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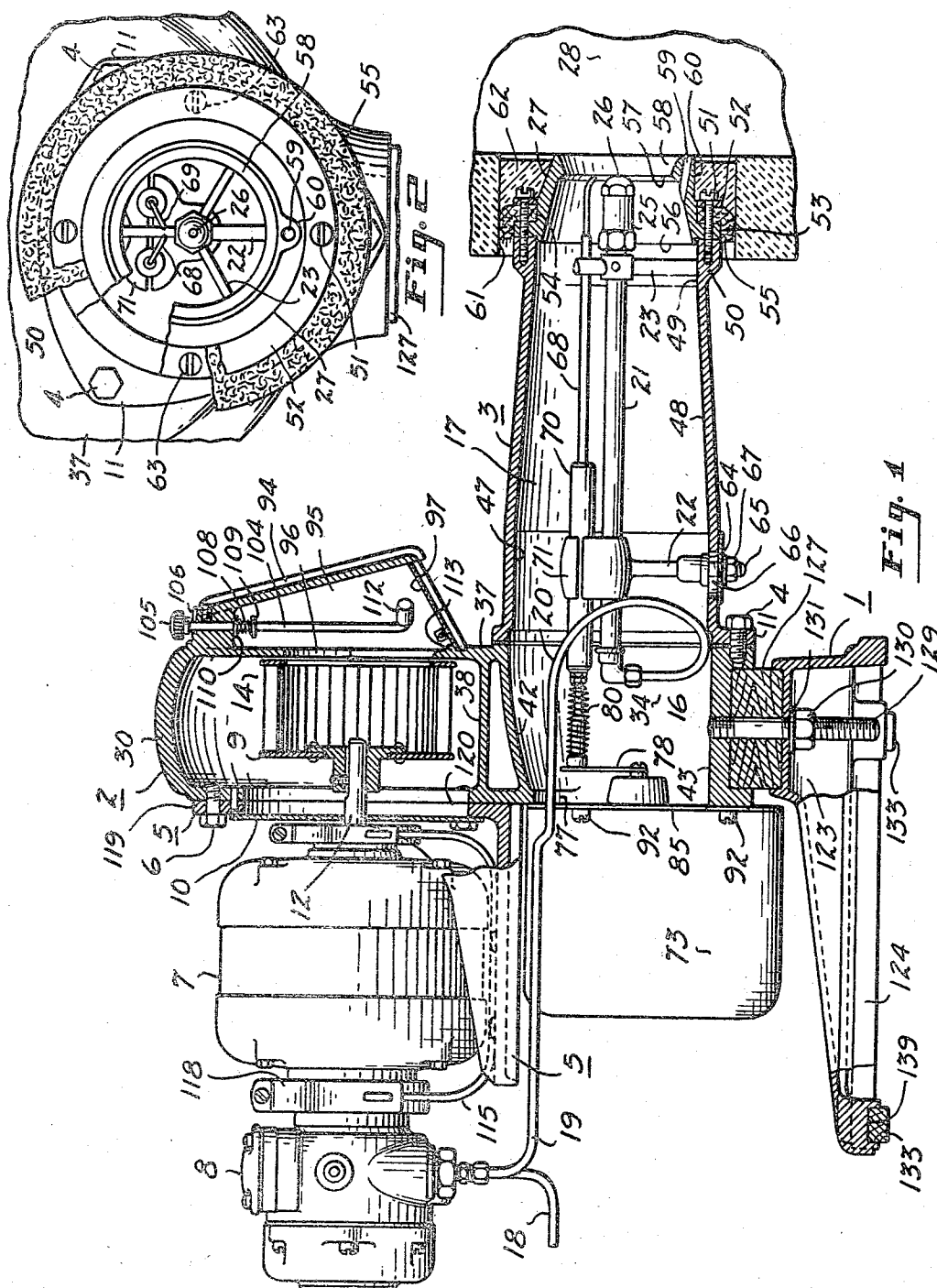
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2,330,191

