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WIDE RANGE OIL BURNER

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3 Claims. (Cl. 299—120)

This invention relates to oil burners and has for its object, the provision of a novel construction of burner which will be capable of efficient operation over a wide range.

A feature of the invention resides in the provision of a novel construction of that type of burner in which mechanical and steam atomization are combined to produce a wide range fuel oil burner which will operate efficiently at moderate pressures.

A further feature of the invention resides in a novel construction and arrangement of parts whereby a burner of the aforementioned type may be operated either as a pressure mechanical atomizing burner, a steam atomizing burner, or as a combined pressure mechanical and steam atomizing burner.

A further feature of the invention resides in the provision of a novel construction whereby a burner of the aforementioned type is capable of wide range operation upon heavy fuels, and fuels of the type generally known as colloidal fuels.

Other features of the invention relate to certain novel and improved constructions, arrangements and combinations of parts hereinafter described and particularly pointed out in the claims, the advantages of which will be readily understood and appreciated by those skilled in the art.

The invention will be clearly understood from the accompanying drawing illustrating the invention in its preferred form and the following detailed description of the construction therein shown.

In the drawing:

Figure 1 is a view in front elevation illustrating a burner constructed in accordance with the present invention.

Figure 2 is a longitudinal sectional view thereof on an enlarged scale, the view being taken substantially on the line 2—2 of Figure 1.

Figure 3 is a sectional view taken at right angles to Figure 2, the view being taken substantially on the line 3—3 of Figure 2, and

Figure 4 is a detail perspective view of one of the elements of the burner.

One practical embodiment of the invention is illustrated in the accompanying drawing, but it is to be understood that the invention is not to be limited to the specific embodiment herein illustrated, but is capable of such other forms as rightfully fall within the scope of the appended claims.

In the drawing, the reference numeral 10 designates the body of the burner. The burner body is preferably circular in cross-sectional form and

has a threaded portion 11, herein illustrated as a reduced extension of the body portion 10.

The rear end of the body portion 10 is provided with two internally threaded recesses 12 and 13 and connected respectively to these recesses, there is an oil supply line 14 and a steam supply line 15.

Leading from the recess 12 and terminating in the forward end of the burner body 10, there is a passage 16. This passage 16 extends through the burner body at an angle to the axis thereof, as best illustrated in Figure 2.

Leading from the recess 13 and terminating in the forward end of the burner, there is a passage 17 and this passage is herein illustrated as extending parallel with the axis of the burner body 10.

The forward end of the burner is formed with a recess 18 which is circular in form and mounted within this recess, there is an atomizing element 20, the purpose of which is to impart a swirling motion to the oil before it is delivered to the sprayer plate 27. The atomizing element 20 is circular in form and is of a diameter to fit snugly within the recess 18 as best illustrated in Figure 2.

The atomizing element 20 may be milled or otherwise formed with a recessed portion 21 which, when the same is in its operative position, forms together with the rear wall of the recess 18 of the burner body 10, a chamber 22 into which fuel oil is introduced from the passage 16. Upon its opposite or front face, the atomizing element 20 may be milled or otherwise formed with a recess 25, which construction results in a main body portion 24 in the form of a partition within a ring-like member 26. Near its outer edge, the body portion 24 is provided with a circular series of spaced openings 23, the purpose of which will be hereinafter described.

The reference numeral 27 designates a sprayer plate which has its rear face recessed as at 28 to receive the forward edge of the ring-like member 26 of the atomizing element 20. This sprayer plate has a reduced forwardly projecting extension 29 which provides an annular shoulder 30 for engagement by the annular flange 31 of a tip nut or sleeve 32 which in turn has threaded engagement with the threaded portion 11 of the burner body 10. By reference to Figure 2 of the drawing, it will be obvious that the tip nut or sleeve 32 retains the several parts in their operative positions when it is screwed home upon the threaded portion 11 of the burner body 10.

Upon its forward face and disposed within the circular series of openings 23, the main body portion 24 of the atomizing element 20 has a

plurality of forwardly projecting spaced lugs 35, of which there are four illustrated in the present embodiment of the invention. Each of these lugs 35 has a curved outer edge 36 while its inner edge consists of a straight portion 37 which terminates in a curved portion 38, which construction provides a wide end 39 at one end of the lug, while the opposite end of the lug terminates in a thin or feather edge 40 by reason of the merging of the curved outer edge 36 with the straight portion 37 of the inner edge of the lug.

The lugs are preferably formed integral with the atomizing element 20 and are also so formed that the wide end 39 of each lug is in juxtaposition to the straight portion 37 of the inner edge of an adjacent lug which construction and arrangement of parts provides tangential passages 41 between adjacent lugs, there being four of these passages 41 in the present embodiment of the invention.

