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ROTARY FUEL FEEDER FOR FLAME RING BURNERS

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2 SHEETS—SHEET 1

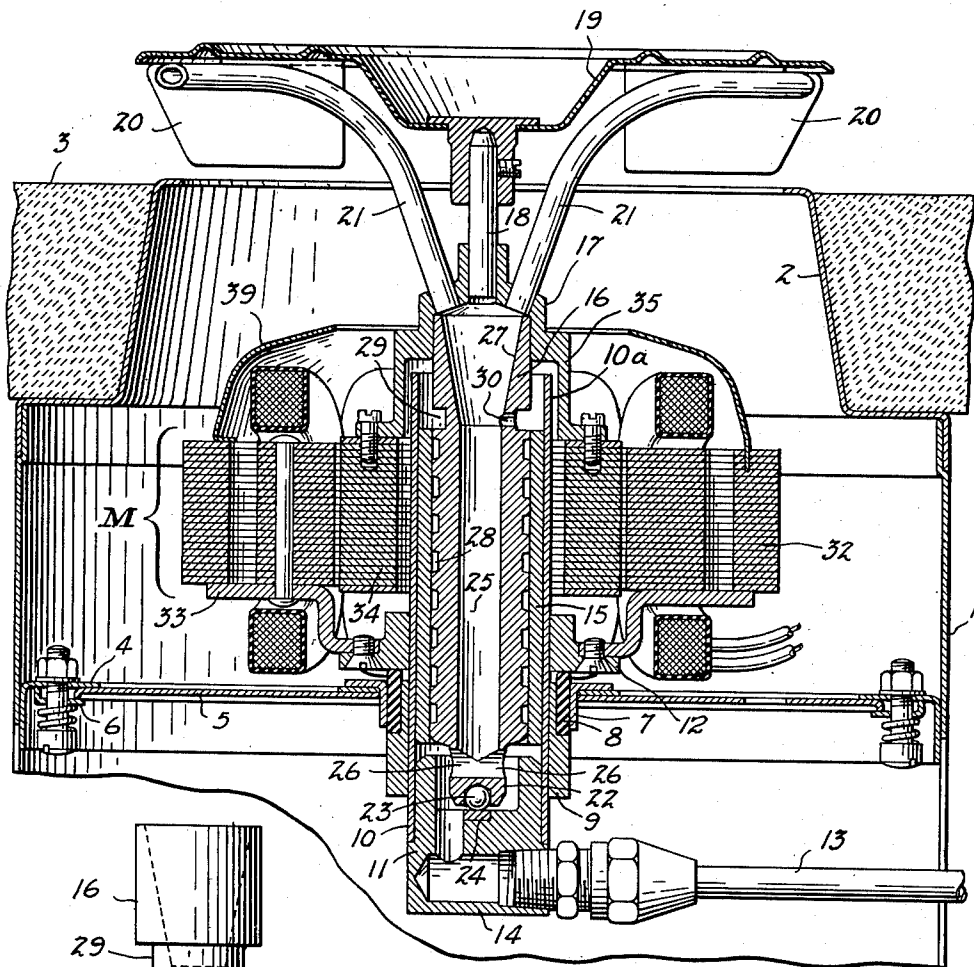


Fig. 1

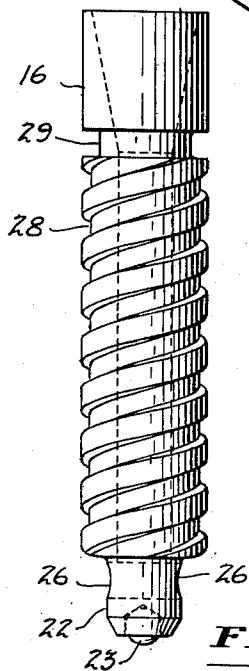


Fig. 2

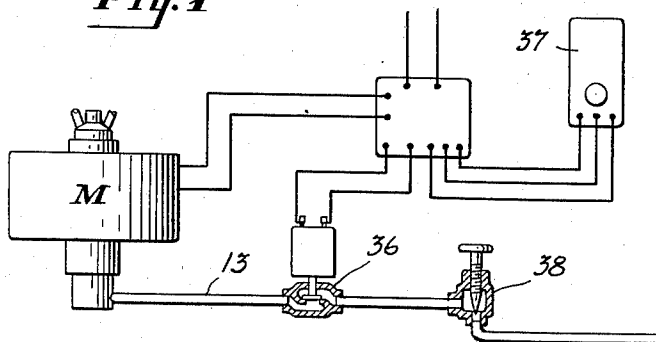


Fig. 3

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ROTARY FUEL FEEDER FOR FLAME RING
BURNERS

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This invention relates to feeders for liquid fuel burners, and more particularly to feeders which include a rotary distributor for delivering the fuel to the flame ring of a burner of the wall flame type.

