Sept. 13, 1955 W. B. PERDUE 2,717,638

OIL BURNER

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Fig. 1.

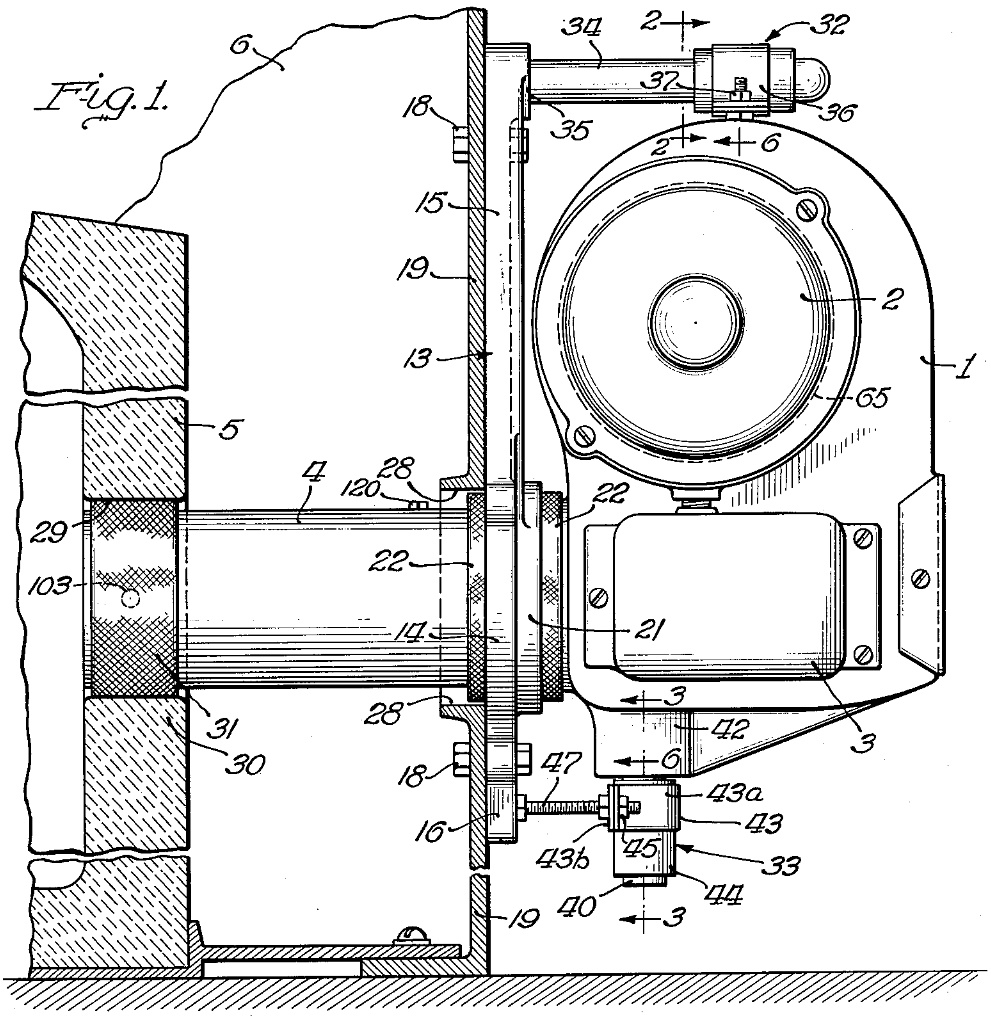


Fig. 3.

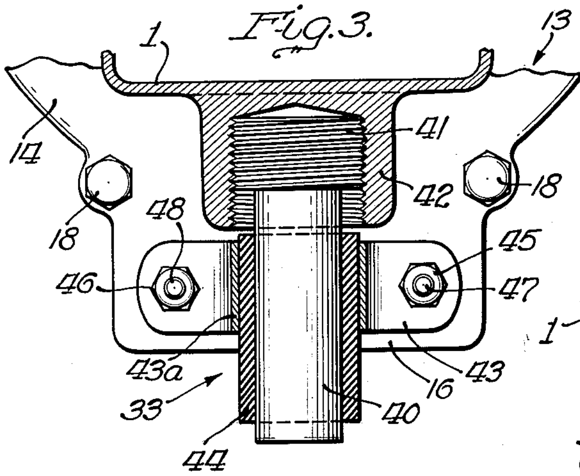
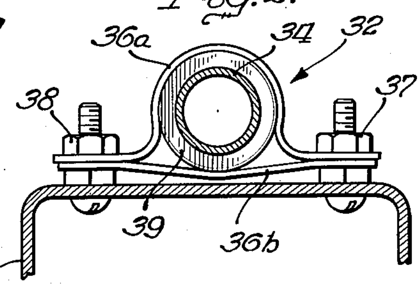


Fig. 2.



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OIL BURNER

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Fig. 4.

