

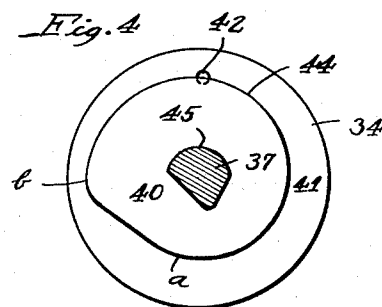
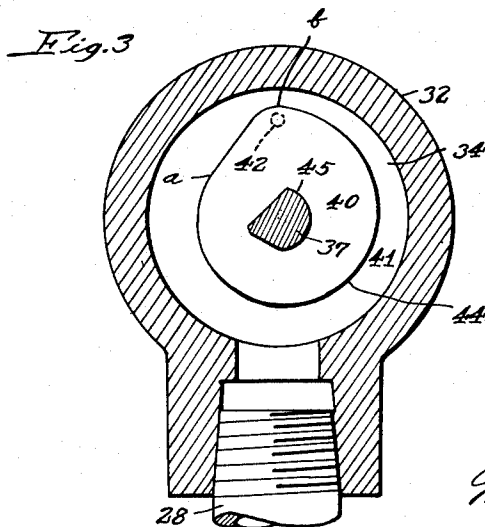
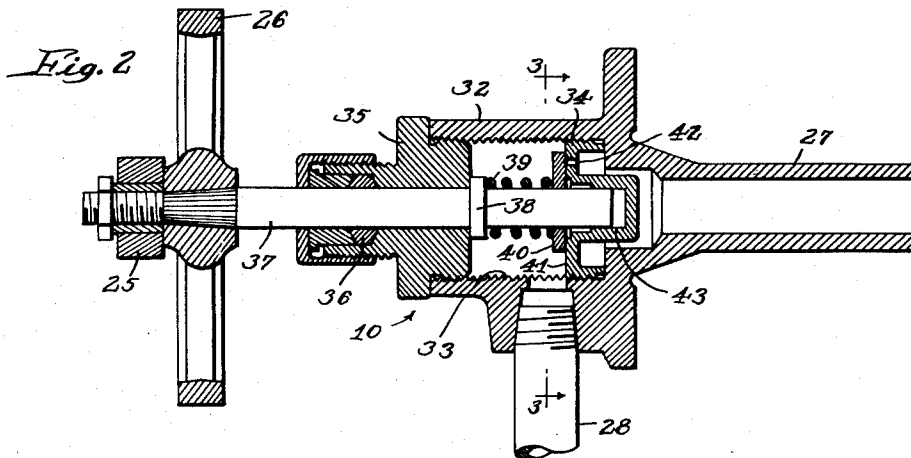
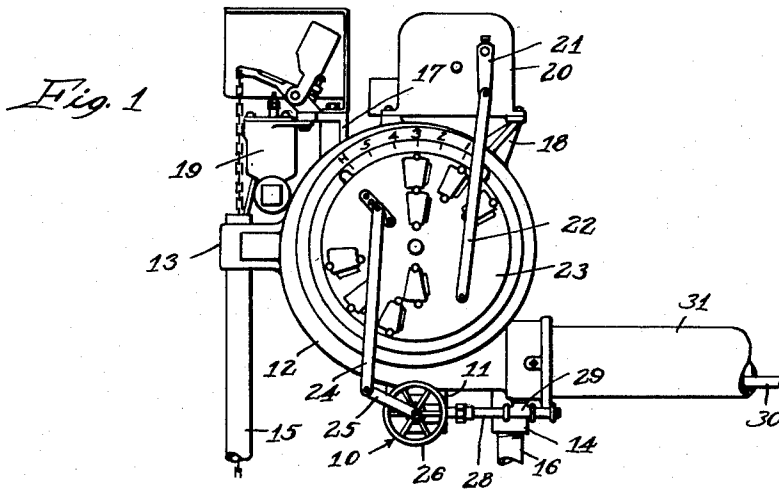
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CONTROL VALVE FOR OIL BURNERS

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CONTROL VALVE FOR OIL BURNERS

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8 Claims. (Cl. 251—86)

This invention relates to liquid fuel or hydrocarbon burners, commonly known as oil burners, and is particularly concerned with an improved control valve for regulating the oil feed according to the heat demand.

