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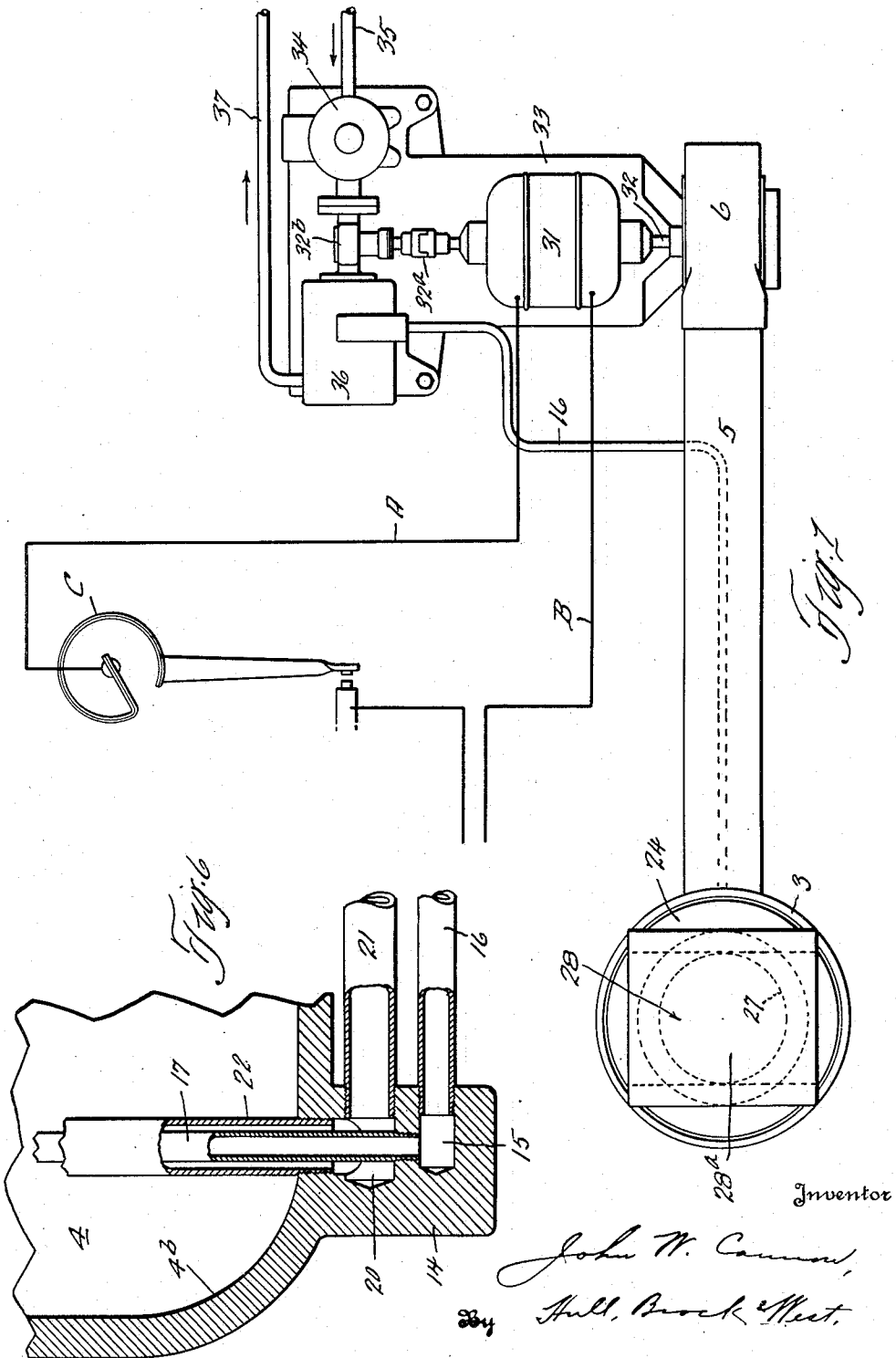
J. W. CANNON

