

T. W. MUCKLE.

BURNER.

APPLICATION FILED JULY 30, 1918.

1,302,950.

Patented May 6, 1919.

2 SHEETS—SHEET 1.

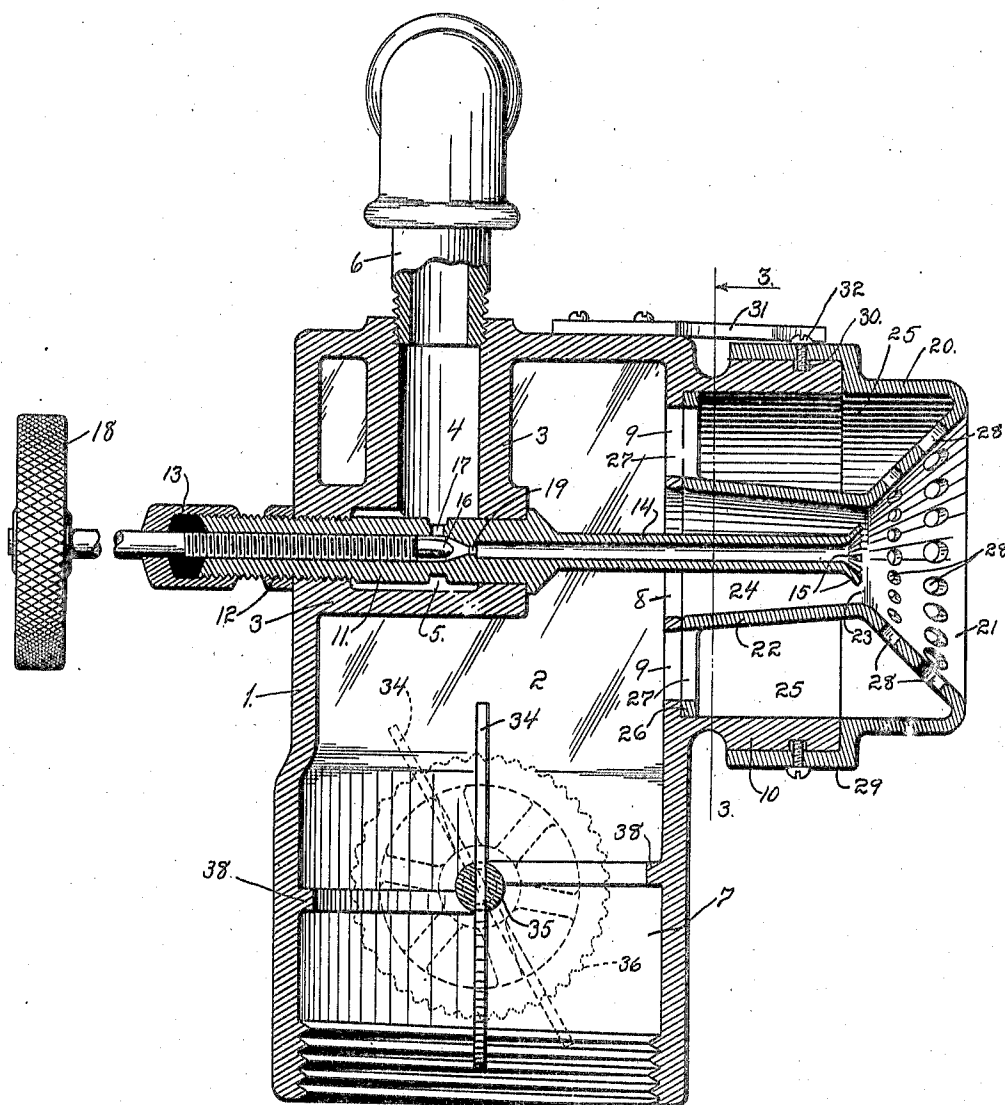


Fig. 1.

Witnesses

John B. Oade.

