

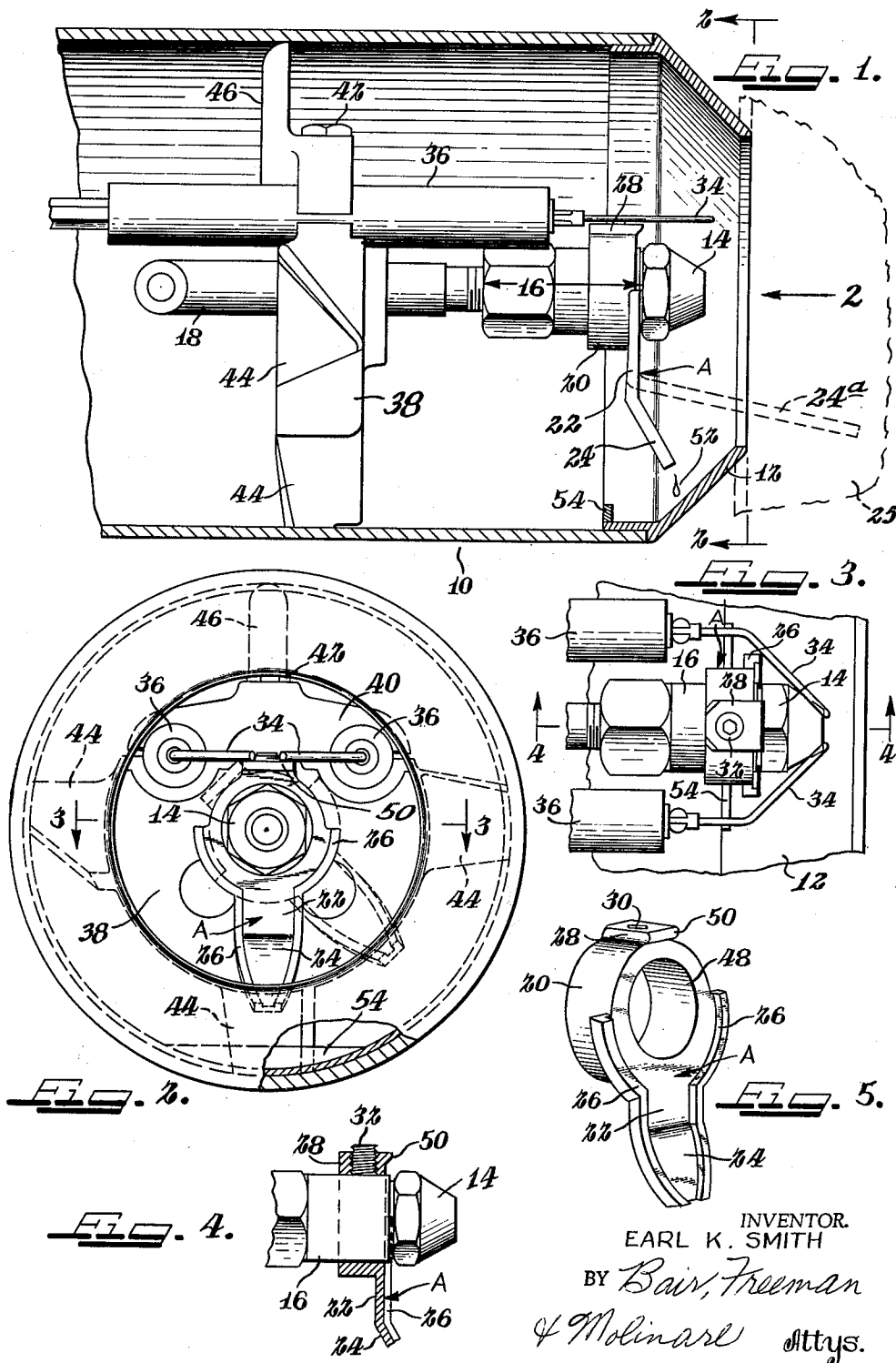
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DRIBBLE VAPORIZER FOR AN OIL BURNER NOZZLE

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This invention relates to a dribble vaporizer in the form of an attachment for oil burner nozzles which are subject, upon shut-off, to oil dribble. Such oil is objectionable unless some means is provided to vaporize it.