1,933,044

APPARATUS FOR BURNING OIL

Filed Dec. 26, 1929

4 Sheets-Sheet 1



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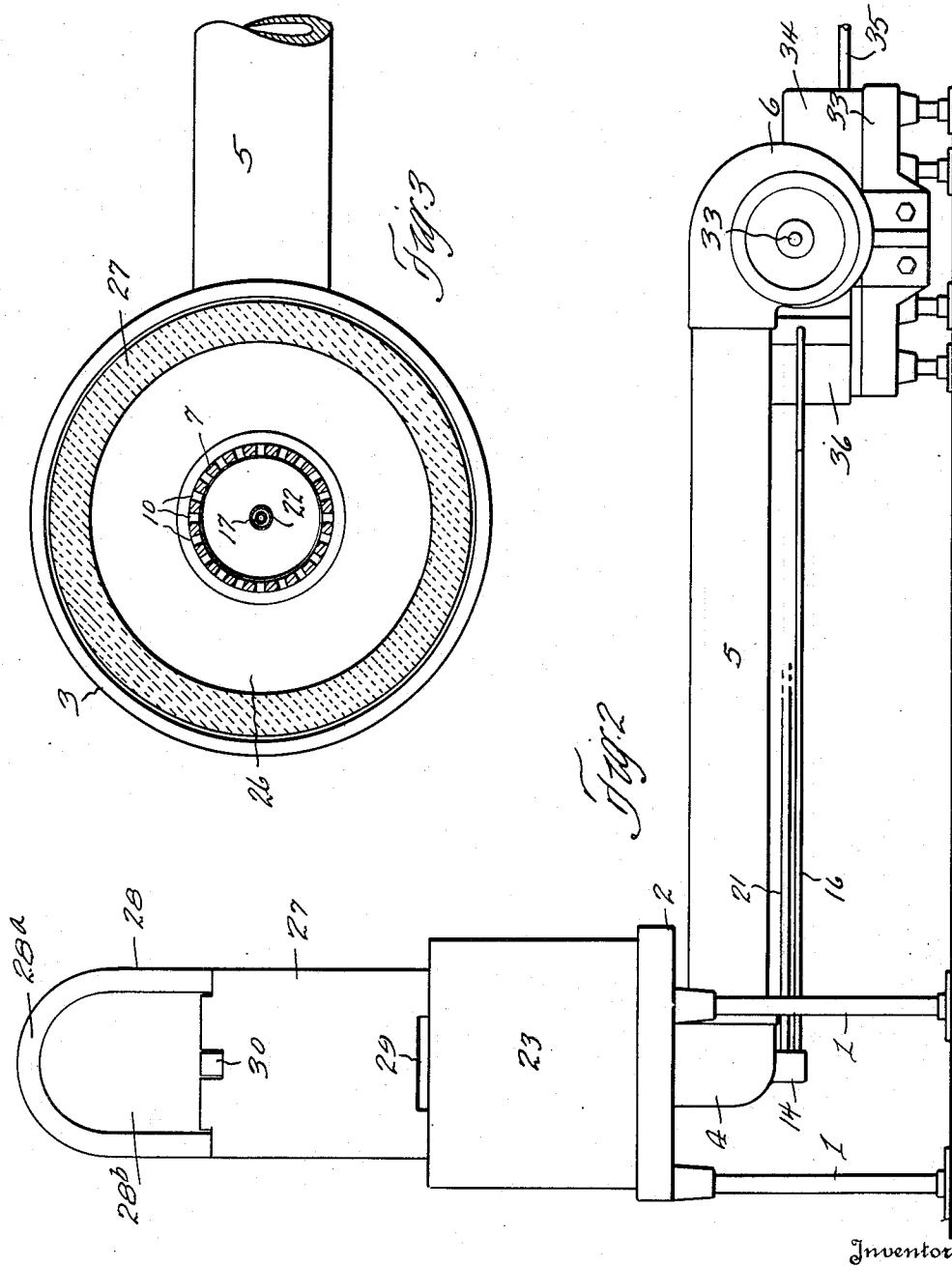
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