

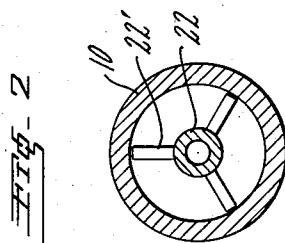
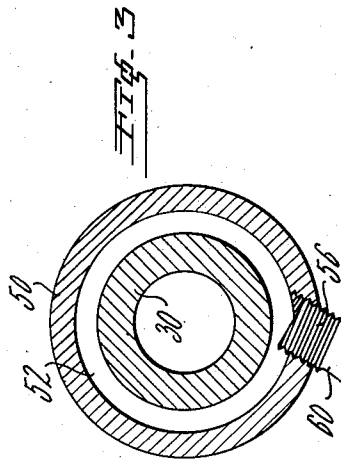
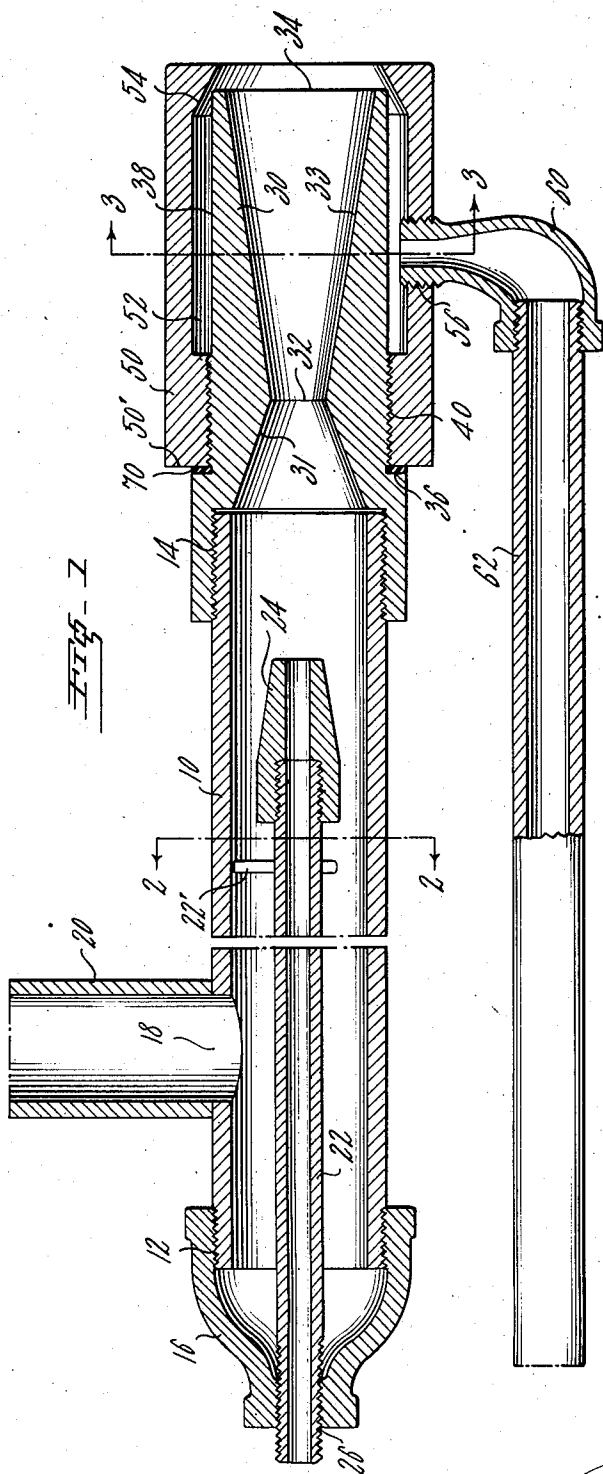
Dec. 25, 1945.

H. S. JACKSON

2,391,422

FUEL ATOMIZER

Filed Jan. 7, 1944



INVENTOR.

