June 9, 1942. B. W. TULLIS 2,285,689

ATOMIZER

Filed Jan. 12, 1940

Fig. 1.

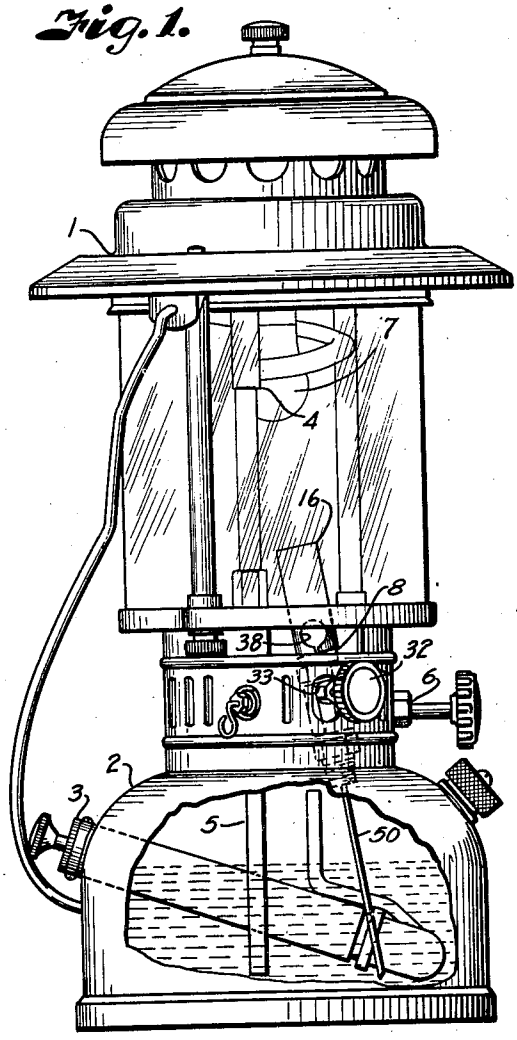


Fig. 2.

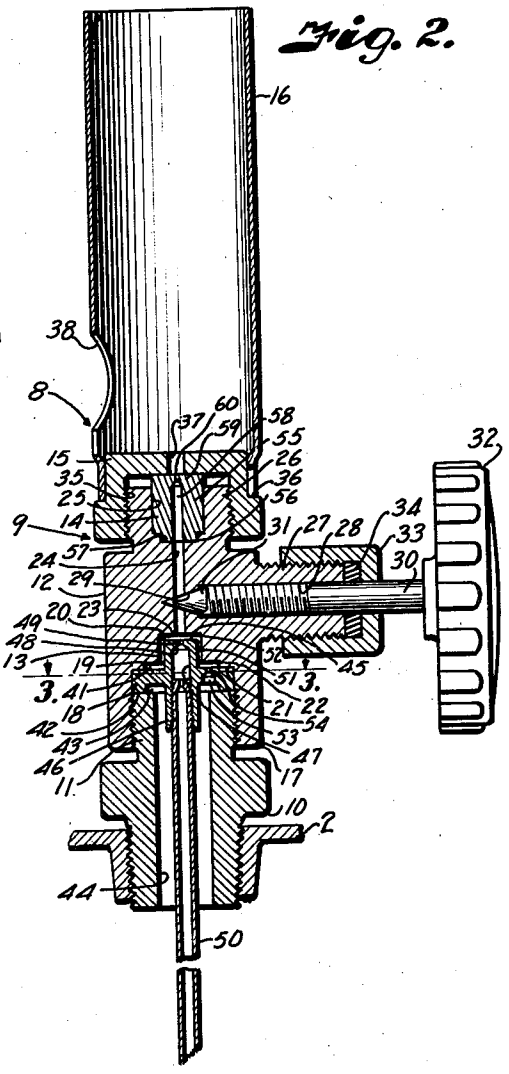


Fig. 4.