Inventor

Theodore W. Muckle.

by Wilkinson & Ginstel

his Attorneys

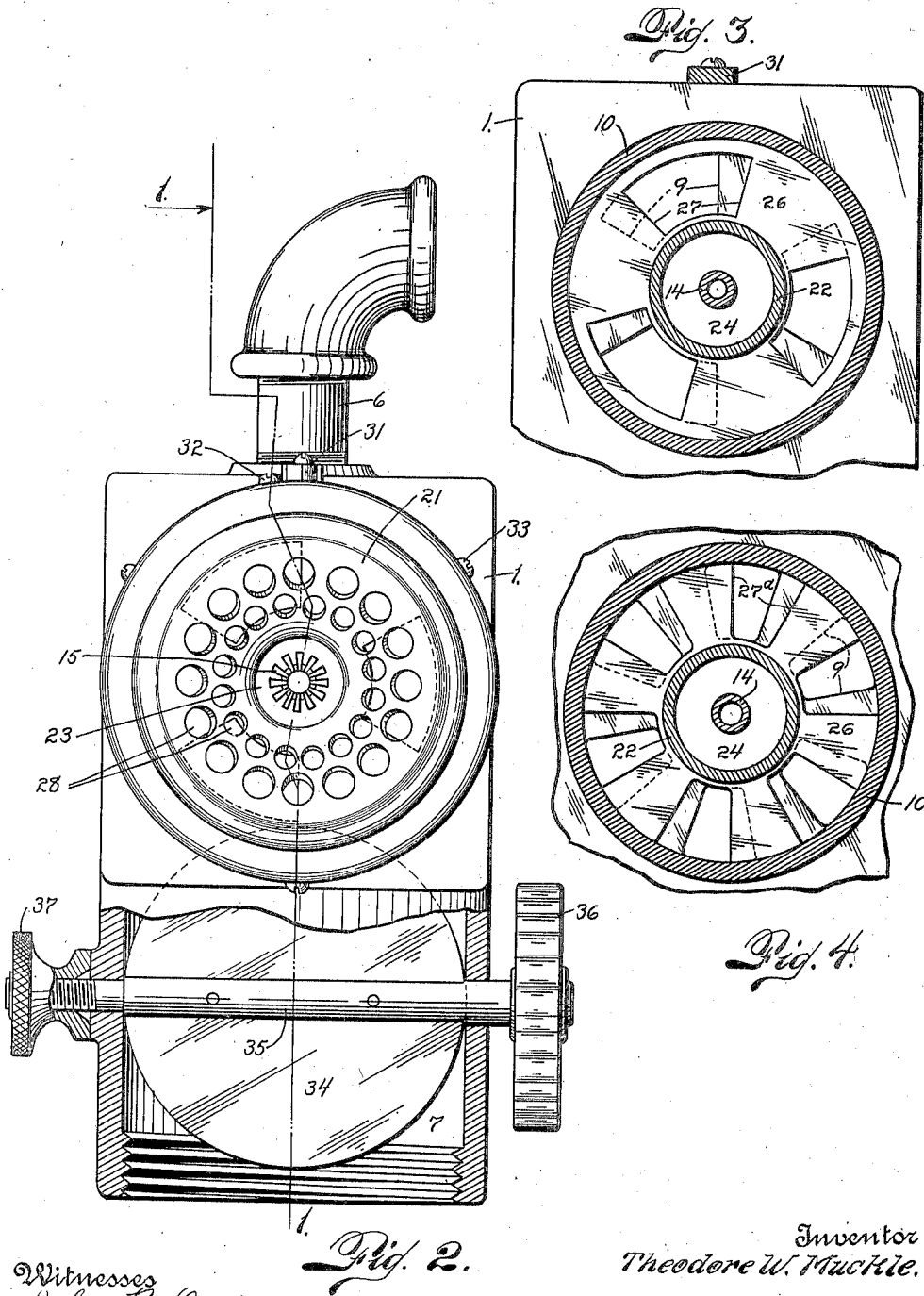
T. W. MUCKLE.
BURNER.

APPLICATION FILED JULY 30, 1918.

1,302,950.

Patented May 6, 1919.

