April 17, 1945. E. H. PEABODY 2,373,707

ATOMIZER

Filed Aug. 19, 1941

Fig. 1

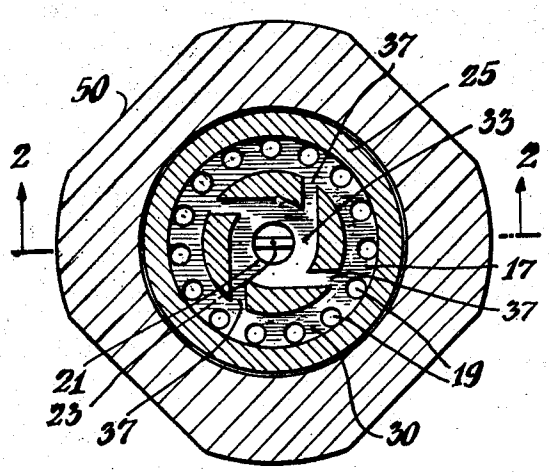


Fig. 3

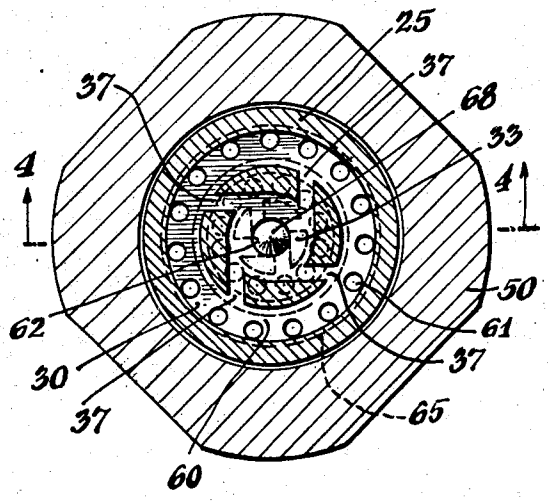


Fig. 2

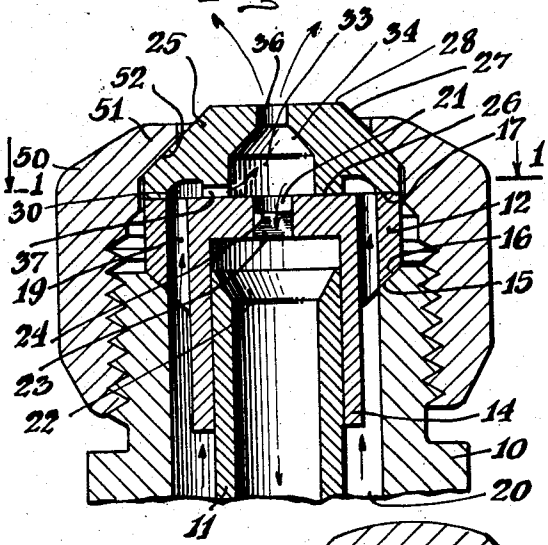


Fig. 4

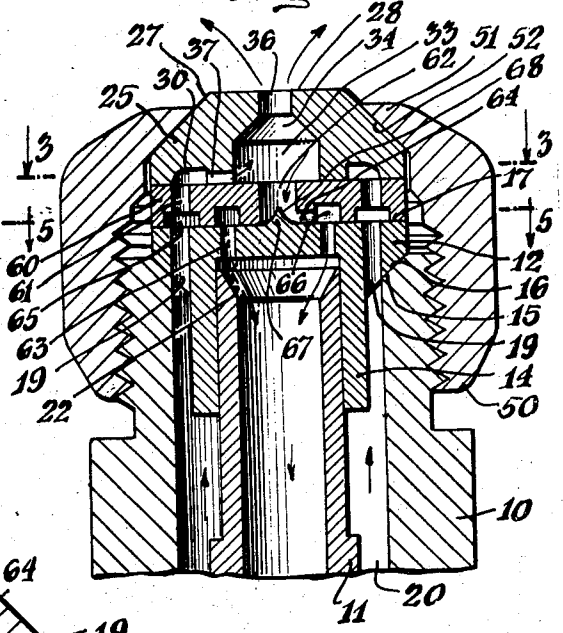
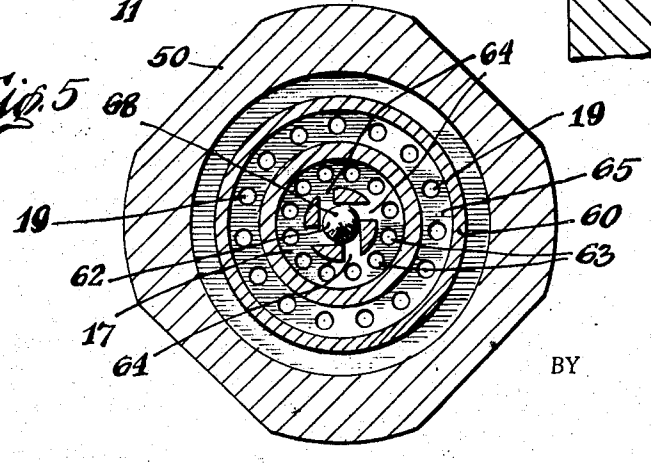


Fig. 5



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ATOMIZER

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9 Claims. (Cl. 299—120)

This invention relates to mechanical atomizers of the wide range variable return type and more particularly to mechanical atomizers of the type having a whirling chamber in which a fluid to be atomized is given a rapid whirling motion as it advances to a discharge orifice, whereby centrifugal force is built up which serves to atomize the fluid as it is discharged in a cone shaped spray. A wide range of capacities is obtained by withdrawing a controlled portion of the fluid from the whirling chamber before it reaches the discharge orifice.

An object of this invention is to provide a novel and improved method and means for withdrawing the return fluid from the whirling chamber.

Another object is to provide an atomizer construction in which the energy of the rotating fluid in the whirling chamber is not dissipated by producing rotational movement in the return conduit.

Another object is to provide an atomizer of the above type having a central return duct from the whirling chamber, constructed and arranged to prevent the rotation of the fluid in the whirling chamber from being transmitted through the return duct to the fluid in the return conduit.

