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G. T. COSTELLO ETAL

3,049,173

BURNER

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2 Sheets-Sheet 1

FIG. 1

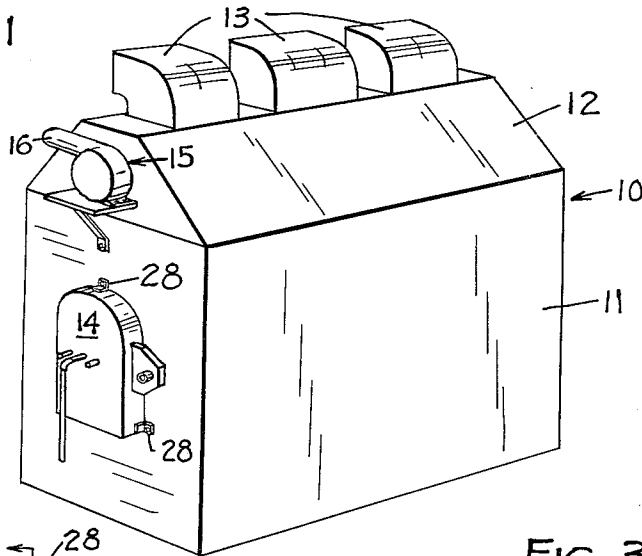


FIG. 2

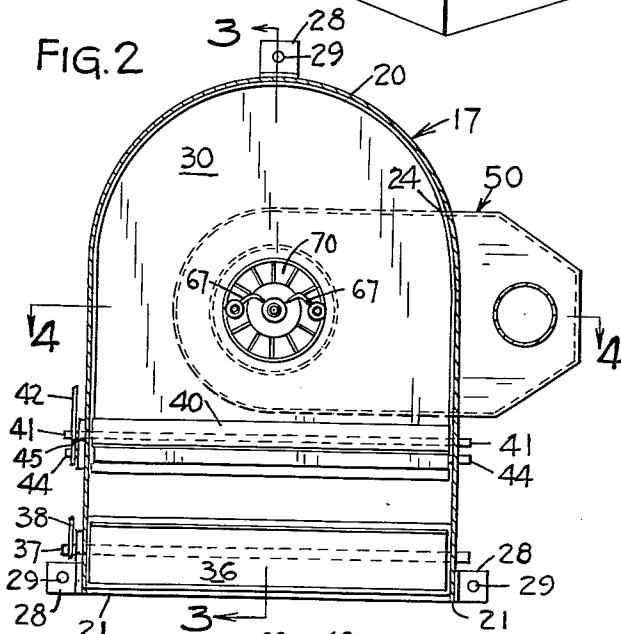


FIG. 4

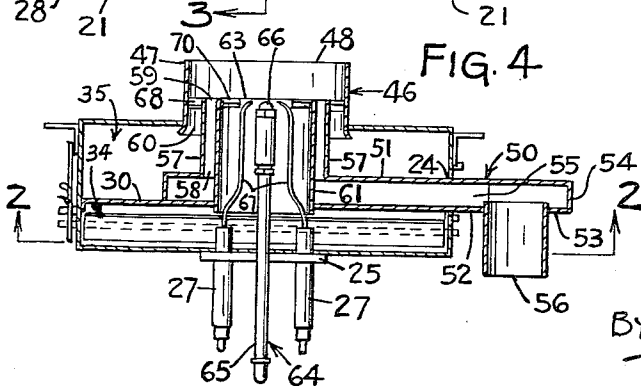
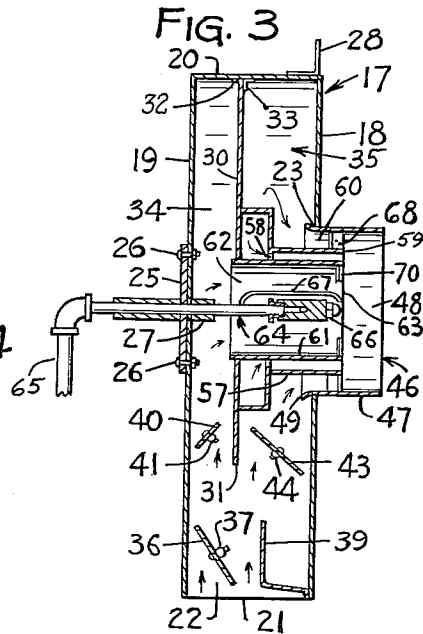