2 SHEETS—SHEET 2.



Witnesses
John B. Wade

Inventor
Theodore W. Muckle.
by Wilkinson & Ginstad

his Attorneys

UNITED STATES PATENT OFFICE.

THEODORE W. MUCKLE, OF DENVER, COLORADO.

BURNER.

1,302,950.

Specification of Letters Patent.

Patented May 6, 1919.

Application filed July 30, 1918. Serial No. 247,454.

To all whom it may concern:

Be it known that I, THEODORE W. MUCKLE, a citizen of the United States, residing at the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in 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.

This invention relates to improvements in burners, and more particularly to that type of burner utilizing a hydrocarbon oil, which is caused to flow and be entrained by a pressure stream of atomizing air, the resultant blast of combustible mixture being further supplied by an auxiliary source of air, to provide additional oxygen for enhancing combustion, where it is desired to feed a greater quantity of fuel oil than would normally be intimately taken up by the initial atomizing air.

A practical form of this type of burner is illustrated by the W. W. Case, Sr., Patent #1,003,873 of September 19, 1911, over which the present invention is designed as a substantially distinct improvement, but it will be apparent, from the following disclosure, that my improvements may generally be employed effectively with other analogous forms of burners, and whether or not the fuel be actually a hydrocarbon oil in its restricted sense. It will be understood, therefore, that, in the employment of the term oil, fuel, or the like, the invention is not necessarily limited to the specific use of oils, where a gas, or even other suitable highly volatile hydrocarbon substances may be found practical as an expedient fuel, when reduced to fluidity.

In the structure of the Case patent, however, and such others in the art embodying the principle involved, the auxiliary supply of air, while regulable in volume perhaps, is not regulable in point of pressure relatively to the pressure of the atomizing air, for while the auxiliary air is diverted, it is still supplied from the same source and under the same pressure as the said entraining or initial atomizing air.

When such a burner is associated with a metallurgical furnace, for instance, or in analogous employment, the resultant blast

flame, upon ignition of the combustible mixture, is projected with great force toward that side of the combustion chamber opposite to the burner opening, so that heating is naturally more intense at positions distant from the entrance into the furnace body or combustion chamber.

The primary object of the present improvements, therefore, in advancing the effectiveness of this type of burner, is to provide means, whereby this auxiliary or secondary source of air is made regulable both as to volume and pressure, independently of the entraining atomizing air, and is so introduced, into intimate association with the carbureted and burning mixture, as to partly control the projection of the blast flame, and aid combustion at the entrance of the combustion chamber to more evenly or uniformly distribute the heat therein.

Further initial reference to other objects and advantages would only be unnecessarily prolix, being more clearly apparent as incidental to the following description, and reference will now be had to the accompanying drawings, illustrating a practical embodiment of the improvements, in which drawings—

Figure 1, is a vertical sectional view, taken along the line 1—1 of Fig. 2; Fig. 2, is a front elevational view of the burner, the lower casing being broken away and parts being shown in section to illustrate the mounting of a valve control for the air inlet; Fig. 3, is a fragmentary vertical sectional view, taken along the plane of the line 3—3 of Fig. 1; and Fig. 4, is a view similar to Fig. 3, but showing a modified construction.

1 designates the burner casing, providing an upper box-like housing for an air chamber 2 and an internally cast hollow support 3, forming a vertical oil inlet 4, terminating at its lower end in a horizontally disposed chamber 5, the upper end of the oil inlet being connected up with an oil supply pipe 6.

The lower end of the casing extends downwardly as a cylindrical (or a conical) nipple or hollow extension, to provide an enlarged air inlet 7, threaded to connect up with a conduit pipe supplied with air under pressure, preferably from a rotary blower of the low pressure type, not shown.

The upper front wall of the casing is provided with an enlarged central aperture or opening 8, circumscribed by a series of apertures 9, illustrated in Fig. 3 as being of segmental shape and three in number, although obviously they may be of any suitable number and contour.

Projecting forwardly of said casing is a shallow rim or hollow circular boss 10, encompassing said apertures 8 and 9, and preferably cast integral with the casing front.