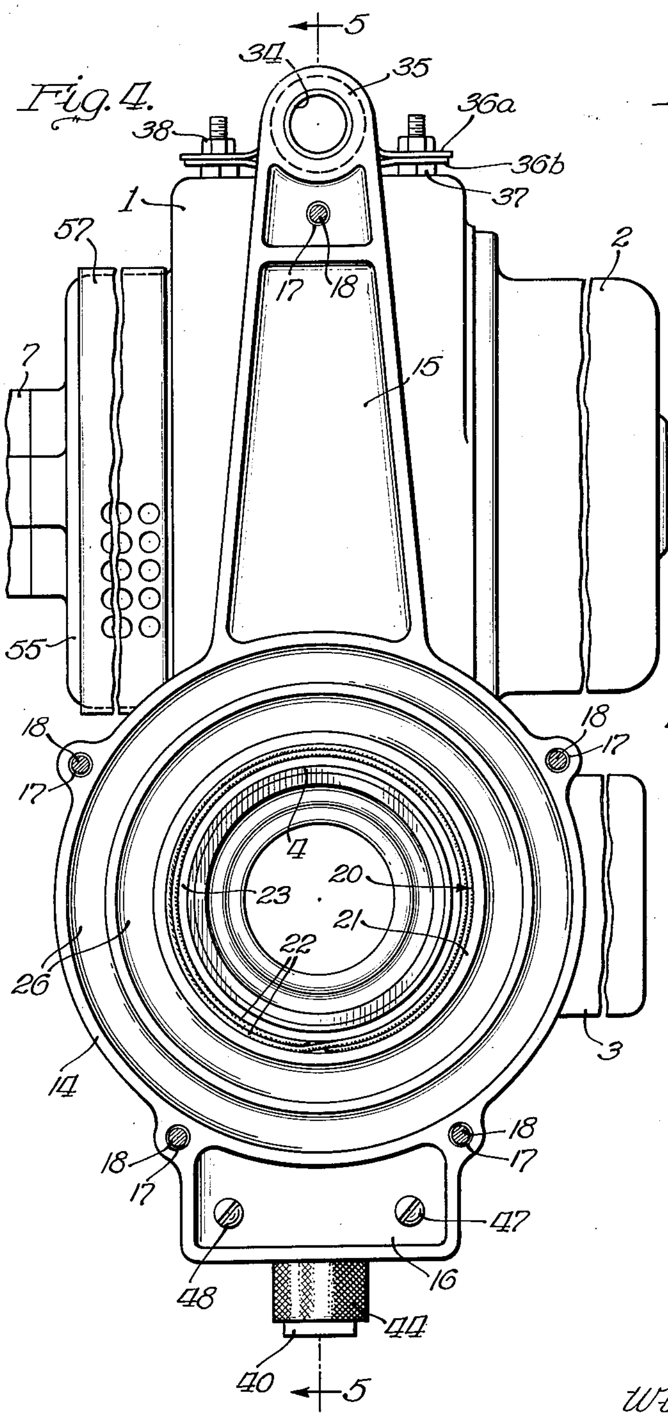
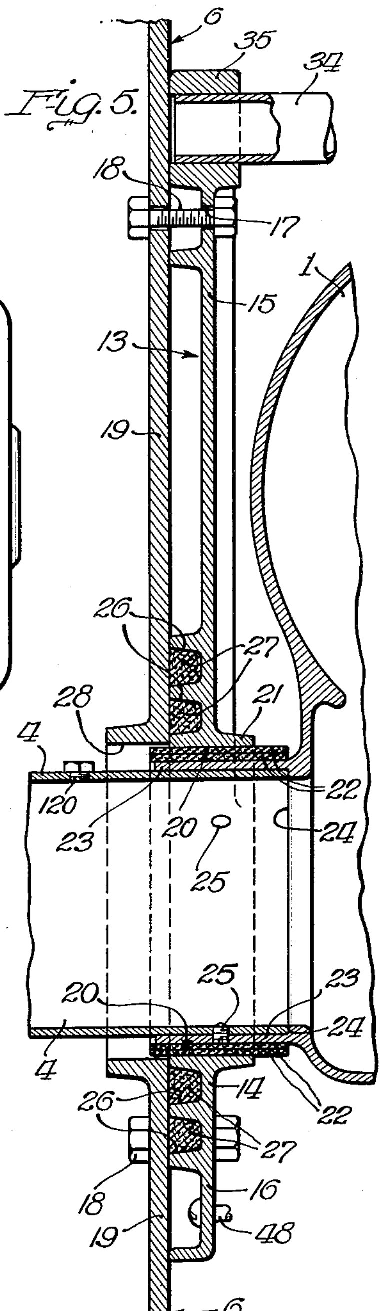


Fig. 5.



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OIL BURNER

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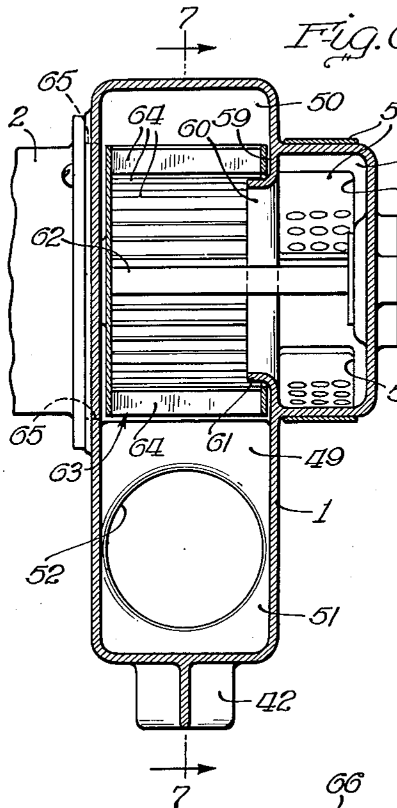
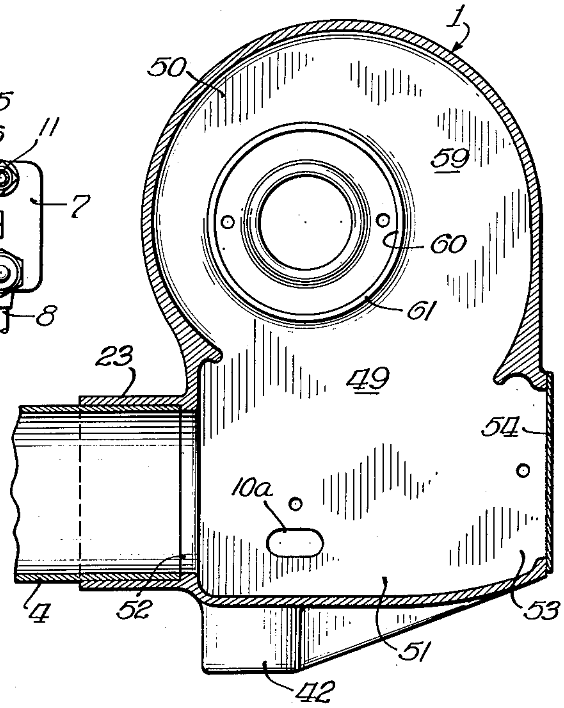


Fig. 6.

Fig. 7.



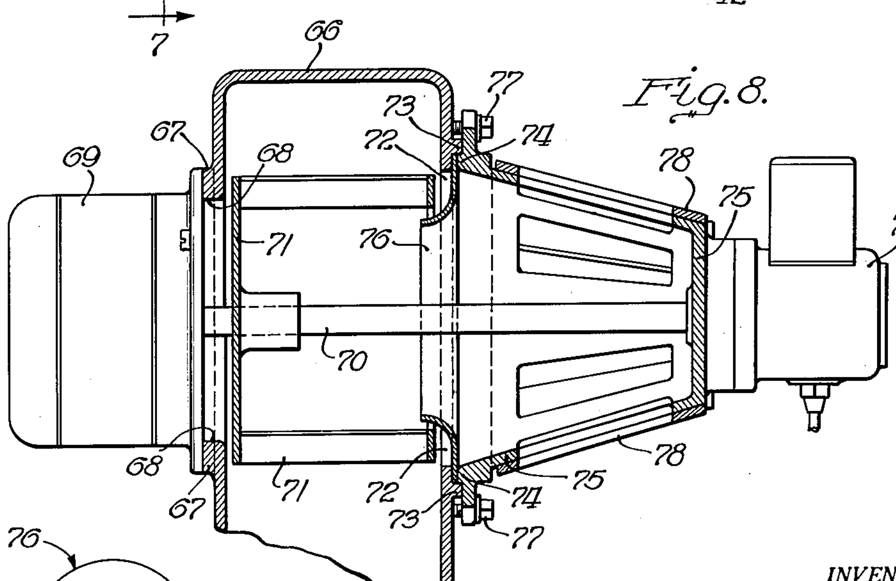


Fig. 8.

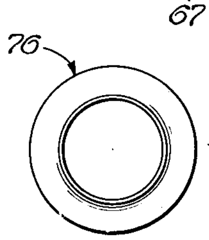


Fig. 9.

