Oct. 27, 1936. R. J. S. PIGOTT 2,058,823

NOZZLE FOR SPRAYING VISCOUS OIL

Filed June 11, 1935

Fig. 1.

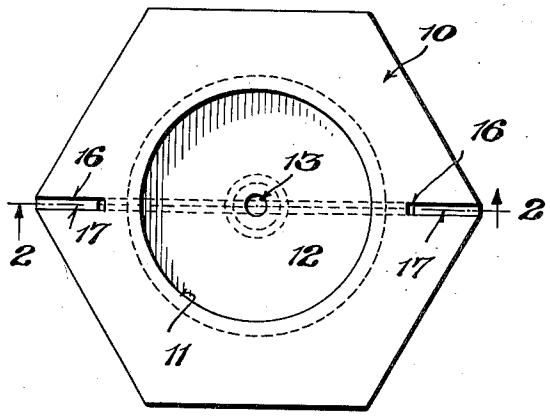


Fig. 4.

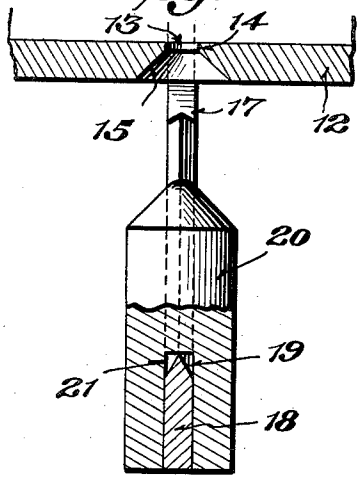


Fig. 2.

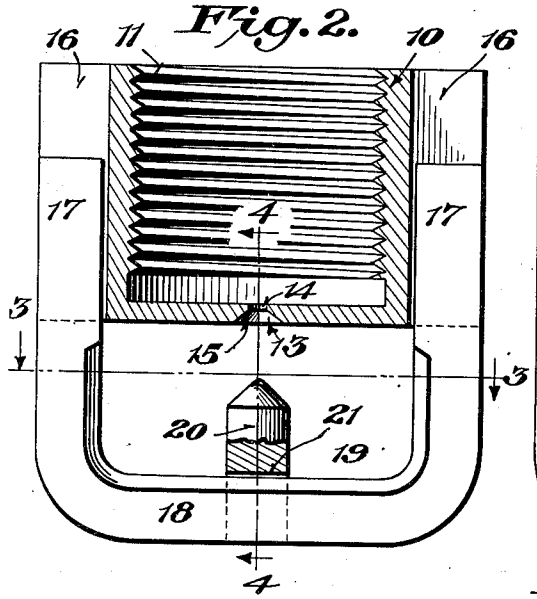


Fig. 5.

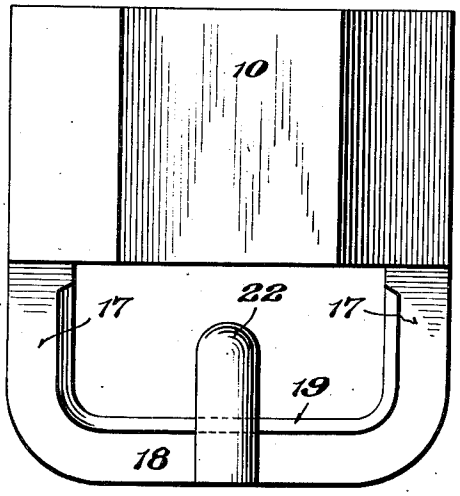


Fig. 3.

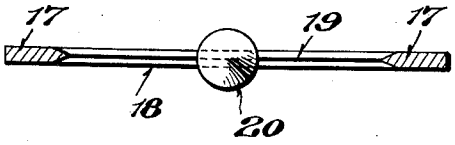


Fig. 6.



Fig. 7.



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Patented Oct. 27, 1936

2,058,823

UNITED STATES PATENT OFFICE

2,058,823

NOZZLE FOR SPRAYING VISCOUS OIL

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Application June 11, 1935, Serial No. 26,055

7 Claims. (Cl. 299—121)

This invention relates to a nozzle for spraying viscous oil under pressure with minimum loss of energy in the conversion of pressure into velocity, and wherein the velocity of the issuing stream of oil is utilized to explode it into a fine spray by impinging the jet so emerging from the discharge orifice of the nozzle against a target positioned in its path but spaced from such orifice.