The internal support 3 is apertured, in line with the chamber 5, to receive a longitudinally bored plug member 11, the outer end of which is threaded and projects through the rear of the casing to receive a lock nut 12 and stuffing box 13, while the inner end extends forwardly through and substantially beyond the central opening 8, as an elongated reduced oil discharge pipe nozzle 14, terminating in subdividing means for the outflowing oil, illustrated by flaring spaced fingers 15, although obviously other well known equivalent means might be employed, such as a freely perforated cap member.

The bore of the pipe 14 may be less in diameter than the bore of the rear portion of the plug member 11, which latter receives the threaded spindle of a needle valve 16, controlling the admission of oil through the inlet port 17, and operated by a milled wheel 18. Thus far the arrangement is practically similar to that of the Case patent heretofore mentioned.

An important distinction, however, is that the fingers 15, at the end of the nozzle, project substantially beyond the central opening 8, instead of terminating in line therewith. Also the bore of the plug member 11, between the port 17 and the bore of the pipe nozzle 14, is of a novel formation, including an intermediate restricted inlet port 19 opening from the conical end of the needle valve seat into the pipe nozzle proper, so that when oil is forced therethrough, by gravitation or otherwise, the pressure is relieved as it falls into the bore of the pipe nozzle, an important advantage which will be hereinafter more fully emphasized.

Means are provided at the delivery end of the burner for directing the projected course of the atomizing and auxiliary air blasts before referred to.

Although not necessarily limited to the exact structure, as illustrated this means consists in detail of a rotatably mounted unitary controlling cap or hollow head, comprising an annular wall portion 20, having an interiorly projecting funnel-shaped shell, formed by reversely joined truncated conical sections 21 and 22. The outer section 21 is comparatively shallow and flares outwardly, while the inner section 22 is

more elongated and terminates in registered alinement with the central opening 8 of the foraminated front wall of the burner casing, the position of merger 23, between the cone sections, being of slightly less diameter than the opening 8, thus providing a restricted annular space encompassing the discharge end of the pipe nozzle after the fashion of an aspirator.

The construction of this unitary controlling cap provides not only the conically converging channel 24, for receiving the atomizing air at constant pressure and volume, but also provides the enlarged annular expansion chamber 25 therearound, for controlling the volume and reducing the pressure of the auxiliary air from the same source of supply—the pressure air chamber 2, the volume of this auxiliary air being controllable by means of the foraminated inner flange plate or disk 26, of the cone section 22, which disk is rotatably mounted therewith flatwise against the foraminated front wall of the burner casing, the apertures 27 thereof corresponding in number and shape to the apertures 9 of the casing wall, and adapted to be brought into and out of register therewith.

The outwardly flaring wall 21 of the shell is apertured with one or more circular series of small delivery orifices 28 for the auxiliary air, and owing to the conical shape of this frontal wall, the auxiliary air is delivered forwardly, as conical sheets of jets, enveloping the carbureted mixture, issuing through the opening 23, with an entrained glancing action.

The rotatable mounting of the unitary controlling cap may be effected through the medium of a circular offset flange portion 29, encompassing the boss 10 of the burner casing, and is maintained in place by a plurality of guide screws riding in a peripheral groove 30 of the boss 10. Limiting stops are also employed, which cooperate with a fixed pointer 31 for indicating the open and closed positions of the burner, and these limiting stops may obviously be separate elements, or simply two of the guide screws as indicated at 32 and 33.

As previously stated the lower end of the burner casing is connected up by a conduit pipe, preferably with a rotary blower of the low pressure type, delivering air to the chamber 2 at an approximate pressure of eight ounces. To control the volume of air thus delivered and hence the pressure in the chamber 2, within the limits of zero to eight ounces, there is located in the enlarged air inlet 7 a damper or butterfly valve 34 rotatably supported on a cross shaft 35, operated at one end by the milled wheel 36, and at its other end provided with a thumb screw lock nut 37. Thus by manipulating the milled wheel 36 with the left hand in one direction

and the lock nut 37 in the reverse direction with the right hand, a nicety of adjustment is afforded for regulating the air supply at the inlet end of the burner casing. 38 simply designates an internally projecting seating ledge for the butterfly valve 34.

