July 31, 1951 R. C. HOPKINS 2,562,460

COMBINATION BURNER EQUIPMENT FOR ROTARY DRIERS

Filed April 15, 1949 2 Sheets-Sheet 1

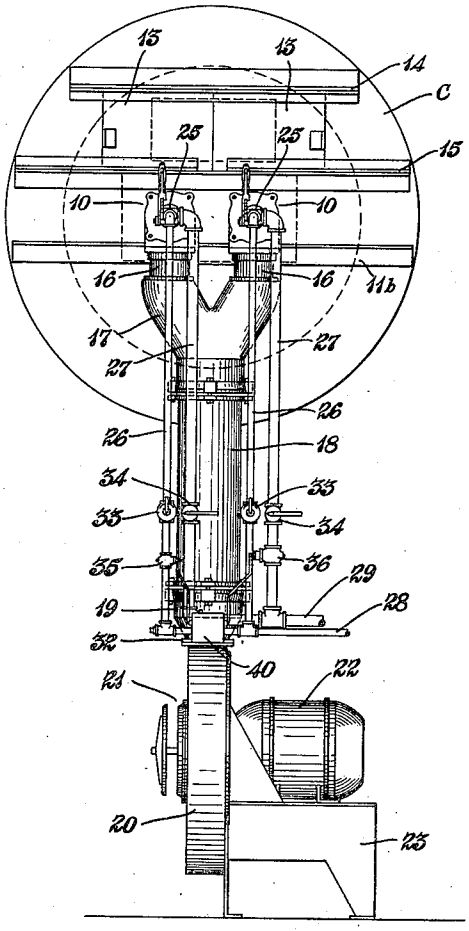


Fig. 1

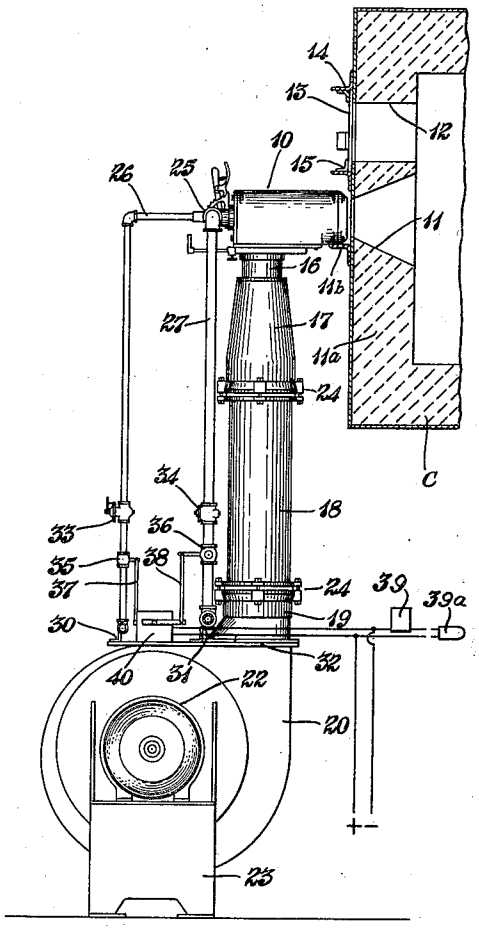


Fig. 2

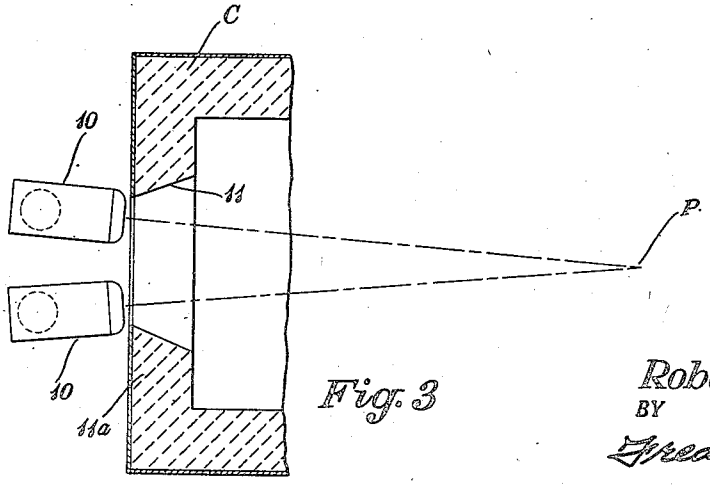


Fig. 3

INVENTOR.
Robert C. Hopkins
BY
Fraser and Bishop
ATTORNEYS

July 31, 1951 R. C. HOPKINS 2,562,460

COMBINATION BURNER EQUIPMENT FOR ROTARY DRIERS

Filed April 15, 1949 2 Sheets-Sheet 2

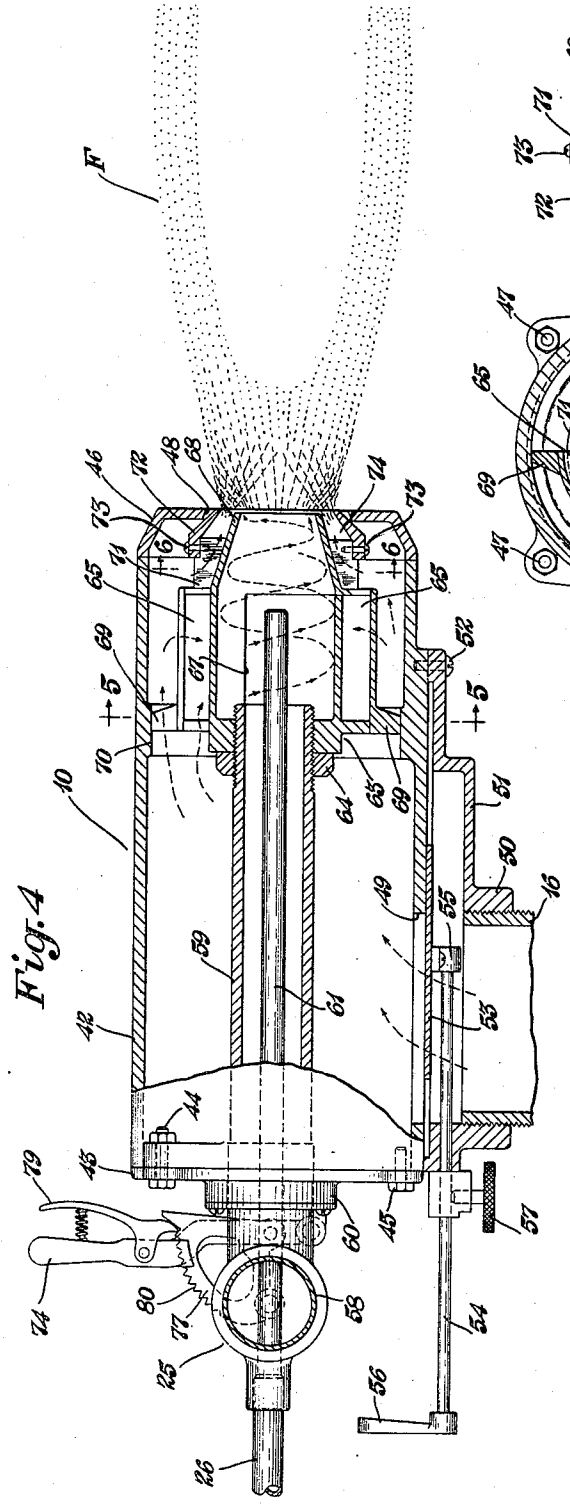


Fig. 4

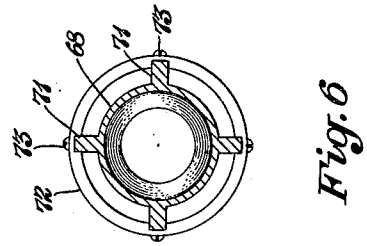


Fig. 6

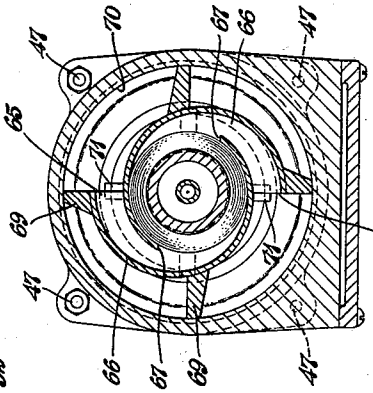


Fig. 5

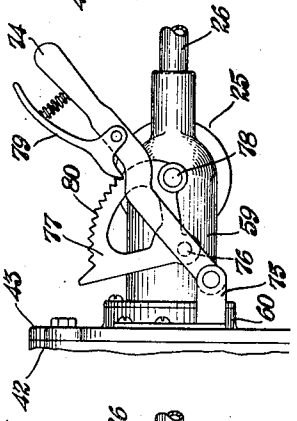


Fig. 8

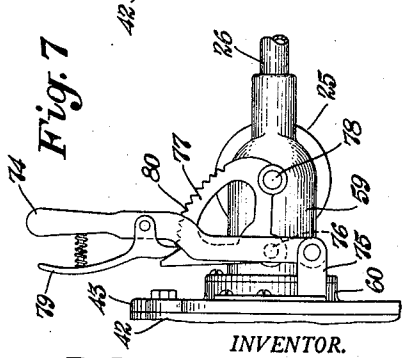


Fig. 7

INVENTOR.
Robert C. Hopkins
BY
Frease and Bishop
ATTORNEYS

Patented July 31, 1951

2,562,460

UNITED STATES PATENT OFFICE

2,562,460

COMBINATION BURNER EQUIPMENT FOR ROTARY DRIERS

Robert C. Hopkins, Alliance, Ohio

Application April 15, 1949, Serial No. 87,595

8 Claims. (Cl. 158—11)

1