AIR TUBE AND BURNER HEAD FOR OIL BURNERS AND THE LIKE

Filed March 22, 1940

2 Sheets-Sheet 1



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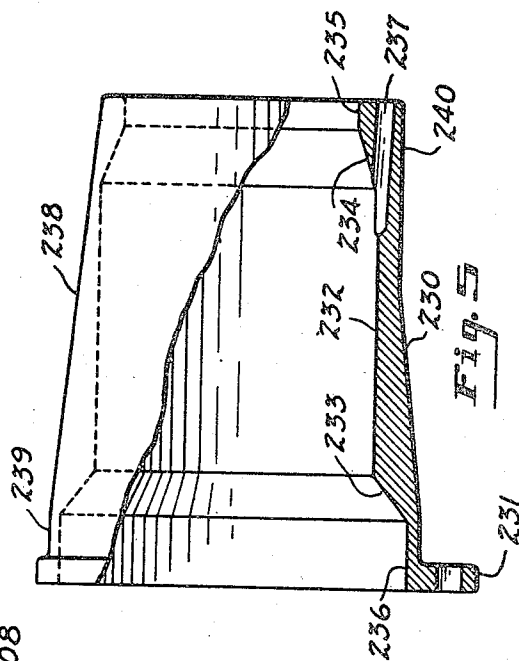
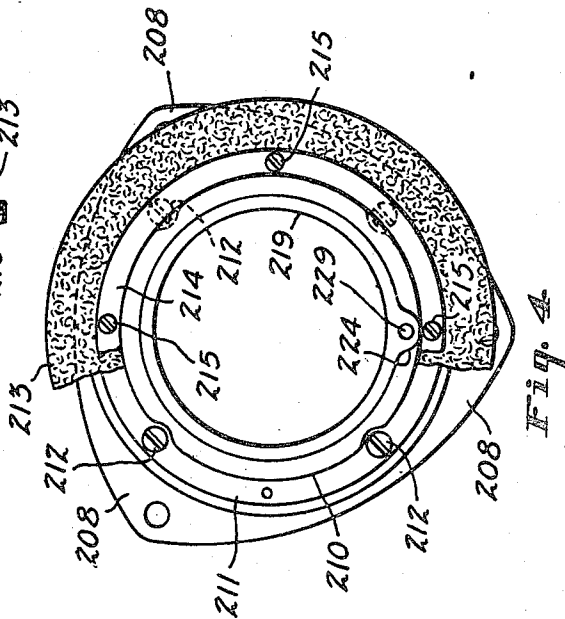
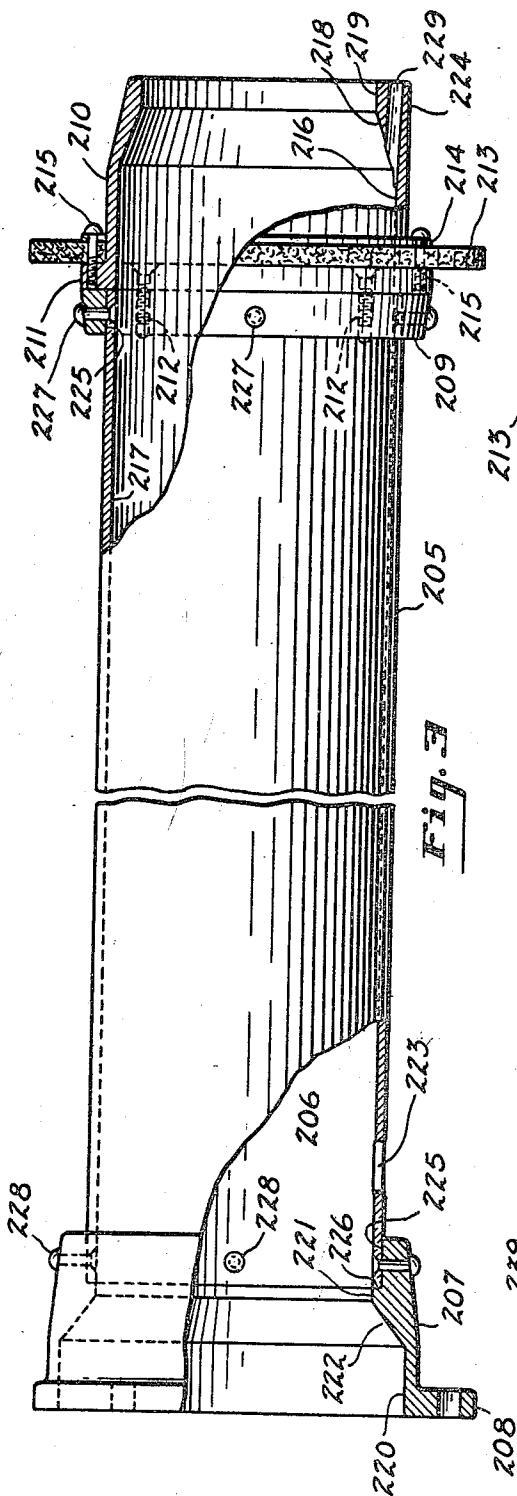
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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AIR TUBE AND BURNER HEAD FOR OIL
BURNERS AND THE LIKE

Reginald W. Beckett, Elyria, Ohio

Application March 22, 1940, Serial No. 325,370

9 Claims. (Cl. 158-76)

This invention relates to fuel burners, and more particularly to improvements in oil burners of the gun type in which a blast or current of combustion air is forced past and around a nozzle ejecting fuel under high pressure and into a combustion chamber. The present application is a continuation in part of my copending patent application, Serial No. 188,731, filed February 4, 1938, now matured into Patent No. 2,310,274, dated February 9, 1943.