In Fig. 2, the burner is illustrated in its full open position, and in Fig. 3, it is shown as being only partly open, while the slight modification of Fig. 4 is substantially the same as in Fig. 3, excepting that a greater number of retarding openings 9 and 27^a are employed, while the openings 27^a of the retarding disk 26 are cut clean out to the edge instead of leaving a slight marginal rim as in Fig. 3.

As the action and general efficiency of the type of burner illustrated is well understood in the art, especially as disclosed in the Case patent heretofore mentioned, it will only be necessary to refer more particularly, in the following statement of operation, to those features, which are deemed substantial improvements over prior constructions.

The flow of the fuel oil is controlled primarily by the needle valve 16 cooperating with the inlet port 17, but by employing the intermediate inlet port 19, of restricted opening, the pressure behind this flow of oil is relieved as the oil enters the bore of the pipe nozzle 14, so that it is caused to flow and be drawn more evenly into the zone of its atomizing air, owing to the equable aspirating force of the latter (projected through the annular space 23 encompassing the oil subdividing nozzle tip) rather than having the tendency of being spurted therein, as subdivided jets, from the pressure behind.

In the instant case, the oil nozzle tip projects substantially forward of the constant central opening 8, and the atomizing air blast, passing through the passageway 24, is converged toward the spreading fingers 15, or analogous means, into more intimately compressed assimilation with the molecular particles of the subdivided oil, tending to adhere thereon in film-like fashion, thus insuring the most effective carburetion.

From this position (the annular space 23) the carbureted mixture begins to spread out into a divergent cone, the degree of divergence being dependent upon the force of the atomizing air blast, which will also determine the length of the cone or the position, substantially distant from the burner, where the mixture will begin to burn, after ignition.

The force of the atomizing air blast may be effectively controlled by the butterfly valve 34, between the limits of zero and eight ounces, where the rotary blower is designed to create an eight ounce pressure. For instance if the valve 34 is only partially open, the volume of pressure air, through the inlet 7, is decreased accordingly, and will expand

and be proportionately reduced, in the pressure chamber 2, to any desired extent. In that case, the length of the cone of combustible mixture would be shortened, while the degree of divergence would be increased.

Thus within the atomizing pressure limits of zero to eight ounces, the dimensions of the cone of combustible mixture, the concentration of its ignition position, and the amount of heat generated may be controlled for obvious reasons, without opening up the auxiliary air passage at all, by simply adjusting the butterfly valve 34 and regulating the oil feed relatively to the atomizing blast.

But if an intensified heat is desired, with the atomizing air pressure maintained at any predetermined degree, then it being necessary to feed more oil to the burner, it also becomes necessary to open up the auxiliary air passageway in commensurate proportion to the additional oil supplied, for furnishing the necessary oxygen to enhance combustion. This latter is accomplished by simply turning the controlling cap the desired distance, between the limiting stops 33—32, to bring the apertures 27, of the disk flange regulator 26, into partial or complete registration with the apertures 9 in the foraminated front wall of the burner casing.

When so regulated, the pressure air from the chamber 2, passing into the annular chamber 25, will expand and be discharged, at a reduced pressure or almost as still air, through the orifices 28, into a glancing entrained admixture with the oil and atomizing air, in the manner previously set forth. Thus not only will complete combustion be attained but also the position of ignition of the combustible cone will be advanced close in toward the burner opening of the furnace, and the interior of the latter thereby heated more uniformly throughout or from one end to the other.

From the foregoing complete disclosure, it will therefore be observed that, in the adoption of the present invention, all arising conditions, of varying desired control over the flame generated, heretofore requiring several sizes of burners, are adequately and fully provided for, in a single burner, by the simple combined expedients of the butterfly valve arrangement and unitary controlling cap, operated independently or conjointly as occasion may require; and while provision has only been suggested for a rotary blower developing eight ounce pressure as the maximum, which has been found to be the approximate standard for general uses, still it is to be understood that the invention is equally applicable for use with higher pressures developed, thereby increasing its range of employment accordingly.

