

Sept. 21, 1948.

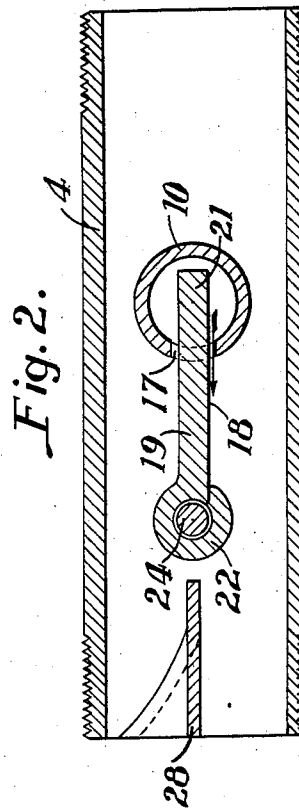
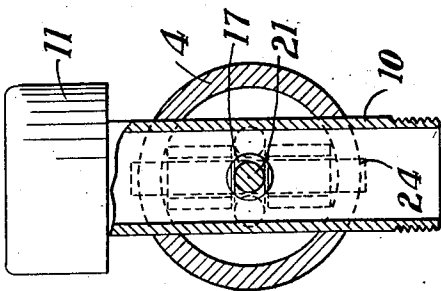
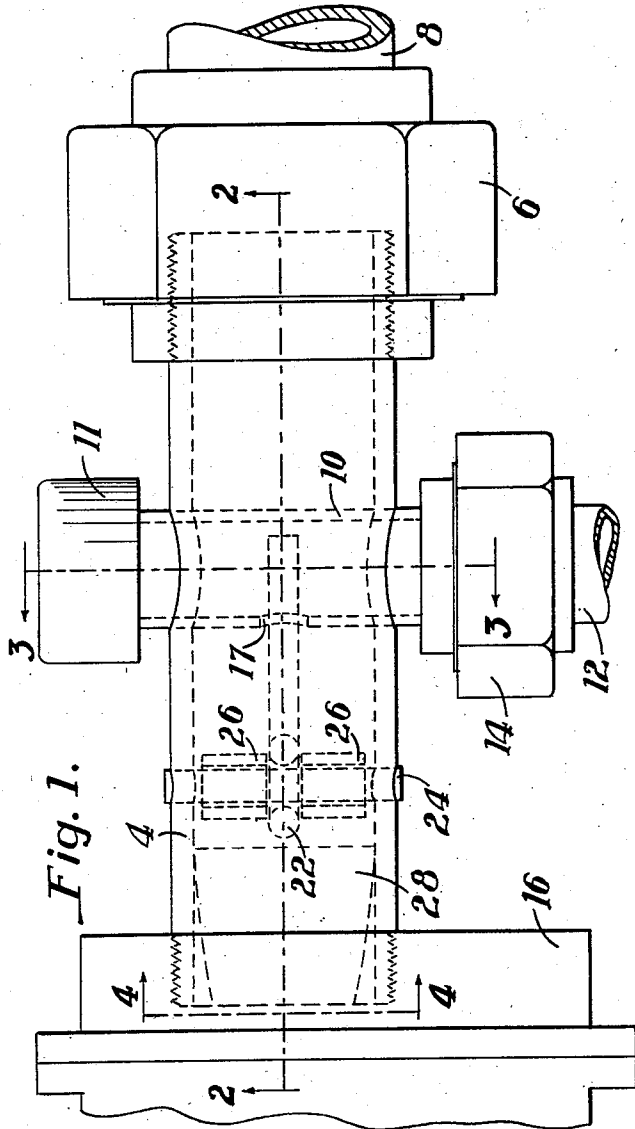
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2,449,927

ATOMIZER

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2 Sheets-Sheet 1



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Fig. 5.