This invention has for its object to provide a fuel distributing rotor that is mounted in bearings that are submerged in fuel oil, and to provide means for causing oil to circulate through the rotor bearings.

A further object of the invention is to provide means for maintaining a constant flow of oil through the bearings during operation of the feeder.

Another object of the invention is to provide means for maintaining the bearings submerged in oil when the rotary distributor is stationary.

With the above and other objects in view, the invention may be said to comprise the feeder as illustrated in the accompanying drawings, hereinafter described and particularly set forth in the appended claims, together with such variations and modifications thereof as will be apparent to one skilled in the art to which the invention pertains.

Reference should be had to the accompanying drawings forming a part of this specification, in which:

Figure 1 is a vertical axial section through a fuel feeder embodying the invention;

Figure 2 is a side elevation of the rotor shaft;

Figure 3 is a diagrammatic view showing the fuel feed controlling means; and

Figures 4 and 5 are views showing rotor shafts of slightly modified construction.

The fuel feeder of the present invention is mounted in a housing 1 that is adapted to be positioned in the base of a furnace, the housing 1 being provided at its upper end with a tapering portion 2 that fits in the central opening of a hearth 3. The housing 1 has a fixed horizontal partition 4 which carries a damper 5 that is adjustable to regulate the flow of air through the upper portion of the housing into the furnace, the damper 5 being held in adjusted positions by means of suitable spring pressed clips 6 which engage peripheral portions of the damper. The partition 4 has a central opening in which is mounted a flanged ring 7 and within the ring 7 there may be a suitable cushioning member 8 which preferably is of elastic rubber as indicated in the drawing. If desired the rubber ring 8 may be bonded to the inside of the flanged ring 7 and to the external surface of the sleeve 9 that fits within the ring 3. The cushioning ring 8 pref-

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erably is annular in form with the upper end projecting above the flanged ring 7 to provide a cushioned or yielding support for an upright oil reservoir or cup 10 which comprises a cylindrical tube 10a and a plug 11 closing the lower end of the tube. The tube 10a has a sliding fit in the internal sleeve 9 and may be yieldably supported on the cushioning ring 8 by means of a collar 12 suitably attached to the tube 10a and resting on the top edge of the cushioning ring 8.

The tubular wall 10a of the cup 10 has an elongated bearing sleeve 15 attached to the interior thereof, the sleeve 15 extending throughout the major portion of the length of the tubular wall 10a with its lower end above the bottom of the plug 11 and its upper end below the top of the tubular wall 10a. The sleeve 15 is preferably made of a suitable bearing material. The cup provides a support for a fuel distributing rotor which comprises a vertical shaft 16 and a head which comprises a cap 17 attached to the upper end of the shaft 16, a post or extension 18 extending upwardly from the center of the cap 17 and a fan comprising a horizontally disposed disk 19 attached to the upper end of the post 18 and blades 20 depending from the disk 19.

The distributor head which may be of conventional construction has fuel delivery tubes 21 which are attached at their lower ends to the cap 17 and which have their delivery ends disposed beneath the disk 19 and closely adjacent the peripheral portions of the disk.

The shaft 16 has a lower end portion 22 of reduced diameter in which is mounted a bearing ball 23 that rests upon a steel insert 24 mounted in the top face of the plug 11. The shaft 16 has an axial passage 25 that communicates with the interior of the reservoir below the sleeve 15 through lateral openings 26 and which has a flaring upper end portion 27 of conical form. The conical portion 27 of the passages extends from the upper end of the shaft 16 downwardly and merges into the cylindrical portion of the passage 25 below the top of the tubular wall 10a, the cap 17 being positioned adjacent the top of the tubular wall 10a.