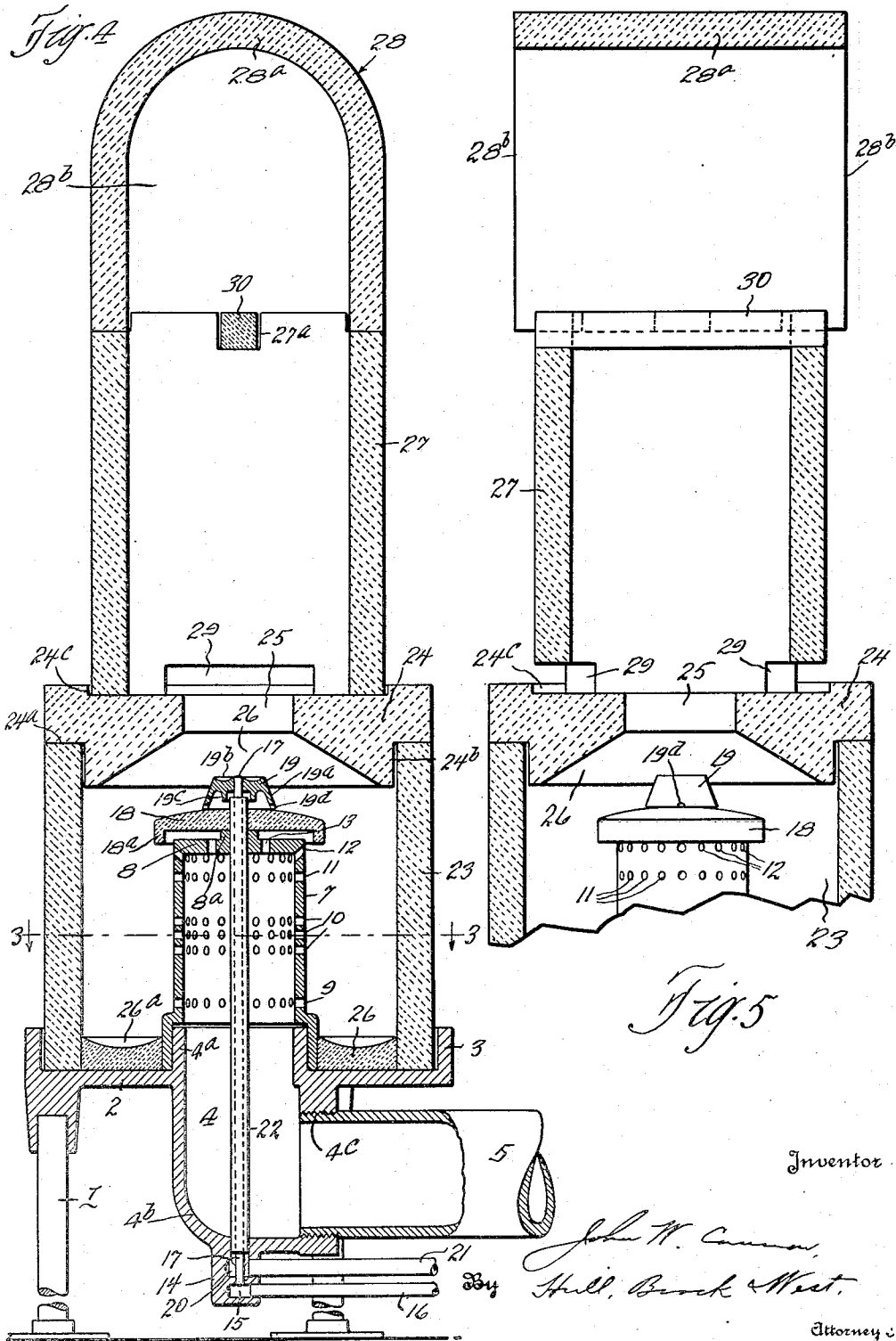
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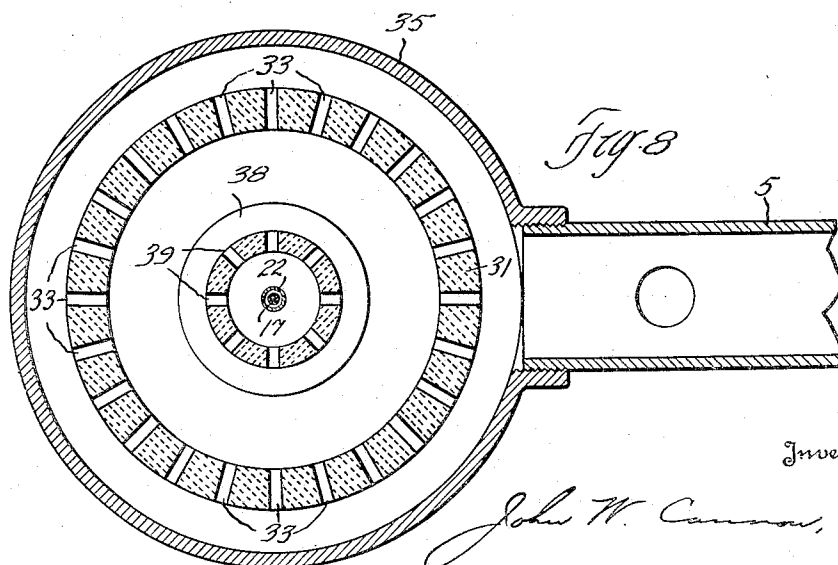
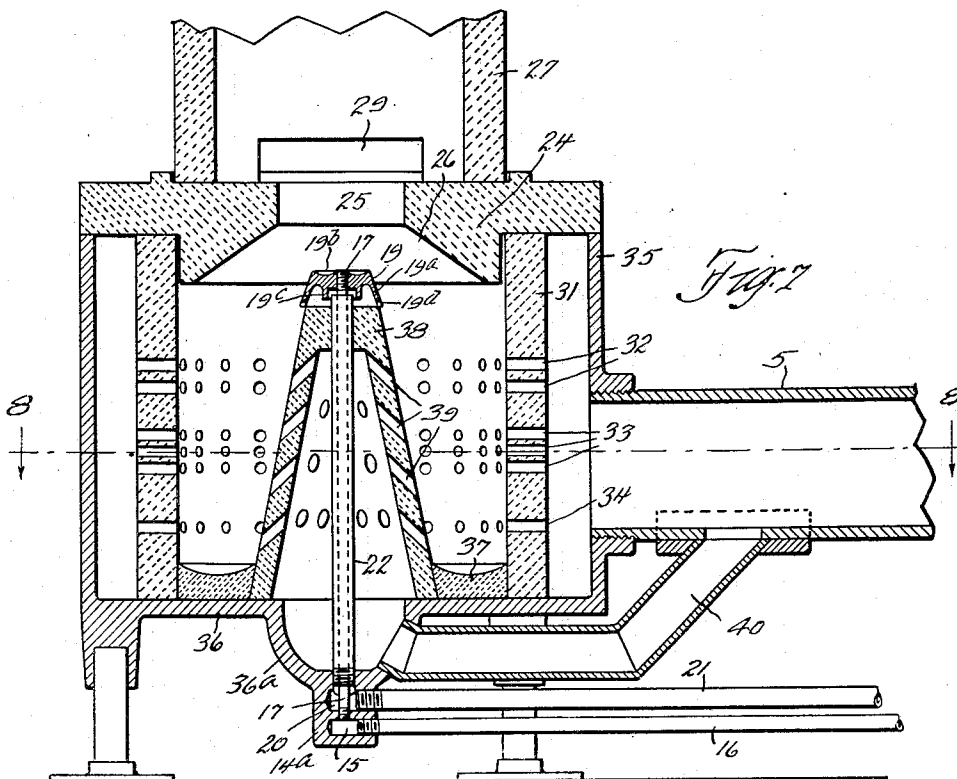
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

