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S. L. NORTON

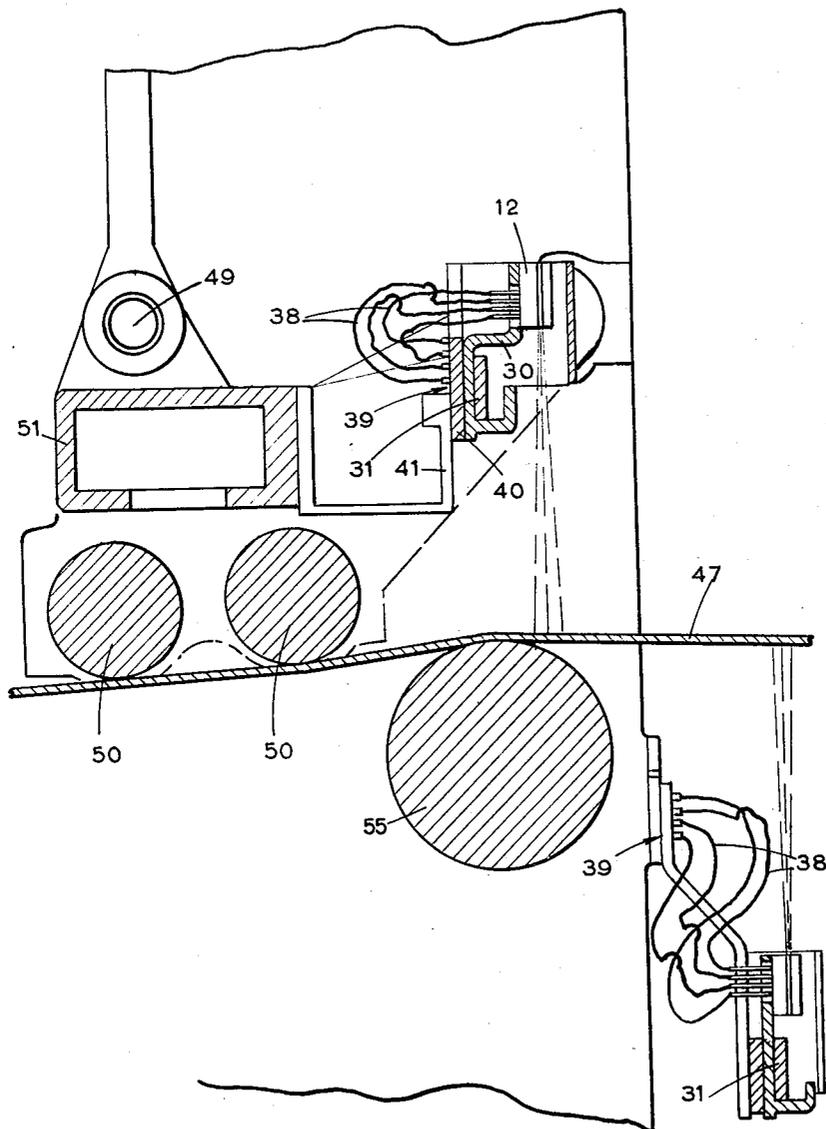
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NOZZLES

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FIG. 2.