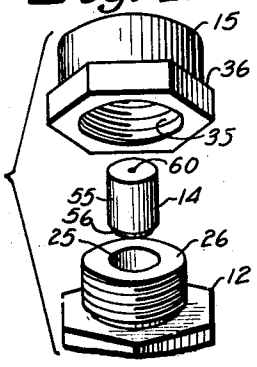


Fig. 5.

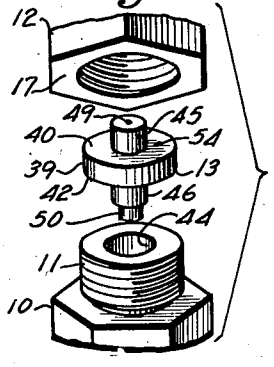
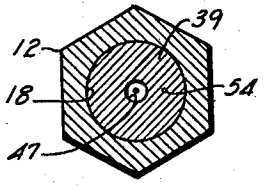


Fig. 3.



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BY
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UNITED STATES PATENT OFFICE

2,285,689

ATOMIZER

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Application January 12, 1940, Serial No. 313,562

6 Claims. (Cl. 299—140)

This invention relates to fuel atomizers particularly for starting liquid hydrocarbon burning appliances which require generators for vaporizing the fuel. It is common practice to provide such appliances with preheaters of the atomizer type and which are supplied with fuel and air from a fount of the appliance, but these atomizers have not been dependable principally because of insufficient atomization and irregular air flow which results in a low temperature, smoky and unstable flame. Such devices have also been expensive and difficult to manufacture, especially as to machining of the air and fuel orifices in the body parts of the atomizer. The critical character of these orifices requires complete replacement of the parts when the orifices are enlarged through cleaning or erosion so that upkeep of the appliance is expensive for the user.

The principal objects of the invention are, therefore, to provide an atomizer structure which more effectively atomizes the fuel, producing a better mixture and giving a hotter, more uniform, and dependable flame; to provide an atomizer structure which is capable of inexpensive and accurate manufacture; to provide an atomizer having removable tips so that it is only necessary to replace the tips when the orifices become enlarged or clogged; and to provide a construction wherein the atomizer parts and orifices may be accurately formed so that the parts may be standardized and the tips replaced at small cost to the user.

It is a further object of the invention to effect atomization of the fuel by multiple stages, each stage being progressively effected to produce finer, ultimate atomization.

In accomplishing these and other objects of the invention, as hereinafter pointed out, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawing, wherein:

Fig. 1 is a side elevational view of a lantern equipped with an atomizer embodying the features of the present invention, a part of the fount being broken away to better illustrate the pump and fuel supply tube to the atomizer.

Fig. 2 is an enlarged section through the atomizer.

Fig. 3 is a horizontal section on the line 3—3 of Fig. 2.

Fig. 4 is a detail perspective view of the fuel mixture discharge tip and its retaining parts shown in disassembled spaced relation.

Fig. 5 is a similar view showing the air and fuel tip with its retaining parts in disassembled spaced relation.

Referring more in detail to the drawing:

1 designates a liquid fuel hydrocarbon burning appliance which may be a lantern as shown, in which case the appliance includes a fount 2 for containing the liquid fuel, such as kerosene, under pressure generated by a pump 3. The appliance also includes a generator 4 for vaporizing the fuel which is delivered from the fount through a tube 5 under control of a valve 6, the generator 4 being located within the heat zone of the consumed fuel which, in the illustrated instance, is a mantle 7.

