invention illustrated in Fig. 9, however, we have provided an apparatus which might be preferred in certain installations, this apparatus comprising in addition to the structure of Fig. 1 for instance, a low pressure blower 47 connected by a conduit 48 to the intake 12 of the burner. This type of apparatus might be desirable in high rating installations.

In all the forms of our invention above described, we provide an oil burning apparatus employing an air register in which the register is enclosed, this construction together with the restricted paths provided by the register and by the conduit 12 and the damper 13 preventing the transfer of reflex heat from the furnace to the boiler room and the passage of inflammable gases or flames in the event of flare or blowback during operation.

We have also provided as will now be understood a unitary construction adapted to be mounted on hinges, if desired, in the front of a furnace, the hinge mounting enabling the entire apparatus to be swung away from the furnace for the purposes of inspection, repair, etc.

It will be seen also that we have provided in the embodiments of our invention as illustrated in Figs. 1 and 9 for automatic control of the air damper, whereby the correct amount of air is taken into the apparatus at all times.

It will be seen also that we have provided for reducing noise of operation by the construction illustrated at the rear end of Fig. 1 and described above in detail.

In the above description the brief statement was made that the blades 10 of the air register are preferably of special construction as distinguished from the flat plane blade heretofore used. In this connection reference should be made to Fig. 4 for example from which figure it will be seen that each of the blades 10 is provided with a surface which we will designate 50 which is a section of the surface of a cylinder. It will be seen also from this figure that the axis of this cylindrical surface which is designated X—X is parallel to the axis Y—Y about which the adjacent vane or blade is moved when adjusting.

By this construction the effective area through the vanes or blades of the register has been increased as compared with existing flat vane or plane blade shutters, thereby permitting the passage of more air through the register with a fixed or definite angular position of the blades. It will be seen also that with this type of construction the restriction to the passage of the air due to sharp edges of the blades or vanes in the plane type shutter is eliminated in the present design.

It will be understood that changes may be made in the details of construction and arrangement of parts above described within the purview of our invention.

What we claim is:—

1. Oil burning apparatus comprising a burner tube, an air register surrounding the same, a casing enclosing said tube and register, said casing having a partition or wall intermediate its ends, whereby two chambers are provided, one of said chambers accommodating said register, the other of said chambers communicating with said burner tube, a fan in said last-mentioned chamber, said casing being provided with an inlet for air forwardly of said partition, and a conduit extending into said partition adjacent said inlet and having its other end in communication with the chamber of said fan, whereby air entering said inlet branches, a portion thereof passing directly to said register in the one compartment of said casing, the remainder passing to the fan chamber provided by the other compartment of said casing.

2. Oil burning apparatus comprising a burner tube, an air register surrounding the same, a casing enclosing said air register and tube, a partition extending transversely of said casing dividing the same into two compartments, one of which accommodates said air register, the other of which is in communication with said burner tube, a fan in the last-mentioned compartment for compressing air and delivering the same to said tube, said casing being provided with an inlet for air, a conduit exterior of said casing, one end of said conduit extending through a wall of said casing adjacent the air inlet, the other extending into the wall of the fan compartment, whereby air entering the casing through said inlet branches, a portion thereof passing directly to said register the remainder passing to the fan compartment to be compressed thereby and delivered to said tube.

3. Oil burning apparatus comprising a burner tube, an adjustable air register surrounding the same, a casing enclosing said register and tube and having an inlet for the admission of air to the casing at the rear of said register, a partition extending transversely of said casing dividing the same into two compartments, one of which is in constant communication with said tube, said register being located in the other of said compartments, a fan located in the first of said compartments, a conduit exterior of the casing, one end of which is in communication with the register compartment of the casing,

the other end of which is in communication with the fan compartment of the casing, and a damper adjacent the inlet of the casing for controlling the air passing thereinto, said air branching, a portion thereof passing directly to the register, the remainder directly to the fan compartment.

4. Oil burning apparatus comprising a burner tube, an air register surrounding the same, a casing surrounding said register and burner tube, said casing having a transversely and forwardly extending partition, said forwardly extending portion of said partition carrying said burner tube, said partition dividing the casing into two compartments, one of which is out of communication with the burner tube and receives said register, a fan in the other of said compartments, an inlet to the casing for admitting air thereto at the rear of said register, and a conduit passing through one wall of said casing adjacent said inlet and communicating with the fan compartment, whereby air entering said inlet branches, a portion thereof passing directly to the register, the remainder to the fan compartment, means being provided for the direct delivery of air from said fan to the interior of said burner tube, an oil tube within said burner tube for conducting oil toward the forward end thereof, a cup mounted adjacent the forward end of said oil tube, and means for conducting air direct from the fan compartment to the exterior of said cup.

5. Oil burning apparatus comprising a burner tube, a register surrounding the same, a casing enclosing the register and tube, an air conduit communicating with said casing, a blower for said conduit, a conduit leading from said first-mentioned conduit to the rear of said casing, said casing being provided with a compartment in communication with said last-mentioned conduit, a fan in said compartment for delivering air to the burner tube, air supplied by said blower to the apparatus branching, a part of said air passing directly to said register, the remainder passing through the second intermediate conduit to the fan compartment.

6. Oil burning apparatus comprising a burner tube, an air driven rotary atomizing cup within the same, a rotary fan axially aligned with said tube for supplying air thereto to drive the cup, ar air register surrounding said tube, a casing completely enclosing said register, fan and tube, and a valve-controlled inlet to the casing at the rear of said register intermediate the fan and register.

7. Oil burning apparatus comprising a burner tube, an air driven rotary atomizing cup within the same, a rotary fan axially aligned with said tube for supplying air thereto to drive the cup, an air register surrounding said tube, a casing completely enclosing said register, fan and tube, a valve-controlled inlet to the casing at the rear of said register intermediate the fan and register, and a conduit branching from said casing adjacent the air inlet thereof for conducting air to said fan.

8. Oil burning apparatus comprising a burner tube, an air driven rotary atomizing cup within the same, a rotary fan axially aligned with said tube for supplying air thereto to drive the cup, an air register surrounding said tube, a casing completely enclosing said register, fan and tube, a valve-controlled inlet to the casing intermediate the fan and register, and a conduit branching from said casing adjacent the air inlet thereof opening into the chamber of said fan, so that air entering said inlet is divided, a portion of the air passing to the register, the remainder to the said fan.

This specification signed this 11th day of December, 1928.

JAMES N. MACRAE.

This specification signed this 11th day of December, 1928.

RALPH S. THORESEN.