The recess 25 of the atomizing element 20 together with the rear face 42 of the sprayer plate 27, provides a chamber 43 and the circular series of openings 23, from the means of communication between the chamber 22 and this chamber 43, while the tangential passages 41 establish communication between the chamber 43 and the central area 45 within the lugs 35 of the atomizing element 20.

The two chambers 22 and 43, being in direct communication with each other through the openings 23, form in effect a single fuel chamber within the atomizing element 20, the only outlet of which is a passage leading through the sprayer plate 27, which passage will be hereinafter more specifically described.

The outer face of the sprayer plate is formed with a recess 46, the rear or bottom wall 47 of which is of flat circular form, and the side walls 48 are flared outwardly as best illustrated in Figure 2 of the drawing. The sprayer plate has a fuel discharge passage which extends through this passage having a cylindrical portion 49, which merges into a tapered or conical portion 50 which in turn terminates in a reduced cylindrical portion 51 which forms the burner orifice of the burner.

The sprayer plate 27 is of a smaller diameter than the tip nut or sleeve 32 which construction provides a chamber 55 which surrounds the sprayer plate 27 and the atomizing element 20 and into which the steam passage 15 discharges.

Leading through the sprayer plate 27, there are tangential passages 56 which establish communication between the chamber 55 and the recess 46 in the outer face of the sprayer plate 27, these passages 56 leading into the recess 46 preferably at the bottom wall thereof as designated at 57 in the drawing. By this construction and arrangement of the passages 56, it will be apparent that steam, when it is discharged from the passages 56, will be directed across the path of travel of fuel being discharged from the burner orifice and will also impinge against the side walls of the recess 46 at points opposite to the discharge ends of the passages for a purpose which will be hereinafter more specifically described.

The operation of the burner will now be described.

When operating at full capacity or peak load, the burner functions as a mechanical or pressure atomizer burner and I will first describe the manner in which the burner operates under such conditions.

Fuel is passed through the passage 14 under pressure from which it is discharged into the passage 16. From the passage 16, the fuel is discharged into the chamber 22 from which it passes by way of the circular series of openings 23 into the chamber 43. From the chamber 43, the fuel passes by way of the passages 41 between the lugs 35 into the area 45 within the lugs from which it passes by way of the passage through the sprayer plate 27, to the burner orifice 51 where it ignites.

By reason of the construction of the form of the inner edges of the lugs 35, the fuel as it is discharged from the passages 41 is given a violent swirling action sufficient to atomize the same to such an extent as to render it highly combustible as it emerges from the burner orifice and mixes with the air. When operating as just described, the flame takes the conical or so-called umbrella form illustrated by the dash lines A in Figure 2 of the drawing and so long as sufficient pressure is maintained in the oil line 14, the burner will continue to operate as described.

The foregoing operation is, generally speaking, that of the so-called pressure atomizer burner. As aforementioned, however, this type of burner is not capable of operation over a wide range since reduction of pressure in the fuel line results in incomplete atomization of the fuel, thus giving improper combustion.

The present burner is so constructed as to maintain proper atomization of the fuel even at low pressures in the fuel line and I will now describe the manner in which this is accomplished.

With the burner operating as just described, that is at peak load, and it is desired to reduce the flame, the pressure in the fuel line 14 is reduced to the desired degree and the steam line 15 is opened up to admit steam to the chamber 55 from which it passes by way of the passage 56 and is discharged across the burner orifice 51. The steam as it is discharged from the passages 56 impinges upon the fuel as it emerges from the burner orifice 51 with sufficient force to effect complete atomization of those particles not broken up by the mechanical action of the atomizing element 20 because of the reduction of pressure in the fuel line.

It is to be understood that as the pressure in the fuel line is reduced, the pressure in the steam line is proportionately increased to maintain atomization of the fuel at the burning point.

By proportionately increasing the steam pressure as the fuel pressure is reduced, complete atomization of the fuel may be had at extremely low pressures or at any point in between maximum and minimum pressures in the fuel line thus resulting in a burner capable of efficient wide range operation.

When operating at extremely low pressures, however, the flame changes in its shape from that designated by the dash lines A to that designated by the dot and dash lines B. This change in flame shape is caused by reason of the fact that since the pressure in the fuel line is insufficient to maintain the flame shape indicated by the lines A, the fuel as it emerges from the burner orifice is deflected by the steam discharged into the recess 46 from the tangential passage 56 and is forcibly impinged against the side walls 48 of the recess 46 which action, due to the tangential position of the passages 41, imparts a swirling action to the fuel resulting from its forcible projection against the side walls 48

of the recess 46. This swirling action, together with the forcible impingement of the fuel against the side walls 48 of the recess 46 serves to subject the fuel to both a mechanical and steam pressure action which insures complete atomization thereof even at extremely low pressures in the fuel line.