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Fig. 10.

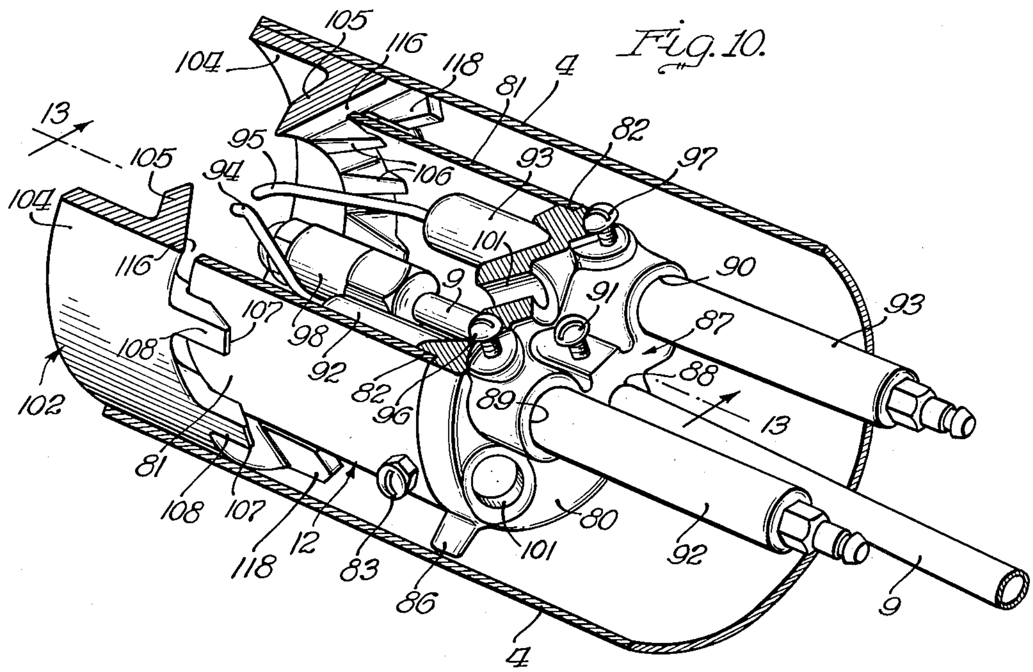

Fig. 11.

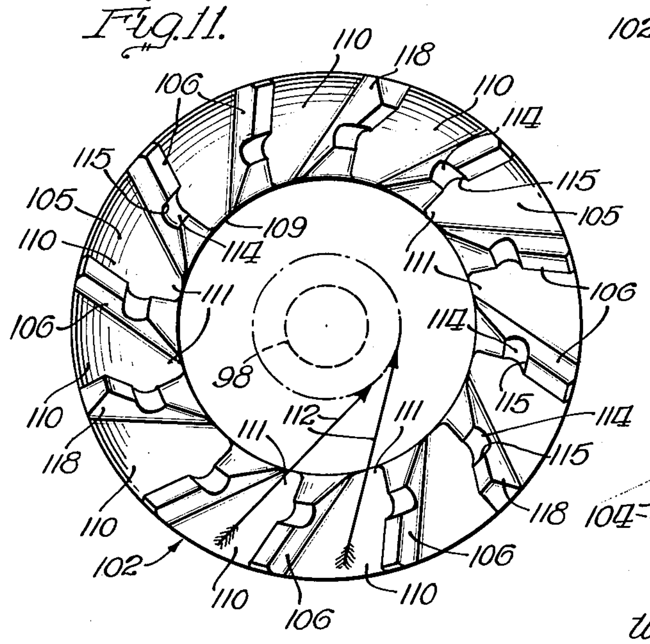

Fig. 12.

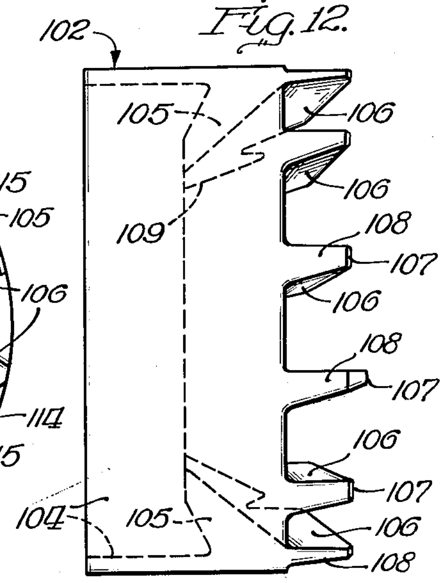

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Fig. 13.

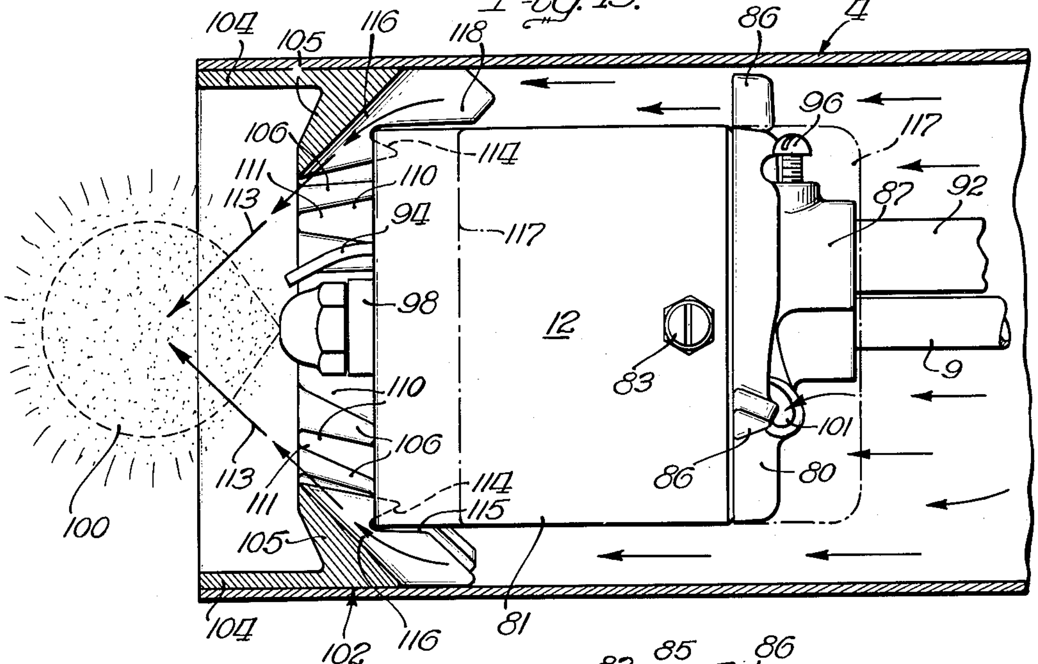


Fig. 14.