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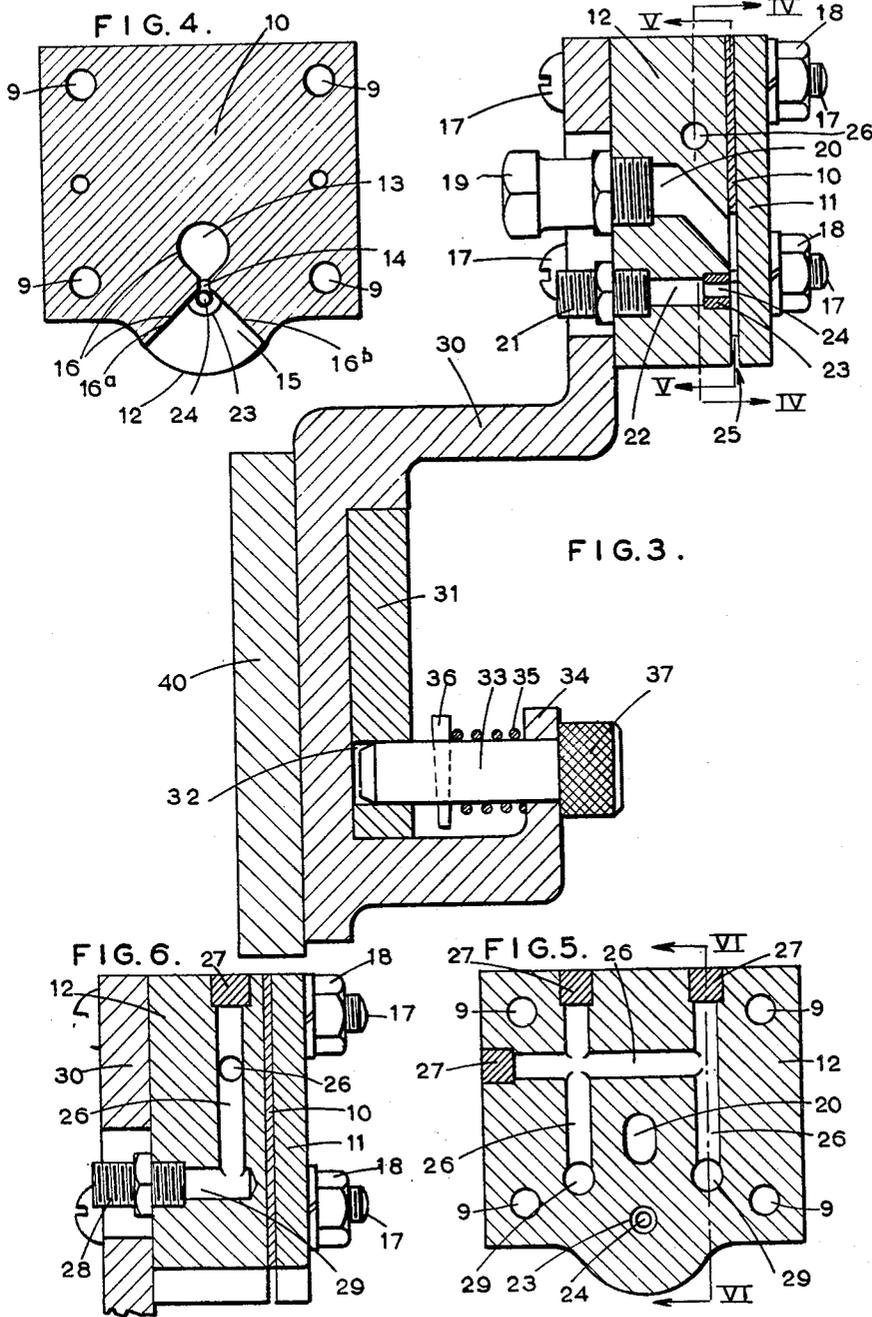
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NOZZLES

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6 Claims. (Cl. 118—302)

This invention relates to nozzles for the distribution of sprays of liquid, and has particular, but not exclusive, reference to nozzles used in apparatus for reducing strip metal stock. In this process of manufacture it is required to apply a lubricating fluid in the form of a mist generated by atomising a stream of the fluid (normally palm oil) and to project the mist against the stock which is being passed through the rolling mill, and the velocity of which may be considerable. Various methods of applying palm oil have been used between the mill stands of fast tandem tin plate mills, but the problem has not been satisfactorily solved hitherto. Temperatures are critical, as it is essential that the palm oil be at the correct temperature if good distribution is to be obtained, and it has also not been possible to effect satisfactory control of the volume of the mist delivered to accord with changes of velocity of the stock being rolled.

Objects of the invention are to obtain improved atomisation with adequate temperature control and so to obtain improved distribution of the palm oil over the stock at whatever speed the stock attains.

According to the invention, a nozzle for producing a flat fan-shaped spray of atomised liquid comprises a flat nozzle plate held between two support plates spaced apart in parallel relation, the nozzle plate being formed with a substantially circular aperture, a throat leading radially therefrom, and a discharge mouth communicating with the throat and constituted by a recess in an edge of the plate. Preferably, the mouth has two sides diverging from the throat and subtending an angle of 90°. Preferably also the junction of the aperture with the throat is defined by two walls each being coaxial with one of the sides of the mouth and tangential to the periphery of the aperture.

One of the support plates may be apertured to give passage to a supply of pressure gas to the aperture, and also to give passage to a supply of the liquid to be atomised, said supply being delivered into the mouth at a point just outside the throat.

At least one support plate may be provided with heating means to heat the fluids supplied to the nozzle, and conveniently a support plate may be formed with conduits for the supply of steam therethrough.

