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FUEL FEEDING SYSTEM FOR OIL BURNERS

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Fig. 1.

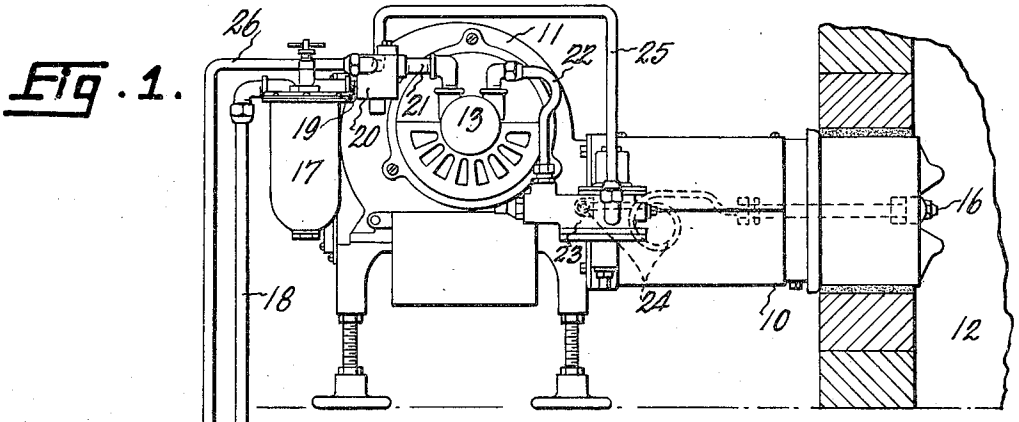


Fig. 2.

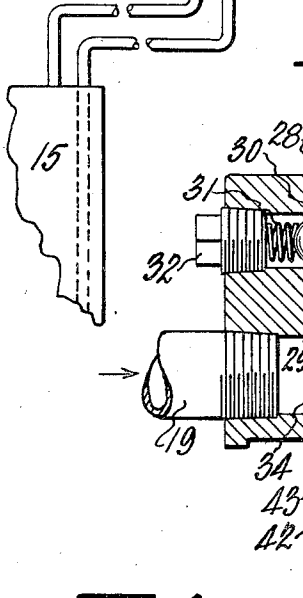


Fig. 3.

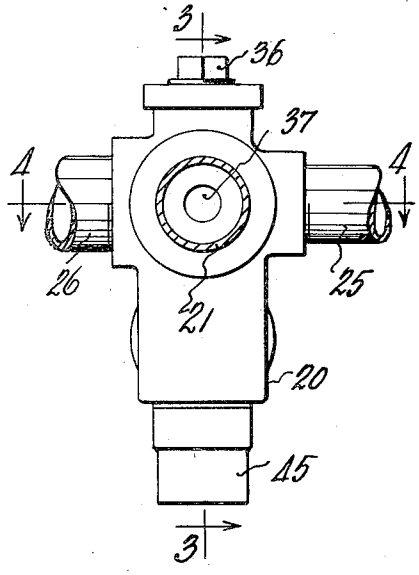


Fig. 4.

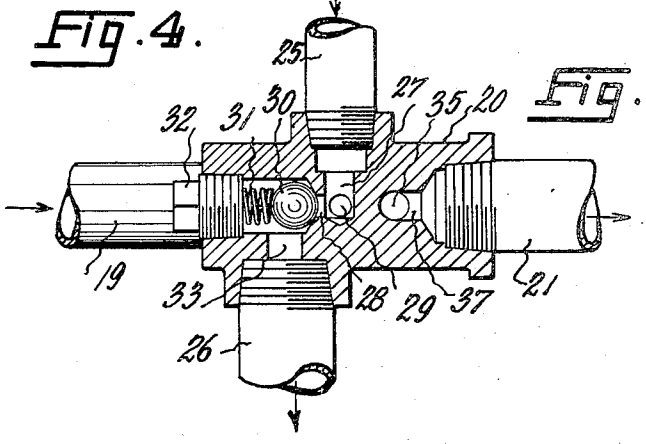
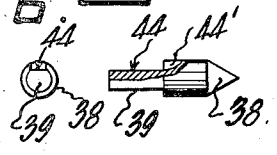


Fig. 5.