The principal object of my invention is to provide a valve in which the rotary valve member is in the form of a cam shaped valve plate slidable on a flat seat having the orifice for metering the oil provided therein, whereby the cam shaped periphery progressively closes said orifice transversely, as distinguished from the endwise movement of a needle valve in an orifice. The advantage of this construction is that, while the total area of opening at any adjustment is a given value, it is not of as narrow section as where a needle valve is adjusted in a circular hole. Consequently, skin friction is reduced to a minimum. A further advantage resulting from the sliding of the valve plate on its seat is that there is no opportunity for a film of gummy substance to collect between the parts and affect the oil feed. A still further advantage is that the accuracy of adjustment is not affected by play in threaded parts, the rotary plate being operable by means of a smooth rotary stem.

The invention is hereinafter described by reference to the accompanying drawing, wherein—

Figure 1 is a side view of an oil burner apparatus suitable for application to a heater or furnace for a home, the control valve of my invention being shown as an assembled part of the apparatus;

Fig. 2 is a longitudinal section through the valve;

Fig. 3 is an enlarged cross-section on the line 3—3 of Fig. 2, and

Fig. 4 is a view similar to Fig. 3, showing the valve turned part way open.

The same reference numerals are applied to corresponding parts in the four views.

The valve of my invention is indicated generally by the reference numeral 10 as mounted on a lug 11 projecting downwardly from and cast integral with the housing 12 of a centrifugal fan. This housing also has integral projections 13 and 14 provided thereon for support of the housing on legs or posts 15 and 16, and has still other integral projections 17 and 18 for support of a float valve 19 and regulator 20, respectively. The latter has a rotatable crank arm 21 connected by means of a link 22 with a shutter plate 23 rotatably adjustable on the side of the housing 12 for regulating the amount of air delivered by the fan in said housing. The shutter plate forms the subject matter of McIlvaine Patent No. 1,797,—

293. Another link 24 provides an adjustable connection between the shutter plate and a lever arm 25 fixed to the hand wheel 26 of the control valve 10, so that the control valve is opened wider and wider at each step toward wider and wider opening of the shutter. In such automatic controls, the room thermostat causes the regulator 20 to operate so as to adjust the size of the flame and constantly balance the heat loss of the building and thus maintain a very even temperature.

The oil passing through the valve 10 flows usually by gravity through a filter, not shown, and then into the bottom of the float valve 19 which maintains a constant level of fuel with respect to the valve 10 so as to insure an even pressure and consequently an even flame free from pulsations or surges. The oil flows from the float valve 19 by gravity through a solenoid valve, not shown, and into the neck 27 of the control valve 10. The solenoid valve is kept open by energization of its coil by the same current that operates the motor for driving the fan in housing 12. The motor does not appear in Fig. 1, it being on the opposite side of the housing from the shutter plate 23. If the current for the motor is interrupted, a main valve in the solenoid valve is closed and the oil is by-passed through a secondary valve therein, adjusted to reduce the flow to approximately one-third of the maximum capacity of the burner, so as to maintain a reduced flame using natural draft, which flame will be sufficient to keep the house warm until the normal feed and forced draft is resumed. Now, the adjustment of the valve 10 regulates the oil feed, and the oil flows by gravity from the valve through pipe 28 to a connection 29 communicating with a pipe 30 extending lengthwise inside the air tube 31. The tube 31 communicates with a fire-pot, and the pipe 30 has a discharge elbow at its remote end for discharging the oil in a fine stream into the firepot. It is therefore clear that the burner has simple gravity feed regulated in accordance with heat demand by the valve 10, and the solenoid valve utilized in connection therewith is for changing from a normal oil feed, while the motor is running to furnish a forced air draft, to a restricted feed for a low carry-over flame when the current for the motor is interrupted by reason of a temporary shut down of the electric service for the home. The control valve 10, as appears in Fig. 2, has the hollow body 32 thereof formed integral with the neck 27 and threaded internally substantially its full length, as at 33, for the entry of the screw plug 34 into the inner end, and a closure plug 35 into the outer end.