In gun type liquid fuel burners it is important that the combustion air be directed past and around the fuel ejecting nozzle in such manner that the ejected fuel is entrained therein and held in suspension until vaporization and combustion is complete. It is generally considered preferable to impart a helical or spiral motion to the air in the region of the fuel nozzle. Various devices and arrangements have been resorted to for this purpose, usually involving the use of vanes or similar deflecting elements in the path of the advancing air column for the purpose of guiding the air in the desired direction or directions. An objection to such arrangements is that the air directing vanes resist the flow of air through the air tube of the burner and reduce the capacity of the burner. Additionally, the more complex devices are expensive to manufacture, requiring intricate castings and difficult machining operations. It is, therefore, an object of the present invention to provide an air tube and burner head for oil burners and the like which produces an improved flow of air past and around the fuel ejecting nozzle of the burner and properly entrains the ejected fuel and holds the same in suspension until vaporized and burned.

Another object is to provide an air tube and burner head assembly which is relatively free of vanes or other large projections which objectionably interfere with the flow of combustion air.

Another object is to provide an air tube and burner head assembly of the character mentioned in which combustion air forced there-through is alternately accelerated and stabilized by being permitted to flow at a constant velocity.

Another object is to provide a device of the character mentioned in which relatively small air deflecting formations are positioned to deflect air toward the center of the passage while retaining its rotational motion.

A further object is to provide improved means for effecting a seal between a burner head and the fire opening or hole of the combustion chamber in a boiler or furnace.

A further object is to provide an improved air tube and burner head assembly which can be supplied in various lengths as desired, and an improved method of making the same.

5 A still further object of the invention is to provide a generally improved burner head and air tube assembly simple in design and construction and relatively inexpensive to manufacture. Other objects and advantages will become apparent from the following detailed description of suitable embodiments of the invention in which like parts throughout the several views are indicated by the same numerals of reference.

10 Figure 1 is a side elevational view, partly in section and with parts removed, showing an oil burner incorporating a preferred embodiment of the invention attached to the refractory lining of the combustion chamber for a boiler or furnace;

15 Fig. 2 is a fragmentary front end elevation showing the burner head and insulating sealing ring of the burner illustrated in Fig. 1 before the same is installed in the fire opening or hole of the combustion chamber;

20 Fig. 3 is an elevational view, partly in section and with parts removed, of a modified form of burner head and air tube assembly which is particularly useful for the construction of a number of air tubes having different lengths;

25 Fig. 4 is a front end view of the burner head and air tube assembly shown in Fig. 3; and

30 Fig. 5 is a side elevational view, partly in section and with parts removed, of another modification of the invention in which the burner head and air tube are an integral casting.

35 The burner comprises a pedestal or base, indicated generally by the numeral 1, which is surmounted by and supports a main body portion or housing, indicated generally by the numeral 2. A horizontally disposed air or blast tube 3 is secured to the lower portion of the housing 2 at one end thereof by cap screws or studs 4 which extend through a radially directed flange 11 formed at the inlet end of the air tube. On the upper portion of the housing 2 at the end thereof opposite the blast tube 3 a supporting member or bracket 5 is removably secured by cap screws or studs 6.

40 The bracket 5 carries a removable unit which comprises all the movable parts of the burner including motor 7, fuel pump and pressure regulator 8, blower 9 of the sirocco type, and cover plate 10. The blower 9 is actuated and supported by shaft 12 of the motor 7 which also actuates
55 the fuel pump. The circular cover plate 10 has

a running or clearance fit on the shaft 12 between the motor 7 and blower 9.

The blower 9 is received in a chamber 14 formed in the upper portion of the housing 2 and forces air downwardly through a throat tangentially into inlet end 16 of combustion air passageway 17 extending longitudinally through the bottom of the housing 2 and the air tube 3.

The fuel pump and pressure regulating device 8 draw liquid fuel through supply conduit 18 and force it under relatively high pressure through fuel pressure conduit 19 having a flexible loop 20 into fuel pipe 21 supported by bracket 22 and spider 23 in the air tube 3. A vaporizing or spray nozzle 25 is secured on the end of the fuel pipe 21 at the discharge end of the air tube 3 so that its outlet orifice 26 is disposed substantially in the plane of the smallest cross-sectional area portion of a burner head 27, to be later described. Air forced through the passageway 17 by the blower 9 and moving in a helical path commingles with the oil spray emerging from the nozzle orifice 26 to form a mist of finely dispersed oil particles which burn in combustion chamber 28 of a heating unit such as a domestic furnace.

In the bottom of the housing 2 is formed the inlet end 16 of the passage 17, as previously mentioned. Air moving through the throat 15 in a downward direction is directed tangentially into the passage portion 16 by the curved bottom wall 34 of the housing, the inside surface of which gradually approaches the passage 16 and is tangent thereto at substantially the bottom of the housing.

Air entering the inlet 16 of the air passage 17 tangentially through the throat is directed in a helical path to flow through the tube 3. The opening in front end wall 37 of the housing 2, which is covered by the air tube 3, is of substantially the same effective cross-sectional shape and area as the corresponding end of the air passage in the tube 3 so that the walls of the inlet portion 16 are substantially flush with the walls of the air tube 3.