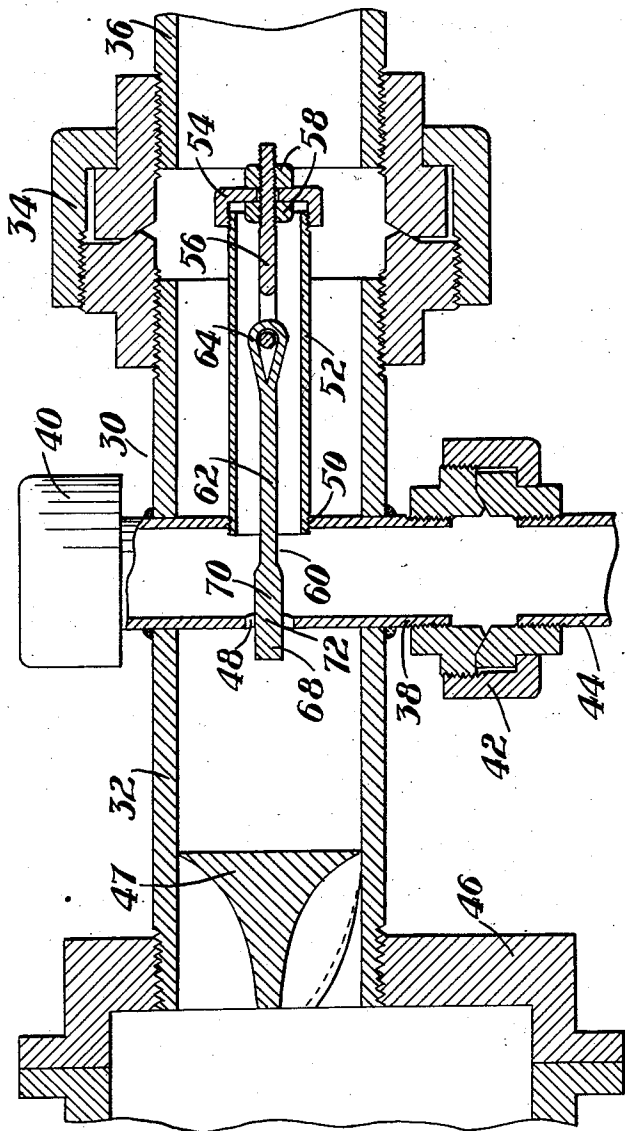
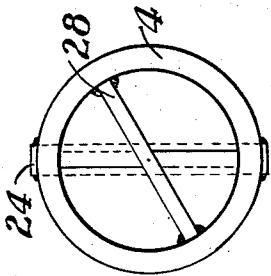


Fig. 4.



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ATOMIZER

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4 Claims. (Cl. 261—78)

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This invention relates to an atomizer for atomizing liquids and semi-liquids.

Among the objects of the invention is the provision of a simple, dependable atomizer which will operate in a constant condition over long periods of time. Another object is the provision of an atomizer having a self-cleaning aperture through which the substance to be atomized passes into the atomizing fluid. A further object is the provision of an atomizer which requires less atomizing fluid to break up the material to be atomized and thus operates more efficiently. These and further objects of the invention will become apparent in the following description.

Although the atomizer of the present invention is capable of application in numerous fields where liquids or semi-liquids must be broken up and dispersed in an atomizing fluid, and it is not intended to limit the invention to any particular one of such applications, for purposes of illustration it will be described in connection with a burner for a furnace, such as an open hearth furnace. Many present day furnaces, such as open hearth furnaces, employ burners using liquid or semi-liquid fuels, such as oils and tars. Such fuels are particularly advantageous in open hearth furnaces because of their high heat content and because they produce a long flame which can be easily directed in the desired direction over the bath of metal being treated. For the efficient burning of oils and tars, however, it is necessary to atomize or break up the fuel into very small globules so that it can be uniformly mixed with combustion air. If the atomization is not properly done, it is impossible to get an intimate mixture of air and fuel and dense smoke will result with a consequent low efficiency and the creation of a nuisance.

Many different types of atomizers have been used in the past for atomizing such fluid fuels in furnace burners. Most, if not all of these, employ orifices out of which the material to be atomized is forced under pressure, such orifice being so located relative to the stream of atomizing fluid that the stream of fuel issuing from the orifice is subjected to currents and cross currents of the atomizing fluid, which break up the fuel and produce an intimate mixture of fuel globules and atomizing fluid. Such mixture is then fed to the burner where it is mixed with combustion air, the final mixture then being burned at the nozzle of the burner.

In atomizers of such design much difficulty has been experienced through the tendency of

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the orifice through which the fuel enters into the atomizing stream to clog. In spite of the relatively high speed of issuance of the fuel from such orifice, which is of fairly small diameter relative to the volume of fuel supplied the burner, fuel particles gradually build up on the orifice, probably starting on the tapered inner surfaces of the fuel supply pipe adjacent the orifice where the stream of fuel is forced to change direction.