One object of the invention is to provide a dribble vaporizer in the form of an oil drip receiver having a depending trough in position to receive any drops of fuel dribbling from a fuel nozzle, and to vaporize the same by residual heat of the oil dribble receiver itself following shut down after a burner operation.

Another object is to provide the oil drip receiver in the form of a trough which receives any drops of oil dribbling from the fuel nozzle and is sufficient in length and area to effect vaporization of a few drops following a burner operation, but which if there are further drops, will direct them onto a fire cone of the burner which has also been heated by a burner operation. The fire cone may thereupon complete the vaporization, within a hot well provided in the fire cone to receive any drippings, creepage or seepage from the trough and thereby either insure vaporization following a burner operation or that any oil not vaporized will be accumulated and held against escaping downstream into the combustion chamber, upstream into the internal or external portion of the burner or onto the floor under the burner mechanism, thereby eliminating any odor that would occur from such post-operative oil dribble, creepage or seepage.

A further object is to provide an oil drip receiver which is simple and comparatively inexpensive to manufacture as by casting from bronze or the like and which requires a minimum of machining, the receiver being so designed as to snugly fit the lower portion of a fuel nozzle adaptor when secured in position thereon thereby preventing any seepage of dribble from the fuel nozzle back along the adaptor and the fuel pipe leading to the adaptor.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my dribble vaporizer for an oil burner nozzle, whereby the objects above contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in detail on the accompanying drawings, wherein:

FIG. 1 is a vertical sectional view through the combustion end of a burner tube showing an adaptor and a fuel nozzle with my dribble vaporizer attached to the adaptor;

FIG. 2 is an end view thereof in the direction of the arrow 2 adjacent FIG. 1;

FIG. 3 is a plan view of the adaptor, nozzle and vaporizer;

FIG. 4 is a vertical sectional view on the line 4-4 thereof, and

FIG. 5 is a perspective view of the vaporizer per se.

On the accompanying drawing I have used the reference numeral 10 to indicate a burner tube of a "gun type" burner and 12 the usual fire cone thereof. A fuel nozzle is shown at 14 and a nozzle adaptor at 16 for connecting the nozzle to a fuel pipe 18 in the usual manner.

My dribble vaporizer comprises an oil drip receiver shown generally at A consisting of a hub 20, a depending trough 22 and a slanting trough 24. The sides of the troughs 22 and 24 are formed by beads 26. The hub 20 also has a boss 28 which is threaded as indicated at 30 in FIG. 5 to receive a set screw 32 shown in FIG. 4.

Other elements of the burner are illustrated such as the spark electrodes 34 and the insulators 36 therefor. The fuel pipe 18 and the insulators 36 are supported by a spider body 38 and a clamp 40 secured to the spider by a clamp screw 42. The spider 38 has spokes 44 and a finger 46 for centering the entire assembly within the burner tube 10.

The casting forming the oil drip receiver A is reamed out with a bore 48 which is only a few thousandths of an inch larger than the outside diameter of the adaptor 16 so that a snug fit can be had on the underside between the two. The reaming operation is facilitated by having the boss 28 formed with a portion 50 of a height equal to that of the beads 26 so that the two beads and the boss portion 50 serve as a base during reaming operations. Since the outer dimension across the corners of the hexagon portion of the nozzle 14 is slightly less than the outer diameter of the adaptor 16 the casting A can be readily installed on the adaptor of an already installed burner. The boss 28 is located to avoid electrical interference with the electrodes 34 and may clear them during installation by rotation of the casting to the dotted position shown in FIG. 2 during installation of the vaporizer on the adaptor. Thereafter the vaporizer is rotated to the vertical position shown by solid lines and the set screw 32 tightened. Since the set screw is located at the top of the hub 20, it draws the lower portion of the hub into tight metal-to-metal engagement with the lower surface of the adaptor 16 thereby providing a tight fit which prevents any oil creepage from the nozzle past the vaporizer and along the adaptor and fuel pipe 18 upstream of the combustion chamber where it could cause odors.