Tube 3 is substantially circular in cross-section throughout its length and has a portion 47 of cylindrical form and uniform diameter adjacent the housing 2 which merges into a tapering portion 48 which extends toward the discharge end of the tube where a second cylindrical portion 49 of uniform internal diameter and relatively short axial length is formed. The walls of the tube 3 are relatively thick and of heavy section at the discharge end thereof, preferably being in the form of an integral, thick-sectioned, annular collar 50 which reinforces the tube end and receives the screws which hold the head 27. A circular, radially directed flange 53 is integrally formed about the large diameter end of the head 27 and circumferentially abuts against the annular collar or thickened section 50 on the discharge end of the tube 3. A pair of screws 63 extend through suitable drill holes in the flange 53 and are threadedly secured in the collar 50 to clamp the head 27 in heat exchanging circumferential contact with the collar. The relatively extensive radial area of contact between the head 27 and tube 3 facilitates the conduction of heat from one of these metal parts to the other. Accordingly, heat is rapidly conducted away from the head 27 during operation of the burner so that it is maintained at a relatively lower temperature than would otherwise prevail, thus reducing the deterioration of the head and increasing its life.

Another pair of screws 51 extend through an annular holding ring 52, disposed about the head

27, through the flange 53 and are threadedly received in the annular thickened collar portion 50 at the discharge end of the tube 3. The ring 52 and flange 53 preferably have substantially the same outside diameter and the ring is axially movable over an external cylindrical portion of the head 27 which extends forwardly from the base of the flange 53. Between the ring 52 and flange 53, and seating on the cylindrical portion 54 of the head, is an annular ring 55 of fireproof fibrous material such as asbestos. This ring has insulating properties and is clamped between the holding ring 52 and flange 53 by the screws 51 which also hold the head 27 to the tube 3.

In the event that a new ring of asbestos 55 is to be fitted in place on the head 27, only the screws 51 need be removed, the screws 63 remaining in position to retain the head on the tube 3. The heat resisting asbestos ring, covered by the metal ring 52, protects the head from the heat in the combustion chamber and minimizes the corrosion of the screws 51 and 63 so that the screws may be more easily removed when desired.

Combustion air forced through the passage 17 in a spiral path is gradually accelerated in velocity by the general tapering form of the tube 3 which decreases in cross-sectional area towards the discharge end. The head 27 is formed to present a substantially continuous circular shoulder 56 to the advancing air and effects an agitation thereof which is beneficial in forming a suitable combustible mixture with the fuel oil. This shoulder 56 is adjacent the small diameter cylindrical portion 49 of the passageway 17 in which is located the spider 23. From the shoulder 56 the head 27 is tapered and the internal walls thereof converge to provide a progressively decreasing, substantially circular cross-sectional area in the direction of air flow. At substantially the region of smallest cross-sectional area the head 27 is formed with a shoulder 57 which further turbulates or agitates the moving air. From the shoulder 57 to the extreme end of the head 27 there is an outwardly tapering outlet or mouth 58.

A downwardly sloping passage or drill hole 59 extends through the bottom wall of the head 27 from the inside thereof between the annular shoulders 56 and 57, through a depending boss 60 integral with the head, to the outermost end or edge of the head. This hole serves as a drain for fuel oil that may drip from the nozzle 25 and directs the same into the combustion chamber 28. Preferably the end of the hole 59 inside the head is enlarged or dished to more effectively drain off the oil.

When installing the burner in a heating system, such as a domestic furnace, having the refractory lined combustion chamber or fire pot 28, the asbestos ring 55 is moistened to render it pliant and flexible so that the head 27 can be inserted into opening 61 in the fire pot 28 and the asbestos ring 55 accommodates itself to the walls of the opening 61 to effect a circumferential seal therewith. If desired, an additional quantity of plastic asbestos cement or the like may be packed around the head 27 in advance of the asbestos ring 55 so as to provide a more permanent seal and to protect the head 27 from the heat of the fire pot.

The bracket 22 which holds the fuel pipe 21 has a curved or cylindrical bottom surface 64 which corresponds in curvature to the internal cylindrical surface of the portion 47 of the tube 3. This curved surface 64 assists in aligning the bracket in the air passageway 17 and affords a snug fit between the bracket and tube. The

bracket is held in place by a depending threaded stud 65 which extends through an elongated slot 66 formed in the bottom of the cylindrical portion 47 of the air tube 3. Preferably, the stud 65 is made separately from the bracket 22 and threadedly secured therein. Accordingly, the bracket 22 may be adjusted longitudinally in the tube 3 so as to vary the position of the nozzle 25 with respect to the head 27. A nut 67 on the stud 65 locks the bracket in adjusted position and the novel shape of the tube 3 which provides a cylindrical portion for holding the bracket 22 retains the fuel pipe 21 centered in the air passageway 17 in all positions of adjustment. The cylindrical portion 49 at the discharge end of the air tube which has a uniform internal diameter permits the spider 23 to move longitudinally in the passageway 17 while the ends of the spider legs maintain sliding engagement with the walls of the tube. Thus, both ends of the fuel oil pipe 21 are supported and retained centrally in the air passageway 17 regardless of the movement of the bracket 22 and spider 23 in adjusting the nozzle 25.