The invention relates generally to rotary drying equipment, and more particularly to an automatically controlled burner system therefor, adapted to use oil or gas interchangeably.

Prior burner equipment of this type has been adapted for using either oil or gas, but is not interchangeable, so that a gas burner system is not adapted to use oil, and vice versa. Moreover, while certain of such prior equipment has been automatically thermostatically controlled, the complete shutting off of the burners when a predetermined temperature is reached results in allowing the moisture content in the drier to build up excessively before the drop in temperature is sufficient to again turn on the burners.

It is an object of the present invention to provide a novel combination burner unit for rotary driers, said unit having automatically controlled multiple burners.

Another object is to provide a novel combination burner system adapted for use with oil or gas interchangeably.

Another object is to provide a novel combination burner system in which the fuel supply to certain burners is automatically controlled, but the flow of air through all the burners is continuous for supplying a constant flow of air through the drier.

A further object is to provide a novel combination burner unit having at least two burners with a separate oil and gas supply to each burner.

Another object is to provide a novel combination burner unit having at least two burners with a separate oil and gas supply to each burner, and a single automatic control connected to the oil supply of one burner and to the gas supply of another burner.

A still further object is to provide a novel self-contained and self-supported burner unit which can be quickly placed in operating position for discharging into the combustion chamber of a rotary drier.

These objects, together with others which will be apparent from the drawings and following description, or which may later be referred to, are attained by the combinations, constructions and arrangements comprising the present invention, as defined in the appended claims.