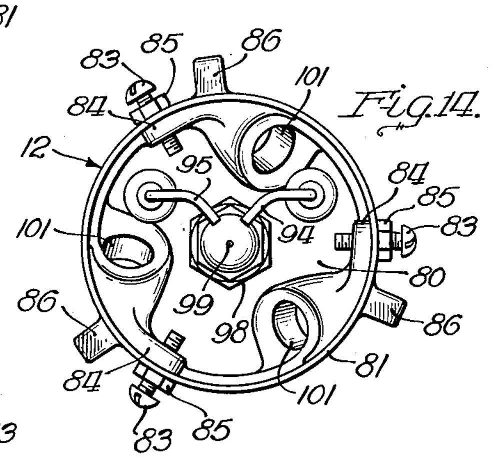
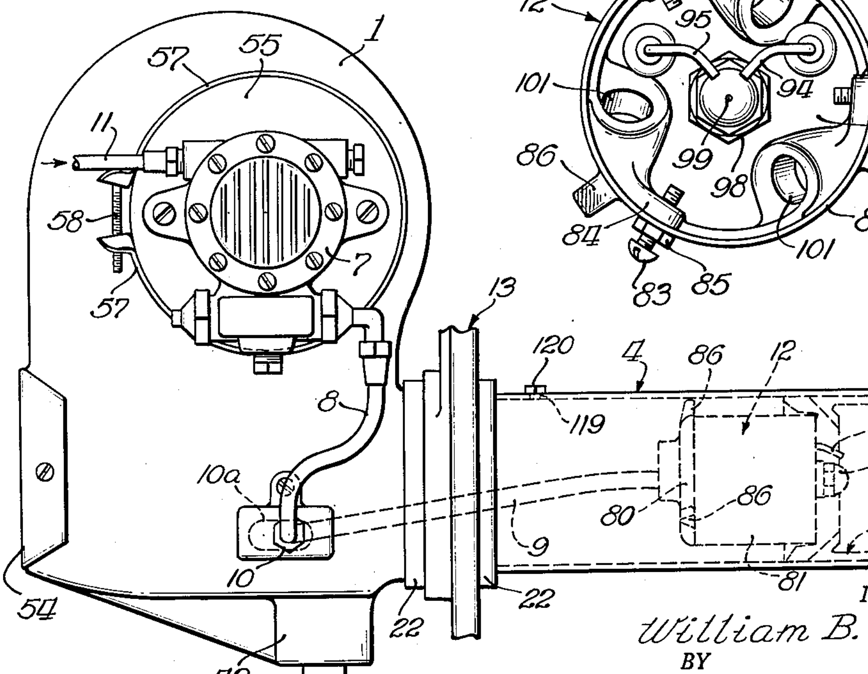


Fig. 15.



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OIL BURNER

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Application September 14, 1949, Serial No. 115,665

8 Claims. (Cl. 158—76)

This invention relates to an oil burner and more specifically to the complete apparatus for the combustion air supply system employed, and to the various means and mechanisms used to produce a quiet and efficient burner having a hot clear flame with comparatively low fuel consumption with a correspondingly economical operation.

The design and construction of oil burners have always presented numerous problems of variable natures with no actual classification as to their individual importance in the oil burner structures. Burner nozzles, heads, cones, air supply means and oil supply means together with flow controls, etc., cannot be considered individually in a burner system to obtain the optimum in design and construction for the increased efficiency of a unit paralleled by noticeable savings in operating costs and maintenance.

It is one of the main objects of the present invention to provide a completely correlated combination of structures to increase the maximum efficiency of an oil burner by a controlled air supply system for a fixed oil supply ratio to eliminate variable output under the same conditions of use. The air supplied by this burner is only needed air for combustion, no more, no less, and the manner of commingling of the air with the oil is also an improved departure from the conventional oil burner tactics of the past and present day methods. In burners as at present or previously produced the volume and/or static pressure of the combustion air have been given little attention. Consequently correct fan housing designs have not been employed. Fan housing designs have long been known, but such housings as described herein, have never been used in combination with the features herein embodied in an oil burner, wherein the incorporation of such a housing functioning as described is essentially new.

The present invention also contemplates certain adjustments of the system by the composite mechanisms contributing to the value of the burner. For example, the head and cone are relatively movable at the exhaust end of the blast tube for controlling the volume and/or the air pressure at the outlet end of the blast tube. Air inlet adjusting means are also used in obtaining a final adjustment after a balanced system having a predetermined static pressure in the blast tube has been established by the amount of opening selectively provided between the head and cone of the oil burner. This is a new and necessary feature in the present burner design for obtaining the results contemplated in this unit.

As a further improvement, the burner is constructed for resilient and noiseless support from the wall of the heater, boiler or furnace, thus giving quiet operation with a minimum of vibration to eliminate disturbances such as would directly affect shifting or loosening of the adjustable burner mechanisms and to thereby insure constant highly efficiency B. t. u. output under the exact conditions and adjustments selected for the operation of a particular burner.

It is another object of this oil burner to use for the first time a fan and housing or blower with a housing of a prescribed design and performance in combination with a burner blast tube, which housing will have a fixed and tested air output during operation to supply the blast tube with a constant air delivery to create in said tube, in combination with the burner head and air cone control at the outlet end of said tube, a predetermined plenum of air under a given static air pressure. This involves the use of a housing scroll of optimum design with the proper cut-off correctly rounded and spaced in proper relation to the blower wheel and housing inlet. And as one of the main controlling considerations, this static air delivery feature of the fan housing must include the proper size air inlet to the fan or blower wheel.

Through experience it has been found that the fan intake area must have an uninterrupted "area of approach" which is equal in area to one and one-half times the area of the fan inlet to establish and maintain a constant static air pressure in the burner blast tube.

The oil burner of the present invention includes a blower having the above characteristics with a housing of integrally cast walls to form the required inlet and outlet chambers to connect with the burner blast tube for functioning in the manner described.

The oil burner of this invention includes such features as providing an integral fan housing design to eliminate recirculation of inlet air; to provide means for testing the static pressure of the blast tube air; to provide an air cone design incorporated into this burner to obtain a combustible mixture with high economy fuel consumption; and amongst others, to incorporate an arrangement of nozzle and oil line to eliminate soot and stench by automatically guarding against after drip of the fuel oil.

Other features and advantages embodied into the present design of oil burner shall hereinafter appear in the following detailed description having reference to the accompanying drawings all forming a part of this specification.

In the drawings:

Fig. 1 is a side elevational view of an oil burner constructed according to the principles above set forth to carry out the improved functions stated, this illustration showing a general installation of the oil burner for a heater;

Fig. 2 is a fragmentary detail cross sectional view of the upper burner support as attached to the top of the oil burner;

Fig. 3 is another fragmentary detail cross sectional view of the lower burner support as the same is attached to the bottom of the oil burner;

Fig. 4 is an end elevational view of the oil burner as seen from the blast tube end thereof to show the supporting bracket as if removed from the burner with the securing screws shown in section;

Fig. 5 is a vertical cross sectional view of the bracket and adjacent burner parts substantially as seen along the plane of the line 5—5 in Fig. 4;

Fig. 6 is a transverse vertical cross sectional view through the burner fan housing and associated air chambers as seen substantially along the plane of the line 6—6 in Fig. 1 and illustrating the means that prevents air recirculation;

Fig. 7 is another vertical cross sectional view of the burner fan housing as taken along the line 7—7 in Fig. 6 with the fan and drive means omitted to better illustrate certain details of construction;

Fig. 8 is a fragmentary transverse vertical cross sectional view of the fan housing of another form of oil burner to show a further contemplated structure for preventing air recirculation.