The latter has a stuffing box 36 formed thereon through which the smooth stem 37 of the valve extends for connection with the hand wheel 26. An annular shoulder 38 is formed on the stem to bear against the inner end of the plug 35 and provide an abutment for a coiled compression spring 39 which encircles the stem and holds the cam-shaped valve plate 40 in full engagement with the flat valve seat 41 provided on the plug 34. The plug has an orifice 42 provided therein through which the oil flows at a rate determined by the setting of the valve plate 40. The plug, it will be noted, provides a central bearing 43 for the end of the stem 37, whereby to better insure accurate location of the valve cam with respect to the plug and accordingly secure the proper relationship between the periphery 44 of the valve plate and the orifice 42. The cam-shaped periphery of the valve plate is plotted starting with a certain radius at point *a* and increasing the radius .001" for each 3° in a counterclockwise direction (see Fig. 3) to the point *b* of maximum radius. It is clear therefore that the opening of the valve will be proportionate to the angle through which the valve plate is turned. There are usually four positions of opening, to provide low, small, large, and high flames, respectively. The range from low to high, determined by the total angularity through which arm 25 is moved, is subject to variation by connecting the upper end of link 24 to plate 23 closer to or farther from the center of rotation of said plate. Five ranges are provided by the five radially spaced pivot holes indicated on plate 23. Obviously, if the pivot is closer to the center of plate 23, link 24 will move arm 25 through a smaller angle, in a given movement of the plate, than where the pivot is farther from said center. Thus, the one size of burner is adjustable to any one of five operating ranges and a dealer can purchase the burners in quantity, knowing that any customer's heating requirements can be filled by simple adjustment of the one sized burner to get whatever oil consumption per hour may be required. The valve plate 40 has a specially shaped hole 45 therein to receive the correspondingly shaped end of the stem 37, thus permitting the plate to be assembled on the stem in only the one position of rotation of the plate, and not reversed. The stem 37 is cylindrical but has portions of the end, which is received in the bearing 43 and the hole 45 in the valve plate 40, machined off to provide two different width flats thereon as shown in Figs. 3 and 4. These flats are in angular relation to one another but spaced so as to leave the two substantially diametrically opposed different width arcuate peripheral portions for good bearing engagement of the stem in the bearing 43. This insures the correct relationship between the stem 37 and aperture 42, which of course, is important from the standpoint of accuracy in regulating oil flow in the different positions to which the valve plate 40 will be turned with the stem. This non-symmetrical portion of the stem also insures maintaining a definite relationship of the stem 37, valve plate 40, and the aperture 42 in a given fixed position of the valve seat 41, so that there is accurate regulation of oil flow through the aperture when the valve plate is turned to different positions and substantially the same rate of flow will be obtained every time the valve plate is turned to a certain position. The seating surfaces of the valve plate 40 and the seat 41 are both lapped so as to prevent seepage of oil there-

between and insure the same seating of the valve in different positions of rotary adjustment.