More particularly the invention comprises a nozzle formed with a discharge orifice which is sufficiently large to obviate clogging with dirt or pipe scale, the lip surrounding and defining the orifice being of a thickness not greater than one-quarter the diameter of the opening in order to minimize energy losses which occur in converting the pressure exerted upon the oil into its discharge at high velocity, and a fixture carried at the end of the nozzle consisting of a knife-edge bracket upon which is mounted a projecting target element directed toward the nozzle orifice to convert the issuing stream of oil into a spray of definite pattern while offering no impediment to its flow through the nozzle; all as more fully hereinafter set forth and as claimed.

The nozzle of the present invention is more especially adapted for use in spraying coal with oil in order to prevent dusting and to decrease the possibility of spontaneous combustion, while at the same time improving the burning quality of the fuel so treated.

Exiting apparatus for coal spraying cannot discharge at high velocity the heavy, viscous oils for which this invention is adapted, but instead lighter oils are used, of about 100 seconds Saybolt Universal at 100 degrees, and these are discharged at pressures within the limits of 100 to 300 pounds.

In the use of heavy oils heating has been required to reduce their viscosity to a suitable value. The expedient of heating oil to render it more fluid is well known, but it possesses the disadvantage of entailing additional equipment for the heating and, as a consequence, it renders the spraying apparatus cumbersome and increases its expense.

It is an object of this invention to provide a nozzle for spraying viscous oils of the order of 32 to 6000 seconds Saybolt Universal at pressures up to 600 pounds, and thereby to eliminate the necessity for heating such oils before spraying them.

It is a further object of the invention to provide a nozzle wherein the high pressure exerted upon the issuing oil is efficiently converted into velocity with little loss of energy, and wherein the oil so emerging at high velocity is exploded by impinging it against a target interposed in the stream or jet and supported upon a bracket which is spaced from the nozzle proper and which is so shaped that it offers practically no obstruction to the passage of spray, thereby promoting uniformity of distribution.

Other and further objects will be apparent from the following description and drawing wherein;

Figure 1 is a plan view of the nozzle;

Figure 2 is a vertical section, taken along line 2—2 of Figure 1;

Figure 3 is a detail view of the target supporting bracket, partly in section and taken along line 3—3 of Figure 2;

Figure 4 is a detail view, partly in section, of the discharge orifice and target mounted upon its supporting bracket, taken along line 4—4 of Figure 2;

Figure 5 is a side view of the nozzle carrying a modified form of target; and

Figures 6 and 7 are detail views of another modified form of target of wedge or chisel shape for delivering two flat sprays on either side of the center line.

Referring more particularly to the drawing;

The nozzle may conveniently comprise a cap 10 of hexagonal form which is threaded internally as at 11 for the reception of a pipe end, and which has an end wall 12 formed with an aperture 13 constituting a discharge orifice.

The efficiency of energy conversion from pressure into velocity is greatest in the sharp-edged form of orifice and the rounded approach orifice. A short tube jet such as is found in most spray nozzles, in which the length of the passage is at least equal to, and in most cases greater than its diameter, has much greater loss. The tube type of orifice is therefore unsuitable for efficient energy conversion and the maintenance of high velocity discharge.

Some dirt, however, must be handled with the oil at times. It is accordingly desirable that the orifice be fairly large to prevent clogging, but of a diameter not greater than 50 per cent of that of the bore leading thereto in order to obtain the flat disc orifice effect which is desirable for efficient energy conversion. Since the coefficient of contraction of the sharp-edged orifice is approximately 0.60 while that of the rounded-edge orifice is 1.00, it follows that for the same quantity rate of flow the sharp-edged orifice is about 20 per cent larger than the rounded orifice under the same pressure of discharge. It has therefore been determined that the sharp-edged orifice is preferable, and in order, additionally, to reduce resist-

ance to high velocity discharge the lip 14 of the orifice is made of a thickness not greater than one-quarter the diameter of the opening 13.

Inasmuch as the end wall 12 of the cap must be of substantial thickness to withstand the pressure imposed upon it in use, whereas the orifice lip must be comparatively thin, the end wall is counterbored from the issuing side of the orifice as at 15 to reduce the thickness of the lip 14 the required extent. The outer surface of end wall 12 therefore presents a conical depression concentric with the orifice 13, of about 120 degrees included angle.

Slots 16 are formed in opposite sides of the cap to receive the arms 17 of a generally U-shaped bracket which may be retained therein by soldering, or in any other well known and acceptable manner.

The base portion 18 of the bracket is spaced from the end of the nozzle with its edge beveled as at 19 to present a knife-edge to the issuing oil stream and thereby to present as little disturbing surface to the spray as possible. The bevel is preferably extended somewhat along the side arms 17 of the bracket, as shown in the drawing.