A pair of ignition electrodes 68 and 69 are disposed longitudinally through the passageway 17 slightly above and on opposite sides of the oil pipe 21. These electrodes are mounted in porcelain insulators 70 held in a clamp 71 on the top of the bracket 22.

A transformer, carried in a box 73 disposed against the rear end wall 36 of the housing, furnishes high tension current to the electrodes 68 and 69. Each of the transformer conductors is provided with a springlike brush 78 formed of suitable sheet metal such as bronze or brass and which extends upwardly and at right angles across the axes of the electrodes 68 and 69.

Electrical contact is made between the brushes 78 and the electrodes by means of contact sleeves slidably received on the threaded ends of the electrodes and urged toward the brushes 78 by helical compression springs 80.

Air is drawn into the burner by the blower 9 through a downwardly directed inlet opening in a hood 94 formed on the front wall 37 of the housing 2. An air chamber 95 in the hood 94 communicates with the blower chamber 14 through a circular opening 96 formed in the front wall 37 and concentric with the shaft 12 of the blower and motor.

An air gate 97 is pivotally mounted on reduced diameter pin ends or adjustable pivot screws which are threadedly carried in aligned holes through the side walls of the hood 94. The gate 97 is freely pivoted and falls by gravity to close the inlet opening into the hood except when held in open position by air pressure.

An adjusting rod 104 is vertically disposed in the air chamber 95 and rotatably journaled in a drilled hole in the top of the hood 94. An enlarged knurled head 105 is secured on the top of the rod 104 above the hood 94 so that the rod can be manually rotated. An indexing pin 106 extends through the rod 104 and extends radially therefrom. The rod 104 is urged downwardly by a helical compression spring 108 which seats on a washer 109 secured on the rod 104 and a washer 110 bearing upwardly against the inside of the top wall of the hood 94. A foot is formed at the bottom of the rod 104 by bending the latter substantially through 90°. This foot is disposed a short distance above the air gate 97 when the latter is closed and it is preferably provided with a rubber covering 112 to silence the contact be-

tween the foot and the gate when the movement of the latter is arrested by the foot.

The movable parts of the burner are carried by a substantially U-shaped cradle 115 secured to the floor of the supporting member or bracket 5.

An upright portion 119 of the supporting member 5 is disposed against the upper portion of the rear wall of the housing 2 and a circular opening 120 is formed through the portion 119 and the housing wall to permit passage of the blower 9 when removing or replacing the movable parts or motor drive unit. This opening is closed by the cover plate 10 which is secured to the portion 119 of the bracket 5 by screws.

A stud 129 is secured in the housing and extends downwardly through an aperture in the center of a vibration absorbing block 127 and has a loose fit in a central hole formed in the base. The parts are drawn together by a nut 130 which forces a washer 131 of a material having the capacity to deaden vibrations, such as lead, upwardly against the bottom of the platform portion of the base.

During operation of the burner, combustion air, directed tangentially into the inlet end 16 of the air passageway 17 by the curved wall of the blower throat, moves in a curved path which develops into a spiral path as the air travels forwardly through the tube 3. On account of the taper of the passageway 17 in the portion 48 of the air tube, the spirally moving column of air is gradually accelerated so that its rotational and linear velocity is greater as it enters the head 27 than when leaving the cylindrical portion 47 of the tube.

The increased taper of the conical internal walls of the head 27 between the shoulders 56 and 57 with respect to the taper of the portion 48 of the air tube, further accelerates the combustion air in the region of the nozzle 25 so that the maximum velocity of the column of spirally moving air is substantially in the plane of the orifice 26 of the nozzle. Liquid fuel oil forced by the pump through the conduit 19 and pipe 21 is projected under high pressure from the orifice 26 of the nozzle 25 in the form of finely divided particles or droplets into the rapidly rotating stream or vortex of air surrounding and moving past the nozzle.

The spirally moving air column in the air tube 3 has a greater velocity at the radially outward portions thereof than at the center, and as the air enters the head 27 the radially outermost or peripheral portions of the air stream are deflected by the circumferential shoulder 56 in the passageway 17 and directed to flow transversely across the helical air column in advance of the nozzle 25 to entrain particles of the sprayed fuel oil. At substantially the region of smallest cross-sectional area and adjacent the extreme outlet end of the passage 17 the circumferential or annular shoulder 57 deflects the outermost part of the spirally advancing air column to flow transversely across such column and entrain particles of fuel oil projected from the nozzle 25. In this manner each of the shoulders 56 and 57 serves to create crosswise currents in the spiral column of accelerated combustion air which are beneficial in creating an increased turbulence or agitation of the air immediately in advance of the nozzle orifice 26. As atomized oil is projected into the combustion chamber or firebox it is rapidly vaporized and the increased rotational turbulence of the air immediately around and ahead of the atomizing nozzle results in intimate

