

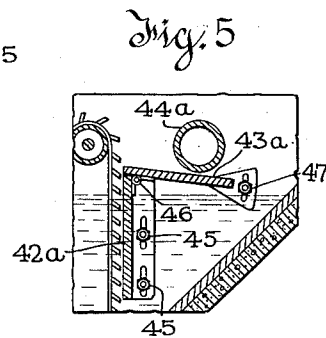
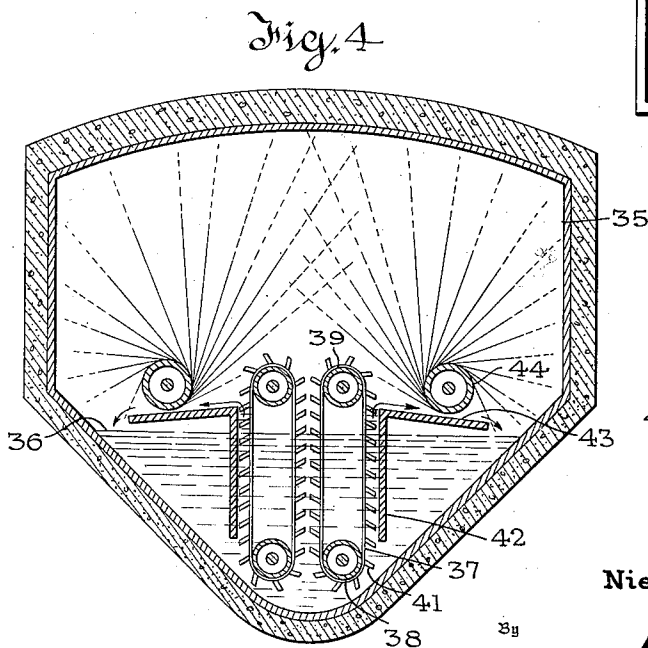
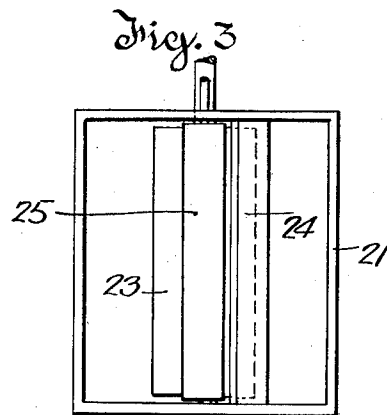
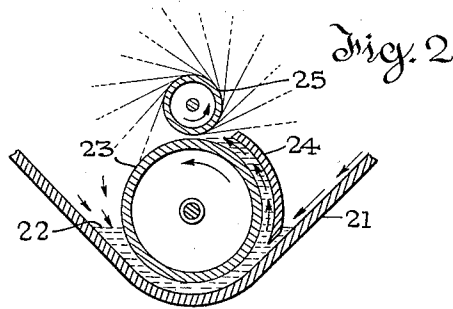
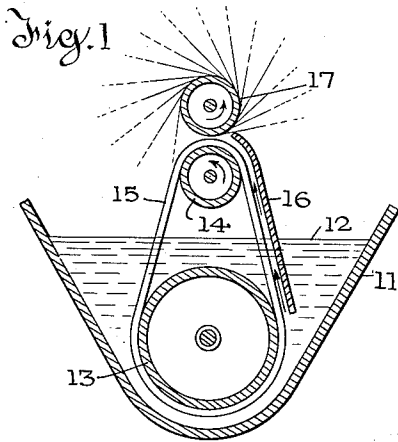
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METHOD AND APPARATUS FOR SPRAYING

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METHOD AND APPARATUS FOR SPRAYING

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This invention relates to liquid spraying and is useful for a wide range of purposes, including all of the various functions of gas and liquid contact apparatus, such as evaporating liquids, adiabatic cooling of gases, humidification and dehumidification of gases, chemical interaction between gases and liquids, air washing, etc.