Fig. 9 is a face view of the air deflector ring used in the Fig. 8 oil burner;

Fig. 10 is a perspective view of a fragmentary portion of the discharge end of the blast tube with the latter partially broken away and in section to show the head and cone as well as their relationship, parts of the head and cone also being broken away and in section to show some of the salient features of their design;

Fig. 11 is a face view of the cone as seen from the side disposed within the blast tube but with the cone removed from the tube to show the surface contour of the structure and design of the cone for directing the air in front of the oil nozzle and into the oil mist zone beyond the burner head;

Fig. 12 is a side elevational view of the air cone per se to show other of the details thereof;

Fig. 13 is a vertical longitudinal cross sectional view of the discharge end of the blast tube to show the air cone and the head as they would appear when viewed substantially along the line **13**—**13** in Fig. 10;

Fig. 14 is an end view of the burner head per se as it appears when viewed from the oil nozzle end thereof; and

Fig. 15 is a side elevational view of the oil burner as seen from the reverse side of Fig. 1 to show the oil supply system and the connections thereof leading to the head of the oil burner.

The oil burner as best seen in Fig. 1 comprises an integrally cast fan housing **1** carrying a motor **2** and an ignition transformer **3**, and said housing **1** being rigidly joined with a blast tube **4** adapted for communication with a combustion chamber such as **5** disposed within a heater or boiler **6**. Fig. 15 shows the reverse side of the burner and the connected fuel oil pump **7** having an oil line **8** connected with an oil line **9** through a coupling **10** passing into an elongated clearance opening **10*a***. Fuel oil is supplied through an oil line **11** from a suitable reservoir and the oil is directed to the oil burner head **12** through the oil line **9**.

To provide a quiet running unit of minimum vibration coupled with the facility of securing the same directly to the wall of the heater or boiler, the burner structure is coupled with a cast bracket **13** illustrated in Figs. 1 to 5. This arrangement permits the oil burner to be rigidly supported upon the device for which it provides heat and this form of a support eliminates floor standards, pedestals, together with cement blocks and adjustable means normally used for mounting an oil burner adjacent a heating unit.

Bracket **13** is of light weight construction comprising an annular body **14** with an upstanding arm **15** and a depending apron **16** each disposed at opposite edges of the body **14** and in vertical alignment, said members **14**, **15** and **16** including appropriately arranged bolt holes **17** for bolts **18** which securely fasten the bracket to the wall **19** of the heater **6**. The body **14** has an opening **20** for the blast tube **4**, the opening being outlined by a peripheral flange **21**. Flange **21** is large enough to compactly encircle an asbestos fabric wrapping **22** which is wound about the tubular exhaust sleeve **23** that comprises part of the fan housing **1**.

Sleeve **23** which forms an integral part of housing **1** is shouldered at **24** and snugly receives the housing end of the blast tube **4** fixing the tube to the sleeve by such means as the screws **25** as shown in Figs. 4 and 5 thus providing a snug air tight seal between the blast tube **4** and the housing **1**. Several annular grooves **26** are positioned to surround the blast tube opening **20** in bracket **13** and packing **27** may be used in grooves **26** for the purpose of contacting the wall **19** of the heater **6** to produce an air tight seal at the heater opening **28** as seen in Figs. 1 and 5. The outer or discharge end of the blast tube **4** is received in an opening **29** in the wall **30** of the combustion chamber **5**, and a winding of asbestos fabric **31** surrounds tube **4** and is interposed between the tube **4** and the circular wall of opening **29** to further quiet noise and operational vibrations. This asbestos fabric **31** and the manner of receiving the end of the tube **4** in the combustion chamber wall opening **29** lends further rigidity to the burner and acts to stabilize the supported burner and its parts.

The mounting of the burner as a self contained and bodily attachable unit to the wall **19** of the heater **6** is completed through upper and lower bracket supported mountings **32** and **33** respectively as illustrated in Figs. 1 to 5 inclusive. The upper mounting **32** comprises a tube **34** fixed in the upper bracket boss **35** to project outwardly over the fan housing **1** to be encircled by a two part clamp **36** that is tightened by nut and bolt means **37** and **38** which also simultaneously secure the clamp structure to the top of the fan housing **1** as seen in Fig. 2. A rubber sleeve **39** is interposed between the tube **34** and the tube encircling clamp parts **36*a*** and **36*b*** for dampening vibrations and noises to counteract the transmittal of noises to the heater **6** through the bracket **13** with the corresponding resilient supporting action of the oil burner to limit vibratory disturbance in the latter which may throw burner parts out of adjustment causing improper functioning of the burner.

The lower mounting **33** comprises a vertical tube **40** having a threaded head **41** to screw into the internally threaded boss **42** forming a part of the fan housing **1**, and including a clamp **43** having parts **43*a*** and **43*b*** encircling a rubber sleeve **44** carried upon the tube **10**. The clamp parts **43*a*** and **43*b*** are tightened upon the sleeve **44** by nut and bolt means **45** and **46** having bolts **47** and **48** connected at spaced points with the apron **16** of the bracket **13**. This completes the structural details comprising the means that suspended the burner bodily from a wall of the heater in a vibration dampened noise proof manner with quiet results under resilient but stabilized operational conditions during all ordinary functions of the burner.

By including further refinements and improvements into the combustion air circulatory and supply system of the burner greater combustion air efficiency is possible with quiet operational results due to the elimination of some of the air disturbing factors of the blower and associated parts. As seen in Figs. 6 and 7, the fan housing **1** comprises a vertical fan chamber **49** having the scroll chamber **50** communicating with the outlet chamber **51** through which air is directed out of the sleeve opening **52** into the blast tube **4**. The outlet chamber **51** includes an offset pocket **53** closed by a detachable cover **54** which will permit removal of the burner head **12**, etc., if such parts require inspection or servicing.

The fan chamber **49** has a laterally connected air inlet chamber **55** which is concentric with the axis of motor **2**. Chamber **55** has circumferential air inlet openings **56** and a suitably perforated metal band **57** is adjustably secured about the walls of chamber **55** by a clamp screw **58** such as best seen in Fig. 15. Circumferential regulation of the band **57** around the wall of chamber **55** and the attainment of a properly selected inlet air volume at the inlet end of the fan housing will provide a given volume of air for use and combustion at the burner head and oil discharge end of the blast tube **4**.