1,933,044

APPARATUS FOR BURNING OIL

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Serial No. 416,469

12 Claims. (Cl. 158—92)

This invention relates to an apparatus for burning oil and has for its general purpose and object the production of an apparatus of this character which will enable oil to be burned, and the heat generated by the combustion thereof to be utilized, in a particularly efficient manner; also the production of a burner apparatus which is capable of burning and utilizing efficiently oil of low gravity, such as No. 3 heavy furnace oil, as well as oil of higher gravity. Further and more limited objects of the invention will appear hereinafter and will be realized in and through the construction and arrangement of parts shown in the drawings, wherein Fig. 1 represents a somewhat diagrammatic plan view of a fuel burning system including one form of burner embodying my invention; Fig. 2 a side elevation of the system and burner shown in Fig. 1; Fig. 3 a sectional view corresponding to the line 3—3 of Fig. 4; Fig. 4 a central vertical sectional view through the burner shown in the preceding views; Fig. 5 a similar view through the upper portion of the burner shown in Fig. 4 and taken at right angles to the former view; Fig. 6 a detail in section through the lower portion of the burner shown in Figs. 2 and 4; Fig. 7 a vertical sectional view through the lower portion of a modified form of burner; and Fig. 8 a sectional view corresponding to the line 8—8 of Fig. 7.

Describing the various parts by reference characters and first in connection with Figs. 1-6 inclusive, 1 denotes a plurality of standards supporting the circular base 2 of a firepot, the base being preferably of cast iron and having an annular vertical marginal wall 3. Preferably cast with the base 2 is a central air supply chamber 4, the said chamber having a portion 4^a projecting above the base and preferably to about the height of the wall 3 and having a portion 4^b depending below the base and closed at the bottom and provided in one side thereof with a threaded opening 4^c for the reception of the pipe 5 by means of which air is supplied through the chamber 4 from a blower 6.

Air delivered to the chamber 4 through the pipe 5 is forced into a cylindrical distributor 7, the lower end of which surrounds the upper end 4^a of the chamber 4, the upper end of the distributor being provided with an integral cover 8. The distributor may be of any suitable refractory material capable of withstanding the temperature existing within the firepot and is provided in its cylindrical wall with a lower horizontal series of openings 9, in the intermediate

portion of such cylindrical wall with several horizontal series of openings 10, in its upper portion with a horizontal series of openings 11, and at the junction of its side and its cover with a horizontal series of upwardly inclined openings 12; the cover 8 being provided with a plurality of vertical openings 13 near the center thereof.

The lower portion of the chamber 4 is provided with a hub 14 having in the lower portion thereof a chamber 15 which receives oil from a pipe 16 and delivers such oil to a small pipe 17 which extends axially of the chamber 4 and distributor 7 and through the cover of the distributor and through a pair of spreaders indicated respectively at 18 and 19. The hub 14 is provided, above the chamber 15, with a chamber 20 which receives gas from a pipe 21 and delivers it through a pipe 22 which surrounds the pipe 17 and extends through the spreader 18 to a point below the bottom of the spreader 19.