The nozzles according to the invention may be fitted to means for lubricating a web of moving material, such as strip metal stock, comprising an array of the nozzles located so that fan-shaped sprays of lubricant are projected on to one surface of the web side by side along a line transverse of the web. Conveniently, the distance between the nozzles and the web may be varied and the nozzles may be mounted on a carrier so as to be laterally adjustable thereon relatively to the web.

The lubricant may be supplied by a pump the output of which may be varied in accordance with the speed of the moving web and there may also be an array of nozzles for projecting similar sprays of lubricant on to the other surface of the web.

One embodiment of the invention will be described

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with reference to the accompanying drawings, in which:
Figure 1 is a fragmentary front elevation of an installation,

Figure 2 is a fragmentary diagrammatic side elevation of the installation,

Figure 3 is a central sectional side elevation, drawn to a larger scale, of a nozzle and its mounting,

Figure 4 is a fragmentary sectional front elevation on the line IV—IV, Figure 3,

Figure 5 is a fragmentary sectional rear elevation on the line V—V, Figure 3, and

Figure 6 is a fragmentary sectional side elevation on the line VI—VI, Figure 5.

The embodiment to be described has reference to the supply of lubricant to a tin plate rolling mill. Considering the construction of a nozzle shown in Figures 3—6, this comprises a nozzle plate 10 located vertically between two support plates 11, 12 like the ham in a sandwich, the nozzle plate 10 being the ham. The nozzle plate 10 is shaped with a cut out portion constituting an aperture 13, a throat 14, and a discharge mouth 15. These three may be regarded as bounded by a continuous wall indicated at 16 having the configuration of the letters

$$\frac{O}{X}$$

The O represents the aperture 13, with two tangents running downwardly therefrom in the manner of the X. This wall defines an aperture which is circular, but with a projecting area at its bottom, bounded by the two tangents leading into the throat 14 and thence out into the discharge mouth 15, the angle between the two diverging walls 16^a, 16^b of the mouth 15 being 90°, and these diverging walls being coaxial with the tangents.

This "ham" is clamped by bolts 17 and nuts 18 between a front support plate 11, which is quite plain, and a rear support plate 12, which has provision for the supply of pressure fluid, lubricating fluid and applied heat, both the support plates 11 and 12, and the nozzle plate 10, being formed with holes 9 to provide a passage for the bolts 17. The pressure fluid is air, which is led in from any convenient source (not shown) through a union 19 and discharged into the aperture 13 through a conduit 20 in the rear support plate 12, being led in at an angle of 45° so that it has already been given a downward component. The palm oil is led in from a reservoir (not shown) through a union 21 to a conduit 22 in the rear support plate 12 and discharged through a bushing 23 having a passage 24 at a point just below the throat 14 of the nozzle plate 10, that is, near the top of the discharge mouth 15.

Due to the location of the nozzle plate 10 between the two support plates 11, 12, there is a flat space indicated at 25 between the two support plates having the configuration described above, and the air passes out through the throat 14 at a very high velocity, so that the oil is atomised and blown from the nozzle in the form of a mist, the jet being defined by the divergent sides 16^a, 16^b of the mouth 15 to form a fan-shaped spray travelling directly down on to the stock beneath it. The edges of the fan are sharply defined and the width of the fan may therefore clearly be controlled by locating the nozzle at the requisite distance from the stock.

The rear support plate 12 is also formed, as shown in Figures 5 and 6, with conduits 26 formed by drilling passages in the plate 12 and closing them with suitable plugs 27. The conduits 26 are so located as to heat the area surrounding the air conduit 20 and oil passage 24, and are supplied with steam through two unions 28 and passages 29. In this way the palm oil may be brought to any predetermined temperature.

Referring to Figures 1 to 3, the nozzle is mounted horizontally on a support bar 31 located transversely of the mill, the support bar 31 being apertured as at 32 at spaced intervals to receive a peg 33 slidable in an aperture lug 34 extending from the bracket 30 and urged into an aperture 32 by a spring 35 retained by a taper pin 36. A knurled head 37 on the peg 33 enables it to be withdrawn so that the bracket 30 may be slid along the support bar 31.

Each nozzle is therefore adjustable laterally as desired. Flexible supply pipes 38 are employed to connect the unions 19, 21, and 28 to a chest 39 supported on a transverse bar 40 extending across the mill. A mounting bar 41 carries the bar 40 so that it is adjustable for height, vertical slots 42 in the bar 40 giving passage to clamping screws 43.