The fan housing **1** and inlet chamber **55** are separated by an integrally cast dividing wall **59** including an air inlet opening **60** arranged concentrically with the axis of the motor **2**. The opening **60** is defined by an annular flange **61** originating in the plane of the dividing wall **59** and terminating within the fan housing substantially in the location best seen in Fig. 6. The motor **2** has a drive shaft **62** traversing the fan housing **1** and the intake chamber **55** for driving connection with the fuel oil pump **7** to deliver the fuel oil under pressure to the burner head **12**. A squirrel cage fan **63** is secured to and driven by the shaft 62 and the fan is substantially the width of the housing 1 and of a diameter such as to cause the outer ends of the fan blades 64 to rotate about the dividing wall flange 61.

The cooperative arrangement of the fan 63 and the air discharging flanged opening 60 of the fan housing definitely prevents recirculation of the inlet air in the fan housing thus eliminating turbulence of air with consequent noisy operation all accompanied by inefficiency in performance and in combustion air delivery to the fuel burning point in the oil burner. The integral construction of dividing wall 59 and the flange 61 of the opening 60 coact to strengthen the entire body of the fan housing and the adjacent manifold parts including the pump supporting section of the housing 1. Furthermore, the inlet air may be accurately metered by the combination of the control of the inlet air at chamber 55 by the perforated band 57 together with the flange 61 forming an air funnel to axially spill the air directly into the fan blade cavity of the fan 63 for full and complete transmission of air directly to the burner head 12 and to the flame propagation point of such oil burner. The area of chamber 55 considered transversely to shaft 62 is one and one-half times the area of opening 60 to the fan, and openings 56 must provide a collective inlet area at least equal to the area of chamber 55 so as not to starve the fan.

The solid cast noise free housing shown in Figs. 6 and 7 shows an oil burner wherein the motor 2 is capable of attachment to housing 1 about and over an opening 65 which is large enough to limit the fan 63 from the motor side with the fan blades 64 encircling the flange 61 of opening 60. In larger oil burners the motor mountings do not permit assembly of the fan arrangement as in the foregoing described structure.

Figs. 8 and 9 therefore illustrate a modified arrangement for air transmission from the air inlet to the fan housing having the same advantageous air funnel features. The burner housing 66 has a motor boss 67 arranged about the opening 68 for the motor 69 with the motor shaft 70 passing through opening 68 to support a squirrel cage fan 71. The latter is brought into the casing through an opening 72 having a peripheral ring 73 to receive the edge 74 of the detachable inlet casing 75. A removable annular shield 76 is interposed between ring 73 and edge 74 and tightly held in place by the bolts 77 that secure the casing 75 to the adjacent wall of tthe casing 66. An adjustable and rotatable louver cone 78 is mounted upon the apertured casing 75 and the latter also carries a fuel oil pump 79 driven by shaft 70. Removal of bolts 77 allows removal of casing 75 and shield 76 to remove the fan 71.

In this burner the shield 76 provides the baffle means to separate the fan housing and inlet chamber and it functions to spill combustion air axially into the interior of the blade barrel of the fan to provide even and efficient air passage through the blower and into the carburetion zone of the oil burner.

The burner head 12 and its associated mechanisms are all best illustrated in Figs. 10 to 15 inclusive. The head 12 comprises a cup structure having a cast base 80 and a tubular sleeve 81 having its attached end seated in an annular base recess 82 with a plurality of screws 83 positioned radially through suitable sleeve openings for threaded connection with base bosses 84. Lock nuts 85 engage the surface of sleeve 81 and lock the screws 83 in place as shown in Fig. 14.

Base 80 also has radially positioned lugs 86 to engage the interior of the blast tube 4 to position the head 12 centrally within the tube as best shown in Figs. 10, 13 and 15, thus providing an annular air space between the head 12 and tube 4 through which the air for combustion is directed by the blower system comprising the inlet unit 55 and 57, opening 60 and flange 61, fan 63 and housing 1, and the connected blast tube 4.

Base 80 also has a boss 87 on the outer face thereof with the boss having a configuration to accommodate three axially disposed bores 88, 89 and 90. Bore 88 loosely receives and supports the head end of the oil delivery tube 9 centrally of the base 80 and of the sleeve 81. A set screw 91 fixes the relative positions of the tube 9 and head 12 and holds the latter in a predetermined longitudinal position within the last tube 4.

Electrodes 92 and 93, carrying the ignition wires 94 and 95, are loosely supported in the bores 89 and 90 respectively. Suitable set screws 96 and 97 engage the electrodes to position each longitudinally relatively to the base 80 and to position each electrode against rotation within its respective bore to thus bring the ignition wires 94 and 95 into operative relation.

The oil line 9 is connected with and supports the oil delivery nozzle 98 having a small diameter central opening 99 at its head end through which oil is discharged by the pump in a finely atomized mist 100 as best shown in Fig. 13. As shown in Fig. 15, the oil line 9 is arranged to incline upwardly from its oil receiving end at the coupling 10 to the head end for the purpose of preventing after drip from the nozzle 98 thereby eliminating the cause of sooting and the stench which accompanies such conditions. With an upslope in the oil line 9 any entrapped air in the line will find its way out of the line and nozzle without carrying fuel oil with it through the nozzle. This arrangement therefore provides means for automatically purging the oil line and nozzle in a gun type pressure burner to eliminate the heretofore objectionable after drip in an oil burner. Obviously, during operation this arrangement carries on its intended task in the same fashion as any other type of burner.

The base 80 of the head 12 includes a plurality of boss configurations accommodating openings 101 best seen in Figs. 10 and 14. These openings 101 are bores having their axes angularly disposed with respect to the general plane of the base 80 and also angularly arranged with respect to the axial center line of the head to produce a composite whirl of air within sleeve 81 that moves toward the open end of sleeve 81 past the electrode ignition wires 94 and 95 and past the oil blast nozzle 98. The air that enters the head through the openings 101 is bypassed from within the blast tube 4 containing air under pressure as supplied from the fan 63 through the housing 1 into the blast tube 4.

The purpose of the air inlets 101 at the rear of the head 12 is to provide a means to prevent the formation of a vacuum within the head as a result of the velocity of the combustion air that sweeps over the head and over the front end thereof. The stolen air passing through inlets 101 provides a means to assist in stretching out the arc from the spark at the ends of the ignition wires of the electrodes at a point adjacent the discharge zone of the nozzle 98. This bypassed air also contributes to support combustion of the burning oil when ejected from nozzle 98 during operation of the burner.

With this head structure the efficiency of the burner is increased by the fact that the oil flame is only directed forwardly out of the head and blast tube and into and across the combustion chamber of the heater. No vacuum detractions exist in the head. And these features when combined with the type of air cone 102 as herein used introduce burning efficiencies and performance that have not been attained in comparable old type burners.

The air cone 102 is secured within the discharge end of the tube 4 by one or more set screws 103, see Fig. 1. This cone 102 as best illustrated in Figs. 10 to 13 comprises a peripheral sleeve 104 terminating in a conical apron 105 disposed radially inwardly from the sleeve 104 and reentrant from the rear thereof which is the head receiving end of the sleeve. A plurality of vanes 106 line the rear or air receiving face of the apron 105 and terminate rearwardly of the apron as prongs 107 having their end walls 108 circumferentially coincident with the outer circumferential surface of the sleeve 104 for flush contact within tube 4.