In initially starting the appliance, it is necessary to preheat the generator and this is effected by a preheater 8 including a vaporizer 9 supplied with fuel and air under pressure from the fount, as now to be described. The vaporizer assembly includes a sleeve-like nipple 10 threaded into an opening at the top of the fount and which has a threaded neck 11 for mounting a valve body 12 containing an atomizing tip 13, a discharge tip 14, and a closure cap 15 carrying a nozzle-like mixing tube 16 which directs a flame against the generator 4. The valve body 12 has an internally threaded skirt 17 for engaging threads of the neck 11. Formed within the valve body are coaxially stepped cylindrical bores 18, 19 and 20 to form a clamping shoulder 21 and annular fuel impacting surfaces 22 and 23 which are arranged in planes transversely of the axis of the bores and concentric with a port 24 extending to a bore 25 formed in a threaded neck 26 on the upper end of the valve body. The valve body also includes a laterally extending threaded branch 27 having an axial bore 28 terminating in a cone-shaped valve seat 29 intersecting the port 24. The axial bore 28 is internally threaded to accommodate the threaded stem 30 of a cone-shaped valve 31 which is adapted to be moved to and from the cone-shaped seat 29 upon actuation of a hand-wheel 32 fixed to the outer end of the stem 30. The threaded branch 27 carries a packing nut 33 for compressing a packing 34 about the valve stem 30.

The cap 15 is carried on the threaded neck 26 of the valve body and has internal threads 35 engaging the threads of the neck and which is provided with an annular shoulder 36 to seat the lower end of the nozzle-like mixing tube 16. The closure cap 15 also includes a non-critical outlet orifice 37 located in axial alignment with the outlet port and through which atomized fuel is discharged for combustion in the tube when the

mixture is lighted through an opening 38 that is formed in the side of the tube as clearly shown in Figs. 1 and 2.

The atomizing tip 13 is a separate part from the valve body and nipple and is clamped therebetween. The atomizing tip 13 includes a disk portion 39 snugly received within the bore 18 and which is provided with a flat upper face 40 engaged with the clamping shoulder 21 and cooperating with the annular fuel impacting surface 22 to form an annular air distributing space 41 therebetween. The lower face of the disk portion has an annular rib 42 which is engaged by the end face of the neck 11 when the valve body and nipple are screwed together, thereby spacing the central, lower portion of the disk from the nipple to provide an annular passageway 43 having direct connection with the bore 44 of the sleeve-like nipple 10.

Formed coaxially with the disk portion 39 and extending from the respective sides thereof are cylindrical portions 45 and 46 having a bore 47 opening from the end of the cylindrical portion 46 but terminating short of the end of the cylindrical portion 45 as shown in Fig. 2, leaving a relatively thin end wall 48 that is provided with an orifice 49 which controls flow of fuel. Threaded in the open end of the bore is a tube 50 leading to the bottom of the fount for conducting the liquid fuel to the tip 13. The cylindrical portion 45 of the tip extends within the bore 20 which cooperates therewith to provide an annular air passageway 51 extending in the direction of the impact surface 23. The upper end of the cylinder portion 45 terminates short of the surface 23 to form an atomizing chamber 52.

Air is delivered from the fount through the bore 44 to the annular passageway 43 from where it is discharged through a bore 53 connecting with an orifice 54 formed in the thinner part of the disk portion 39 and in line with the space 41, the orifice 54 being arranged to discharge air against the annular surface 22 so that it is diverted circumferentially of the air distributing space 41 whereby the air flows uniformly into the passage 51 around the periphery of the cylindrical portion 45 of the tip. Upon striking the surface 23 the air is diverted laterally and transversely across the stream of fuel discharged through the orifice 49 to break up the fuel and effect atomization thereof in the chamber 52. The atomized fuel and air are then delivered as a mixture through the port 24.

The port 24 is of relatively small bore to facilitate contact by the liquid portion of the mixture causing break down of the liquid globules on the metal surface in the form of a thin film. This filming is effected because the metal surface has a greater adhesion for oil than the cohesion force holding the oil in globule form. The erosive force of the moving mixture in contact with the oil film effects very minute atomization. To be effective, the port 24 should be of considerable length in ratio to the bore so that all the globules discharged from the atomizing chamber have opportunity to break down in the form of a film. This port extends into the tip 14 so that it may be more accurately and economically drilled since a portion thereof is in the body and the upper portion is formed in a separate part, thereby providing shorter drilling operations but giving the length required for attaining the desired results.