Referring to the accompanying drawings, in which a preferred form of the invention is illustrated by way of example:

Figure 1 is a front elevation of a novel combination burner unit embodying the present invention, in position for firing into the combustion chamber of a rotary drier;

2

Fig. 2 is a side elevation of the unit, showing a portion of the combustion chamber in section;

Fig. 3 is a diagrammatic plan section showing the direction of firing of the burners into the combustion chamber;

Fig. 4 is an enlarged fragmentary longitudinal sectional view partly in elevation, of one of the improved combination burners;

Fig. 5 is a transverse sectional view thereof, as on line 5—5, Fig. 4;

Fig. 6 is a fragmentary transverse sectional view thereof, as on line 6—6, Fig. 4;

Fig. 7 is a fragmentary side elevation, looking toward the side opposite to that in Fig. 4, showing the lever mechanism for adjusting the flame of the burner; and

Fig. 8 is a similar view showing a different position of adjustment.

Similar numerals refer to similar parts throughout the drawings.

Referring to Figs. 1, 2 and 3, a self-contained, self-supported two-burner unit is shown in position for firing into one end of the combustion chamber C which communicates at its other end with a rotary drier in a usual manner. It will be understood that the two-burner unit is shown by way of example, and that the number of burners may be increased as desired, without departing from the scope of the invention.

The burners are indicated generally at 10 and are directed into a flared opening 11 in the end wall 11a of the combustion chamber at its central portion, for discharging a mixture of hot combustible gases into the combustion chamber and generating heat for evaporating moisture in the rotary drier connected thereto. If desired, the front ends of the burners 10 may rest on an angle bracket 11b secured to end wall 11a. As shown in Fig. 3, the burners 10 are preferably inclined toward each other at a slight angle so that their centerlines of discharge converge and meet at a desired point P, which may be about six feet from the burner tips and within the combustion chamber.

The end wall 11a of the combustion chamber is provided above the burner opening 11 with an accessory air opening 12 for admitting cold air as desired to supplement the air in the mixture discharged by the burners. This opening 12 is closed by doors 13 which are preferably slidable toward and away from each other in angle guideways 14 and 15, so that a greater or lesser amount of air can be admitted to suit conditions. The air entering through the opening 12 may be induced by a suction fan if de-

sired, and due to the fact that this cold air enters into the upper part of the combustion chamber where the temperature generated by the burners is normally the highest, the introduction of the cold air at this point funtions to balance the temperature in the combustion chamber and promote uniformity of temperature throughout the same.

The burners 10 are supported on air supply ducts 16 which are connected to a preferably Y-shaped branch fitting 17, and the Y is in turn connected to the top of the vertical duct 18, the lower end of which is connected to the discharge end 19 of a centrifugal blower 20. The inlet to the blower is indicated generally at 21 and the blower is driven in a usual manner by an electric motor 22, the motor and fan being supported solidly on a base 23. The vertical duct 18 is preferably connected to the discharge end of the blower and to the Y fitting 17 by means of adjustable ring flange connections 24 which permit a certain amount of vertical adjustment for lining up the burners with the combustion chamber inlet port 11.

The fuel supply line to each burner preferably includes a T connection 25 at the rear of the burner, and an oil pipe 26 is connected to the end of each T connection, while a gas supply pipe 27 is connected to the side thereof. The oil and gas pipes 26 and 27 extend vertically downward as shown and the oil pipes 26 are connected at their lower ends with a main oil supply line 28, while the gas pipes 27 are connected at their lower ends with a main gas supply line 29. Preferably each of the supply lines 28 and 29 are supported by angle brackets 30 and 31, respectively, on a metal plate or platform 32 which is carried on top of the blower housing 20.

Means for controlling the fuel supply to the burners preferably includes a manually operable valve 33 in each oil pipe 26, and a manually operable valve 34 in each gas pipe 27. As shown, an automatic control valve 35 is provided in one of the oil lines, and an automatic control valve 36 is provided in the gas line pipe going to the other burner. These automatic valves 35 and 36 are operatively connected by links 37 and 38, respectively, to a small thermostatically controlled motor 40 of well-known construction, and the motor is electrically connected in a usual fashion to a thermostatic control switch 39 operated by a pyrometer or high temperature thermometer 39a which is located in a suitable part of the drier, preferably at its discharge end.