FIG. 3



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FIG. 5

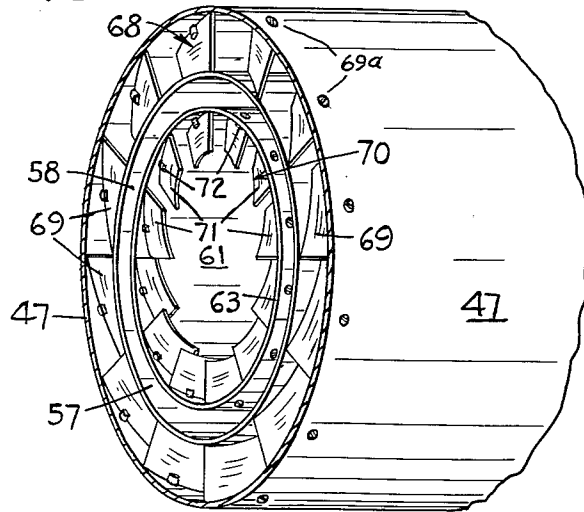
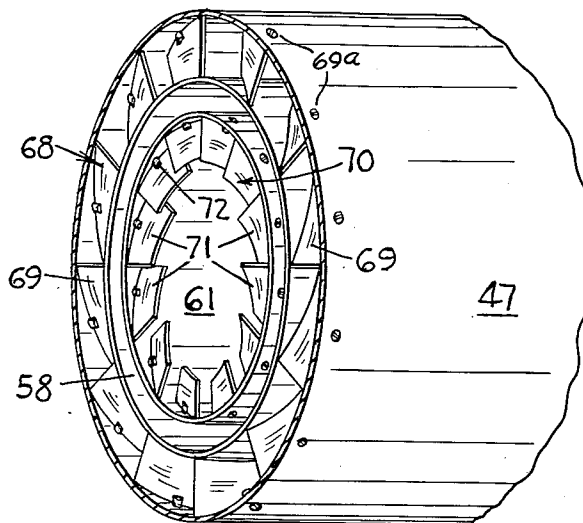


FIG. 6



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3,049,173
BURNER

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5 Claims. (Cl. 158—110)

This invention relates to heating equipment, and more particularly to a burner of the type utilized in conjunction with space heaters and the like.

It is a general object of the invention to provide a burner which is safe and efficient, yet is simple and economical to fabricate.

A more specific object of the invention is to provide a burner in which all mixing of air and fluid fuel is accomplished forwardly of air deflectors, and the fuel terminates, so that there is no possibility of flashback or flame impingement on burner parts which would be subjected to warpage or destruction from heat.

Another object of the invention is to provide a burner head of efficient design which concentrically swirls primary air and secondary air from separate annular outlets and effects dispersion and mixing of fluid fuel by injecting the fuel into the zone between the streams of swirling air.

A further object is to provide a burner which has flexibility of operation in that it can handle fluid fuels of different types such as oil and gas in the manner described either alternatively or simultaneously.

A still further object of the invention is to provide a burner of the class described in which air and fuel proportion can be easily and safely adjusted, and which is specially adaptable to conditions wherein air is induced through a burner head so as to project a swirling flame into a combustion chamber having a pressure less than atmospheric.

A still further object of the invention is to provide a burner which is capable of construction solely with sheet metal parts and does not require expensive and heavy castings of any nature.