In operation, the orifice 42 is closed when the valve plate 40 is in the position shown in Fig. 3. The orifice is opened by turning the valve plate 40 in a counterclockwise direction, as illustrated, for example, in Fig. 4. Manifestly, since the periphery 44 of the valve plate 40 is graduated, as above described, the radius being increased .001" for each 3°, the oil flow can be regulated to a nicety, there being a definite increase in area uncovered at orifice 42 for each degree of counterclockwise rotation of the valve plate 40, and, of course, the converse is true—the orifice will be closed progressively, transversely, in the clockwise turning of the valve plate. In Fig. 4, the orifice is shown as open half way and it will be observed how wide is the section of opening as distinguished from what a narrow section of opening would be afforded where a needle valve, for example, is adjusted in a circular hole to open the same half way. In other words, the total area of opening is brought into as wide a section as possible by virtue of the present invention. Consequently, skin friction resistance to oil flow is reduced to a minimum. Valves having a needle for metering the oil flow are found to have zero flow when the valve is nearly closed, due to skin friction preventing flow. That condition is avoided with my invention. Another condition equally as serious which I avoid with my invention is that of a film of gummy substance collecting in the valve between the two surfaces and preventing, or at least restricting oil flow, when the valve is only slightly opened. In the valve of my invention, the fact that the valve plate slides on the seat eliminates the objection mentioned, there being no opportunity for the substance to collect between the lapped surfaces. Furthermore, there are no threaded parts to develop play due to wear and thus affect the accuracy of regulation of the valve; the stem 37 is smooth and merely serves to turn the valve plate, and there is no perceptible change in the relationship of the valve plate to the orifice as a result of such small wear as may occur, particularly since the stem 37 finds good bearing support in the plugs 34 and 35.

It is believed the foregoing description conveys a good understanding of the objects and advantages of my invention. The appended claims are drawn with a view to covering all legitimate modifications and adaptations.

I claim:

1. A valve of the character described comprising a body having an inlet and an outlet opening and a flat valve seat therebetween, the valve seat having an aperture spaced from the center thereof establishing communication between the inlet and outlet openings, a valve stem extending into the body and rotatable on an axis normal to the plane of the valve seat, a thin cam-shaped valve plate of uniform thickness throughout having a non-symmetrical shaped opening provided therein providing a short bearing for receiving a correspondingly shaped portion of the valve stem, whereby said valve plate is rotatable with the stem but in floating relation thereto to permit even contact of the surface of the plate with the valve seat, said plate being removably but non-reversibly assembled on said stem in only one position of rotation of the plate relative to the stem whereby to retain a predetermined relationship between the cam-shaped periphery of said plate and said aperture, and a coiled com-

pression spring surrounding the valve stem and pressing the plate into full engagement with the valve seat, the cam-shaped periphery of said plate being arranged to gradually open or close the aperture in the seat according to the direction of rotation of the stem.

2. A valve as set forth in claim 1 wherein the stem is cylindrical and the non-symmetrical portion comprises portions formed to provide two different width flats thereon in circumferentially spaced angular relation to engage the correspondingly shaped opening provided in the valve plate.

3. A valve of the character described comprising a body having an inlet and an outlet opening, a removable valve seat member inserted in said body between said inlet and outlet openings and having a central bearing therein and an aperture in radially spaced relation thereto establishing communication between the inlet and outlet openings, the valve seat member having a flat seat thereon, a valve stem extending into the body and having a smooth cylindrical end portion received in the bearing in said valve seat member for rotation of the stem on an axis normal to the plane of the valve seat, said cylindrical end portion having two different width flats formed thereon in angular relation and extending from the periphery thereof, a thin cam-shaped valve plate of uniform thickness throughout having an opening provided therein conformed to the said end portion of the stem and providing a short bearing for receiving the valve stem, whereby said valve plate is rotatable with the stem but in floating relation thereto to permit even contact of the surface of the plate with the valve seat, said plate being removably but non-reversibly assembled on said stem in only one position of rotation of the plate relative to the stem whereby to retain a predetermined relationship between the cam-shaped periphery of said plate and said aperture, and a coiled compression spring surrounding the valve stem and pressing the plate into full engagement with the valve seat, the cam-shaped periphery of said plate being arranged to gradually open or close the aperture in the seat according to the direction of rotation of the stem.

4. In a valve of the character described comprising a body having an inlet and an outlet and an intermediate flat valve seat, the valve seat having a central bearing provided therein and an aperture in radially spaced relation thereto for establishing communication between the inlet and outlet, the combination of a thin cam-shaped valve plate of uniform thickness throughout engaging the valve seat with its periphery arranged to gradually open or close the aperture according to the direction of rotation of said plate, a valve stem extending through an opening in said plate into the aforesaid bearing, and spring means urging the plate into engagement with the valve seat, the valve stem being cylindrical but having portions of the end, which is received in the bearing of the valve seat and the opening in the valve plate, removed so as to provide different width flats thereon in angular relation to one another, while still retaining two substantially diametrically opposed arcuate portions for bearing engagement of the stem in the bearing in the valve seat to insure a desired relationship between the stem and aperture, and the opening provided in the valve plate being correspondingly shaped to receive the stem non-reversibly and in only one position of rotation of the plate relative to the stem and so that the one side of the plate in-

tended for engagement with the valve seat will be disposed for abutment with said seat.