BY HENRY S. JACKSON

James D. Bock

ATTORNEY

UNITED STATES PATENT OFFICE

2,391,422

FUEL ATOMIZER

Henry S. Jackson, Springhill, La.

Application January 7, 1944, Serial No. 517,339

6 Claims. (Cl. 299—140)

It is the primary object of this invention to provide a fuel atomizing nozzle particularly adapted to handling extremely viscous fuels such as tar, evaporated kraft black liquor, or viscous mixtures of solid and liquid fuels.

It is a further object of this invention to provide a nozzle of the type described in which the velocity of emergence of the atomized mixture may be reduced to a point at which, for the particular fuel, such velocity of emergence will approximate the velocity of flame propagation.

It is a further object of this invention to provide an atomizing device as aforesaid to which there are no constricted passageways.

It is a further object of this invention to provide an atomizer of the class described capable of a wide range of easily made adjustments to adapt the device to a wide range of fuels.

The accomplishment of the above and other objects will be made clear from the following detailed description taken in connection with the annexed drawing in which:

Fig. 1 is a sectional view showing the relationship of all the elements of the improved atomizer;

Fig. 2 is a cross section on the line 2—2 of Fig. 1; and

Fig. 3 is a cross section on the line 3—3 of Fig. 1.

In many industries combustible waste materials are produced; but when such materials are in an amorphous or viscous condition, it is difficult in the extreme to burn them. The only way in which such materials can be burned efficiently and without generation of objectionable smoke is to produce so fine a subdivision of the material as to enable the subdivided particles to be consumed almost instantaneously. Various means heretofore have been devised to handle viscous fuel. But these are all subject to either or both of two primary defects. The first, and most serious, defect arises from efforts to effect a preliminary mechanical subdivision through the use of restricted orifices, to produce relatively fine streams. Such restricted orifices, when the material is both viscous and dirty are extremely apt to plug. The second defect arises from the attempt to subdivide by resort to extreme velocities. This usually results in a velocity of emergence very much greater than the velocity of flame propagation. As a result combustion can only take place several feet beyond the extremity of the atomizer at which point the mixture has become so expanded as not to be capable of sustaining combustion and such combustion must, therefore, be supported by the radiant heat from the furnace walls. There are two disadvantages resulting

from this: first, a great deal more room is required in the fire box; and second, there is real difficulty in starting up a cold furnace. The atomizer of this invention avoids all of these difficulties.

Referring now to Fig. 1, there is shown a cylindrical body portion 10 having threads 12 at one end and threads 14 at the other. A reducer 16 engages the threads 12 and partially closes one end of the body 10. Adjacent to that end of the body 10 is an orifice 18 around which a fuel supply pipe 20 is welded or otherwise secured. An injection pipe 22 extends co-axially of the body 18 and has a nozzle tip 24 screwed to one end. Its other end is threaded at 26 into the reducer 16.

The threads 14 of the body 10 engage a member 30, the interior of which is finished to form a Venturi passage comprising a converging portion 31, throat 32, and a diverging portion 33. The diverging portion 33 terminates in an open mouth 34.

The injector pipe 22 is supported in its co-axial relationship to the body 10 not only by its threaded engagement with the reducer 16 but also by a spider 22' which supports the nozzle 24 against radial deviation and is best shown in Fig. 2. In practice, the threaded portion 26 of injector pipe 22 is considerably longer than it is shown in Fig. 1. Rotation of the pipe will, by means of the threads 26, provide an adjustment of the nozzle 24 toward and from the throat 32 of the member 30. This adjustment regulates the quantity of fuel delivered under any given combination of fuel supply pressure and viscosity and velocity of the jet emerging from nozzle 24. The spider 22' is secured to the injector pipe 22 and has a relatively free fit in the body 10. Accordingly, the spider 22' moves with the pipe 22 as the latter is adjusted by means of the threads 26. The threads 26 should provide an adjustment of nozzle 24 away from the throat 32 of member 30 equal to at least $1\frac{1}{2}$ times the diameter of the chamber 10.