In any event, it has been found that after extended periods of operation the orifices have become so narrowed due to their gradually becoming clogged that the volume of fuel which can be supplied to the burner is markedly cut down. Such change requires alterations in the amount of atomizing fluid and combustion air from the original ideal adjustment, and eventually requires the complete shutting down of the burner and the cleaning of the atomizer. Furnace operators tend to put off such shut-down for cleaning of the burner as long as possible, since usually the atomizer is located in such position inside the conduit supplying the atomizing fluid as to make it very inaccessible. The disadvantages in such prior art atomizers therefore have resulted in an overall decreased operating efficiency of the burner and consequently of the furnace.

The atomizer of the present invention overcomes the difficulties due to the inherent tendency of the material being atomized or of foreign particles therein to be deposited upon the walls of the orifice from which it issues and consequently gradually to change the characteristics of the atomizer. Broadly, such object is accomplished by the employment of a vibrating element located in such orifice, the vibrating element being so designed that it repeatedly and continuously contacts various portions of the walls of the orifice during operation of the atomizer, thereby accomplishing the dislodging of particles from the walls of the orifice and the maintenance of the original size of the opening.

The invention will be more readily understood by reference to the accompanying drawings, in which:

Figure 1 is a view in plan of one modification of the atomizer of the present invention attached to a burner;

Figure 2 is a view in longitudinal section taken through the line 2—2 in Figure 1;

Figure 3 is a view in cross section taken through the line 3—3 of Figure 1;

Figure 4 is a view likewise in cross section, taken through the line 4—4 in Figure 1; and

Figure 5 is a view in longitudinal cross section of a second modification of the atomizer of the present invention.

The atomizer shown in Figures 1 to 4, inclusive, consists of a casing 4, in this instance in the form of a pipe, which is connected by union 6 to pipe 8 which supplies a stream of atomizing fluid under pressure longitudinally through the casing. The atomizer is supplied with fluid fuel through the pipe 10, which in this instance is of smaller diameter than casing 4, extends transversely through the casing, and is welded thereto to form a fluid-tight connection. One end of pipe 10 extending a substantial distance outside casing 4 is provided with a conventional pipe cap 11 screwed to the end thereof, such cap being removable for inspection purposes. The opposite end of pipe 10 extending on the other side of casing 4 is connected to pipe 12 which supplies fluid fuel to the atomizer. Connection between pipe 12 and pipe 10 is effected by union 14. The atomizer may thus be easily removed, if necessary, simply by disconnecting unions 6 and 14 and by unscrewing it from the rear of the burner 16, the rear of which is shown schematically in Figure 1, or other elements to which it may be connected. It is to be understood that burner 16 incorporates therein means (not shown) for supplying and mixing combustion air with the atomized fuel fed thereto from the atomizer.

Pipe 10, through which the fuel to be atomized is supplied, is provided with an orifice 17 located, as shown, on the side of pipe 10 opposite the direction from which the atomizing fluid is fed and, for purposes of operating efficiency and convenience, on the axis of casing 4. Fluid fuel supplied under pressure from pipe 12 to pipe 10 issues as a stream from orifice 17, as indicated by the arrow in Figure 2, and is immediately subjected to the action of the atomizing fluid, which may be air, steam, or the like, which is traveling through the casing 4 toward the left in Figure 2. The presence of the transverse pipe 10 in the casing causes a narrowing of the path with a consequent speeding up of the atomizing fluid, as well as a splitting of such fluid into two streams which flow about pipe 10 and unite, with numerous eddies, at a point slightly to the left (in Figure 2) of orifice 17. Such impingement of the atomizing fluid upon the stream of fluid fuel issuing from the orifice effects a very efficient breaking up of such fuel into small globules and their distribution uniformly throughout the atomizing medium. The mixture of atomized fluid and atomizing medium mixture continues to progress to the left, passing twist plate 28, which is in the form of a small portion of a spiral and is welded to the inner surface of casing 4 at a position adjacent the burner. Such twist plate still further agitates the mixture, breaking the fuel globules up into still finer particles and preventing their settling in the progress of the mixture into and through the burner.