5. A valve of the character described comprising a body having an inlet and an outlet opening and a flat valve seat therebetween, the valve seat having an aperture spaced from the center thereof establishing communication between the inlet and outlet openings, a valve stem extending into the body and rotatable on an axis normal to the plane of the valve seat, and a thin cam-shaped valve plate of uniform thickness throughout having a non-symmetrical shaped opening provided therein providing a short bearing for receiving a correspondingly shaped portion of the valve stem, whereby said valve plate is rotatable with the stem but in floating relation thereto to permit even contact of the surface of the plate with the valve seat, said plate being removably but non-reversibly assembled on said stem and being held in full engagement with the valve seat, the cam-shaped periphery of said plate being arranged to gradually open or close the aperture in the seat according to the direction of rotation of the stem, the stem being cylindrical and the non-symmetrical portion comprising portions formed to provide two different width flats thereon in circumferentially spaced angular relation to engage the correspondingly shaped opening provided in the valve plate.

6. In a valve of the character described comprising a body having an inlet and an outlet and an intermediate flat valve seat, the valve seat having a central bearing provided therein and an aperture in radially spaced relation thereto for establishing communication between the inlet and outlet, the combination of a thin cam-shaped valve plate of uniform thickness throughout engaging the valve seat with its periphery arranged to gradually open or close the aperture according to the direction of rotation of said plate, and a valve stem extending through an opening in said plate into the aforesaid bearing, the valve stem being cylindrical but having portions of the end, which is received in the bearing of the valve seat and the opening in the valve plate, removed so as to provide different width flats thereon in angular relation to one another, while still retaining two substantially diametrically opposed arcuate portions for bearing engagement of the stem in the bearing in the valve seat to insure a desired relationship between the stem and aperture, and the opening provided in the valve plate being correspondingly shaped to receive the stem non-reversibly and in only one position of rotation of the plate relative to the stem and so that the one side of the plate intended for engagement with the valve seat will be disposed for abutment with said seat.

7. In a valve of the character described comprising a body, a flat valve seat therein having an aperture at a predetermined radial distance from the center thereof, a valve stem centrally arranged with respect to said seat and normal to the plane thereof, a thin cam-shaped valve plate of uniform thickness throughout non-rotatably and removably mounted on the valve stem and engaging the valve seat with its periphery arranged so as to gradually open or close the aperture in the rotation of said plate with said stem, and cooperative key means between the stem and plate which prevents the positioning of the plate on the stem in any way except with the cam-shaped periphery disposed in one predetermined relation to said aperture, said cooperative key means including two flat angularly related surfaces of dif-

ferent widths on the stem received in a corresponding shaped opening provided in said plate.

8. In a valve of the character described comprising a body, a flat valve seat therein having
5 a bearing provided centrally thereof, and an aperture in radially spaced relation thereto, a valve stem centrally arranged with respect to the valve seat and normal to the plane thereof and having a cylindrical end portion received with a
10 close working fit in said bearing, a thin cam-shaped valve plate of uniform thickness throughout non-rotatably and removably mounted on the valve stem and engaging the valve seat with its periphery arranged so as to gradually open

or close the aperture in the rotation of said plate with said stem, and cooperative key means between the stem and plate which prevents the positioning of the plate on the stem in any way except with the cam-shaped periphery disposed in one predetermined relation to said aperture, said
5 cooperative key means including two different width flat surfaces in angular relation to one another provided on said stem received in a corresponding shaped opening provided in said plate,
10 the apex of the angle formed by the angularly related surfaces lying in the circular periphery of the end portion of the stem.

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