The control motor 40 is supported on the plate 32 and operates the valves 35 and 36 simultaneously. Thus the blower 20 and motor 22 are carried on the base 23 and the blower carries the control motor 40, and the gas, oil and air pipes; and the burners 10 are carried on the air pipes. The result is a novel self-contained and self-supporting unit which can quickly be positioned to fire into the combustion chamber C of a rotary drier.

If the burners 10 are using oil, the oil valves 33 would be open and the gas valves 34 would be closed, so that the oil supply to the one burner would be automatically thermostatically controlled by the valve 35, while the oil supply to the other burner would be manually controlled by the valve 33 in the other oil supply pipe. If the burners 10 are using gas, the oil valves 33 would be closed and the gas valves 34 would be open, so that the gas supply to one burner would be automatically thermostatically controlled by the valve 36, while the gas supply to the other burner would be manually controlled by the valve 34 in the other gas supply pipe.

In either case when one burner is shut off by the automatically controlled valve, the air blast from the blower continues to discharge from the burner which has been shut off and the air flows through the combustion chamber into the rotary drier for carrying away moisture therefrom. At the same time the other burner is manually controlled, and can be nicely regulated to suit conditions.

Thus the novel burner unit is interchangeable for burning either oil or gas, and the burner which is automatically controlled when gas is used is manually controlled when oil is used, and vice versa.

Referring to Figs. 4–8 of the drawing, each combination burner 10 includes a substantially cylindrical housing 42 having a closure plate 43 secured to its rear end by bolts 44 and screws 45. The front end of the housing has secured thereon a substantially conical nozzle portion 46 by means of bolts 47, and the nozzle portion has a central discharge opening 48. An air inlet 49 is provided at one side of the housing adjacent its rear end, for receiving the air blast from the air pipe 16 which is screwed into the annular flange portion 50 of a blast gate housing 51 secured to the housing 42, as by screws 52. A blast gate 53 is slidably mounted within the housing 51 for adjustably regulating the air blast entering through the opening 49, and a rod 54 is secured to the blast gate by means of a bracket 55 for adjusting the blast gate, there being a handle 56 on the outer end of the rod and a set screw 57 for holding the rod in any adjusted position.

The fuel supply connection 25 has the oil pipe 26 screwed therein axially of the burner, and the gas pipe is connected at right angles thereto to the opening 58. This T connection is carried on the rear end of a gas conduit 59 extending axially through the burner housing 42, and the conduit 59 is slidable through the boss portion 60 of the rear closure plate 43. An oil pipe 61 extends axially through the gas pipe 59 and communicates with the oil pipe 26 at the outer end of the T connection 25.

An atomizing barrel indicated generally at 63 is screwed on the front end of the gas conduit 59 and secured in position by lock nut 64. Preferably the atomizing barrel is provided with two diametrically opposite tangential inflow ports 65 which are at the outer ends of spiral passageways 66 communicating with the interior of the atomizing barrel at openings 67. The front end of the atomizing barrel converges to form a conical discharge portion 68 which terminates within the discharge opening 48 when the atomizing barrel is adjusted forwardly, as in Fig. 4.

Preferably, the atomizing barrel is provided with guide lugs 69 which are slidable back and forth on the interior annular surface 70 within the housing. The convergent discharge portion 68 of the atomizing barrel may have outer radial ribs 71 on which is mounted an annular deflecting ring 72 by means of screws 73, and the ring 72 forms an inwardly directed annular air passage 74 around the conical portion 68 of the barrel. As the barrel is adjusted rearwardly, another annular air discharge passage is formed between ring 72 and discharge opening 48 in nozzle 46.

