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HEATING DEVICE

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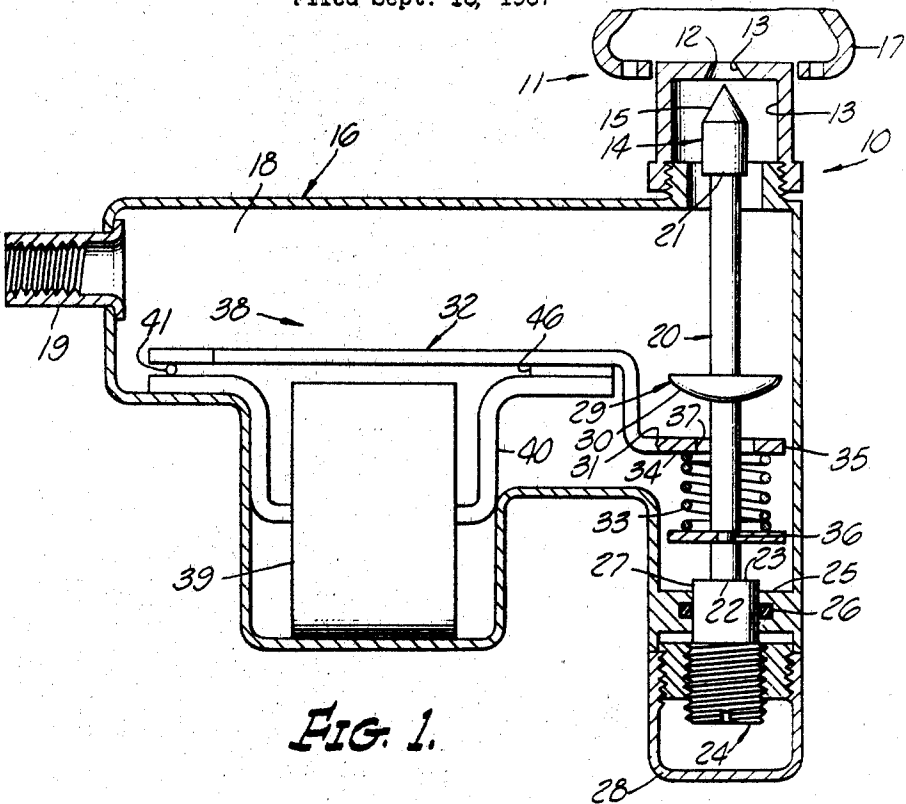


FIG. 1.

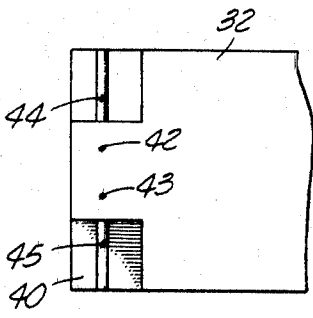


FIG. 2.

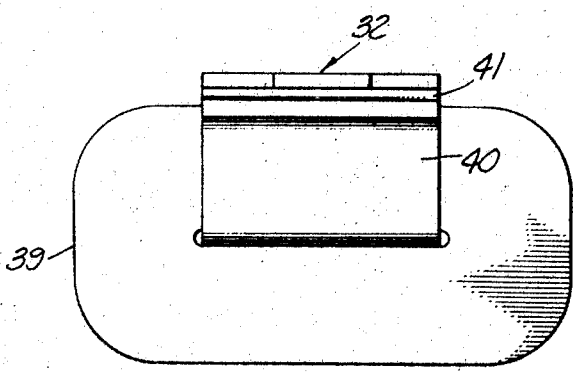


FIG. 3.

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HEATING DEVICE

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3 Claims

ABSTRACT OF THE DISCLOSURE

The invention comprises a needle valve operating in a fluid fuel burner orifice. A solenoid operator has a torsion-rod biased armature. A set screw adjustably limits the opening travel of the valve. The use of the burner orifice as a valve seat eliminates a duplication of parts. The valve is also small so that relatively little solenoid power is required to open it.

Background of the invention

This invention relates to apparatus for burning fluid fuels, and more particularly to a burner and a valve therefor.

In the past, it has been the practice to employ a relatively small orifice at a burner. In addition, a fuel control or shut off valve is employed in the line.

This system therefore requires a substantial number of component parts and a relative large amount of solenoid power to operate the valve because the valve must have a large, low-resistance opening. Further, the valve is often not adjustable.

Summary of the invention

In accordance with the device of the present invention, the above-described and other disadvantages of the prior art are overcome by providing a liquid fuel burner with an inlet orifice and valve to fit the orifice. Thus, the orifice serves a dual function. It provides a reduced diameter inlet which is conventionally necessary, and it provides a small opening for a small valve. The device of the invention is thus compact, requires little solenoid power and a saving in component parts is realized.

In accordance with another important feature of the invention, a small amount of solenoid power is required to open the valve because a needle valve is employed.

Still another feature of the invention resides in the use of means to limit the opening of the valve, whereby the amount of fuel which is permitted to enter the burner may be adjusted and controlled.

The above-described and other advantages of the invention will be better understood from the following description when considered in connection with the accompanying drawing.

Brief description of the drawing

In the drawing, which is to be regarded as merely illustrative;

FIG. 1 is a vertical sectional view through the combination burner and needle valve constructed in accordance with the present invention;

FIG. 2 is a broken-away top plan view of an armature and core employed with a solenoid to operate the needle valve; and

FIG. 3 is a rear end elevation view of the solenoid, armature, and core.

Description of the preferred embodiment

In the drawing in FIG. 1, the combination burner and needle valve is indicated at 10. A fluid fuel burner is indicated at 11 having an inlet orifice 12 with tapered surface 13 which is in the shape of the curved surface

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of a frustum of a right cone. A needle valve 14 is provided which has a conical surface 15 that mates and seats upon orifice surface 13.