The shaft 16 is of a diameter to fit within the bearing sleeve 15 and engages with the sleeve 15 from the upper to the lower end thereof. A helical groove 28 is formed in the exterior cylindrical surface of the shaft 16 and the inclination of this groove is such that the rotation of the shaft in the direction in which it is driven during the fuel feeding operation tends to cause liquid to flow downwardly in the groove. Im-

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mediately above the upper end of the sleeve 15 the shaft 16 is provided with a circumferential groove 29 and a lateral opening 30 is provided from the groove 29 to the axial passage 25. During operation of the feeder, oil flows upwardly through the axial passage 25 and is discharged by centrifugal force through the delivery tubes 21. Some of the oil flows outwardly through the passage 30 and oil is caused to flow downwardly through the groove 28 during rotation of the shaft. The shaft passage 25 and the passages of the tubes 21 are so dimensioned that during operation of the feeder the volume of liquid fuel contained in the passages and in the reservoir 10 during rotation is sufficient to fill the reservoir to a level below the top of the tubular wall 10a and in the region of or adjacent the top of the bearing sleeve 15.

The fuel feeding rotor is preferably operated by means of an electric motor indicated generally by the letter M, this motor comprising a motor rotor 34 and a motor stator 32 that surrounds the tubular wall 10a and that is supported upon a suitable spider 33 attached to the collar 12. The motor rotor 34 extends around the tubular wall 10a within the stator 32, the rotor 34 being attached to a skirt 35 carried by the cap 17.

Flow of liquid fuel to the bearing cup through the conduit 13 is controlled by a suitable normally closed solenoid operated valve 36 that is automatically opened and closed when the motor M is energized or deenergized, the solenoid of the valve 36 being in circuit with the motor M and with a thermostat 37 which controls the motor. Whenever the motor M is deenergized the valve 36 is closed to cut off the flow of fuel to the feeder so that any liquid remaining in the tubes 21 and conical portion 27 of the passage after the distributor ceases to rotate will flow by gravity back into the axial passage 25. The level of the liquid will thus establish itself in the passage 25 and in the reservoir exteriorly of the shaft 16 at a level a short distance below the top of the tube 10a and near the upper end of the bearing sleeve 15 so that the bearing will be substantially submerged in oil.

The helical groove 28 provides a reservoir for a considerable volume of oil within the tubular bearing 15 so that effective lubrication is provided even though the feeder may remain idle for a long period of time.

When the motor M is started into operation, rotation of the shaft 16 will cause the liquid to flow downwardly in the groove 28 so that the pressure of the liquid in the bottom of the cup will be increased and the level of liquid in the axial passage 25 will be raised above the lower end of the rotating conical portion 27, which exerts a lifting action on the liquid as soon as the level of the liquid in the passage 25 reaches the lower end thereof, so that delivery of liquid fuel to the burner begins immediately after rotation of the rotor is started.

In addition to maintaining a constant flow of liquid lubricant through the bearing, the helical groove assists in keeping the level of the liquid exteriorly of the shaft below the top of the cup and preventing overflow during operation of the feeder.

In order to accurately regulate the rate of flow of fuel to the burner, a suitable metering valve such as the needle valve 33 is provided in the conduit 13.

A suitable shield 39 may be provided for the motor, this shield being attached to the top of

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the stator 32 and overlying the stator coils to protect them from the heat of the burner.

It is not essential that the shaft have bearing within the sleeve 15 throughout the length thereof. The shaft may be provided if desired with axially spaced bearing portions which engage with the bearing sleeve as shown in Fig. 4 of the drawings where the rotor shaft has an upper bearing portion 40 provided with a helical groove 41 and a plain bearing 42 at the lower end of the bearing sleeve which is spaced from the bearing portion 40, the shaft being provided with a reduced portion 43 intermediate the bearing portions. In this modification the fuel oil is circulated through the bearings in a manner similar to the modification above described, a lower plain bearing 42 being preferably provided with a groove 44 or other suitable passage in the shaft or bearing to permit free passage of liquid past the lower bearing so that a fairly rapid circulation of oil may be maintained during operation.