In accordance with the present invention, aperture 17 is provided with a vibrating member 18 projecting into the orifice, such vibrator being so mounted as to allow its free vibration or oscillation with an amplitude sufficient to allow it to touch all points on the periphery of the orifice. In the modification shown in Figures 1 to 4, inclusive, the vibrating member 18, which consists of a cylindrical stem having a zone 19 external of the pipe 10, a zone within the boundaries of the orifice 17, and a zone 21 within the pipe 10, is

supported from a point in front of the orifice, that is, at a point where the fluid fuel has already been atomized. As shown, the support for vibrator 18 consists of a pin 24, extending transversely through the axis of casing 4, to which vibrator 18 is attached by the eye portion 22 on the rear thereof. The vibrator is centered by means of spacer sleeves 26 on either side of the eye portion 22. Pin 24 is welded to the casing 4 to make a fluid-tight assembly. The internal diameter of the eye portion 22 is sufficiently larger than the diameter of the pin 24, and the spacer sleeves 26 are sufficiently short relative to the internal diameter of the casing and the width of eye 22, to allow the vibrator member 18 to oscillate freely so as to be able to contact every point on the periphery of the orifice.

In order to allow the passage of a desired amount of fuel to be atomized, orifice 17 must be made of such area relative to the cross-sectional area of the vibrator 18 that the difference in their areas provides sufficient passage for the fuel required. Both the orifice and the vibrator are preferably made cylindrical, since such configurations allow repeated contacts between the vibrator and the walls of the orifice with a minimum of wear and allow easy calculation of the sizes of both necessary for a given fuel requirement in a particular application. It is to be understood, however, that other shapes of orifice and vibrator may be employed, so long as the effective area through which the fluid passes is correct for the job in hand and the vibrator is of such shape that it may contact all or substantially all of the orifice wall.

In the modification shown in Figures 1 to 4, inclusive, vibration of member 18 is accomplished by the passage through the atomizer of the fluid to be atomized and of the atomized fluid. It is obvious that element 18 is vibrated or oscillated primarily through the impingement upon zone 19 thereof of the mixture of atomized fluid and atomizing medium, since such zone has the greatest effective area and is subjected to eddying currents of high velocity. Superimposed upon such effect, however, are the tendencies of the fluid fuel in pipe 10 to thrust the vibrator 18 in the direction in which the fuel travels in the pipe by its action against zone 21, and the action of the fluid flowing through the orifice between it and the inner zone of the vibrator, which action probably tends to center the vibrator in the orifice. As a result of such three coacting forces, the vibrator oscillates rapidly during use of the atomizer, apparently describing random paths and effectively contacting all points on the inner surface of the orifice. The orifice is therefore continuously maintained at its original size, and deposits of fuel or foreign matter are effectively prevented from building up in the orifice or on the inner approaches thereto, as well, due to the agitation in the fuel produced by oscillation of portion 21 of the vibrator.

In the modification of the atomizer shown in Figure 5, the relationship of the parts is in general the same as that in the first modification, the main difference lying in the manner in which the vibrator is suspended. The atomizer 30 consists of a casing 32, connected by union 34 to the pipe 36 which supplies the atomizing medium. Pipe 38, which carries the fuel, extends transversely of the casing 32, as shown, and is welded thereto to provide a fluid-tight structure. One end of pipe 38 is provided with cap 40, whereas the opposite end is connected by union 42 to fuel

supply pipe 44. As in the case of the first modification, the atomizer is shown connected to a burner, the rear end of which, designated 46, is shown schematically in Figure 5. The end of the atomizer adjacent the burner is provided with a twist plate 47 similar to that employed in the first modification, to aid in promoting and preserving uniformity of distribution of the fuel in the atomizing medium.

Fuel pipe 38 is provided with an orifice 48 which is preferably located, as shown, on the longitudinal axis of casing 32 and on the side of pipe 38 toward the discharge end of the atomizer. A hole 50 is provided in the pipe 38 at a location diametrically opposite the orifice 48, and into such hole, which is threaded, there is screwed the pipe 52. Cap 54 on the opposite end of pipe 52 provides a fluid-tight structure, said cap also serving as a support for the elongated hook member 56 which is held in place through a centrally located hole in the cap by means of nuts 58.