Conveniently, there are three nozzles 44, 45, 46 located side by side, the centre nozzle 45 being a reserve and the two outer nozzles 44, 46 being so mounted that the width of each fan-shaped spray where it impinges on the strip 47 just covers half the width of the strip. In this way, under normal conditions, the entire width of the strip 47 is subjected to the spray. The reserve nozzle 45 is adjustable for height by being slidably mounted on a post 48 so that by being brought further away from the strip 47 and its fan-shaped spray thereby being widened, it can cover the entire width to be sprayed, if necessary, or alternatively it may be moved laterally to take the place of either of the nozzles 44 or 46 should either of these experience a stoppage.

The entire array and the support bars 40, 41 are mounted so as to be pivotable about a transverse axis 49 under the influence of a pair of strip hold down rollers 50 on a tensometer beam 51, the strip 47 passing under the holddown rollers 50 and over a support roller before it reaches the spray.

A similar array of nozzles 52, 53, 54 may be provided if it is desired to spray the underside of the strip 47.

The palm oil is supplied by pumps (not shown) feeding from the reservoir, the pump motors being controlled by a variable voltage supply obtained through the mill electrics. The proportioning pumps, one for each palm oil unit, are connected into the palm oil ring main supply to the mill.

The apparatus not only enables effective control to be maintained over the volume and temperature of the palm oil delivery but also enables different settings to be made according to whether fresh palm oil or reclaimed palm oil is used.

I claim:

1. A nozzle for producing a flat fan-shaped spray of atomized liquid, comprising a flat nozzle plate, a support plate on either side of and engaging said nozzle plate, means securing said support plates and said nozzle plate together, said nozzle plate being formed with a substantially circular aperture and a throat communicating with said aperture and extending radially outward therefrom with a discharge mouth extending through one edge of said nozzle plate defined by a pair of walls diverging from and subtending an angle of 90° at the throat, side support plates being so disposed as to enclose both sides of said mouth, one of said support plates being formed with passages therein through one of which fluid to be atomized is to be introduced into the throat of said nozzle plate and through the other of which atomized fluid is introduced into the aperture of said nozzle plate.

2. A nozzle as claimed in claim 1, in which said support plate is provided with an additional passage there-

through within which fluid at an elevated temperature is introduced thereby to elevate the temperature of said plate and the fluids introduced into said other passages.

3. A nozzle as claimed in claim 1 in which there is included a horizontal bar, a support member secured to and adjustable vertically of said horizontal bar, a bracket secured to said nozzle and mounted for slidable movement along said member, and means for releasably securing said bracket to said member.

4. Means for lubricating a web of moving material, comprising an array of nozzles as claimed in claim 1, a horizontal support bar located transversely above the web, a supporting bracket for each nozzle, laterally adjustable means releasably securing each bracket to the support bar, vertically adjustable means for one of the nozzles relatively to the support bar, a flexible supply pipe for each nozzle serving to deliver liquid to be atomized to a point in the nozzle plate where the throat debouches into the mouth, a flexible supply pipe for each nozzle serving to deliver an atomizing fluid to the aperture in each nozzle plate, and heating means for the nozzles.

5. Means for lubricating a web of moving material, comprising means for moving the web horizontally, an array of nozzles as claimed in claim 1, a horizontal support bar located transversely above the web, a supporting bracket for each nozzle, laterally adjustable means releasably securing each bracket to the support bar, vertically adjustable means for one of the nozzles relatively to the support bar, a flexible supply pipe for each nozzle serving to deliver pressurized liquid to be atomized to a point in the nozzle plate where the throat debouches into the mouth, a flexible supply pipe for each nozzle serving to deliver a pressurized atomizing gas to the aperture in each nozzle plate, and heating means for the nozzles.

6. Means for lubricating a web of moving material, comprising means for moving the web horizontally, a first array of nozzles as claimed in claim 1, an upper horizontal support bar located transversely above the web, a second array of nozzles as claimed in claim 1, a lower horizontal support bar located transversely below the web, a supporting bracket for each nozzle, laterally adjustable means releasably securing each bracket of the first array to the upper support bar, laterally adjustable means releasably securing each bracket of the second array to the lower support bar, vertically adjustable means for one of the nozzles of the first array relatively to the upper support bar, a flexible supply pipe for each nozzle serving to deliver liquid to be atomized to a point in the nozzle plate where the throat debouches into the mouth, control means effective to vary the delivery of fluid to be atomized influenced by movement of the web of material, a flexible supply pipe for each nozzle serving to deliver a pressurized atomizing gas to the aperture in each nozzle plate, and heating means for the nozzles.

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