Fig. 6.



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FUEL FEEDING SYSTEM FOR OIL BURNERS

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2 Claims. (Cl. 277—60)

This invention relates to an improved method of and apparatus for feeding fuel to oil burners.

It is common practice to provide a pump which will feed oil to the burner at a rate somewhat in excess of the maximum rate at which fuel is consumed by the burner, and to by-pass the excess oil thus fed either to the suction side of the pump or to the supply tank. By connecting the outlet end of the by-pass pipe to the suction pipe of the pump, at a point closely adjacent the pump (usually between the strainer and the pump), a separate return pipe to the supply tank can be dispensed with and only one pipe,—from the tank to the pump,—is necessary. This sort of one pipe system is satisfactory where indoor tanks are used and located at an elevation above the burner pump so that oil feeds to the pump by gravity. Where, however, the tank is located outside and underground, a single pipe system is unsatisfactory and it is usual to run the by-pass pipe back to the supply tank. A heavy suction is necessary to pull the oil from the remote and low level tank and because of the suction pull, air is more likely to be drawn into the system through joints in the suction pipe. It is even possible for small portions of the lighter fractions of the oil to be vaporized because of the vacuum produced in the suction line. The pipes need to be larger to secure the necessary mechanical strength and because they are larger than would otherwise be necessary to carry the oil, there is room for air to accumulate, particularly in pockets in the suction line. Air is entrapped in the oil to a certain extent and such air is more likely to be liberated under a condition of vacuum than under pressure. It will thus be clear that air is carried along with the oil in systems where the pump has to exert a suction pull in order to draw oil to the pump.

To rid the system of such air, the separate return line to the supply tank is used. More oil than is needed for the burner is pumped and the excess oil and the air are by-passed back to the tank. The disadvantages of this practice are that the returning oil causes agitation of the oil in the supply tank and a possible stirring up of the sludge therein; also that more oil than is necessary is drawn through the strainer, necessitating more frequent cleaning of the same and the consumption of more power to drive the pump as the strainer clogs.

The object of this invention is to get rid of the air in the system and at the same time to return as little oil, as is compatible with the accomplishment of the above purpose, to the supply tank.

More particularly, the method of this invention provides for dividing the excess pumped oil not used by the burner and returning part of it, preferably the smallest part, with the air to the supply tank and the remaining and preferably the largest and air-free part into the suction side of the pump, preferably at a point between the strainer and the pump.

With this method of operation, the work of the pump is reduced in that less oil is drawn from the tank; the strainer will not require as frequent cleaning because less oil is drawn through it; and there will be less agitation in the tank because less oil is returned to it.

The invention provides a gauged opening for predetermining the volume of oil that can flow directly back to the pump per unit of time under any given conditions of pressure and temperature. This opening can be accurately adjusted as to size and set so as to allow any desired proportion of the excess oil to flow back to the pump,—the balance returning to the tank.

The invention also has for an object the provision of a valve for closing the gauged opening when the pump is not in operation, so that when the pump is again started up it will not suck air from the return line. Such valve is supplied with an adjustable stop to limit the degree of its opening movement, whereby the effective area of said gauged opening may be varied by adjustment of the valve.

The invention also contemplates the provision of a device in which are included the necessary passages, the gauged opening and the cooperating valve, so that all that is necessary to apply the invention to a burner is to connect said device in the suction pipe of the pump and to connect the by-pass pipe and the tank return pipe thereto.

Other objects will appear as the detailed description proceeds and will be pointed out in the appended claims.

The invention will be disclosed with reference to the accompanying drawing, in which:

Fig. 1 is an elevational view showing an oil burner and a fuel feeding means therefor embodying the invention;

Fig. 2 is an exterior end elevational view of the proportioning by-pass device;

Figs. 3 and 4 are sectional views taken on the lines 3—3 and 4—4, respectively, of Fig. 2;

Fig. 5 is an elevational view, partly in section,

showing a detail of construction of the metering valve; and

Fig. 6 is an end elevational view of the valve shown in Fig. 5.