The tip 14 includes a cylindrical body 55 snugly engaged within the bore 25, a lower end abutting against the bottom of the bore 25. The bore 58 in the tip terminates short of the upper end thereof to provide a thin end wall 59 having an orifice 60 of sufficiently small diameter to produce a small jet of the atomized mixture at sufficiently high velocity to produce a Bunsen-like effect in the nozzle tube.

In operating a vaporizer constructed and assembled as described, pressure is built up in the upper portion of the fount by actuating the pump 3. The hand-wheel 32 of the shut-off valve is then rotated to open the port 24 and effect release of pressure from the fount through the bore 44, the annular passageway 43, and orifice 54, so that a jet of air is discharged against the surface 22 and distributed in the space 41 uniformly about the periphery of the cylindrical portion 45 to move upwardly through the annular passageway 51 and impinge against the surface 23 to be diverted laterally at right angles into the atomizing chamber 52 and across the jet of liquid fuel discharged through the orifice 49, under pressure of the air acting on the surface of the liquid in the fount. This lateral movement of the air from all directions across the stream of liquid effects atomization thereof, and results in an atomized mixture discharged into ports 24 and 58, where the filming action of the oil globules effects more complete atomization, and the more thoroughly atomized mixture is discharged through the orifice 60 into the mixing nozzle 16. When the mixture is ignited, it burns with a uniform, steady flame of intense heat to quickly preheat the generator. When the generator is heated the valve 6 is opened and the fuel flowing therethrough is vaporized and readily ignitable when discharged into the mantle. When the fuel is vaporized sufficiently to operate the mantle, the valve 31 is closed to shut off flow of liquid fuel through the tube 50 and prevent discharge of air through the atomizer.

It is obvious that by constructing the tips separately from the body portions of the atomizer, they are cheaper to manufacture and the critical orifices therein may be more accurately formed. The separate tips also provide ready replacement of these parts so that it is not necessary to replace the major parts of the atomizer.

It is also obvious that by uniformly distributing the air about the passageways and effecting lateral flow uniformly across the orifice of the atomizing tip, supplemented by the filming action on the metal surfaces of the ports 24 and 58, the atomization effect is efficient and a readily ignitable mixture is produced with a uniform flow of air and fuel at the pressure carried within the fount, thereby providing a stable flame which plays smoothly on the generator and which is free of smoke and odors usually resulting from improper atomization.

What I claim and desire to secure by Letters Patent is:

1. In a device of the character described, a body member having stepped bores forming a shoulder therebetween, an atomizing tip having a disk portion in the larger of said bores, means spacing the disk portion from said shoulder to form an annular air distributing space therebetween, a coaxial cylindrical portion projecting from said disk portion of the atomizing tip and having exterior surfaces thereof spaced from corresponding surfaces of the smaller of the bores to form an initial atomizing chamber and an annular passageway connecting the air dis-

tributing space with said initial atomizing chamber, means supplying liquid fuel to said atomizing tip for discharge through an axial orifice in the cylindrical portion thereof, said disk portion of the atomizing tip having an air discharge orifice connecting with said air distributing space, means retaining said disk portion in fixed position within said body member and forming a connection to a pressure chamber for supplying air to said last named orifice, a discharge tip having an elongated bore registering with an axial bore in said body member to form a fuel break-down chamber and provided with a restricted discharge orifice to effect retardation of droplets of liquid fuel and cohesion thereof on the wall surface of the break-down chamber, and a cap removably retaining said last named tip.