Finally, the invention is not limited to the exact details as specifically disclosed, excepting as they fall within the purview of the

ensuing claims, when construed in the light of the specification, contemplating a fair range of equivalents.

What I do claim, as new and patentable, is:—

1. The combination with a burner casing, providing a primary pressure air chamber, a pressure air inlet therefor, and an oil inlet; of a nozzle leading from said oil inlet; outlet means for said primary chamber so formed and disposed, relatively to the discharge end of said nozzle, as to direct an entraining blast-stream of atomizing air into carbureted admixture with the discharging oil; a suitably walled expansion chamber for receiving a supply of auxiliary air from said primary chamber; regulable communicating means therebetween for controlling the volume of said auxiliary supply; and outlet means for said expansion chamber, suitably formed and disposed to deliver said auxiliary air into entrained impregnation with the aforesaid carbureted blast-stream and at a substantially reduced pressure relatively thereto, substantially as described.

2. The combination with a burner casing, providing a primary pressure air chamber, a pressure air inlet therefor, and an oil inlet; of a nozzle leading from said oil inlet; outlet means for said primary chamber so formed and disposed, relatively to the discharge end of said nozzle, as to direct an entraining blast-stream of atomizing air into carbureted admixture with the discharging oil; a suitably walled expansion chamber for receiving a supply of auxiliary air from said primary chamber; regulable communicating means therebetween for controlling the volume of said auxiliary supply; and outlet means for said expansion chamber, suitably formed and disposed to deliver said auxiliary air, as a converging encompassing cone of substantially reduced pressure, into entrained impregnation with the aforesaid carbureted blast-stream, substantially as described.

3. The combination with a burner casing, providing a primary pressure air chamber, a pressure air inlet therefor, and an oil inlet; of a nozzle leading from said oil inlet; outlet means for delivering atomizing pressure air from said primary chamber to the discharging oil; a hollow capping member disposed forwardly of said nozzle, and providing a suitably walled expansion chamber cooperating with said primary chamber; regulable communicating means, between said primary and expansion chambers, embodying apertured wall parts adapted for controlled registration; and auxiliary air outlet means for said expansion chamber, the several elements being operatively associated and disposed, to function in combined relation, substantially as described.

4. The combination with a burner casing,

providing a primary pressure air chamber, a pressure air inlet therefor, and an oil inlet; of a nozzle leading from said oil inlet; outlet means for delivering atomizing pressure air from said primary chamber to the discharging oil; a rotatably mounted capping member, providing a suitably walled revoluble expansion chamber cooperating with said primary chamber; regulable communicating means, between said primary and expansion chambers, controlled by the rotation of said capping member; and auxiliary air outlet means for said expansion chamber, the several elements being operatively associated and disposed, to function in combined relation, substantially as described.

5. The combination with a burner casing, providing an oil inlet chamber, a primary pressure air chamber, and a pressure air inlet for the latter; of a nozzle leading from said oil inlet chamber to the exterior of said casing; outlet means for said primary chamber so formed and disposed, relatively to the discharge end of said nozzle, as to direct an entraining stream of atomizing air into carbureted admixture with the discharging oil; a butterfly valve disposed in said pressure air inlet for controlling the volume of air delivered to said primary chamber; and regulable coacting means for delivering a predetermined supply of auxiliary air from said primary chamber, in the form of a converging encompassing cone of substantially reduced pressure, into entrained association with the resultant carbureted mixture, substantially as described.

6. The combination with a burner casing, having an oil inlet chamber, a primary pressure air chamber, and a pressure air inlet therefor; of a nozzle leading from said oil inlet chamber and terminating in a discharge tip providing oil subdividing means; an inlet port for said oil inlet chamber with a controlling needle valve therefor; a reduction port interposed between the chamber of said needle valve and the bore of said nozzle, for relieving the pressure behind the flowing oil; outlet means for said primary chamber so formed and disposed, relatively to the discharge end of said nozzle, as to direct an entraining stream of atomizing air into carbureted admixture with the discharging oil; and regulable coacting means for supplying auxiliary air as desired, from said pressure air source to the resultant carbureted mixture, substantially as described.