One end of the exterior of the member 30 is turned down to provide a shoulder 36 and a cylindrical barrel 38 carrying threads 40 adjacent the shoulder 36. The threads 40 engage a nozzle member 50 which has been internally machined to provide a channel 52 between the nozzle member 50 and the cylindrical barrel 38 of the member 30. The interior of the nozzle member 50 terminates in an inwardly directed conical portion 54 which, with the rim 34 of the member 30, defines a nozzle opening.

A screw threaded opening 56 communicates with the channel 53. An elbow 60 enters the

opening 56 and at its opposite end has a screw-threaded engagement with pipe 62. The opening 56 is nearly tangential to the channel 52 so as to produce a swirling motion.

When an atomizing medium such as steam is supplied through the pipe 62, it emerges through the orifice, defined by the rim 34 of the member 30 and the conical wall 54 of the member 50, to form an inwardly converging, hollow, conical jet. For any given steam pressure, the thickness of the walls of the conical jet, and therefore the quantity and velocity of steam, is determined by the adjustment of the conical wall 54 of nozzle 50 toward or away from the rim 34 of member 30. The optimum adjustment is determined experimentally for any given operative condition and is maintained by the insertion of shims 70 between the shoulder 36 of the member 30 and the end 50' of the member 50. Either air or steam usually constitute the atomizing medium projected through the nozzle 24 and the supplementary nozzle defined by members 30 and 50. The atomizing medium, even though air be used is not intended to supply the oxygen required for combustion. Air for combustion will be supplied to the fire box through the conventional louvers. The only passageway which can be considered at all restricted is that of the supplementary jet, which, in the nature of things, is not subject to clogging under the action of either air or steam. The fuel passages are extremely open and in practice this nozzle has virtually eliminated plugging even with viscous mixtures containing a substantial proportion of solids. The nozzle was designed to meet a problem arising from an acute fuel shortage, during which time black liquor soap mixed with turpentine was supplied to ordinary furnaces in place of fuel oil. The nozzle is, however, extremely useful for mixtures having general characteristics similar to those of such a mixture. Atomizing is partly accomplished by the sheer impact of the jet emerging from nozzle 24 upon the mass of fuel contained in the body 10. The throat 32 serves to reduce pressure and increase velocity of the moving mixture, and the expansion in the portion 33 of member 30 effects a further atomization with a sharp decrease in velocity. As the partially atomized mixture emerges from the mouth 34, it is immediately subject to the high velocity of the secondary jet. The velocity of the secondary jet does not, however, increase the velocity of emergence of the mixture to an unreasonable point because only one component of the velocity of the secondary jet is in the same direction as the velocity of the mixture emerging from the mouth 34. The supplementary jet, therefore, is influential almost entirely as an atomizing rather than a propelling medium and thus fits the condition of permitting combustion to take place close to the nozzle with a sufficient concentration of fuel to make the combustion self-sustaining.

In the handling of viscous fuels, pumping requirements should be minimized, and accordingly the nozzle should be adapted to operate at extremely low fuel pressures. The nozzle 24 co-acts with the Venturi throat 32 to produce, if desired, a partial vacuum. Pressures as low as 25 inches of mercury below atmospheric have been attained under some conditions of adjustment.

The adjustment of nozzle 24 and the adjustment of the supplementary jet formed between members 50 and 30 permit very considerable control of the shape and length of the flame so that optimum conditions may be secured for any par-

ticular fuel. At the same time, there does not occur at any point a passageway for the fuel so constructed as to be subject to plugging.