A target 20 is slotted at 21 to straddle the base portion of the bracket upon which it is fastened by soldering or in any other desired manner. It may have a conical tip as in Figures 2, 3, and 4, or it may be rounded as at 22, Figure 5. Since it is supported beyond the orifice it will not retard the oil stream passing through the nozzle, and consequently, the velocity of discharge at the orifice is maintained at a high rate.

The oil stream issuing from the discharge orifice of the nozzle is broken up into a fine spray of a pattern which may be varied by moving the target to different distances from the nozzle, or by changing its shape. Thus, the resulting spray may take the form of a cone of from about 150 degrees to about 40 degrees included angle. Experiments have shown that if placed too close, the energy loss increases: if placed too far, the control of shape of spray is lost, and it becomes very difficult to center the target in the small stream. It has been determined that the distance may be varied from one to five diameters of the orifice for successful results.

From the foregoing it will be understood that this invention provides a nozzle of simple construction which is adapted to spray heavy oils under high pressure, and which is so designed that the pressure energy of the issuing oil stream is effectively converted into high velocity discharge whereby complete conversion of the issuing stream into a fine spray is thereupon accomplished by interposing a target in the path of oil stream emerging from the nozzle orifice, at a limited distance from the orifice.

What I claim is:

1. A nozzle for spraying oil comprising a head formed with a discharge orifice of a diameter not greater than half that of the interior of said head, a lip defining such orifice and of a thickness not greater than one-quarter the diameter thereof, and a target spaced from the orifice in the path of the liquid stream emerging therefrom.

2. A nozzle for spraying oil comprising a threaded cap apertured at its end to define a discharge orifice of a diameter not greater than half that of the interior of said head, the wall of the cap at the edge of such orifice being of a thickness not greater than one-quarter the diameter of the orifice, a supporting bracket carried by said cap and spaced from the issuing end of the nozzle and a target element projecting from said bracket toward the discharge orifice but spaced therefrom.

3. A spray nozzle for oils comprising a cap having a flat end wall formed with an aperture of a diameter not greater than 50 per cent of any portion of the preceding bore through which oil to be sprayed is delivered, the end wall of said cap at the aperture being of a thickness less than the diameter of such opening, a bracket carried by said cap, a target supported on said bracket in the path of the fluid stream issuing from the aforesaid aperture, said bracket having a knife-edge presented to the nozzle aperture to avoid impeding the spray which is produced by impinging the issuing stream of fluid under high velocity against the target.

4. A spray nozzle for oils comprising an apertured cap the end wall of which adjacent the aperture has a sharp approach edge of a thickness not greater than one-quarter the diameter of such opening, and the diameter of such opening being not greater than 50 per cent of the internal diameter of said head, a bracket having rearwardly extending elements attached to said cap and a connecting portion spaced from the issuing end of the nozzle, the bracket being formed with a knife edge in those portions which are presented to the spray in order to promote uniformity of its distribution, a target mounted upon said bracket to project into proximity to the nozzle aperture and upon which a stream of oil emerging from the aperture impinges at high velocity and is exploded into a fine spray.

5. A nozzle for spraying oil comprising a head formed with a sharp edge orifice of a diameter greater than its length and less than half that of the interior of said head, a target mounted coaxial with the orifice and spaced therefrom a distance not less than 0.6 the diameter of the orifice, whereby it will not interfere with complete formation of the issuing oil jet, but will be positioned sufficiently close to the orifice to obviate scattering of the jet by air entanglement therewith.

6. A nozzle for spraying oil comprising a head formed with an orifice of a diameter greater than its length and less than half the interior diameter of said head, a target mounted coaxial with the orifice and spaced therefrom a distance of from one to five diameters of the orifice whereby it is positioned beyond the vena contracta of the issuing oil jet and consequently permits complete formation of the jet, but is sufficiently close to the orifice to prevent scattering of the jet by air entanglement therewith.

7. A nozzle for spraying oil comprising a head formed with a discharge orifice, the diameter of which is not greater than 50 per cent of the interior diameter of said head, a lip defining such orifice having a sharp edge at the approach thereto and of a thickness not greater than one-quarter the diameter thereof, a target mounted coaxial with the orifice and spaced therefrom a distance of from one to five diameters of the orifice whereby it is positioned beyond the vena contracta of the issuing oil jet and consequently permits complete formation of the jet, but is sufficiently close to the orifice to obviate scattering of the jet by air entanglement therewith.

REGINALD J. S. PIGOTT.