The vanes 106 are narrow at the outer cone periphery and widen out at the fringe of the cone discharge opening 109 to produce a plurality of air channels 110 on the surface of the apron 105 which then become restricted at 111 adjacent the air outlet opening 109 in the cone 102. As shown in Fig. 11, the vanes 106 are also located angularly with respect to true radial planes of the cone to position the air channels 110 in locations for discharging air that strikes apron 105 in individually concentrated streams along the directions of the arrows 112 in Fig. 11. Arrows 112 show the air stream paths as seen when looking at the face of the air cone in Fig. 11, but the same air streams are directed into the oil mist ball 100 in paths indicated by arrows 113 in Fig. 13.

The blower air from fan 63 passes through the blast tube 4 as shown by the arrows in Fig. 13 and strikes the apron 105 to divide into the channels 110 which, due to their restricted discharge ends 111, discharge the blower air in straight but nonspinning independently definable streams of high velocity air through such restrictions and in a direction to drive this combustion air toward the center of the oil mist ball that is forming ahead of nozzle 98 to provide intimate intermingling of air and oil for promoting complete burning of the fuel. The oil discharged under pressure from the nozzle 98 expands into the oil mist ball 100 and in doing so penetrates and intercepts the plurality of individual forced air streams guided by the shape of the cone toward the central zone of the oil mist ball. This action functions to stabilize the flow of oil mist and combustion air and contributes to the production of a clear hot flame of a predetermined size, shape and character, and with a substantially constant B. t. u. output for the arranged setting of the burner. The cone 102 thus provides the means to drive the combustion air through the oil mist to support combustion of the mist principally by means of air within the oil mist ball.

Since the cone 102 has the apron 105 leading from its full external diameter, the vanes 106 pick up, deflect and guide the blast tube air from the full diameter of the tube and including some of the air coming out of the sleeve 81 of the head 12, all in a direction to inject air inside the oil mist ball for internal flame propagation. This arrangement prevents turbulation within the blast tube except in the manner described; while the air entering the head through openings 101 produces spinning air in said head to prevent fouling with carbon deposits and to secure perfect air-oil mixture.

Referring again to Figs. 10 to 13, it should be noted that the vanes 106 are all notched at 114 to provide a series of landings 115 circularly positioned to receive and/or support the open end of the sleeve 81 of the head 12 in concentric relation with respect to the cone 102. When the head 12 is in the full forward position with sleeve 81 bottomed in the notches 114, the sleeve 81 is disposed at a given minimum distance from the surface of the cone apron 105 creating a valvular means to regulate air flowing through the passageways 116 as seen in Figs. 10 and 13. This provides a set up with a given fuel capacity consumption. By the loosening the oil line screw 91 and by drawing the head rearwardly in the blast tube 4 to a position indicated in dot and dash lines at 117 (Fig. 13) to move the sleeve 81 relative to the apron 105, another set up is obtained which provides an increased fuel capacity consumption with a greater B. t. u. output to the heater 6 by reason of the control of the air flow and air pressure at the cone by the movable head.

As a means for supporting or further guiding the front end of the head 12 under the adjustable arrangement described, certain of the vanes 106 are provided with extensions 118 to increase the lengths of the lands 115 of the cone notches 114.

In installations requiring larger heat output from burners and a correspondingly larger size of blast tube such as 4, the same head may be used to supply the fuel oil. In such constructions the same type of cone may be used with a larger central opening and without notches 114 and the head 12 may be centered in the tube by backing out the screws 83 until a three point positional support is affected in the larger tube. Head 12 may then still be adjusted along the oil line 9 for movement toward or away from the cone and cone opening to regulate the air supply and pressure for the conditions of use.

In the past the practice has been to use an oversupply of air which is wasteful and leads to fluttering and pulsation in the burners. An excess of cold air which is driven around the oil mist exerts considerable chilling effect between the flame and the heating surfaces. These undesirable conditions have been eliminated in the oil burner of the present design and construction. With the burner of this invention it is possible to regulate the air flow and/or pressure of the combustion air from the blower system, and with the cone used in conjunction with the head described, the air is forcibly directed in streams into the oil mist ball to promote combustion from within the flame propagation zone without chilling the flame and the heating surfaces.

This action requires air control and the delivery of air from a reservoir source supplying the correct amount of static pressure, such a source being the blast tube. By the head being movable on the oil line and in relation to the cone, a metering arrangement is established at the outlet point of the blast tube to control, at this point, the volume of air and the air pressure. By the same token that the outlet air should be controlled in this burner, it is also a function of the burner to supply only a given amount of required air for potential but releasable storage in the blast tube for sustaining combustion as needed and this can be done by air control to the fan at the intake end by the movable perforated band 57 upon the apertured inlet housing 55.

Since the burner may be set up to deliver a certain flame of a given size and shape to fit the size of combustion chamber 5 of a heater 6 for obvious and added economy, and since this burner lends itself to empirical conditions for consistency of performance and operation, the provision of a given static pressure condition within the blast tube 4 prepares the oil burner for use to deliver a fixed B. t. u. output with less fuel consumption than has been possible with burners of comparable capacities.

A test hole 119 normally closed with a threaded plug 120 has been provided in the blast tube 4 as shown in Figs. 5 and 15 for the purpose of having a means for the attachment of a manometer or other instrument to determine the static air pressure within the blast tube, and for the purpose of guiding adjustments in the air flow system of the oil burner to obtain the set up that has the optimum efficiency and performance made possible by the construction and design of the present oil burner.

Attention is directed to one other feature which resides in the production of a hollow flame by the present burner as made possible by the head and cone combination herein disclosed and described relating to the driving of air into the central zone of the oil mist. Hollow flames have a greater outside surface and are more radiant to thus transfer more of the radiant energy to a heat absorbing surface thus effecting a further saving in fuel costs.

To produce this hollow flame by the cone and head structure under predetermined and uniform static air pressure, the means such as the blower or air supply system and the details of construction thereof become essentially important. The fan housing herein used is made to conform with the best known standards of construction of blower wheel housings and includes such refinements that prevent recirculation of air within the housing which interferes with controlled air delivery.

In burners of the past construction the air was driven around the oil mist ball so that little attention was given to precision fan housing design. The sole aim was to supply sufficient air to support combustion plus enough excess air to prevent such oil burners from producing a smoky flame. Uniform static air pressure was not a reqirement nor was it considered as essential to the operation of oil burners.

The burner of this invention illustrates a complete change in the operation of oil burners and incorporates all the essential mechanisms which when combined produce a burner having all the salient features disclosed and described which all contribute to economical and low cost operation. The burner is clean and precise in performance and requires little attention.