mixing of the fuel oil vapors with air, with consequent increase in efficiency and an inherent stability in the flame. Outwardly of the burner mouth 59 the spirally moving air stream expands radially in the combustion chamber 28. The central part of the air stream is highly agitated or in a state of great turbulence effected by the cross currents influenced by the shoulders 56 and 57 and the outer portion of the air stream continues to move spirally. Fuel oil sprayed from the orifice 26 forms a rich mixture in the highly agitated central portion of the combustion air. Combustion is initiated in this rich mixture and is completed in the outer shell of relatively leaner mixture which is rotating in a spiral fashion. A spark plays across the tip ends of the electrodes 68 and 69 in the region of the nozzle orifice 26 and ignites the combustible mixture in the highly agitated central portion of the air stream. If desired, the spark may be discontinued after ignition has been obtained and the burner is in operation.

In Figs. 3 and 4 there is illustrated a modification of the invention which is useful in applications where the oil burner requires a relatively long air tube. The central or body portion of this combination air tube and burner head assembly is formed by an elongated tubular portion 205 of substantially cylindrical form, which provides an air passage 206 corresponding to the combustion air passageway 17, previously described. One end of the tubular part or member 205 is secured in an end of a tubular supporting portion or member 207, which may be secured to the front end wall 37 of the burner housing 2 similar to the manner in which the air tube 3, previously described, is secured thereto, there being a triangularly shaped flange 208 on the supporting member or portion 207, which corresponds to the flange 11 on the tube 3.

At the front or burner head end of the assembly, the tube 205 is received in a ring member 209 to which is secured a head portion or member 210. This head portion has a radially extending flange 211 which corresponds to the flange 53 of the head 27 previously described, and is disposed flatwise against the ring member 209, being secured to the latter by a number of screws 212. These screws are preferably countersunk in the head flange 211 so that an annulus or ring 213 of fire-resistant, flexible material, such as asbestos, can be placed around the head portion and flatwise against the flange 211. The insulating ring or annulus 213 corresponds to the asbestos insulating ring 55, previously described, and may be held in place by a ring 214, preferably formed of metal, which is secured by screws 215 to the flange 211, the screws extending through the asbestos annulus 213. The head portion 210 of the assembly is preferably formed with internal cylindrical surface 216, which is of substantially the same diameter as internal cylindrical surface 217 of the tubular member 205. The surfaces 216 and 217 provide bearing portions for longitudinally movable spacing elements of the electrode assembly, not shown, but which may correspond to the legs of the spider 23, previously described.

Toward the outlet end of the air tube and burner head assembly, the head portion 210 is internally formed with a frusto conical or tapering portion 218, which serves to accelerate the movement of the air advancing through the passage in the air tube and deflect the same toward the

center of the tube in the manner previously described in connection with the burner head 27. At the extreme end of the head portion 210, there is formed a cylindrical portion 219 of lesser diameter than the cylindrical portion 216 and which extends as a continuation of the tapered portion 218.

The supporting portion 207 of the air tube and burner head assembly is formed with a cylindrical surface 220, preferably of approximately the same diameter as the cylindrical portion 47 of the air tube 3, previously described. Accordingly, the internal surface 220 of this modified form of the air tube may be disposed flush with the walls of the inlet end 16 of the air passageway formed in the burner housing 2. The end of the supporting portion 207 which receives the tubular member 205 is formed with an internal cylindrical surface 221 of approximately the same diameter as the internal surface 217 of the tube 205, so that such surfaces are flush with one another. Between the surfaces 220 and 221 of the supporting portion 207, there is formed a tapering or frusto conical internal surface portion 222 which imparts an initial acceleration to the air entering the passage 206 and also deflects the air toward the center of the tube after it enters the same.

This modification of the invention, like that first described, provides an air tube and burner head assembly in which a plurality of substantially cylindrical surfaces alternate with a plurality of frusto conical or tapered surfaces so that the air passing therethrough is alternately accelerated and allowed to proceed at substantially a constant velocity. Longitudinal adjustment of an electrode and fuel supply conduit assembly may be made in the air tube, similarly to the manner shown in Fig. 1. The spider or spacer of the electrode and supply conduit assembly, corresponding to the spider 23 previously described, seats in the forward end of the tube 205 or the cylindrical portion 216 of the head 210 while the bracket portion of the electrode and conduit assembly, corresponding to the bracket 22 previously described, can be secured in the tube 205 by means of a bolt passing through an elongated slot 223, which corresponds to the slot 66 previously described.

In its preferred form, the embodiment shown in Figs. 3 and 4 may be made by casting the ring 209 integral with the supporting portion 207. The integral casting is then bored or machined to the required diameter to receive both ends of the tubular portion or member 205, which desirably may be a length of steel or cast iron pipe. This boring or machining operation accordingly provides an accurate cylindrical surface 225 to receive the ends of the tube 205 and a circumferentially extending shoulder 226 adjacent the cylindrical portion 221, against which the end of the tube 205 in the supporting portion 207 may abut.