A conventional mixer tube 17 is located around orifice 12 and supported in that position in the conventional way. Fluid fuel is admitted to chamber 18 through a fitting 19 fixed to housing 16. Valve 14 has a shaft 20 with an upper end fixed to valve 14, and a lower end 22 which abuts the upper end 23 of a set screw 24. Thus, shaft 20 and set screw 24 are not fixed to each other, shaft 20 being fixed to valve 14 and movable therewith away from set screw 24 when valve 14 is closed.

Set screw 24 is threaded onto housing 16, as shown. Housing 16 has a ring 25 welded thereto which carries a sealing O-ring 26 that bears against a relatively smooth cylindrical surface 27 of a set screw 24. A cap 28 is threaded to housing 16 covering set screw 24. A head 29 is fixed to shaft 20, head 29 having a tapered surface 30 to rock on an upper surface 31 of a solenoid armature 32. If desired, a portion of surface 31 may be made concave to conform to the shape of the head surface 30. A helically coiled spring 33 is located around shaft 20 between a surface 34 of an armature 32 and a conventional snap ring 35 which fits in a groove 36 in shaft 20. Armature 32 has a hole 37 therethrough through which shaft 20 projects.

Valve 14 is operated by a solenoid 38 which has a winding 39 around a core 40. Solenoid 38 also has the armature 32 which is hinged to a torsion rod 41 fixed both to core 40 and to armature 32.

As shown in FIG. 2, armature 32 is spot welded at 42 and 43 to torsion rod 41. Core 40 is spot welded to torsion rod 41 at 44 and 45. Spot welds 42, 43, 44, and 45 are made while armature 32 is in the open position, not shown. Thus, torsion rod 41 spring biases armature 32 to the open position.

The arrangement of armature 32, core 40, torsion rod 41, and solenoid winding 32, with armature 32 in the closed position, is shown in FIG. 3.

In the operation of the device 10 shown in FIG. 1, valve 14 is normally closed when solenoid 38 is deenergized. Torsion rod 41 urges armature 32 upwardly in this case, as viewed in FIG. 1. Armature surface 31 is then normally in engagement with head surface 30 pressing valve 14 tight against the valve seating surface 13. In this case, torsion rod 41 should still be under stress. The same is true of spring 33.

When it is desired that valve 14 should open, solenoid 38 is energized, and armature 32 moves to the solid line portion shown in FIG. 1. A portion of armature 32 then abuts a thin sheet 46 of a material fixed to core 40. Alternatively, sheet 46 may be fixed to armature 32. In any event, sheet 46 should be made of a nonmagnetic material. Sheet 46 prevents armature 32 from sticking to core 40 due to residual magnetism in armature of core or both when solenoid 38 is deenergized.

In the energized position, armature 32 pulls valve 14 away from surface 13 until shaft end 22 engages end 23 of set screw 24. Thereafter, spring 33 is compressed to the position shown in FIG. 1.

When solenoid 38 is deenergized, both spring 33 and torsion rod 41 tend to open armature 32 until armature surface 31 engages head surface 30. From that point, torsion rod 41 closes valve 14.

From the foregoing, it will be appreciated that the use of burner orifice 12 both as a fuel restriction and as a valve seat performs a dual function. Further, the use of needle valve 14 makes it possible to close valve 14 with a relatively small amount of solenoid power. Still further, the amount valve 14 can open is adjustable by the setting of set screw 24.

Many changes and modifications of the invention will, of course, suggest themselves to those skilled in the art. Thus, the invention is not to be limited to the specific embodiments shown and described herein, the true scope of the invention being defined only in the appended claims.

What is claimed is:

1. A fluid-fuel burning device comprising: a burner having an inlet orifice; a housing fixed relative to said burner; a needle valve to seat on said orifice, said valve being reciprocable in said housing; operator means to actuate said valve, said operator means including a solenoid having a spring biased movable armature; a spring in addition to the spring for biasing said armature for engagement by said armature, said spring being adapted to bias said valve open when said armature moves in a predetermined direction; and an adjustable stop to limit the amount said valve may open, said spring biasing said valve relative to said stop, said spring being adapted to allow over-travel of said armature after movement of said valve has been stopped by engagement of said stop.

2. The invention as defined in claim 1, said orifice being tapered, said valve having a tapered end to seat on the tapered portion of said orifice, wherein said solenoid has a torsion rod fixed to a core at two spaced points therealong and an armature fixed to said rod at a point between said spaced points, said solenoid being constructed in a manner to hold said armature away from said core by the torsional force of said rod when said solenoid is deenergized.

3. The invention as defined in claim 1, said orifice being tapered, said valve having a tapered end to seat on the tapered portion of said orifice, wherein said valve has an operating shaft with a tapered head therearound, said

armature having a hole through a movable end thereof, said valve shaft extending through said hole, said head being larger than said hole and being large enough to bear on said armature around said hole, said shaft having an annular groove spaced from said head on the side thereof opposite the side on which said valve is located, said operator means also including a snap ring in said groove, said spring being helically coiled around said shaft in compression between said armature and said snap ring, said stop including a set screw threaded inside said housing to adjust the open position of said valve by engagement with the end of said shaft opposite the end thereof on which said valve is located, said solenoid armature being spring biased open in a direction to urge said valve closed, the magnetic closing force of said solenoid on said armature exceeding the forces supplied by both of said springs, said armature and core having a thin, non-magnetic sheet therebetween to prevent complete closing of said armature and thereby to prevent said armature from sticking to said core after deenergization of said solenoid by virtue of residual magnetic flux in said armature and core.

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EVERETT W. KIRBY, Primary Examiner

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251—140; 431—159