Another object is to provide a novel and improved atomizer of the above type which may be readily assembled and dis-assembled.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

Although the novel features which are believed to be characteristic of this invention are pointed out more particularly in the claims appended hereto, the invention itself will be better understood by referring to the following description, taken in connection with the accompanying drawing, in which certain specific embodiments thereof have been set forth for purposes of illustration.

In the drawing,

Fig. 1 is a transverse section of an atomizer tip embodying the present invention and taken along the line 1—1 of Fig. 2;

Fig. 2 is a longitudinal section of the atomizer taken along the line 2—2 of Fig. 1;

Fig. 3 is a transverse section through an atomizer tip illustrating a different embodiment of the invention and taken along the line 3—3 of Fig. 4;

Fig. 4 is a longitudinal section taken along the line 4—4 of Fig. 3; and

Fig. 5 is a transverse section taken along the line 5—5 of Fig. 4.

In the following description and in the claims certain specific terms are used for convenience in referring to various details of the invention. These terms, however, are to be given as broad an interpretation as the state of the art will permit.

In the drawing, the invention is shown by way of illustration as applied to an atomizer of the type which is adapted for use as a liquid fuel burner. It is to be understood, however, that the atomizer may be used for fuel injection in internal combustion engines or for other purposes where a variable capacity spray under pressure is required or it may be adapted to use with other fluids such as gaseous fuels.