The vibrator member 60 is provided with an elongated stem 62 having an eye member 64 on the rear thereof, said eye member being threaded over the hook on member 56. Such construction allows sufficient freedom of movement of the vibrator member 60 that it can oscillate or vibrate so as to touch the periphery of the orifice 48 at every point. The bottom portion of the vibrator in the vicinity of the orifice 48 is shown as having a somewhat larger diameter than the stem. Such enlarged portion may be considered to consist of three zones, each subjected to different forces during the operation of the oscillator. The zone 68, below and outside the orifice 48, is subjected to the eddy currents of the atomizing fluid and of the mixture of such fluid and atomized fuel. The action of such fluids on zone 68 of the vibrator tends to vibrate it like a musical reed; such action undoubtedly contributes the greatest effect in vibrating the element 60. As in the case of the first modification, however, added to the effect of such outer portion of the vibrator are the effects of the fluid fuel upon the zone 70 of the element, which lies within pipe 38 and above the upper edge of the orifice, and the effect of the fluid fuel in flowing downwardly between the boundaries of the orifice 48 and the zone 72 of the vibrator 60, which confronts the orifice. As a consequence of such forces, element 60 vibrates during operation of the atomizer, contacting every portion of the orifice apparently at random, thereby keeping of the orifice free from any deposits and of a constant effective area. The modification of the atomizer shown in Figure 5 is particularly advantageous because of the fact that the supporting means for the vibrator is readily accessible when the atomizing fluid supply pipe is disconnected from the atomizing casing. Thus, inspection and renewal of the vibrator element or any of its parts, may be readily carried out merely by disconnecting union 34 and swinging pipe 36 away, thereby exposing the rear end of the pipe 52 and the cap 54. The atomizer shown in both modifications is adapted for quick removal as a whole and for replacement by another atomizer, when necessary, thereby requiring the burner with which it is used to be out of service for a minimum of time.

Where as I have shown and described particular preferred embodiments of my invention, it is to be understood that such embodiments are illustrative only and that numerous variations obvious to those skilled in the art may be made

within the scope of the invention. I therefore claim as new the following:

1. An atomizer comprising an elongated casing, said casing having an open passage of substantial area therethrough at all times, means to feed an atomizing fluid under pressure into the casing, means to introduce material to be atomized into the casing comprising a conduit leading into the casing, said conduit being disposed substantially at right angles to the stream of atomizing fluid through the casing, said conduit having an orifice therein on the side thereof opposite the direction from which the atomizing fluid flows whereby a stream of material issuing from the orifice is subjected to the atomizing action of streams of atomizing fluid flowing around the conduit, an elongated member having a stem of less diameter than the orifice projecting at all times a substantial distance from a point outside the conduit through the orifice and into the conduit, said member being so located that its axis substantially coincides with the axis of the orifice, a cylindrical member positioned across the casing at a point a substantial distance from the orifice in the direction of flow of the atomizing fluid, an eye member on the end of the elongated member fitting loosely about the cross member, and spacer sleeves on each side of the eye member for holding the elongated member in general alignment with the orifice, the cross member and spacing members holding the elongated member loosely so as to allow it to oscillate into contact with the entire periphery of the orifice when subjected to the action of the streams of the atomizing fluid, the material to be atomized, and the mixture of atomizing fluid and atomized material.

2. An atomizer comprising a casing having an inlet for introducing atomizing fluid under pressure and an outlet, a transverse conduit entering said casing between said inlet and said outlet and having a discharge orifice within said casing directed toward said outlet for introducing fluid to be atomized, mounting means within said casing, and a stem loosely carried by said mounting means and having a free end portion extending through said orifice, said stem having a centered position in said orifice in which its axis is perpendicular to the plane of said orifice and when subjected to the action of the stream of atomizing fluid vibrating freely and continuously from said centered position into contact with the orifice walls throughout the periphery of the orifice for preventing clogging of the orifice.

3. An atomizer comprising a casing having an inlet for introducing atomizing fluid under pressure and an outlet, a transverse conduit entering said casing between said inlet and said outlet and having a discharge orifice within said casing directed toward said outlet for introducing fluid to be atomized, mounting means supported in said casing between said orifice and said outlet, and a stem loosely carried by said mounting means and having a free end portion extending through said orifice, said stem having a centered position in which it is spaced equidistantly from the orifice walls and its axis is perpendicular to the plane of said orifice, said stem when subjected to the action of the stream of atomizing fluid vibrating freely and continuously from said centered position into contact with the orifice walls throughout the periphery of the orifice for preventing clogging of the orifice.

4. An atomizer comprising a casing having an

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inlet for introducing atomizing fluid under pressure and an outlet, a transverse conduit entering said casing between said inlet and said outlet and having a discharge orifice within said casing directed toward said outlet for introducing fluid to be atomized, mounting means supported on said conduit aligned with said orifice and extending toward said inlet, and a stem loosely carried by said mounting means and having a free end portion of uniform diameter extending ahead through said orifice, said stem having a centered position in said orifice in which its axis is perpendicular to the plane of said orifice and when subjected to the stream of atomizing fluid vibrating freely and continuously from said centered position into contact with the orifice walls throughout the periphery of the orifice for preventing clogging of the orifice.

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