It will be noted that the spreader 18 is supported on a central hub 8^a projecting from the center of the top of the cover 8 and through which hub the pipes 17 and 22 extend, and that the top of this spreader is upwardly convex, the spreader being provided at its periphery with an annular depending flange 18^a which is spaced from but overhangs slightly the top of the distributor.

The spreader 19 is considerably smaller than 85 the spreader 18 and is supported from the former spreader by means of its frusto conical wall 19^a. It will be noted that the spreader 19 is provided with a trough 19^b between the center and the periphery thereof; also that it is provided on its under surface with a depending circular wall 19^c which surrounds and is spaced from the upper end of the pipe 22.

The distributor and spreaders are mounted within a firepot comprising the base 2, the cylindrical side wall 23, and a cover 24 having a central cylindrical opening 25 above the spreaders 18 and 19, the bottom of this opening merging with the top of a frusto-conical recess 26 formed in the cover and extending upwardly from the outer portion of the bottom of the cover to the bottom of the opening 25. The upper end of the wall 23 supports the cover by means of an annular seat 24^a on the bottom of the latter, the said cover having a cylindrical wall 24^b depending and fitting within the upper end of the wall 23. The wall 23 and the cover 24 are of refractory material capable of withstanding the temperatures to which they are subjected. I have found silicon carbide to be ad-

mirably adapted for such wall and cover and for the spreaders 18 and 19.

Surrounding the base of the distributor 7 and interposed between the same and the bottom of the wall 23 is an annular base member 26. This base member is also of suitable refractory material and is provided in its upper surface with an annular recess 26^a which may constitute a trough for holding oil for the preliminary starting of the burner as well as for collecting any unvaporized oil, should the gas-fired pilot burner provided beneath the spreader 19 fail to operate.

Seated on top of the cover 24 is a combustion-chamber hood, the said hood comprising a lower section 27, preferably round in section and seated within a peripheral ledge 24^c on top of the cover, and an upper hood section 28 seated upon the lower section. The top of the upper section is semi-cylindrical in section, as shown at 28^a, and is provided with opposed outlets 28^b.

The complete combustion-chamber hood comprising the members 27 and 28 is provided with means for admitting air through opposite sides of the bottom thereof adjacent to the top of the passage 25, these openings being shown at 29. A baffle bar 30 extends across the top of the lower hood section 27, having its ends mounted in slots 27^a in opposite walls thereof. The parts 27, 28 and 30 are also of refractory material, silicon carbide being preferred for such material.

My apparatus as thus far described is shown as forming part of a system including the blower 6 to which reference has been made hereinbefore. The system indicated in these views consists generally of an electric motor 31, the shaft 32 of which operates the shaft of the blower 6, the blower and the motor being supported upon a base 33. The motor drives, through a coupling 32^a, a pump 32^b to which oil is supplied through a strainer 34 and a pipe 35 from any suitable storage tank (not shown). From this pump oil is delivered to a by-pass tank 36 and thence through the pipe 16 to the burner, the surplus oil being conducted back to the storage tank through the pipe 37. This manner of supplying oil from the storage tank to a by-pass tank and delivering the oil from the by-pass tank to a burner while returning the surplus oil to the storage tank is shown and described in my Patent No. 1,572,591, issued February 9, 1926, and in its details forms no part of the invention covered in this application. The by-pass tank may be of any approved construction, such as disclosed in my aforesaid patent and in my application Serial No. 245,357, filed January 9, 1928. In Fig. 1, A and B represent the conductors for supplying current to the motor, and a thermostatic switch C is shown in the circuit, the switch enabling the burner to be used for either an off-and-on fire, or for a high and low fire, according to the requirements of the particular installation.

With the parts constructed and arranged as described, the operation will be as follows: With the switch C closed, oil will be forced through the pipes 16 and 17 and into the trough 19^b, where it will be heated by the flame of the pilot burner issuing through the notches 19^a in the spreader wall 19^a, and the oil flowing down the spreader 19 and 18 will be ignited by such pilot burner. Air under comparatively low pressure and high velocity will be delivered by the blower through the pipe 5 and through the openings 9,

10, 11 and 12. The air passing through these openings atomizes the oil which drops from the spreader 18, and the oil vapors are burned while held in suspension by such air, mainly in the upper half of the firepot formed below the cover 24. The location and arrangement of the openings 12 blows the oil off the bottom of the flange 18^a. However, should any oil succeed in passing around the bottom of this flange, it will be prevented from passing further by the air discharged through the openings 13 and passing beneath the bottom of the spreader 18 and around the bottom of the flange.

As pointed out hereinbefore, the oil is burned while in suspension, passing through the flame while the air which supports combustion and which atomizes the oil is traveling in the opposite direction from the oil as it is delivered from the spreader. This action subjects the oil most effectively to the action of the flame as well as serving to put it into the best condition for complete and efficient combustion.