After the boring or machining operation, the ring portion or element 209 is cut from the casting and secured on one end of the tube 205, such as by brazing or by means of rivets 227 with the cut surface flush with the end of the tube. The other end of the tube 205 is placed in the bored portion of the supporting member 207 and is secured by means such as brazing or rivets 228. Thus, the invention provides an economical process for making air tubes of different lengths for use with burners of the character described, it being apparent that the steel or cast iron pipe

255 may be initially formed or cut to any desired length.

In placing the head end 210 of the air tube and burner head assembly in the fire hole of a furnace, the asbestos ring or annulus 213 is first moistened, as described in connection with the embodiment illustrated in Figs. 1 and 2, so that it may be readily deformed or bent without being broken. A drain passage 229 is formed in a bottom depending boss portion 224 of the head member 210 so that fuel oil leaking into the air tube may be released to flow into the combustion chamber of the furnace or boiler to which the burner is connected. As shown, the passage 229 communicates with the portion of the air passageway formed by the cylindrical surface 216 of the burner head.

In Fig. 5 is illustrated an integral air tube and burner head embodying a number of the features described in connection with the previous figures. This integral device may be formed of cast iron or steel or the like and comprises a generally tubular body 230 which is circular in cross section, or substantially so, throughout its entire length, there being formed thereon a radially extending attaching flange 231 of triangular form, and which corresponds to the attaching flanges 11 and 208 previously described. The major portion of the air passageway through the combined tube and burner head 230 is defined by an integral substantially cylindrical surface 232, which corresponds to the surfaces 216 and 217, previously described in connection with Figs. 3 and 4. At opposite ends of the cylindrical surface 232, the air passage is defined by internal frusto conical or tapering wall portions 233 and 234 which serve to accelerate and deflect the advancing air toward the center of the passageway in the manner previously described. At the head end of the device is an internal cylindrical surface 235 which extends from the open end of the head to the tapered or conical surface 234.

The flanged end of the integral air tube and burner head is formed with an internal cylindrical surface 236 which is preferably of the same diameter as the opening into the end portion 15 of the air passageway formed in the blower housing 2. A drain passage 237 is formed in a depending boss 240 at the outlet end of the head, and communicates with the air passage portion defined by the cylindrical surface 232 so as to release oil therefrom to flow into the combustion chamber of the furnace or boiler to which the burner may be connected.

The outside of the combined air tube and burner body, shown in Fig. 5, may be of substantially frusto conical shape throughout the major portion of its length, as indicated at 238. A short cylindrical portion 239 may be provided adjacent the flange 231, if desired. In this embodiment of the invention, like those previously described, there are a plurality of tapered or conical portions in the tube or head which accelerate and deflect the advancing air, these tapered portions being separated by or disposed in alternating relation to a plurality of internal cylindrical surfaces which may serve to guide and support suitable spacing members or elements of the electrode and fluid conduit assembly. In the embodiment of the invention shown in Fig. 5, the use of an annulus or ring of heat resistant insulating material, such as the rings 55 and 213 previously described, is eliminated and the end of the tube may be inserted in the firing hole of

a furnace and packed with suitable insulating material in the usual manner.

The burner heads described above have a minimum resistance to the flow of air therethrough and are substantially without radially disposed projections which extend inwardly from the surfaces defining the air passages. The walls of the air passages are circumferentially smooth and unobstructed so that air flows therethrough without moving over vanes or fins to retard or impede the movement of the same and thus reduce the capacity of the burner. Accordingly, a given size of impeller or fan 9, used in burners of the character described above, can be used for increased capacity. Furthermore, a more desirable flow of air is provided, which is extremely beneficial in entraining and dispersing fuel oil discharged or projected from the nozzle 25. The accelerating of the air in stages as provided for by the present invention is believed to have a stabilizing effect on the air flow, which results in more uniform air velocities over different cross sections of the air stream so that the flame produced thereby is inherently stable and highly efficient.

The present invention thus provides a unique air tube and burner head assembly which imparts a desirable cross flow and turbulation to the air stream around the fuel ejecting nozzle without the use of vanes or objectionable flow obstructing projections. The invention also provides a nozzle sealing ring of fire resistant and insulating character which facilitates the installation of the burner head in the refractory or other combustion chamber walls of the furnace or boiler with which the burner is to be used.

The principles of the present invention may be utilized in various ways, numerous modifications and alterations being contemplated, substitution of parts and changes in construction being resorted to as desired, it being understood that the embodiments shown in the drawings and described above are given merely for purposes of explanation and illustration without intending to limit the scope of the claims to the specific details disclosed.