The slanting trough 24 terminates above the lower wall portion of the fire cone 12 so that any drops of fuel oil such as shown at 52 in FIG. 1 dripping therefrom, will fall on the fire cone and be vaporized thereby. To insure that any unvaporized fuel will not seep upstream of the fire cone, it is provided with a vertical cross wall 54 adjacent the inner end thereof which together with the lower wall of the cone form a hot well for trapping and containing any accumulation of fuel for further vaporization.

A modification of the oil drip receiver A is shown by dotted lines in FIG. 1 where the trough indicated at 24^a is longer and less inclined than the trough 24. The trough 24^a terminates inside the primary combustion chamber 25 in most types of burners where the fire cone 12 does not project into the chamber. The trough 24^a would have to withstand higher temperatures and could therefore be made of stainless steel or the like.

Having described my invention in detail I will now refer to the need for such a device. In automatic oil burners of the atomizing type commonly called "gun type" utilizing oil pressure for atomizing the liquid into a combustible spray, it is usual to find that when terminating a burner operation there is dribble of one or more drops of fuel oil from the nozzle orifice as the operating pressure on the fuel falls to zero, and especially so on low capacity oil burners. The volume of such dribble is in proportion to the volume of entrained air and/or oil locked in the fuel pipe 18 between the pressure valve and the nozzle orifice, and to the size of the orifice, the rule being that the smaller the nozzle the greater the likelihood of more time being required to dispose of the dribble after shut down of the burner and while the motor and pump are coasting to a dead stop.

Nozzle capacities are rated on an industry-accepted standard of 100 p.s.i. In actual practice, however, the working pressure may be somewhat higher. A pressure reducing valve built into the pump unit incorporates a differential which usually requires about 15 p.s.i. less than the working pressure to open and let oil through to the nozzle. When the burner stops operating, and the oil

pressure reduces to the low differential, the pressure reducing valve shuts off and still there is dribble because of a number of factors which will be mentioned later.

The dribble consists of raw oil leaking out of the nozzle and creeping upstream from it, causing carbon and soot formation on the nozzle and electrodes, and it not disposed of by vaporization it will, in a relatively short time, cause short circuiting of the high tension insulation of the electrode assembly and consequently the spark ignition gap. This condition also allows raw oil to accumulate in the burner tube and cause objectionable odor due to residual heat of the metal parts and the slow burning or vaporizing of the accumulated liquid. In many instances—especially in short cycling—the residual heat in the metal parts of the burner tube is sufficiently high in temperature to actually ignite the accumulated oil which will then burn within the burner tube instead of in the combustion chamber. This is when odor problems are aggravated. The creepage of the fuel oil follows the underside of the profile of the nozzle and adaptor until it accumulates and falls off at the first lowest point it encounters, usually well back in the burner tube 10 such as the point where the spoke 44 contacts the burner tube.

The purpose of my vaporizer is to guide this leakage or creepage toward the primary combustion space and make any accumulation of oil fall off in liquid form at a location provided where temperature is high enough to vaporize it almost instantaneously. Advantageously, this point is immediately adjacent the primary combustion chamber where fumes of such vaporization will be carried upward and outward through the usual furnace vent.

To further explain the consistency and frequency of why this objectionable and sometimes hazardous condition occurs the following causes are cited, which considered separately or more often than not in combination can be traced to:

(1) Failure of the pressure relief valve in the oil pump unit to close perfectly tight at the low differential setting.

(2) Distorted oil spray from the nozzle impinging on adjacent metal parts.

(3) Leaking pipe threads or joints such as defaced union surfaces where the nozzle tip is tightened against the adaptor face.

(4) presence of air in the line between pump outlet and nozzle for different reasons such as:

(a) Inability to purge this air through the nozzle which is the only place it can go once discharged from the pump. Purging difficulties are complicated by use of highly restrictive filters for the oil which are required immediately in back of the nozzle. Also on suction lines of high lift the vacuum required is sufficient to cause entrained air in the liquid oil to separate. This separated air naturally seeks a high spot in the discharge line and becomes trapped off in a compressed bubble when the burner is operating.