Reference has been made to the cover 24 and to the arrangement of the recess 26 and opening 25. This arrangement of cover, recess, and opening concentrates the flame above the tops of the spreaders 18 and 19, thereby heating them to a temperature sufficient to facilitate the distribution of the oil over the surfaces thereof. Furthermore, this heat serves to maintain the top of the spreaders free from any accumulation of carbon, this action being due to the concentration of the flame above and in the vicinity of the spreaders by the cover 24.

The flame and products of combustion pass through the opening 25 under high velocity and entrain air through the openings 29 thereby to facilitate and complete the combustion within the hood 27, 28.

The flame and products of combustion are subjected to a re-circulation in the secondary combustion chamber formed by the hood 27, 28, and the hot walls of this chamber contribute to the rapid combustion therein. The upper or secondary combustion chamber formed by the hood members functions in a manner analogous to a flue whereby, when the blower and oil are shut off, the burner will function in a manner analogous to a lamp to consume the remaining oil vapors without the development of smoke. The baffle 30 in the top of the hood member 27 also facilitates the thorough mixing of the air, flame, and products of combustion and serves as a means for re-igniting this mixture, if accidentally extinguished. Furthermore the baffle, being heated to radiant temperature, will increase the rate of combustion.

The top of the hood 28 is so shaped as to impart a whirling action to the flame and products of combustion prior to their delivery through the oppositely arranged horizontal outlets 28^b. This gives a final mixing of the flame and products of incomplete combustion so that complete combustion is assured at the time the flame and gases of combustion are delivered through the opposed horizontal outlets 28^b; and the hood is particularly useful where it is desired to protect the articles or objects which are heated from direct impingement by the flame and/or gases of combustion.

Summarizing the general operation, combustion is initiated in the firepot proper formed below the cover 24, but is completed in the secondary combustion chamber constituted by the hood members 27, 28. The temperature in the

firepot is very high and serves to gasify the oil with the development of high temperatures within the firepot while burning a quantity of oil which, compared with other burners with which

I am familiar, is very small. As the spreader 18 is of greater diameter than the distributor 7, oil flowing from the spreader cannot come in contact with the wall of the distributor, which might result in the formation of a carbon deposit on the surface of the latter; and this prevention of access of oil to the distributor is further prevented by the passage of the air through the openings therein. The oil enters the firepot at the hottest point in the latter, insuring rapid volatilization of the oil, and it is supplied through the pipe 17 under high velocity (due to the small diameter of the said pipe), thereby preventing the gasification of the oil in the pipe and the choking or clogging of the latter by carbon. Furthermore, the pipe 17 is surrounded by the gas pipe 22, which serves to cool the oil pipe, while both pipes are further cooled by the air passing upwardly in the distributor.

If desired, the burner can be operated with the pot only, including the cover 24, but this will result in producing an elongated flame and will reduce the amount of radiant heat. Furthermore, while the apparatus shown herein will operate without a blower, better results are obtained by the use of the blower, particularly in starting the apparatus in operation, at which time there will be no draft in the flue or chimney of the heating unit. Still further, the use of a blower increases the efficiency of the apparatus, because the air enters the pot at a high velocity, the advantages of such mode of air delivery having been explained hereinbefore.

In Figs. 7 and 8 there is shown a modification of my invention wherein it is contemplated that a hood similar to that shown in the preceding views will be employed, the lower hood member being indicated at 27 and the cover being indicated at 24. The cylindrical side wall of the firepot 31 is similar to the cylindrical wall 24 in the preceding embodiment of my invention, but is provided with vertically spaced horizontally arranged series of openings 32, 33, 34, and this wall is surrounded by an outer cylindrical wall 35, the top of which is engaged by the cover 24. The wall 35 is shown as formed with the base 36 which supports the wall 31 and the troughed base member 37, which is similar to the troughed base member 26 in Fig. 4. The air distributor in this case, indicated at 38, is frusto-conical in shape, having its lower end seated within the base member 37 and being provided with downwardly and outwardly inclined openings 39 in its side wall. The bottom of this distributor registers with the open top of a shallow chamber 36^a at the center of the base 36, this chamber having at the bottom thereof a hub 14^a substantially identical with the hub 14 shown in Figs. 4 and 6 and having therein the chambers 15 and 20 with the former of which the pipes 15 and 16 communicate and with the latter of which the pipes 21 and 22 communicate. The pipes 17 and 22 extend through the top of the distributor 38, the pipe 17 extending through the spreader 19 which is identical in construction with the like-designated spreader in the preceding views, and the pipe 22 serving to deliver gas in the same relation to the spreader 19 as does the like-designated pipe in such preceding views.

The pipe 5 for conducting air from the blower

is connected at its delivery end to the wall 35 and delivers air to the annular space between such wall and the wall 31. A branch pipe 40 leads from the pipe 5 to the wall 36^a and delivers air to the interior of the distributor 38.