This atomizer is shown in Figs. 1 and 2 as comprising a burner barrel 10 and an inner return fuel conduit 11 which is concentric therewith, is spaced therefrom to provide an annular fuel supply space or conduit 20, and is mounted by suitable means, not shown, in a unitary assembly. A plug 12 is mounted on the return fuel conduit 11 by means of a sleeve 14 which extends rearwardly from said plug and makes a close fit with the outside of said return fuel conduit. The body of the plug 12 projects radially beyond said sleeve and is provided with a bevelled under surface 15 which engages a complementary bevelled surface 16 on the end of the barrel 10, the arrangement being such that the bevelled surfaces 15 and 16 assist in centering the plug 12 and the fuel pipe 11 within the barrel 10.

The plug 12 terminates in a plane surface 17 and is provided with an annular row of axially extending fuel supply holes 19 communicating with the annular space 20 between the return fuel conduit 11 and the barrel 10.

The plug 12 is also provided with a central axially extending duct 21 forming a return passage to the fuel conduit 11. The end of the fuel conduit 11 may be bevelled as at 22 to assist the flow of return fluid therethrough. The duct 21 may be provided with an axial vane 23, shown as extending diametrically across the duct 21 with its upper portion 24 below the surface 17 of the plug 12. The vane 23 divides the duct 21 into two semi-cylindrical passages through which the return fluid passes to the conduit 11 and is designed to prevent rotational movement of the fluid in such passages.

A tip 25 is provided having a flat rear surface 26 registering with the surface 17 of the plug 12 and making a fluid tight seal therewith, and having a forward bevelled surface 27 and an end sur-

face 28 which is shown as plane, but may be of other form, such as conical, if desired.

The tip 25 is provided with an annular groove 30 registering with the annular row of holes 19 in the plug 12 and with a cylindrical whirling chamber 33, the forward part 34 of which is tapered and terminates in an orifice 36. A plurality of tangential passages 37 connect the annular groove 30 with the chamber 33. These passages are adapted to introduce the fluid from the passages 19 into the chamber 33 tangentially so as to cause the fluid to whirl or rotate therein.

The tip 25 and plug 12 are secured by a cap 50 which is threaded onto the barrel 10 and is provided with a flange 51 having a bevelled under surface 52 which engages the bevelled surface 27 of the tip 25 for centering and securing the same. The peripheral surfaces of the tip 25 and of the plug 12 have small clearances with the inner surface of the cap 50 so that the tip may be accurately centered by the cooperating bevelled surfaces of the tip and cap. The end surface 28 of the tip 25 projects beyond the forward surface of the flange 51 of the cap 50 a sufficient distance so that an unobstructed flow of atomized fluid is obtained from the orifice 36.

Operation

In the operation of this device, the fluid to be atomized, such as fuel oil, is supplied through the annular supply conduit 20 between the return fuel conduit 11 and the barrel 10, passes through the holes 19 in the plug 12 to the annular passage 30 of the tip 25, then through the tangential passages 37 of said tip into the whirling chamber 33 wherein it is caused to rapidly whirl. As the whirling liquid advances toward the orifice 36 the speed of rotation thereof is increased due to the decrease in radius of the tapered part 34 of the chamber 33 until the fluid passes through the orifice 36 and is released to form a cone-shaped atomized spray.

The amount of fluid thus released is controlled by regulating the return flow of fluid which passes through the central duct 21 into the return conduit 11. This return conduit 11 leads to a control valve, not shown, by which the amount of fluid withdrawn from the atomizer may be regulated.

It has been found that the rotational motion of the fluid within the chamber 33 is transferred to the column of fluid within the return conduit 11, thereby extracting energy from the rotating fluid within the chamber 33 and otherwise decreasing the efficiency of operation. In accordance with the present invention, this is overcome by providing the longitudinal vane 23 which extends diametrically across the central return duct 21 and prevents any rotation of the fluid within the return conduit. In this way the rotation of the return column of fluid is interrupted at its source and variations in the quantity of return fluid are prevented from altering the spray characteristics of the atomizer. The vane 23 may, of course, be somewhat curved in a direction to oppose the rotation of the fluid as it passes through the duct 21 or a plurality of such vanes may be used. Such vanes may, for example, extend radially and divide the duct 21 into a plurality of segments.