(b) Trapped air in the nozzle pipe being compressed into a relatively small bubble when running expands from heat of conduction and radiation to the nozzle pipe when the burner shuts off and the working and/or atomizing pressure is lost. The expanding air bubble pushes oil out the nozzle in proportion to the volume of both the air bubble and the oil in the nozzle pipe.

(c) Fuel lines being allowed to fill with air when running out of fuel in the supply tank.

(d) Minute leaks in some parts of the suction line or connecting fittings, pipe threads, etc., can let a little air into the suction line thus causing a consistent problem.

(e) The nozzle fuel line always becomes filled with air when the nozzle assembly is removed for inspection or for changing or replacing nozzles.

(f) The same is true on new installations where all pipe, pump and oil-carrying lines are empty and have to be primed with solid liquid fuel.

In this connection it is not uncommon for several weeks of normal operation to pass before all air is totally purged

and a real sharp, clean, total cut-off of the oil spray occurs. Total cut-off is seldom attained unless all conditions are perfect. Cut-off is considered excellent in the trade if no more than one or two drops of oil creep or dribble from the nozzle after the pump pressure shows zero p.s.i. on the discharge side. Even this amount will eventually cause trouble.

From the foregoing it is readily seen that air in the nozzle line is at the root of the trouble and is a most elusive condition to cope with because of the variables and combinations involved. My herein disclosed vaporizer counteracts any and all of these causes and gives a clean dry, soot free and odor free cut-off under all normal operating conditions and also under some abnormal conditions such as a small, hard-to-locate suction leak.

Usually the oil drip receiver A disclosed in FIG. 5 is sufficient alone to overcome the problem of disposing of the last few drops of leakage oil. The depending trough 22 provides a sufficiently large hot surface over which the creepage must travel down to the bend leading to the inclined trough 22. This makes the total vertical distance from the center of the nozzle about $1\frac{1}{2}$ times the radius of the widest part of the nozzle and I have found that this much-surface area gets hot enough during a burner operation to vaporize all or most of the oil as it creeps down the vaporizer after termination of the burner operation. The beads 26 all round the forward face of the troughs 22 and 24 keep the oil from creeping around the back of the troughs and guides it into the ever-narrowing lower end from which, if there is any excess, it can drip as at 52 into the hot well provided for in the fire cone 12.

The temperature of the vaporizer A will vary from 300° to 600° F. on short cycles and from 800° to 1100° F. on long midwinter cycling. These are temperatures after shut-off, and immediately thereafter the drops of oil dribbling from the nozzle contact these hot surfaces and are vaporized.

In the event there is more oil than can be vaporized by the vaporizer A itself, drip will occur as at 52 in FIG. 1 and the fire cone 12 being also at a somewhat higher temperature by 200° to 300° F. because of the burner having operated and the mass of metal being closer to the flame will finish the vaporizing of the oil dribbling from the burner nozzle. As final insurance against excessive dribbling under abnormal conditions the cross wall 54 provides a dam against remaining drops of oil flowing upstream into the burner tube 10.

From the foregoing specification it will be obvious that I have provided a vaporizer which may readily be applied to gun-type burners, either during original installation or as an attachment to existing burners now in use with beneficial results. Its use reduces ignition failures due to shorted high tension insulators of the spark electrodes and holders and eliminates odors due to flash-backs and small slow burning smoky flames causing fires in the air tube and such odors at times getting into the room air.

The hub and set screw mounting of the vaporizer on the adaptor permits adjusting the whole nozzle assembly forward and backward with respect to the burner tube and fire cone as required for best combustion results and then also adjusting the vaporizer along the adaptor to the best point for oil dropping therefrom to impinge the fire cone about midway of its length for most effective vaporization of the oil dropping thereon. The wall 54 serves in conjunction with the fire cone as means to form a hot well for vaporizing any dribble and as a means to capture any excess oil instead of letting it creep upstream along the nozzle assembly and the burner tube interior.