The operation of the burner or apparatus shown in Figs. 7 and 8 is similar to that of the apparatus shown in the preceding views. The oil is supplied through the pipes 16 and 17 to the top of the spreader 19 and is there ignited by the pilot burner supplied by gas from the pipes 21 and 22. The oil dripping from the spreader in this case flows along the thickened top of the distributor which functions also as a spreader. By the time the oil reaches the upper series of openings 39, it is met by the air delivered under comparatively high velocity through such openings, and is also subjected to the air entering the upper orifices in the wall 31. The oil vapors, being mixed with air, burn within the firepot, developing a high temperature, and the flame and the products of combustion pass through the opening 25 in the cover 24 and into the hood thereabove, where they are subjected to the same action as described hereinbefore in connection with Figs. 1-6.

Because of the construction and mode of operation of the apparatus shown and described herein, I am enabled to burn efficiently heavy fuel oils, such as No. 3 heavy furnace oil; to accomplish this result without the formation and deposition of carbon on the operating parts of the apparatus; to develop high temperatures within the firepot and within the hood thereabove, with the consumption of a proportionately small quantity of oil; and also to insure a thorough mixing of the oil and air throughout a wide range of operation. For instance, a small-sized apparatus can operate efficiently with three quarts of oil per hour, but can be adjusted so as to burn three gallons of oil per hour efficiently, without any change in construction or design. The apparatus as a whole is of very high efficiency and, for that reason as well as because of its adaptability for use with low-grade oils, is extremely economical in operation.

The cover 24, due to its construction and arrangement with reference to the distributor, directs the products of combustion and the flame away from the distributor. But for this construction and arrangement, the products of combustion and flame would be directed against and into the distributor.

Having thus described my invention, what I claim is:

1. In an apparatus for burning oil, the combination of a firepot, an air distributor extending upwardly from the central portion of the firepot and having perforations in the side wall thereof for the delivery of air into the said firepot, an oil supply pipe extending vertically through the said distributor, a spreader above the said distributor through which the delivery end of the said pipe extends and having an exposed surface for the flow of oil thereover, means for supplying air under pressure to the interior of the said distributor, and means associated with said spreader for igniting the oil delivered by the oil supply pipe upon the said spreader.

2. In an apparatus for burning oil, the combination of a firepot, an air distributor extending upwardly from the central portion of the firepot and having perforations in the side wall thereof for delivery of air into the said firepot,