2. A device for atomizing a liquid hydrocarbon including a body member having stepped bores in one end thereof, an atomizing tip in said body member having portions corresponding to said bores to form air passageways and a mixing chamber therebetween, a nipple connected with the body member for retaining the atomizing tip in fixed position within said body member, said body member having an elongated smaller bore axially connecting said stepped bores with a bore at the opposite end of said body member to form a vaporizing chamber in connection with the mixing chamber, a tip in said last named bore having a port registering with said vaporizing chamber, a retaining cap connected with the body member for retaining the last named tip, a valve in said body member for controlling flow through said vaporizing chamber, said atomizing tip having an air discharge orifice connected with the air passageways, and a tube extending through said nipple and connected with the atomizing tip for supplying a liquid hydrocarbon to said tip.

3. In a device for atomizing a liquid fuel, a body member having axial bores in opposite ends thereof connected by a smaller bore extending through said body member, the wall of said smaller bore forming a film collecting surface, a fuel atomizing tip removably mounted in one of said end bores, said end bore mounting the atomizing tip having stepped portions cooperating with corresponding portions of the tip to form an air passageway terminating at the outlet of said tip in a mixing chamber discharging into the smaller bore, a fuel mixture discharge tip removably mounted in the other bore and having a restricted discharge orifice, means clampingly retaining said tips in the respective bores, means supplying liquid fuel to the atomizing tip, and means supplying air to said passageway for intersecting the liquid discharged from said tip in the mixing chamber to atomize said fuel and for picking up particles of said film from the wall of the smaller bore.

4. In a device for atomizing a liquid hydrocarbon, a body member having stepped bores forming an annular shoulder therebetween, said smaller bore being terminated by an end wall having an orifice therethrough, an atomizing tip having a disk portion in the larger of said bores, means spacing said disk portion from said shoulder to form an annular air distributing space, a coaxial cylindrical portion projecting from said disk portion of the tip and having an end face spaced from said end wall to form an atomizing chamber and having a circumferential surface spaced from the corresponding surface of the smaller of the bores to form an annular passage connecting the air distributing space with the atomizing chamber, means supplying liquid hydrocarbon to said tip for discharge through an axial orifice in the cylindrical portion thereof, said disk portion of the tip having an air discharge orifice connecting with said air distributing space, and means retaining said disk portion in fixed position within said body member.

5. In a device of the character described, a body member having a series of stepped bores forming a shoulder therebetween, said smaller bore being terminated by an end wall having an orifice therethrough, an atomizing tip having a disk portion in the larger of said bores, means spacing said disk portion from said shoulder to form an annular air distributing space therebetween, a coaxial cylindrical portion projecting from said disk portion of the tip having an end face spaced from said end wall to form an atomizing chamber and having a circumferential surface spaced from the corresponding surface of the smaller bore to form an annular passage connecting the air distributing space with the atomizing chamber, means supplying a liquid to said tip for discharge through an axial orifice in the cylindrical portion thereof, said disk portion of the tip having an air discharge orifice connecting with said air distributing space, and a nipple having threaded connection with the body member and having an end retaining the disk portion in fixed position, said nipple forming a connection to a pressure chamber for supplying air to said last named orifice.

6. A device for atomizing a liquid hydrocarbon including, a body member having a mixing chamber and a liquid break-down chamber of smaller diameter than the mixing chamber and having coaxial connection therewith, means for admitting a liquid hydrocarbon and an atomizing medium into the mixing chamber for effecting initial atomization of the liquid hydrocarbon, said break-down chamber being located in the path of atomized liquid and said medium so that droplets of liquid hydrocarbon contact the wall of the break-down chamber to effect atomization of said droplets and spreading thereof in a thin film on said wall to be picked up by scouring action of said medium moving through said break-down chamber for effecting further reduction of said liquid hydrocarbon, said body member having a recess coaxial of the break-down chamber at the end opposite said coaxial connection, a tip in said recess having a bore forming a continuation of the break-down chamber and having a restricted discharge orifice, and means connected with the body member to retain the tip in said recess.

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