These and other objects and advantages of our invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIGURE 1 is a perspective view of a space heater unit to which our burner is attached and adapted to use under induced draft;

FIGURE 2 is a rear view of the burner with the back wall of the housing removed, the section being taken on the line 2—2 of FIGURE 4;

FIGURE 3 is another vertical section taken on the line 3—3 of FIGURE 2;

FIGURE 4 is a horizontal section taken on the line 4—4 of FIGURE 2;

FIGURE 5 is a perspective view of an enlarged segment of the burner head with the shield portion cut back in section and showing bladed spinner members pitched in the same direction; and

FIGURE 6 is a view similar to that of FIGURE 5 showing the burner head with the bladed spinner members pitched in opposite directions.

With continued reference to the drawing, FIG. 1 shows an entire heater of the type used for heating large volumes of air and conventionally called "space heaters." The space heater is indicated generally at 10 and is provided with a casing or shell 11 within which are blower and combustion chambers and tubes (not shown) and an upper plenum chamber 12 from which heated air is

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forced through ducts 13. The space heater is shown as provided with our novel burner 14 which is the subject matter of this specification. In the particular arrangement shown, a blower 15 is employed to connect with the interior of the combustion chamber and tubes so as to place a negative pressure upon these members. The combustion gases are discharged through the blower opening 16 and exert a continual induced draft through the burner 14 as will be subsequently described. It is to be understood, however, that burner 14 can be utilized with forced draft system wherein air under positive pressure is forced into the burner rather than being induced through it.

Referring now to FIGS. 2, 3 and 4, our burner is constructed with a sheet metal housing 17 which has a flat front wall 18, a flat rear wall 19 and a peripheral wall 20 extending arcuately over the top of the burner and terminating edgewise at 21 at each side of the bottom of the housing. With the arrangement shown, an air inlet opening is created at 22 as shown in FIG. 3. Housing 17 also is provided with a circular opening 23 through the front wall 18 for reception of the burner head parts, as will be subsequently described. Another opening 24 is formed through the peripheral wall 20, as shown in FIGS. 2 and 4, and this opening is adapted to receive the gas inlet parts to be subsequently described.

Mounting plate 25 may be fastened to rear wall 19 by means of fasteners such as bolts 26 and is provided with dielectric sleeves 27 for igniting oil, also to be subsequently described. The housing 17 is provided with lugs 28 having openings 29 suitable for mounting to the housing of a heater such as that disclosed in FIG. 1.

Internally of the housing is a divider or baffle plate 30 which may be substantially parallel to both the front and rear walls 18 and 19 respectively, and is coextensive therewith except at bottom edge 31 which terminates well above the bottom edges 21 of peripheral wall 20. Divider or baffle plate 30 may also be formed of sheet metal with a peripheral flange 32 fitting against the inner surface of peripheral wall 20 and abutting against a seat flange 33 which may be welded or otherwise secured to peripheral wall 20, as shown in FIG. 3. The spaces created by the divider or baffle plate 30 are designated as primary combustion air chamber 34 and secondary combustion air chamber 35. As seen in FIG. 3, the inlet air passageway 22 is common to both of the chambers 34 and 35, the incoming air being divided at the lower edge 31. The total quantity of air flow through the inlet 22 is controlled by a main air damper 36 which is swingably mounted upon a rod 37 extending through the journal in both sides of the peripheral wall 20, as shown in FIG. 2. A radius arm 38 can be adjustably swung to determine the angulation of damper 36 and thereby increasing or decreasing the flow of total air through the inlet 22. The damper 36 is operably mounted between the rear wall 19 of housing 17 and a transverse baffle 39 which permits a certain minimum of air to always flow through inlet 22.

The air which passes through the inlet 22, whether forced draft or induced draft, then becomes divided and enters both the primary combustion air chamber 34 and secondary air combustion chamber 35, as previously described. Individual air dampers are provided for these chambers. The damper 40 is mounted on a shaft 41 journaled across the sides of peripheral wall 20, as shown in FIG. 2, and is provided with a control arm 42 radially secured to shaft 41 and capable of swinging movement to increase and decrease the effective flow of air coming into the primary air chamber 34 and operates between the lower end of divider plate 30 and rear wall 19. Similarly, damper 43 is mounted on shaft 44 journaled across the sides of wall 20. Damper 43 is adjustably positioned by control arm 45 for varying the effective flow of air com-

ing into the secondary air chamber 35 and operates between the lower end of divider plate 30 and front wall 18, as shown in FIG. 3.