The details of construction of the air cone and its design contribute considerably to the operation of the burner. The restricted terminal ends **111** of the channels **110** are made narrower than the widths of the terminal ends of the vanes **106**, while the collective discharge areas of the channels are at least equal to the air discharge area of the blast tube. Thus full air flow is obtained in divided and concentrated streams of air under a static pressure plenum of air as maintained in the blast tube at all times.

The sleeve **104** of the air cone **102** has been designed to perform several functions contributing to the efficiency and performance of the cone. As seen in Figs. 10, 12 and 13, the sleeve **104** acts to stabilize and partially confine discharged air and oil mist to more effectively commingle these fluids at this point, and if desired, the sleeve may be lengthened or thickened to meet certain conditions of operation. Sleeve **104** also provides an annular protection to safeguard the venturi portion of the cone as defined by the apron **105**, and to prevent damage to the cone by the heat of the combustion chamber **5**, counteracting undue distortion and helping to dissipate heat from the body of the cone **102** to the air tube **4**.

As seen in Fig. 11, it should be noted that the air streams from 180 degree positioned valleys are directed as near to the oil mist center as possible, but offset with respect to each other to avoid interference between opposite air streams across the cone.

The preferred construction of burner herein disclosed and described illustrates one general construction adapted to the principles set forth and capable of functioning in the capacity stipulated. Changes in the exact construction and in the precise combination of associated mechanisms are contemplated without departing from the fundamental concept of this invention. Such modification shall, however, be governed by the breadth and scope of the language defining the invention in the following appended claims.

What I claim is:

1. A combustion unit for an oil burner comprising an air delivery tube, a head in said tube of smaller size than the tube to permit air to pass around the head and over the front end of the latter, an oil nozzle carried by said head and adapted to form an oil mist ball in front of the head, and an air deflecting cone carried by said tube in advance of the head and nozzle comprising an annular apron sloped to conically direct the tube air into the oil mist ball ahead of said nozzle, said apron having a plurality of vanes disposed about the surface thereof and positioned to divide said tube air into a plurality of independent air streams that are deflected by said apron into the aforesaid oil mist ball to support combustion of the oil from within said mist zone, and said vanes each being tapered with their narrow ends at the tube periphery and their wider ends adjacent the air opening through said annular apron whereby said vanes together with the surface of the apron provide divisional air concentrating channels on said cone, said cone channels being narrower at their discharge ends than the widths of the vane ends at that point and to reduce the independent air streams in size but to increase their velocities for concentrated air jet penetration of the oil mist ball.

2. A combustion mechanism for oil burners comprising an air delivery tube, a cup shaped head in said tube of reduced diameter to permit air flow about said head and over the open end of the head, an oil delivery nozzle in said head to emit oil mist spray, and an air cone in said tube disposed adjacent and overlapping a part of the open end of said head, said air cone having deflecting surfaces arranged thereon to divert the tube air into said oil spray for combustible commingling, and notched means on said cone to receive the open end of said head in a predetermined minimum proximity with respect to the head overlapping portion of the air deflecting surfaces of the cone, and means to adjustably move said head relatively to said cone surfaces to regulate the capacity of air discharged from said tube and between said cone and head.

3. A combustion mechanism for oil burners comprising an air delivery tube, a fixed oil line in said tube terminating in an oil spray discharge nozzle, an airflow regulating shield slidably carried on said oil line, said shield providing regulatory tube air throttling means to cause a given volume of tube air to discharge annularly over said shield toward the nozzle end thereof, and an air cone disposed within said tube and annularly in front of the nozzle end of said shield, said cone having surfaces arranged to deflect the tube air stream into the oil spray zone at the nozzle, said deflecting cone surfaces including notched portions to accommodate the front end of said shield for movement toward or away from the air deflecting surfaces of said cone, and releasable means for adjustably locking the shield in a given position with respect to said oil line to fix the relation of the shield with respect to the air deflecting cone, certain portions of said notches comprising limit means to establish the maximum approach of said shield toward said air cone for minimum airflow regulation.

4. A combustion mechanism for oil burners comprising an air delivery tube, a cup shaped head in said tube of reduced diameter to permit air flow about said head and over the open end of the head, an oil delivery nozzle in said head to emit oil mist spray, and an air cone in said tube disposed adjacent the open end of said head, said air cone having spirally positioned deflecting vanes arranged thereon to divert the tube air into said oil spray for combustible commingling, said deflecting vanes of said cone including notched portions to center and accommodate the open end of said head for a predetermined approach toward the air deflecting surfaces of the cone, and means to adjustably move said head relatively to said cone surfaces to regulate the air discharge restriction of said tube, said head further including air bleed openings in the closed end thereof to bypass tube air into the cup shaped head to scavenge the interior of said head and the zone surrounding said oil delivery nozzle.

5. An air cone for use in the blast tube of an oil burner and for coaction with the oil feed means thereof comprising a sleeve to fit said tube and having a continuous frusto-conical surface encircling the interior of said tube, said frusto-conical surface of said sleeve having a plurality of vanes arranged upon said surface to provide air delivery channels between said vanes, and said vanes and channels being arranged at their air delivery terminal ends with the vanes of greater width than the widths of said intermediate channels.

6. In an oil burner, an air delivery tube, and an air cone for said tube arranged to direct tube air into the oil spray discharged from the oil feed means of the burner, said air cone comprising a frusto-conical annular apron to divert tube air radially inwardly of the tube and convergingly in the direction of the tube axis, a plurality of vanes on said apron to provide air flow channels therebetween, each of said vanes being spirally positioned upon the apron in respect to a transverse plane of the tube whereby said vanes are disposed at given angular positions with respect to radial planes of the tube

axis and to provide spirally positioned channels therebetween, said vanes each having enlarged widths at the air discharge edge of said annular apron to narrow said channels at their discharge ends, said widths of the vanes being greater than that of the intervening channels.

7. An air deflecting cone for a blast tube of an oil burner comprising a continuous deflecting apron surrounding a given diameter air supply opening in said cone, and a plurality of vanes carried upon said apron to define air channels therebetween, said vanes each being relatively narrow at the outer peripheral part of said apron to broaden the air receiving portions of the channels at this location, and said vanes being relatively wider at the radially inner portion of said apron to restrict the width of the air channels at the air discharge edge of said apron and to thereby increase the intensity of the air streams discharged from said cone.

8. In an oil burner, a blast tube, an endwise adjustable head in said tube, an air cone having an air deflecting surface thereon fixedly carried within the tube in advance of and in the path of said head, projecting vanes formed on said cone surface and extending in the direction of said head, said head having an air metering edge portion coacting with said cone surface at a location intermediate the lengths of said vanes, and notches formed in the surfaces of said cone vanes to provide clearance for the reception of said air metering edge portion of said head, said vane notches having their bottoms located at a predetermined minimum distance from the vane carrying surface of the cone to limit the adjusted approach of said metering edge portion of the head in the direction of the cone surface for permitting low fuel consumption operation but to prevent cut-off of the air supply across the cone surface beyond an allowable predetermined minimum under low fuel burning conditions of operation.

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