In assemblying the atomizer it is only necessary to slide the sleeve 14 of the plug 12 over the fuel conduit 11 and then screw the cap 50 in place while holding the tip 25 against the plug 12. The bevelled surfaces 27 and 52, and 15 and 16, respectively, serve to accurately center the tip and plug. The device may be disassembled in the same manner for cleaning. Obviously, the above named surfaces may be flat or of other forms instead of bevelled if desired. The forward surface 28 of the tip 25 projecting past the end of the cap 50 facilitates the separation of the parts in the event that they adhere and also avoids any interference with the free flow of the atomized fluid.

It is to be understood, of course, that the number of holes 19 in the plug 12 may be varied as desired. In certain instances the annular groove 30 may be omitted, in which event means such as dowel pins, or cooperating tongues and grooves, or the like may be provided for aligning the holes 19 with the tangential passages 37. In certain instances it may be desirable to thread the sleeve 14 onto the conduit 11.

Figs. 3, 4 and 5

In the embodiment shown in Figs. 3, 4 and 5 the construction is generally similar to that shown in Figs. 1 and 2 and similar parts have been given the same reference characters in order to avoid the necessity for repeating the description. In Figs. 3, 4 and 5 the plug 12 and the tip 25 are separated by a plate 60 having an annular row of holes 61 communicating with the annular groove 30 of the tip 25, and terminating in an annular groove 65 communicating with the holes 19 of the plug 12. The surface of the plate 60 forms the rear wall of the whirling chamber 33. The plate 60 is provided with a central return duct 62 extending rearwardly from the whirling chamber 33 and with tangential slots 64 cut into its lower surface and extending outwardly from the central duct 62 in the direction of rotation of the fluid in the whirling chamber so as to remove the fluid without reversal of flow, and terminating in an annular groove 66. The plug 12 is provided with an annular row of return holes 63 communicating with the return conduit 11 and with the annular groove 66.

The plug 12 may carry a boss 67 having a curved upper surface 68 suited to direct the return fluid into the slots 64 with a minimum of turbulence.

The operation of the embodiment of Figs. 3, 4 and 5 is similar to that described above. In this embodiment the rotation of the fluid in the return passage is broken up by the annular row of return holes 63 and the whirling chamber is provided with a flat, unbroken rear surface. The central return duct 62 communicates through the slots 64, groove 66 and holes 63 with the return conduit 11 so that any rotation of the fluid in the chamber 33 is interrupted in the holes 63 before the fluid passes to the conduit 11. The slots 64 extend tangentially in a direction to scoop up a controlled portion of the rotating fluid from the return duct 62. They may, however, extend radially or at any suitable angle to the radius of the duct 62, or may be joined to form a continuous enlarged chamber communicating with the holes 63. If desired, the groove 66 may be formed in the plug 12 instead of in the plate 60.

Certain specific embodiments of the invention have been shown for purposes of illustration. It is to be understood, however, that the construction may take various other forms and that various other mechanical means may be pro-

vided to prevent the transmission of the rotary motion of the fluid to the column of fluid in the return pipe. Various changes and modifications may be made therein as will be readily apparent to a person skilled in the art. The invention is only to be limited in accordance with the scope of the following claims.

What is claimed is:

1. An atomizer having a supply conduit and a return conduit and a tip having a whirling chamber terminating in an orifice through which fuel is discharged for atomization, means including inlet ducts supplying fluid from said supply conduit to said whirling chamber and causing the fluid to rotate therein, said whirling chamber having a rear wall provided with an axial unobstructed return opening of a smaller diameter than said whirling chamber and of a diameter at least as great as that of said orifice communicating with said return conduit, said rear wall providing a smooth, unbroken annular surface in contact with the whirling fluid in said whirling chamber, and means between said opening and said return conduit to arrest the rotational movement of the fluid flowing from said whirling chamber to said return conduit.