Within the housing 17 is mounted combustion head 46, extending forwardly through the front wall 18, as shown in FIGS. 3 and 4. The combustion head 46 has an outer ring shield 47 which is open-ended, terminating forwardly in circular edge 48 and rearwardly in a flared edge 49, so as to be securely mounted in opening 23, as shown. As in the case of other components previously mentioned, the ring shield 47 may be constructed of heat-resistant sheet metal and is adapted to be inserted within a refractory block which, in turn, communicates with the combustion chamber of a furnace or heater, as is well known in the art.

A gas manifold 50 is provided with a front plate 51 and a rear plate 52, as shown in FIG. 4. The rear plate 52 may constitute, in part, the divider plate 30 and an extension 53 coplanar therewith, as shown in the drawing, to conserve on sheet metal. The front plate 51 has rearwardly flanged peripheral edges 54 which are welded or otherwise secured to the divider plate 30 and rear plate 52, as shown. The space between the coplanar rear member 52 and the forward plate 51 constitutes a gas plenum 55, as shown. Extending rearwardly from rear wall portion 53 is a coupling 56 which communicates with the plenum 55 and is adapted to be secured to a source of supply of gas, not shown.

Mounted on the front wall 51 of gas manifold 50 is a sheet duct 57 which communicates through opening 58 with the gas plenum chamber 55, as shown in FIGS. 3 and 4. The gas duct 57 terminates in a forward edge 59 which lies well within shield 47 and rearwardly of edge 48. The sheet duct 57 is concentrically arranged with the ring shield 47 to create a secondary air passageway 60 therebetween, as shown in FIGS. 3 and 4.

A sheet tube 61 is mounted concentrically within the sheet duct 57 and defines therewith the annular gas passageway 58. Sheet tube 61 is mounted upon divider plate 30 and has a rearwardly extending opening 62 which communicates with the primary combustion air chamber 34, as shown in FIG. 3. Sheet tube 61 extends forwardly and terminates in edge 63 which is substantially in the same plane with edge 59 of the sheet duct 57. The sheet tube 61 is open-ended and defines the primary air duct for burner head 46.

Concentrically mounted within the sheet tube 61 is the oil burner 64 which constitutes an inlet pipe 65 and a nozzle 66, as shown in FIGS. 3 and 4. Igniter electrodes 67 provide an arc at nozzle 66 for electrically igniting an oil flame, and these electrodes extend rearwardly through dielectric sleeves 27 which, in turn, are mounted within plate 25, as previously pointed out.

An important feature of the invention resides in the means for swirling both primary and secondary combustion air and causing fluid fuel to be projected into the swirling pathway of the air so as to pass into both streams and be thoroughly intermixed with the air for efficient combustion. To this end, we employ a bladed spinner member 68 mounted between the ring shield 47 and the sheet duct 57 substantially at the outer edge 59 of the latter. The bladed spinner member 68 comprises individual angulated blades 69 which are all pitched in the same direction and adjustably mounted by means of screws 69a to ring shield 47, as shown in FIGS. 5 and 6. Thus, secondary combustion air traveling through duct 60 will be caused to rotate in a clockwise direction, as viewed in the perspective configurations of FIGS. 5 and 6.

A second bladed spinner member 70 is mounted annularly and within the sheet tube 61 adjacent the outer edge 63 thereof, and is provided with individual blades 71 as shown in FIG. 5. Blades 71 may be adjustably secured to the inside of sheet tube 61 by screws 72 and will cause primary air to also circulate in a clockwise spinning direction, as shown in FIG. 5. However, since

the volume of primary air is greater than that of the secondary air, a relative shearing action or turbulent zone will be created between the two streams of air flowing through the respective secondary and primary air ducts. Since gas from manifold 50 is caused to be ejected from the annular opening 58 between the sheet duct 57 and sheet tube 61, the two swirling streams of air will disintegrate and mix the gaseous flow in a thorough manner prior to, and at the beginning of, the propagation of the flame.