What I claim is:

1. In an oil burner, an air tube having an air passage therethrough with a circular outlet opening at one end, a tubular head secured on said end of the air tube over the opening, the head having a circular inlet opening of slightly less diameter than the tube opening to provide a circumferential shoulder at the tube outlet, a fuel atomizing nozzle extending into the head through said inlet opening and means for supplying oil thereto, and means for forcing air through the tube and against the shoulder to be deflected thereby across the tube opening prior to moving across the nozzle orifice to receive and entrain the oil from the latter, said head having a passage extending as a continuation of the tube passage and generally of smaller cross sectional area to effect an increase in velocity of the air subsequent to said deflection thereof, said head and tube passages being substantially free of transverse obstructions to the flow of air therethrough.

2. In an oil burner, an air tube having an air passage therethrough with a circular outlet opening at one end, a tubular head secured on said end of the air tube over the opening, the head having a circular inlet opening of slightly less diameter than the tube opening to provide a circumferential shoulder at the tube outlet, a

fuel atomizing nozzle extending into the head through said inlet opening and means for supplying oil thereto, means for forcing air through the tube and against the shoulder to be deflected thereby across the tube opening prior to moving across the nozzle orifice to receive and entrain the oil from the latter, said head having a passage extending as a continuation of the tube passage and generally of smaller cross sectional area to effect an increase in velocity of the air subsequent to said deflection thereof, and a circumferentially extending shoulder of relatively shallow radial depth extending into the head passage from the walls thereof to effect a further deflection of the air.

3. In an oil burner, an air tube and head construction having walls which define a passage of substantially circular section throughout its length and substantially free from transverse obstruction to the flow of air therethrough, said walls including at least two cylindrical portions of different diameters and at least two tapered portions, the tapered portions alternating with the cylindrical portions and so arranged that air flowing through the passage normally traverses the larger diameter cylindrical portion first, then one of the tapered portions and the smaller diameter cylindrical portion, and then the other tapered portion, and means for supplying fuel oil in finely divided form to flowing air only after the latter is discharged from said other tapered portion of the passage, whereby the flowing air is accelerated in at least two separated zones during its travel through the passage and prior to the supplying of oil thereto.

4. A combined air discharging and sealing device for an oil burner, comprising a tubular head through which combustion supporting air is discharged, means providing a radially directed, circumferentially extending shoulder on the outside of the head, an annulus of pliant heat resistant insulating material disposed about the head in embracing relation thereto and against said shoulder, the annulus being normally of greater radial extent than the shoulder to permit radial and lateral bending of the outer periphery of the annulus over the outer edge of the shoulder in connecting the burner to the combustion chamber of a heater, and clamping means having engagement with the radially inner marginal edge portion of the annulus for holding the annulus against the shoulder.

5. A combined air discharging and sealing device for an oil burner, comprising a tubular head through which combustion supporting air is discharged, means providing a radially directed, circumferentially extending shoulder on the outside of the head, an annulus of pliant heat resistant insulating material disposed about the head in embracing relation thereto and against said shoulder, a rigid ring encircling the head and disposed against the annulus, said annulus extending outwardly in a radial direction beyond the shoulder and the ring to permit radial and lateral bending of the outer periphery of the annulus in connecting the burner to a heater, and

fastening means holding the ring against the annulus to thereby clamp the inner periphery of the annulus between the shoulder and the ring and prevent axial displacement of the annulus on the head.

6. A combined air discharging and sealing device for an oil burner, comprising a tubular head having an end through which combustion supporting air is discharged, means providing a radially directed, circumferentially extending shoulder on the outside of the head and spaced from said end a distance greater than the radial height of the shoulder, an annulus of heat resistant insulating material disposed about the head in embracing relation thereto and against said shoulder, the annulus being normally of greater diameter than the shoulder means and spaced from said head end at least the thickness of the annulus, and means for clamping the radially inner marginal portions of the annulus against the shoulder.

7. A combined air discharging and sealing device for an oil burner, comprising a tubular head of circular section through which combustion supporting air is discharged, a radial flange on one end of the head, an air tube having an end abutting one side of said head flange, an annulus of heat resistant pliant insulating material disposed around the head in embracing relation thereto and against said flange, means extending through the flange and having connection with said end of the tube to secure the head and tube together, and means for holding the annulus against the flange, said annulus projecting radially beyond the flange to permit substantial lateral and radial deformation of the annulus in connecting the burner to a heater.

8. For use in combination with the wall of a heater having an opening to receive combustibles, a tubular oil burner head receivable within the opening so as to be spaced from the walls thereof and having connection with means for supplying combustibles therethrough to the heater, an annulus of fibrous heat resistant insulating material embracing the head and engageable with the walls of the opening, means clamping the inner periphery of the annulus to the head, and a packing of plastic insulating cement disposable in the annular space around the head between the head and the walls of the opening and against one side of the annulus.

9. An oil burner head construction disposable in the fire hole of a heater comprising a tubular head, a ring-like insulating element of pliant deformable heat resistant material disposed about the head in embracing relation thereto, said element having a radial depth greater than its thickness and extending radially outwardly beyond all portions of the head, and means securing the inner periphery only of the element to the head to prevent axial movement of the element along the head whereby the outer periphery can be readily deformed both laterally and radially to fit the contour of the fire hole walls.

REGINALD W. BECKETT.