7. The combination with a burner casing, providing an oil inlet chamber and a pressure air inlet, the front wall of said casing having an atomizing air outlet, circumscribed by a plurality of auxiliary air outlets; of a nozzle leading from said oil inlet chamber into proximity with said atomizing air outlet; means for controlling the flow of oil therethrough; a unitary capping member

having an internal central tubular element, encompassing the discharge tip of said nozzle, in open communication with said atomizing air outlet, and providing for an exterior
 5 annular expansion chamber; a flange plate carried by the inner end of said tubular element, forming the rear wall of said expansion chamber, and foraminated with a series
 10 of auxiliary air inlets for the latter; means permitting of the correlative adjustment of said auxiliary air outlets and inlets to bring them into and out of registration; and means
 15 for delivering auxiliary air from said expansion chamber, as desired, into entrained association with the combustible blast charge resulting from the admixture of the fuel oil and its atomizing air, substantially as described.

8. The combination with a burner casing, providing an oil inlet chamber and a pressure air inlet, the front wall of said casing having an atomizing air outlet encompassed
 20 by auxiliary air outlets; of a nozzle leading from said oil inlet chamber into proximity with said atomizing air outlet; means for controlling the flow of oil therethrough; and
 25 a unitary hollow controlling cap member, rotatably mounted to coact with the foraminated front wall of said burner casing, comprising an annular wall, a frontal wall having an enlarged central discharge opening, a
 30 tubular extension projecting inwardly therefrom, in spaced relation to said annular wall, and a disk flange carried at the inner end of said tubular extension, said disk flange being
 35 foraminated for registration with said auxiliary air outlets, and the frontal wall of said cap member providing auxiliary air discharge orifices surrounding said central discharge opening, the whole being combined
 40 and functioning, substantially as described.

9. The combination with a burner casing, providing an oil inlet chamber and a pressure air inlet, the front wall of said casing
 45 having an atomizing air outlet encompassed by auxiliary air outlets; of a nozzle leading from said oil inlet chamber through and beyond said atomizing air outlets; means for controlling the flow of oil therethrough; and
 50 a unitary hollow controlling cap member,

rotatably mounted to coact with the front wall of said burner casing, comprising an annular wall, a centrally spaced funnel-shaped shell projecting inwardly therefrom, and a disk flange carried by the inner end of
 55 the latter, said disk flange being foraminated for registration with said auxiliary air outlets, and the frontal outwardly flaring wall of said funnel-shaped shell providing auxiliary air discharge orifices, the whole being
 60 operatively combined and functioning, substantially as described.

10. The combination with a burner casing, providing an oil inlet chamber and a pressure air inlet, the front wall of said casing
 65 having an atomizing air outlet, surrounded by auxiliary air outlets, encompassed in turn by a hollow forwardly projecting circular boss; of a unitary hollow controlling cap member, comprising an annular wall rotatably
 70 mounted upon said hollow circular boss, a centrally spaced funnel-shaped shell projecting inwardly therefrom, formed by reversely joined truncated cone sections, the frontal cone section flaring outwardly, and
 75 the inner cone section diverging inwardly to register with said atomizing air outlet, and a disk flange carried by the inner end of said inner cone section, said disk flange being foraminated for registration with said auxiliary
 80 air outlets and forming the rear wall of an enlarged expansion chamber confined by said circular boss and said cap member, while the flaring frontal wall of said cap member provides auxiliary air discharge orifices; an index pointer projecting from said
 85 burner casing over said cap member; limiting stops on said cap member for engaging said index pointer; a nozzle leading from said oil inlet chamber into said inner conical section and terminating in an oil subdividing
 90 tip proximate to the joinder of said cone sections; means for controlling the flow of oil through said nozzle; and means for controlling the volume of pressure air delivered through said pressure air inlet, substantially as described.

In testimony whereof, I affix my signature.

THEODORE W. MUCKLE.