Referring to the drawing and particularly to Fig. 1; there is shown an oil burner of the general type disclosed in U. S. Patent No. 1,832,131, granted to H. A. Kunitz on November 17, 1931. It includes a tubular air conduit 10 connected at one end to the outlet end of a fan casing 11 and opening at its other end into a combustion chamber 12. It also includes a suitable oil pump 13 for drawing oil from a supply tank 15 and forcing it under substantial pressure to the nozzle 16 of the burner. It is usual to interpose in the oil feed line a strainer, herein represented conventionally at 17. A pipe 18 connects tank 15 to the inlet of the strainer and the outlet thereof is connected by a pipe 19 to a valve casing 20, later to be described in detail. This casing is connected by a pipe 21 to the inlet side of pump 13 and the outlet side of the latter is connected by a pipe 22 to a pressure regulating and by-pass valve 23. Such valve has an outlet connected by piping 24 to the burner nozzle 16 and a by-pass outlet which is connected by piping 25 to the valve casing 20. A pipe 26 leads from casing 20 back to the supply tank 15.

The pressure regulating valve 23 may be of any suitable type which will prevent passage of oil into the pipe 24 until the oil has been placed under a predetermined pressure, and which will by-pass some of the pumped oil into pipe 25 after the oil pressure has increased to another and greater predetermined pressure. As an example of one of many types of valves suitable for the purpose, reference is made to the P. S. Russel U. S. Patent No. 1,786,402, granted December 23, 1930. The valve of said patent, when mounted as shown in Fig. 1, provides for the taking off of oil to the burner from the lower part of the casing and for the taking off of oil to the by-pass from the highest point of the casing where the air and air-laden oil accumulate.

The function of the device 20 is to divide the stream of excess oil by-passed by valve 23 through pipe 25, and return a certain part, preferably the smaller part, to the tank 15 by way of pipe 26 and another, and preferably the larger part, to the pump by way of pipe 21. Referring to Fig. 4, the oil by-passed through pipe 25 enters into a horizontal passage 27 which has a right angularly disposed horizontal branch 28 and a vertically disposed branch 29. Passage 28 is counterbored to form a seat for a ball valve 30 and a spring 31, acting between the valve and a plug 32 which closes the outer end of passage 28, tends to hold the valve to its seat. A passage 33 leads from the larger and counterbored part of passage 28 to the pipe 26. Such oil as is returned to the supply tank 15 has to pass the ball valve 30. Preferably, the seat for valve 30 is scored or otherwise formed, to permit a constant although small amount of oil to pass the valve even when the latter is held to its seat. This allows the pressure in the system to drop to zero when the pump is stopped and is desirable for other reasons as pointed out in the Russel patent which also discloses a groove in the by-pass valve of the device 23.

The branch passage 29 leads downwardly to and intersects with a horizontal passage 34, which at one end connects with the suction pipe 19 and at the other end intersects with a vertical passage 35, the upper end of which is closed by a plug 36. The outlet, closed by plug 36, is provided to receive a vacuum gauge when one is desired. Intermediate its ends, passage 35 connects with a horizontal passage 37 leading to pipe 21. The communication between passages 29 and 34 is controlled by a needle valve 38, having a cylindrical shank 39 which is mounted for vertical sliding movement in a hole 40 formed in a screw 41, threaded into the interior of a hollow hub 42. A spring 43, mounted in hole 40, acts between the closed lower end of screw 41 and the lower end of shank 39 tending to hold valve 38 closed. A portion of shank 39 is milled off forming a flattened side 44 and the milling cut is extended into the valve head 38, forming a groove 44'. This groove 44' and the recess formed by cutting away a portion of shank 39 enable constant communication between the interior of hole 40 and the passage 34 so that the valve shank 39 may slide freely back and forth in hole 40. The screw 41 is normally concealed by a cap nut 45. By removing nut 45, screw 41 may be turned with a screw driver to raise or lower its upper end, such end acting as an abutment engageable by the valve head 38 to limit the degree of its opening movement.