What is claimed is:

1. In combination, a member having internal screw threads at one end, and having its interior surface formed into a Venturi passage, with the throat intermediate the ends of said member, the exterior of said member having an annular shoulder intermediate the ends, external screw threads adjacent said shoulder and extending toward the end of said member opposite the internally threaded end and a cylindrical barrel extending from said external threads to the end of said member; a second member having one end engaging said external threads and bearing on a calibrated shim on said shoulder, said second member having its inner surface spaced from and overlying said barrel of said first member to provide a chamber; an inlet for said chamber; and an annular conical flange at the free end of said second member, said flange defining, with the adjacent end of said first member, a conical nozzle.

2. A burner for atomizing and discharging high viscosity fuel comprising, a fuel-receiving chamber, a primary nozzle within said chamber for discharging a jet of atomizing medium, a Venturi tube having a throat in alignment with the jet from said nozzle, the trailing portion of said venturi constituting a final discharge member and terminating in an open delivery mouth of substantially greater diameter than the minimum diameter of said throat, and means adjacent the open end of said final discharge member for discharging a secondary jet of atomizing medium around the entire periphery of said open delivery mouth, said means being constructed and arranged to so direct said secondary jet that the jet forms in space beyond said delivery mouth a hollow cone converging into the mixture emerging from said final discharge member.

3. A burner for atomizing and discharging high viscosity fuel comprising, a fuel receiving chamber, a primary nozzle within said chamber for discharging a jet of atomizing medium, a Venturi tube having a throat in alignment with the jet from said nozzle, the trailing portion of said venturi constituting a final discharge member and terminating in an open delivery mouth of substantially greater diameter than the minimum diameter of said throat, means adjacent the open end of said final discharge member for discharging a secondary jet of atomizing medium around the entire periphery of said open delivery mouth, said means being constructed and arranged to so direct said secondary jet that the jet forms in space beyond said delivery mouth a hollow cone converging into the mixture emerging from said final discharge member, and means for adjusting said primary nozzle axially toward or away from said Venturi throat.

4. A burner for atomizing and discharging high viscosity fuel comprising, a fuel-receiving chamber, a primary nozzle within said chamber for discharging a jet of atomizing medium, a Venturi tube having a throat in alignment with the jet from said nozzle, the trailing portion of said venturi constituting a final discharge member and terminating in an open delivery mouth of substantially greater diameter than the minimum diameter of said throat, means adjacent the open end of said final discharge member for discharging a secondary jet of atomizing medium around the entire periphery of said open delivery mouth, said means being constructed and ar-

ranged to so direct said secondary jet that the jet forms in space beyond said delivery mouth a hollow cone converging into the mixture emerging from said final discharge member, and means for adjusting the wall thickness of said secondary jet.

5. A burner for atomizing and discharging high viscosity fuel comprising, a fuel-receiving chamber, a primary nozzle within said chamber for discharging a jet of atomizing medium, a Venturi tube having a throat in alignment with the jet from said nozzle, the trailing portion of said venturi constituting a final discharge member and terminating in an open delivery mouth of substantially greater diameter than the minimum diameter of said throat, means adjacent the open end of said final discharge member for discharging a secondary jet of atomizing medium around the entire periphery of said open delivery mouth, said means being constructed and arranged to so direct said secondary jet that the

jet forms in space beyond said delivery mouth a hollow cone converging into the mixture emerging from said final discharge member, means for adjusting said primary nozzle axially toward or away from said Venturi throat, and means for adjusting the wall thickness of said secondary jet.

6. A burner for atomizing and discharging high viscosity fuel comprising, a cylindrical fuel-receiving chamber, a member having a venturi coaxial with said chamber and including a diverging final discharge portion terminating in an open delivery mouth, a primary atomizing nozzle mounted coaxially with said chamber and directed toward said venturi, and a sleeve surrounding said member and defining, with the delivery mouth of said member, a nozzle directing a hollow conical jet in space beyond said delivery mouth, said jet converging into the path of material emerging from said mouth.

HENRY S. JACKSON.