As indicated in Fig. 4, the air entering through opening 49 flows around the atomizing barrel 63 and some of it enters tangentially through the

ports 65 into the atomizing barrel and sets up a spiral flow therein while intermixing with the gas entering through conduit 59 or the oil entering through the pipe 61. Part of the air flows forwardly past the ports 65 and then inwardly within the ring 72 and meets the air-fuel mixture being discharged out of nozzle 68 substantially at right angles, to further atomize the mixture being discharged from the burner, and produces a hot flame indicated at F which approaches complete combustion. When the barrel is adjusted rearwardly, the annular discharge outside ring 72 provides an additional atomizing effect.

By extending the oil pipe 61 axially through the gas conduit 59 and terminating the oil pipe 61 about half way between the end of the gas conduit and the atomizing barrel, as shown, either gas or oil can be atomized and burned in the burner, and if it is desired to burn both oil and gas simultaneously in the burner this can be done without having one fuel interfere with the burning of the other.

The whole assembly of the oil pipe 61, gas conduit 59 and the atomizing barrel can be adjusted back and forward in the burner housing 42 to control the length and spread of the flame F. This adjustment is accomplished by means of a hand lever 74 which is pivotally mounted on a bracket 75 attached to the rear plate 43 of the burner. In Figs. 4 and 7, the lever is in upright position and the burner is in its "closed" position; that is, with the atomizing barrel at its farthest forward position. In Fig. 8 the lever is shown pulled back to move the gas tube 59 with the oil pipe 61 and the atomizing barrel 63 rearwardly to "open" position, in which the flame F is elongated and the burner is in its maximum capacity position.

As best shown in Figs. 7 and 8, the lever 74 is pivotally connected at 76 with the front corner of a sector 77, the rear corner of which is pivoted at 78 on the tube 59. Thus, as the handle is rotated rearwardly about the bracket 75, the point 76 rotates rearwardly downward and moves the pivot 78 rearwardly, which causes the tube 59, pipe 61 and atomizing barrel 63 to move rearwardly within the housing 42. The handle 74 is provided with a ratchet pawl 79 which engages the toothed portion 80 of the sector to hold the handle in adjusted position.

I claim:

1. Combination burner equipment for rotary driers including a base, a blower supported on the base, a vertical air pipe connected to the discharge end of said blower, a branched fitting carried on said vertical pipe, burners supported on and connected one to each branch of said fitting, vertical gas supply pipes connected one to each burner and extending downwardly toward said blower, vertical oil supply pipes connected one to each burner and extending downwardly toward said blower, a manually operable valve in each of said gas and oil pipes, an automatic valve in one of said gas pipes and an automatic valve in one of said oil pipes, and a thermostatically controlled motor operatively connected to said automatic valves and supported on said blower.

2. Combination burner equipment for rotary driers including a base, a blower supported on the base, a vertical air pipe connected to the discharge end of said blower, a branched fitting carried on said vertical pipe, burners supported on and connected one to each branch of said fitting, vertical gas supply pipes connected one to each burner and extending downwardly toward said blower, vertical oil supply pipes connected one to each burner and extending downwardly toward said blower, a manually operable valve in each of said gas and oil pipes, an automatic valve in the gas pipe leading to one burner and an automatic valve in the oil pipe leading to the other burner, and a thermostatically controlled motor operatively connected to said automatic valves and supported on said blower.

3. Combination burner equipment for rotary driers including a base, a blower supported on the base, a vertical air pipe connected to the discharge end of said blower, a Y branch fitting carried on said vertical pipe, two burners supported on and connected one to each branch of said fitting, vertical gas supply pipes connected one to each burner and extending downwardly toward said blower, vertical oil supply pipes connected one to each burner and extending downwardly toward said blower, a manually operable valve in each of said gas and oil pipes, an automatic valve in one of said gas pipes and an automatic valve in one of said oil pipes, and a thermostatically controlled motor operatively connected to said automatic valves and supported on said blower.