It is not essential that the axial passage be provided with a flaring conical upper end portion. The passage if desired may be of uniform diameter throughout its length. As shown in Fig. 5, a passage 25a is provided which is of uniform diameter to the upper end of the rotor shaft and passages are provided through the upper end of the shaft to the cylindrical passage 25a to deliver fuel to the delivery tubes 21a. In Fig. 5 the rotor shaft is provided with an upper plain bearing 45 that is journaled in the top portion of the bearing sleeve and with a lower bearing portion 46 that is provided with a helical groove 47, the portion 48 of the shaft between the upper and lower bearing portions 45 and 46 being of reduced diameter to provide a reservoir for additional lubricant. In this modification the shaft has a groove 49 above the upper bearing 45 to increase the liquid capacity of the cup above the bearing, but no passage is provided between the axial passage 25a and the interior of the cup above the bearing. In this modification the fuel oil flows freely up through the helical groove 47 and into the annular space 48 when the feeder is idle, and the level of the liquid within the axial passage 25a and within the tubular wall 10 will be established by seepage of oil past the upper bearing 45 so that the entire bearing will be submerged in oil during periods of idleness. Whenever the rotor is driven the helical groove 47 tends to draw oil down from the reservoir 48, but as soon as the rotor is stopped the bearing will again become filled with oil.

It is to be understood that variations and modifications of the specific devices herein shown and described for purposes of illustration, may be made without departing from the spirit of the invention.

What I claim is:

1. A liquid fuel feeder comprising a support, an axially elongated, upright, open top cup rigidly mounted on said support and including means defining a vertically disposed bearing sleeve within the cup, the upper end of said bearing sleeve being disposed below the upper open end of the cup, whereby the cup defines a liquid retaining reservoir extending above the upper end of said sleeve, a rotor comprising a vertical shaft and a distributor head attached to the upper end of the shaft, said shaft being journaled in said sleeve with sufficient clearance to at least accommodate a continuous film of said liquid fuel therebetween from top to bottom of the bearing surfaces there-

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of, and said rotor having an axial passage therethrough opening at its lower end to the interior of the cup adjacent the bottom thereof and extending above the upper end of said bearing surface, said head having means defining delivery passages connected to said axial passage and extending above the upper end of the cup and outwardly therefrom, whereby liquid flowing through said delivery passages from said axial passage is accelerated by centrifugal force upon rotation of said shaft and head, a supply conduit connected to said cup for delivery of liquid fuel into the cup and said axial passage, means operative to drive said rotor intermittently, means for feeding liquid fuel through said supply conduit into the cup at a rate sufficient to maintain a level of liquid in the cup adjacent the upper end of said sleeve for keeping the sleeve substantially submerged during rotation of said shaft, and means for limiting reverse flow of liquid fuel out of said cup through said supply line, whereby a volume of liquid sufficient to substantially submerge said bearing surface is retained in said cup when said rotor is stationary.

2. A liquid fuel feeder comprising a support, an axially elongated, upright, open top cup rigidly mounted on said support and including means defining a vertically disposed bearing sleeve within the cup, the upper end of said bearing sleeve being disposed below the upper open end of the cup, whereby the cup defines a liquid retaining reservoir extending above the upper end of said sleeve for submerging the sleeve, a rotor comprising a vertical shaft and a distributor head attached to the upper end of the shaft, said shaft being supported by the bottom of the cup and journaled in said bearing surface with sufficient clearance to at least accommodate a continuous film of said liquid fuel therebetween from top to bottom of said bearing surface, and said rotor having an axial passage therethrough opening at its lower end to the interior of the cup adjacent the bottom thereof and extending above the upper end of said bearing surface, said head having means defining delivery passages connected to said axial passage and extending above the upper end of the cup and outwardly therefrom, whereby liquid flowing through said delivery passages from said axial passage is accelerated by centrifugal force upon rotation of said shaft and head, a supply conduit connected to said cup for delivery of liquid fuel into the cup and said axial passage, a valve controlling flow of liquid into said cup, means operative to drive said rotor, and means for closing said valve and rendering said driving means inoperative substantially simultaneously, whereby a volume of liquid sufficient to submerge said bearing surface is retained in said cup when said rotor is stationary.

3. A liquid fuel feeder comprising a support, an axially elongated, upright, open top cup rigidly mounted on said support and including means defining a vertically disposed bearing sleeve within the cup, the upper end of said bearing sleeve being disposed below the upper open end of the cup, whereby the cup defines a liquid retaining reservoir extending above the upper end of said sleeve for submerging the sleeve, a rotor comprising a vertical shaft and a distributor head attached to the upper end of the shaft, said shaft being journaled in said bearing surface with sufficient clearance to at least accommodate a continuous film of said liquid fuel therebetween from top to bottom of said bearing surface, a portion