- a spreader above the said distributor and having an exposed surface for the distribution of oil thereover, an oil supply pipe delivering oil upon said spreader, means for supplying air under pressure to the interior of the said distributor, means associated with the said spreader for igniting the oil delivered by the oil supply pipe to the top of the said spreader, a cover for the said firepot, the said cover having a central opening therethrough and arranged to direct the flame and products of combustion from the firepot in operative relation to the spreader thereby to heat the latter to a temperature to prevent the carbonization of the oil thereon.
3. In an apparatus for burning oil, the combination of a firepot, an air distributor extending upwardly from the central portion of the firepot and having perforations in the side wall thereof for delivery of air into the said firepot, an oil supply pipe extending vertically through the said distributor, a spreader above the said distributor through which the upper end of the said pipe extends and having an exposed surface for the distribution of oil thereover, means for supplying air under pressure to the interior of the said distributor, means associated with the said spreader for igniting the oil delivered by the oil supply pipe to the top of the said spreader, a cover for the said firepot, the said cover having a central opening therethrough and a frusto-conical recess beneath said opening arranged to direct the flame and products of combustion from the firepot in operative relation to the spreader thereby to heat the latter to a temperature to prevent the carbonization of the oil thereon.
4. In an apparatus of the character described, the combination of a firepot, an air distributor extending upwardly from the central portion of the said firepot, a spreader above the said distributor and having an exposed surface for the distribution of oil thereover, an oil supply pipe for delivering oil upon the said spreader, a gas supply pipe for delivering gas in proximity to the said spreader, means for supplying oil and gas through their respective pipes, means for supplying air under pressure to the said distributor, the distributor having openings in the side wall thereof for delivering air into the said firepot, and a cover for the said firepot provided with a central opening therethrough arranged above and in proximity to the said spreader.
5. In an apparatus of the character described, the combination of a firepot, an air distributor extending upwardly from the central portion of the said firepot, a spreader above the distributor and extending beyond the sides thereof, a second spreader mounted centrally above the first-mentioned spreader, an oil supply pipe extending upwardly through said distributor and through the top of the lower spreader and adapted to deliver oil to the top of the second spreader, a gas supply pipe surrounding the said oil pipe in the said distributor and extending through the lower spreader and serving to deliver gas beneath the second spreader, means for supplying oil and gas through their respective pipes, and means for supplying air under pressure to the said distributor, the distributor having openings in the side wall thereof for delivering air into the said firepot below the said spreaders.
6. In an oil burning apparatus the combination of a firepot, an air distributor projecting upwardly from the bottom of said firepot, a spreader above the said distributor and overhanging and extending beyond the side walls thereof, an oil supply pipe extending upwardly through the central portion of said distributor and through the said spreader and adapted to deliver oil upon the said spreader, a gas supply pipe also extending through the said distributor and surrounding the oil supply pipe and terminating below the top of the latter, thereby to provide a pilot burner supply, means for supplying air under pressure to the interior of the said air distributor, the said distributor having openings in the side wall thereof for the delivery of air into the firepot, some of said openings being arranged to direct air against the peripheral edge of the said spreader.
7. In an oil burning apparatus, the combination of a firepot, an air distributor extending upwardly from the central portion of the said firepot, a spreader above the said distributor and having a peripheral flange depending therefrom and overhanging and spaced laterally from the top of said distributor, an oil supply pipe for delivering oil upon the said spreader, a gas supply pipe for delivering gas in proximity to said spreader, means for supplying air under pressure to the interior of the said distributor, the said distributor having openings for the delivery of air to the firepot, some of said openings being arranged to direct air upwardly against the lower edge of the spreader flange, and said distributor also having openings in the top thereof positioned to direct air beneath the bottom of the said spreader within the said flange.
8. In an oil burning apparatus, the combination of a firepot, an air distributor projecting upwardly from the bottom of said firepot, a spreader above the said distributor and having a peripheral flange depending therefrom and overhanging and spaced laterally from the top of said distributor, a spreader above the first-mentioned spreader, an oil supply pipe extending upwardly through the central portion of said distributor and through the said spreaders to deliver oil upon the first spreader, a gas supply pipe also extending through the said distributor and the first-mentioned spreader and surrounding the oil supply pipe and terminating below the second spreader thereby to provide a pilot burner supply beneath the second spreader, means for supplying air under pressure to the interior of the said distributor, the said distributor having openings for the delivery of air to the firepot, some of said openings being arranged to direct air upwardly against the lower edge of the flange of the first spreader and said distributor also having openings in the top thereof positioned to direct air beneath the bottom of the first spreader within the flange thereof.
9. In an oil burning apparatus, the combination of a firepot, a vertically extending air distributor within the said firepot and having openings through the side wall thereof, a spreader supported above the said distributor, a pipe for delivering oil upon said spreader, means for supplying oil under high velocity through said pipe, means for igniting the oil supplied to the said spreader, means for supplying air under high velocity through the openings in the wall of the distributor into the oil and vapors delivered from the said spreader, and a cover for the said firepot, the said cover having an outlet opening positioned to concentrate the flame and

products of combustion delivered through the said cover in proximity to the said spreader.

10. In an apparatus for burning oil, the combination of a firepot having a cover provided
5 with an opening therethrough, means for delivering oil and air under pressure into said firepot and for initiating the combustion of the oil therein, a hood extending from and above the said cover and constituting a secondary combustion chamber, the said hood having a lateral
10 outlet at the top thereof and having openings in the bottom through which air will be entrained by the flame and gaseous products entering the bottom of said hood through the opening in said cover, the top of the hood being
15 arched thereby to impart a whirling action to the flame and gaseous products of combustion and to insure thorough admixture and combustion thereof.

11. In an apparatus for burning oil, the combination of a firepot having a cover provided
20 with a central opening therethrough, means for delivering oil and air under pressure into said firepot and for initiating the combustion of the oil therein, a hood extending from and above the
25 said cover and constituting a secondary combustion chamber, the said hood having a lateral outlet at the top thereof and having openings in the bottom through which air will be
30 entrained by the flame and gaseous products enter-

ing the bottom of said hood through the opening in said cover, the top of the hood being arched thereby to impart a whirling action to the flame and gaseous products of combustion and insure thorough admixture and combustion
80 thereof, and a baffle extending across the upper portion of the said hood below the arched top thereof, the said hood and baffle being made of refractory material having high heat radiating capacity.

12. In an apparatus for burning oil, the combination of a combustion chamber, an air distributor extending upwardly from the central portion of the combustion chamber and having perforations in the walls thereof for delivery of
90 air into the said combustion chamber, a spreader extending beyond the periphery of said distributor and having an exposed surface for the distribution of oil thereover, an oil supply pipe delivering oil upon said spreader, means for
95 supplying air under pressure to the interior of the said distributor, means for igniting the oil delivered by the oil supply pipe to the top of the said spreader, and a cover for the said combustion chamber, the said cover having a central
100 opening therethrough and arranged to direct the flame and products of combustion in heating relation to said spreader.

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