2. An atomizer having a supply conduit and a return conduit and a tip having a whirling chamber terminating in an orifice through which fuel is discharged for atomization, means including inlet ducts supplying fluid from said supply conduit to said whirling chamber and causing the fluid to rotate therein, said whirling chamber having a rear wall provided with an unobstructed axial return opening of a smaller diameter than said whirling chamber and of a diameter at least as great as that of said orifice communicating through an axial return duct with said return conduit, said rear wall providing a smooth, unbroken, annular surface in contact with the whirling fluid in said whirling chamber, and means in said return duct to arrest the rotational movement of the fluid flowing from said whirling chamber to said return conduit.

3. An atomizer as set forth in claim 2 in which said last means comprises a vane in said return duct positioned and arranged to arrest the rotational movement of the fluid as it passes therethrough.

4. An atomizer as set forth in claim 2 in which said last means comprises an axial vane extending diametrically across said return duct, said vane being positioned and arranged to arrest the rotational movement of the fluid as it passes therethrough.

5. An atomizer for a burner barrel having supply and return conduits, comprising a plug adapted to be fitted to the end of said barrel and to form an end closure for said conduits, a tip seated against said plug and having a whirling chamber therein terminating in an orifice through which fluid is discharged for atomization, inlet ducts in said tip communicating with said chamber to supply fluid thereto so as to cause said fluid to rotate therein, passages in said plug communicating with said inlet ducts, the forward surface of said plug forming the rear wall of said whirling chamber, said plug having an unobstructed axial return opening of smaller diameter than said whirling chamber and of a diameter at least as great as that of said orifice communicating through an axial return duct with the return conduit in said barrel, said rear wall providing a smooth, unbroken, annular surface in contact with the whirling fluid in said whirling chamber, and a vane in said duct positioned and directed to arrest the rotational movement of the fluid as it passes therethrough, whereby the rotational movement of the fluid in said whirling chamber is prevented from being imparted to the fluid in said return conduit.

6. An atomizer having a supply conduit and a return conduit and a tip having a whirling chamber terminating in an orifice through which fuel is discharged for atomization, means including inlet ducts supplying fluid from said supply conduit to said whirling chamber and causing the fluid to rotate therein, said whirling chamber having a rear wall provided with an unobstructed axial return opening of smaller diameter than said whirling chamber and of a diameter at least as great as that of said orifice, said rear wall providing a smooth, unbroken, annular surface in contact with the whirling fluid in said whirling chamber, a set of return passages spaced from the axis of said whirling chamber positioned and directed to arrest the whirling motion of said fluid, and communicating with said return conduit, and a channel spaced beyond said rear wall supplying return fluid from said return opening to said set of return passages, whereby said fluid passes through said set of passages on its way to the return conduit.

7. An atomizer as set forth in claim 6 in which said channel comprises a set of tangential grooves communicating with said return opening and with said set of return passages.

8. An atomizer as set forth in claim 6 in which said channel comprises a set of tangential grooves communicating with said return opening and with said set of return passages and extending in the direction of rotation of the fluid received from said whirling chamber so that the rotating fluid enters said tangential grooves without change in direction.

9. An atomizer for a burner barrel having concentric supply and return conduits, comprising a plug adapted to be fitted to the end of said barrel and to form an end closure for said conduits, said plug having an annular row of supply passages communicating with said supply conduit and an annular row of return passages communicating with said return conduit, a plate mounted over said plug and a tip seated against said plate, said tip having a whirling chamber therein terminating in an orifice from which fluid is discharged for atomization, and having inlet ducts communicating with said whirling chamber for supplying fluid thereto and causing said fluid to rotate therein, the surface of said plate forming the rear wall of said whirling chamber, said plate having an unobstructed axial return opening of a smaller diameter than said whirling chamber and of a diameter at least as great as that of said orifice communicating with said whirling chamber, said plate having an annular row of supply passages communicating with the annular row of supply passages in said plug and with the inlet ducts of said tip, and passages in said plate spaced beyond said rear wall extending outwardly from said return opening and communicating with the annular row of return passages in said plug, said annular row of return passages being directed to arrest said whirling motion of said fluid.

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