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of said shaft above said bearing surface being of reduced diameter to increase the volume of fuel that may be accommodated in the cup above said bearing surface, and said rotor having an axial passage therethrough opening at its lower end to the interior of the cup adjacent the bottom thereof and extending above the upper end of said bearing surface, said head having means defining delivery passages connected to said axial passage and extending above the upper end of the cup and outwardly therefrom, whereby liquid flowing through said delivery passages from said axial passage is accelerated by centrifugal force upon rotation of said shaft and head, a supply conduit connected to said cup for delivery of liquid fuel into the cup and said axial passage, a valve controlling flow of liquid into said cup and upwardly through the axial passage of said shaft, means operative to drive said rotor, and means for closing said valve and rendering said driving means inoperative substantially simultaneously, whereby a volume of liquid sufficient to submerge said bearing surface is retained in said cup when said rotor is stationary.

4. A liquid fuel feeder comprising a support, an axially elongated, upright, open top cup rigidly mounted on said support and including means defining a vertically disposed bearing sleeve within the cup, the upper end of said bearing sleeve being disposed below the upper open end of the cup, whereby the cup defines a liquid retaining reservoir extending above the upper end of said sleeve for submerging the sleeve, a rotor comprising a vertical shaft and a distributor head attached to the upper end of the shaft, said shaft being journaled in said bearing surface with sufficient clearance to at least accommodate a continuous film of said liquid fuel therebetween from top to bottom of said bearing surface, portions of said shaft above and below said bearing surface being of reduced diameter to increase the volume of fuel retainable by the cup above and below the bearing surface, and said rotor having an axial passage therethrough opening at its lower end to the interior of the cup adjacent the bottom thereof and extending above the upper end of said bearing surface, said head having means defining delivery passages connected to said axial passage and extending above the upper end of the cup and outwardly therefrom, whereby liquid flowing through said delivery passages from said axial passage is accelerated by centrifugal force upon rotation of said shaft and head, a supply conduit connected to said cup for delivery of liquid fuel into the cup and said axial passage, a valve controlling flow of liquid into said cup and upwardly through the axial passage of said shaft, means operative to drive said rotor, and means for closing said valve and rendering said driving means inoperative substantially simultaneously, whereby a volume of liquid sufficient to substantially entirely submerge said bearing surface is retained in said cup when said rotor is stationary.

5. A liquid fuel feeder comprising a support, an axially elongated, upright, open top cup rigidly mounted on said support and including means defining a vertically disposed bearing sleeve within the cup, the upper end of said bearing sleeve being disposed below the upper open end of the cup, whereby the cup defines a liquid retaining reservoir extending above the upper end of said sleeve for submerging the sleeve, a rotor comprising a vertical shaft and a distributor head attached to the upper end of the shaft, said shaft being journaled in said bearing surface with

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sufficient clearance to at least accommodate a continuous film of said liquid fuel therebetween from top to bottom of said bearing surface, and said rotor having an axial passage therethrough opening at its lower end to the interior of the cup adjacent the bottom thereof and extending above the upper end of said bearing surface, said head having means defining delivery passages connected to said axial passage and extending above the upper end of the cup and outwardly therefrom, whereby liquid flowing through said delivery passages from said axial passage is accelerated by centrifugal force upon rotation of said shaft and head, a supply conduit connected to said cup for delivery of liquid fuel into the cup and said axial passage, a valve controlling flow of liquid into said cup and upwardly through the axial passage of said shaft, an electric motor operatively connected to said rotor for driving the same, and electrical means for closing said valve and rendering said driving means inoperative substantially simultaneously, whereby the volume of liquid remaining in said cup when said rotor is stationary is sufficient to substantially completely submerge said bearing surface.

6. A fuel feeder according to claim 1 in which an opening in said shaft is provided adjacent the upper end of said sleeve for maintaining communication between the axial passage through the shaft and the upper portion of said reservoir.

7. A fuel feeder according to claim 4 in which said shaft is provided with an opening adjacent the upper end of said sleeve for maintaining communication between the axial passage through the shaft and the upper portion of said reservoir.

8. A fuel feeder according to claim 1 in which the clearance between said shaft and said bearing surface is enlarged in at least one region between the upper and lower ends of the sleeve to provide additional liquid reservoir space.

9. A fuel feeder according to claim 1 in which a helical oil feeding groove is provided in the outer surface of said shaft between the upper and lower ends of said sleeve.

10. A fuel feeder according to claim 1 in which a helical oil feeding groove is provided in the outer surface of said shaft, said groove extending downwardly from the upper end of said bearing surface.