4. Combination burner equipment for rotary driers including a base, a blower supported on the base, a vertical air pipe connected to the discharge end of said blower, a branched fitting carried on said vertical pipe, burners supported on and connected one to each branch of said fitting, manually operable valve means mounted on each burner for regulating the flow of air into the burner from the branch line connected thereto, vertical gas supply pipes connected one to each burner and extending downwardly toward said blower, vertical oil supply pipes connected one to each burner and extending downwardly toward said blower, a manually operable valve in each of said gas and oil pipes, an automatic valve in one of said gas pipes and an automatic valve in one of said oil pipes, and a thermostatically controlled motor operatively connected to said automatic valves and supported on said blower.

5. Combination burner equipment for rotary driers including a base, a blower supported on the base, a vertical air pipe connected to the discharge end of said blower, a branched fitting carried on said vertical pipe, burners supported on and connected one to each branch of said fitting, an axial fuel tube in each burner, a T connection on the rear end of said tube, gas supply pipes connected one to each T connection and extending vertically downward, oil supply pipes connected one to each T connection and extending vertically downward, a manually operable valve in each of said oil and gas pipes, an automatic valve in one of said gas pipes and an automatic valve in one of said oil pipes, and a thermostatically controlled motor operatively connected to said automatic valves and supported on said blower.

6. Combination burner equipment for rotary driers including a base, a blower supported on the base, a vertical air pipe connected to the discharge end of said blower, a branched fitting carried on said vertical pipe, burners supported on and connected one to each branch of said fitting, a fuel tube slidable axially in each burner and projecting beyond the rear end thereof, lever means on each burner for slidably adjusting the fuel tube therein, gas supply pipes connected one to each projecting fuel tube and extending vertically downward, oil supply pipes connected one to each projecting fuel tube and extending vertically downward, an automatic valve in one of said gas pipes, an automatic valve in the oil pipe

leading to the other burner, and a thermostatically controlled motor operatively connected to said automatic valves and supported on said blower.

7. A combination oil and gas burner including a tubular housing, a discharge nozzle on the front end of said housing, an atomizing barrel within the front end of said housing and having tangential air inlet ports, said housing having a side air inlet, a gas conduit connected to the rear end of said barrel and extending axially through the rear end of said housing, means slidably mounting said barrel and said conduit for axial movement in said housing, a T connection on the rear end of said conduit for connection with a gas supply line and an oil supply line, and an oil pipe extending from said T connection axially through said gas conduit and terminating within the atomizing barrel intermediate the ends thereof.

8. A combination oil and gas burner including a tubular housing, a discharge nozzle on the front end of said housing, an atomizing barrel within the front end of said housing and having tangential air inlet ports, said housing having a side air inlet, a gas conduit connected to the rear end of said barrel and extending axially through the rear end of said housing, means slidably mounting said barrel and said conduit for axial movement in said housing, a T connection on the rear end of said conduit for connection with a gas supply line and an oil supply line, an oil pipe extending from said T connection axially through said gas conduit and terminating within the atomizing barrel intermediate the ends thereof, and a lever pivoted on said burner housing and having a linkage connection with said conduit for adjustably sliding said conduit and atomizing barrel axially of said housing.

ROBERT C. HOPKINS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,241,135	Mastenbrook	Sept. 25, 1917
1,649,745	Schellens et al.	Nov. 15, 1927
1,703,635	Ranson	Feb. 26, 1929
1,777,337	Tally	Oct. 7, 1930
1,781,174	Greenfield	Nov. 11, 1930
1,786,901	Doherty	Dec. 30, 1930
1,819,459	Doherty	Aug. 18, 1931
1,840,744	Scott	Jan. 12, 1932
1,863,391	Bluemel	June 14, 1932
1,976,162	Debuch	Oct. 9, 1934
2,066,524	Gehnrich	Jan. 5, 1937
2,164,954	Stephens	July 4, 1939
2,204,719	Zink	June 18, 1940
2,412,990	Kruse	Dec. 24, 1946
2,432,525	Kruse	Dec. 16, 1947