Some changes may be made in the construction and arrangement of the parts of my dribble vaporizer for an oil burner nozzle without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims any modified forms of structure or use of mechanical equivalents which may reasonably be included within their scope.

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I claim as my invention:

1. In combination, a gun type pressure atomizing mechanical draft oil burner, a nozzle adaptor therefor, a nozzle mounted on said adaptor and adapted to be inserted into a combustion chamber, and an oil drip receiver, said oil drip receiver having a hub and a depending trough, and fastening means for securing the same to said adaptor, said fastening means being operable to effect drawing of the lower portion of the inner wall of said hub into tight metal-to-metal engagement with the lower portion of said adaptor to thereby prevent fuel dribbling from said nozzle creeping upstream along said adaptor, said depending trough receiving any drops of fuel dribbling from said nozzle, said depending trough being in heat exchange relationship with said nozzle and adaptor by reason of said metal-to-metal contact for vaporizing any accumulation of oil by using the residual heat of said nozzle and adaptor conducted to said oil drip receiver and the heat emanating from a combustion chamber following a burner operation.

2. An oil drip receiver in accordance with claim 1 wherein a fire cone at the end of the gun tube surrounds said nozzle, and said trough is located within said fire cone and has a downwardly depending portion terminating in a downwardly and downstream slanting portion having a terminal end located vertically above the lowermost portion of said fire cone for gravity discharge of any accumulated liquid fuel onto said lowermost portion.

3. An oil drip receiver in accordance with claim 2 wherein upstanding cross wall means are provided on said fire cone to form a hot well to receive oil dripping from said trough.

4. An oil drip receiver in accordance with claim 1 wherein a fire cone mounted on the burner surrounds said nozzle, and said trough has a downwardly and downstream slanting portion directed through said fire cone and terminating inside a combustion chamber.

5. In combination, a gun type pressure atomizing mechanical draft oil burner, a nozzle adaptor therefor, a nozzle mounted on said adaptor and adapted to be inserted into a combustion chamber, an oil drip receiver including a hub, a depending trough, and fastening means for securing said hub to said adaptor, said fastening means being operable to effect drawing of the lower portion of the inner wall of said hub into tight metal-to-metal engagement with the lower portion of said adaptor to thereby prevent fuel dribbling from said nozzle creeping upstream along said adaptor, said depending trough being in

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position to receive any drops of fuel dribbling from said nozzle, said depending trough being in heat exchange relationship with said nozzle and adaptor for vaporizing any accumulation of oil by using the residual heat of said nozzle and adaptor conducted to said oil drip receiver and the heat emanating from a combustion chamber following a burner operation, said depending portion of said trough having beads along its side edges to form the drop receiving trough, and said hub adjacent the top thereof having a projecting portion equal in height to said beads.

6. In combination, a gun type pressure atomizing mechanical draft oil burner, a nozzle adaptor therefor, a nozzle mounted on said adaptor and adapted to be inserted into a combustion chamber, an oil drip receiver mounted on said adaptor, and fastening means for securing the same to said adaptor, said oil drip receiver comprising a hub surrounding said adaptor and a depending trough in position to receive any drops of fuel dribbling from said nozzle, said fastening means comprising a set screw in the upper portion of said hub and engaging the top of said adaptor for drawing the lower portion of the inner wall of said hub into tight metal-to-metal engagement with the lower portion of said adaptor to thereby prevent fuel dribbling from said nozzle creeping upstream along said adaptor, said depending trough being in heat exchange relationship with said nozzle and adaptor for vaporizing any accumulation of oil by using the residual heat of said nozzle and adaptor conducted to said oil drip receiver and the heat emanating from a combustion chamber following a burner operation, high tension ignition components adjacent said nozzle and including spark electrodes, said hub being located in upstream spaced relation to said spark electrodes and said set screw being located between and spaced from said spark electrodes to provide clearance to prevent ignition leakage from said spark electrodes to said oil drip receiver.

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