11. A fuel feeder according to claim 4 in which a helical oil feeding groove is provided in the outer surface of said shaft, said groove extending substantially continuously from the upper end to the lower end of said bearing surface.

12. A liquid fuel feeder comprising a support, an axially elongated, upright, open top cup rigidly mounted on said support and including means defining a vertically disposed bearing sleeve within the cup, the upper end of said bearing sleeve being disposed below the upper open end of the cup, said cup defining a liquid fuel retaining reservoir having upper and lower portions between which said bearing sleeve extends, a rotor comprising a vertical shaft that is journaled in said sleeve and a distributor head attached to the upper end of the shaft, said shaft and sleeve having sufficient clearance to at least accommodate a continuous film of said liquid therebetween, said shaft having an external helical groove that communicates at its upper end with said upper portion of the liquid reservoir and at its lower end with said lower portion of the liquid reservoir, said shaft having an axial passage therein opening at its lower end to said lower portion of the liquid reservoir and extending above said

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bearing sleeve, said head having laterally extending delivery passages connected to said axial passage for discharging liquid therefrom by centrifugal force, means for driving said rotor in a direction to cause downward flow of liquid in said groove from said upper portion of said reservoir to the lower portion thereof, means for continuously delivery liquid fuel into said upper portion of said reservoir exteriorly of said shaft during rotation of said rotor, whereby liquid is continuously pumped through said groove from said upper portion of said reservoir to the lower portion thereof during said rotation, and means for limiting reverse flow of liquid fuel out of said cup to maintain liquid in said groove when said rotor is stationary, whereby downward flow of liquid through the groove is started immediately upon rotation of the rotor.

13. A liquid fuel feeder comprising a support, an axially elongated, upright, open top cup rigidly mounted on said support and including means defining a vertically disposed bearing sleeve within the cup, the upper end of said bearing sleeve being disposed below the upper open end of the cup, said cup defining a liquid fuel retaining reservoir having upper and lower portions between which said bearing sleeve extends, a rotor comprising a vertical shaft that is journaled for rotation in said sleeve and a distributor head attached to the upper end of the shaft, said shaft having a portion of reduced diameter intermediate the ends of said sleeve providing an intermediate reservoir space, said shaft having bearing portions above and below said reduced portion, the upper of said bearing portions having an external helical groove that extends the full length thereof, said shaft being formed to provide a passage between said intermediate space and said lower portion of the liquid reservoir and having an axial passage therein extending above said bearing sleeve and opening to said upper and lower portions of the liquid reservoir, said distributor head having laterally extending delivery passages connected to said axial passage for discharging liquid therefrom by centrifugal force, means for continuously delivering liquid fuel into said upper portion of said reservoir during rotation of said rotor, means for driving said rotor in a direction to cause downward flow of liquid in said groove whereby liquid is continuously pumped through said groove from said upper portion of said reservoir to the lower portion thereof during rotation of said rotor, and means for limiting reverse flow of liquid fuel out of said cup to maintain liquid in said groove during idle periods of the rotor, whereby downward flow of liquid through the groove is started immediately upon rotation of the rotor.

14. A liquid fuel feeder comprising a support, an axially elongated, upright, open top cup rigidly mounted on said support and including means defining a vertically disposed bearing sleeve within the cup, the upper end of said bearing sleeve being disposed below the upper open end of the cup, said cup defining a liquid fuel retaining reservoir having upper and lower portions between which said bearing sleeve extends, a rotor comprising a vertical shaft that is journaled in said sleeve and a distributor head attached to the upper end of the shaft, said shaft and sleeve having sufficient clearance between them to at least accommodate a continuous film of said liquid therebetween, said shaft having an axial passage therein opening at its lower end to said lower portion of the liquid reservoir and extend-

ing to the upper end of the shaft, said passage having an upper end portion that flares upwardly from adjacent the top of said sleeve to the upper end of said shaft, said head having laterally extending delivery passages connected to the flared upper end of said axial passage for discharging liquid therefrom by centrifugal force, means for driving said rotor, means for rendering said driving means inoperative, means for delivering liquid fuel into said cup at a rate sufficient to maintain a level of liquid in the cup above the lower end of said flared portion of said passage while said rotor is being driven, and means for limiting reverse flow of liquid fuel out of said cup for maintaining the liquid level within the cup adjacent the upper end of said sleeve when said rotor is stationary.

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