Referring now to FIG. 6, the inner annularly mounted blades 71 are there shown as pitched in the opposite direction so that the primary air will be caused to swirl in a counter-clockwise direction. We have found that an extremely efficient flame can be produced by ejecting fuel into the violent and turbulent zone between the two streams of air emitted from the primary and secondary air ducts, as previously described.

The use and operation of our burner will be evident from the foregoing. Our design is such that either the gas manifold or the oil burner may be employed alternatively or simultaneously and adjustment of the burner can be made in a matter of seconds. In either case, the fuel is caused to project into the turbulent annular zone between the swirling streams of primary and secondary air. In the case of the gas, it is inserted through the narrow annular gas passageway 58 directly between the streams, and in the case of the oil burner, it is caused to spray outwardly from the nozzle 66 and pass into the zone of turbulent shear. The spinner blade arrangement, as shown in FIG. 5, generally operates in a more quiet manner than that shown in FIG. 6 because of the opposite flow of the streams of air in the latter instance. In either case, the efficiency is very high and control of all the variable elements is easily made while preserving a safe and constant flame.

It will be noted that, since both of the fuel outlets are located substantially in the same plane with bladed spinner members, there is no opportunity for flashback or burning of fuel behind the delicate blades. On the other hand, because the fuel and air are so thoroughly and quickly intermixed in a controlled pair of air streams, the flame will not tend to blow forwardly and extinguish.

It will, of course, be understood that various changes may be made in the form, details, arrangements and proportions of the parts without departing from the scope of our invention as set forth in the appended claims.

What we claim is:

1. A burner comprising a housing formed of sheet metal and having a front wall, a rear wall and a peripheral wall disposed between said front and rear walls, a baffle sheet positioned between said front and rear walls and having its top and side edges secured against the inner face of the peripheral wall to define a primary air chamber with the rear wall which is open at the bottom and a secondary air chamber with the front wall which is also open at the bottom, said peripheral wall having an air inlet communicating with both of said chambers through their said open bottoms, a ring shield mounted on said front wall and communicating with the secondary air chamber, an open-ended sheet tube mounted on said baffle and extending forwardly and terminating coaxially within said ring shield, said sheet tube communicating with the primary air chamber, a bladed air spinner annularly mounted within said ring shield in a plane substantially including the outer terminus of said open-ended sheet tube and adapted to swirl secondary combustion air, a relatively smaller annular bladed air spinner mounted within said sheet tube in substantially the same plane with the first mentioned air spinner, and a gas passageway terminating in an annular discharge opening between the annular bladed air spinners and substantially in the same plane therewith, the innermost ends of the blades of said first-mentioned air spinner terminating adjacent said annular discharge opening.

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2. The structure set forth in claim 1 in which said gas passageway is formed by a sheet duct coaxially arranged in spaced relation between said ring shield and said sheet tube, the innermost ends of the blades of said first-mentioned air spinner engaging the outer surface of said sheet duct.

3. The structure set forth in claim 1 including a first damper disposed at the bottom opening of said primary air chamber and a second damper disposed at the bottom opening of said secondary air chamber.

4. The structure set forth in claim 3 in which the walls of said housing extend below the lower edge of said baffle sheet, and a third damper disposed within said housing beneath said baffle sheet for controlling the air to both said first and second dampers.

5. The structure set forth in claim 4 including a transverse baffle with which said third damper coacts so as

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to cause a minimum amount of air to flow to said first and second dampers when said third damper is in closed position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,907,838	Leask et al. -----	May 9, 1933
1,953,590	Cone -----	Apr. 3, 1934
2,000,733	Avery -----	May 7, 1935
2,335,188	Kennedy -----	Nov. 23, 1943
2,458,543	Urquhart -----	Jan. 11, 1949
2,835,320	McClure -----	May 20, 1958
2,836,409	Harrison -----	May 27, 1958

FOREIGN PATENTS

18,359	Great Britain -----	1912
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