As the fuel is forcibly impinged against the side walls 48 of the recess 46, the said side walls act as baffles serving to effect a breaking up of such particles of the fuel as have not been broken up or completely atomized by the combined mechanical action of the atomizing element 20 in the chamber 43 and action of the steam in the recess 46.

The fuel oil is discharged from the outer peripheral edge of the recess 46 in the form of a swirling or rotary spray enveloped in steam which gives greater turbulence resulting in a more intimate mixture of fuel and air and also serves to inject a greater volume of air into the mixture which results in a highly desirable short flame.

In order to again return to peak load operation of the burner, it is only necessary to increase the pressure in the fuel line and proportionately, decrease the pressure in the steam line until maximum pressure in the fuel line is reached at which time, the steam will be entirely cut off and the burner will operate as a pressure atomizing burner.

In the illustrated embodiment of the invention, there has been no means illustrated for controlling the pressures in the fuel oil supply line 14 and the steam supply line 15. It is to be understood, however, that suitable valves will be employed in these lines and that the operation of these valves may be by way of example, manual, automatic, or synchronized depending upon the type of installation made.

Although an air register has not been herein illustrated, burners of this general type employ such devices to introduce air at the burning point and it has been found that with the burner herein illustrated, an air register may be operated at much lower velocities than is the common practice and that under certain operating conditions, efficient operations may be had even without an air register.

From the foregoing it will be apparent that the present invention provides a new and novel oil burner which employs a new and novel method of operation, resulting in a burner having a variable capacity or wide range operation.

While I am aware that burners which employ pressure atomization and burners which employ steam atomization are not in themselves new, the combination and interrelation of these two principles as herein set forth have not heretofore been employed. Furthermore, the method of combining two types of mechanical atomization, namely atomization by pressure and atomization by impact with atomization by steam, is a feature of this invention which has not heretofore, to my knowledge, been attempted.

Having thus described my invention what I claim is:

1. An oil burner comprising a burner body having a fuel passage and a steam passage leading therethrough, an atomizing element, a sprayer plate, a tip nut or sleeve for retaining the atomizing element and sprayer plate in operative position upon the burner body, said burner body,

atomizing element, sprayer plate, and tip nut or sleeve being so constructed and arranged as to provide noncommunicating fuel and steam chambers having communication respectively with the fuel passage and the steam passage aforementioned, an outwardly flared recess upon the outer face of the sprayer plate, said recess having a flat bottom wall, a fuel discharge passage leading through the sprayer plate and terminating at its outer end in a burner orifice in the bottom wall of the outwardly flared recess, and steam passages leading tangentially through the sprayer plate substantially in the plane of the flat bottom of said outwardly flared recess for projecting steam across the path of the fuel discharged through the burner orifice.

2. An oil burner comprising a burner body having a fuel passage and a steam passage leading therethrough, an atomizing element, a sprayer plate, a tip nut or sleeve for retaining the atomizing element and sprayer plate in operative position upon the burner body, said burner body, atomizing element, sprayer plate, and tip nut or sleeve being so constructed and arranged as to provide noncommunicating fuel and steam chambers having communication respectively with the fuel passage and the steam passage aforementioned, an outwardly flared recess upon the outer face of the sprayer plate, said recess having a flat bottom wall, a fuel discharge passage leading through the sprayer plate and terminating at its outer end in a burner orifice in the bottom wall of the outwardly flared recess, and steam passages leading tangentially through the wall of the outwardly flared recess of the sprayer plate for projecting steam across the path of the fuel discharged through the burner orifice, and forcibly impinge said fuel against the side walls of the outwardly flared recess upon the outer face of the sprayer plate.

3. An oil burner comprising a burner body having a fuel passage and a steam passage leading therethrough, an atomizing element, a sprayer plate, a tip nut or sleeve for retaining the atomizing element and sprayer plate in operative position upon the burner body, said burner body, atomizing element, sprayer plate, and tip nut or sleeve being so constructed and arranged as to provide a fuel chamber within the atomizing element having communication with the fuel passage and a steam chamber surrounding the atomizing element, said fuel chamber and said steam chamber being isolated with respect to each other, an outwardly flared recess upon the outer face of the sprayer plate, said recess having a flat bottom wall, a fuel discharge passage leading from the fuel chamber through the sprayer plate and terminating at its outer end in a burner orifice in the bottom wall of the outwardly flared recess, and steam passages leading from the steam chamber through the sprayer plate and terminating at their discharge end substantially in the plane of the flat bottom wall of the outwardly flared recess of the sprayer plate whereby to project steam across the flat bottom wall of the recess and across the path of fuel as it is discharged from the burner orifice and forcibly impinge the fuel against the side walls of the outwardly flared recess as it is discharged from the burner orifice.

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