In operation, the pump 13 draws up oil from tank 15 through pipe 18, strainer 17, pipe 19, passages 34, 35 and 37 and pipe 21 and forces such oil through pipe 22 into the valve 23. When sufficient pressure has been built up, oil is permitted to flow into piping 24 and thus to nozzle 16. If, as is usual, the pump supplies oil at a rate in excess of that at which it is used by the burner, the pressure soon builds up in casing 23 above the predetermined pressure desired for the supply of oil to the nozzle and then the excess oil is permitted to flow out through pipe 25. Such by-passed oil enters passages 27 and 29 and the inner end of passage 28. The spring 43 is a light one and of less strength than spring 31. Consequently, the valve 38 will open before valve 30. As a matter of fact, it opens almost immediately when oil enters passage 29, the spring 43 being just strong enough to hold the valve closed when there is no oil being by-passed. Then valve 38 opens to the limit permitted by the upper end of screw 41.

The valve 38 has a metering function in that, when open to the limit allowed by screw 41, it gauges the size of the opening through which by-passed oil may flow to the suction side of the pump. As much by-passed oil flows back to the pump as is permitted by the effective area of this opening and the prevailing conditions of temperature and pressure. In accomplishing this function, the valve might be fixed in its open position or other means used for providing an orifice of the desired size. However, it is preferable to have the arrangement disclosed because the valve will close off communication of the pump suction passage 34 with passage 29 when the pump stops and avoid what would otherwise be a bad leak in the suction line when the pump starts up.

Such of the by-passed oil as cannot pass through the restricted outlet opening of passage 29 leaves by way of passage 28, forcing valve 30 to open. This passage 28 is located at a higher point in the by-pass line than the outlet of passage 29 so as to carry off the air and air-laden oil. The valve 30, however, does not open until valve 38 has been opened to the limit available and then only when oil in excess of the capacity of the aforesaid restricted outlet is flowing in passage 27. By proper adjustment of the screw 41 and the extent of opening of valve 38 for any given rate or flow of by-passed oil in pipe 25, such oil can be divided into two streams of such relative proportions as are desired. For example, assume

that the capacity of the pump 13 is 40 gallons per hour and only 10 gallons per hour are used at the nozzle, the balance,—30 gallons per hour,—is by-passed by valve 23 into pipe 25. Then valve 38 may be adjusted so that 90 per cent of the volume of the by-passed oil, or 27 gallons, will flow into the suction passage 34 and the remainder, or 3 gallons, will have to leave by way of passage 28 and be returned to the tank.

From this one example, the importance of the invention will be appreciated. Far less oil is drawn through strainer 17 in a given time than would be the case if all the by-passed oil were returned to tank 15 in accordance with prior practice. Less frequent cleaning of the strainer will be required. Far less oil will be returned to tank 15 to cause agitation of the oil therein and the undesirable stirring up of sludge therein. And, since less oil is drawn through the strainer in any given time, less work will be required of the pump. Much of the excess oil is returned to the suction side of the pump and therefore less oil has to be pulled up by suction from tank 15 in any given time.

It will thus be seen that the invention provides for the ridding of air from the system without requiring all of the by-passed oil to be returned to the tank, as heretofore. The desired object is accomplished with a minimum waste of pumped oil and without making the strainer perform as much work as formerly.

What we claim is:

1. A device of the class described, comprising a casing having an inlet and outlet and a passage connecting the inlet and outlet for the flow of liquid in one direction therethrough, said casing having a second inlet, a second outlet and a second connecting passage for the flow of liquid therethrough in a reverse direction, said second passage having a part overlying a part of the first passage and said casing having a third passage interconnecting said parts with an inlet at its upper end from the second passage and an outlet at its lower end into the first passage, a valve for the last named outlet, resilient means effective to close the valve and hold it closed until the pressure in the third passage exceeds that in the first passage by a predetermined degree, and means for limiting the extent of opening of said valve under the pressure of liquid in said third passage.

2. A device of the class described, comprising, a casing having an inlet and outlet and a passage connecting the inlet and outlet for the flow of liquid in one direction therethrough, said casing having a second inlet, a second outlet and a second connecting passage for the flow of liquid therethrough in a reverse direction, said second passage having a part overlying a part of the first passage and said casing having a third passage interconnecting said parts with an inlet at its upper end from the second passage and an outlet at its lower end into the first passage, a valve located between the inlet of the third passage and the outlet of the second passage for closing said second passage, said valve opening in response to pressure of liquid in the second passage above a predetermined degree, and a valve for closing the outlet of the third passage and opening in response to pressure in the third passage of a less degree, and means for limiting the extent of opening of the second valve.

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