More important still is the fact that suspensions of solids in liquids may be sprayed much more successfully than heretofore, and such suspension when sprayed may be subjected to various treatments, notably chemical interaction with gases and vapors.

In applicant's prior Patent 1,462,363, July 17, 1923, there is described a highly successful spray producing means, comprising a smooth cylinder, dipping very slightly in a bath of liquid to be sprayed and rotated at appropriate speed. The character of the spray could be controlled by varying the depth of penetration of the cylinder into the bath and the surface speed of the cylinder in proper relation to one another.

Since the performance depended in part on depth of penetration, accurate maintenance of liquid level was a controlling consideration. The scheme could not be used on moving vehicles or with any bath subject to surging or violent agitation. While suspensions could be sprayed where the solids would remain in suspension without agitation, difficulty was encountered when even moderate agitation was necessary.

Aside from the above considerations the requirement of an accurately maintained level and quiescent bath imposed a burden, both as to design and maintenance, on an otherwise simple process characterized by very effective spraying and low power consumption.

The present invention removes these limitations, without material increase in power consumption. It permits better and more flexible control of the character of the spray, and affords a simple secondary agitating effect on the bath which in no way impairs the performance of the sprayer.

Basically the inventive concept involves the use of means to lift the liquid and deliver it in a thin even stream over a guiding surface which will present the stream to the spraying cylinder. This cylinder turns in such direction that the surface of the cylinder moves in opposition to the moving stream and picks up the liquid, discharging it as a spray. The fineness of the spray and the range of its dispersion are determined by the speed of the cylinder and its penetration into the moving stream of liquid.

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The spraying unit above described in general terms can take various forms, and before describing specific applications of the invention, a number of such arrangements will be described. While these are approximate equivalents, broadly considered, they have slightly different characteristics which will be explained.

While the invention is useful when any liquid is to be sprayed, it has an important secondary advantage where suspensions of solids in liquids are to be sprayed, because the elevating means tends to agitate the bath of liquid. Where a suspension having pronounced settling characteristics is to be sprayed, the design of the elevating mechanism can be such as to produce very marked agitation of the bath. It is to be understood therefore that in the description the term "liquid" will be used to indicate a liquid or a suspension of finely divided solids in liquid, without reiteration of this important fact.

In the drawings:

Figure 1 is a vertical section diagrammatic in character showing an arrangement which is considered particularly desirable for use on moving vehicles, though it may be used for other purposes.

Figure 2 is a similar view showing a modification of this same idea.

Fig. 3 is a plan view of the device shown in Fig. 2.

Figure 4 is a section through a treatment chamber showing a dual spraying arrangement and illustrating an elevating device particularly useful where pronounced agitation of the bath is desirable.

Figure 5 is a fragmentary view similar to a portion of Figure 4 and illustrating possible adjustments of the height and slope of the surface which guides the stream of material into contact with the spraying drum.

Referring now to Figure 1, 11 represents a trough or basin which contains the liquid to be sprayed. The level of the liquid which is indicated at 12 need not be very precisely maintained. Submerged in the bath of liquid is a grooved cylinder 13 and mounted above the level 12 is a smaller grooved cylinder 14. Running on these two cylinders are a plurality of closely spaced V belts 15 which may be of the type commercially known as Tex-rope belts (trade name). A guard 16 overlies the up moving run of the belts and one of the grooved drums 13 or 14 is driven in the direction indicated by the arrow at a speed such that the belts entrain the liquid and carry it up-

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ward in a stream which is engaged by the rapidly rotating spraying drum 17.

The amount of liquid entrained is controlled by the speed of motion of the belts and is not particularly sensitive to the level 12 of the liquid or the surging of the liquid. Furthermore the liquid in the bath is violently agitated, and if there are solid particles in suspension, they are kept in suspension.

Figures 2 and 3 show an even simpler arrangement in which the liquid retaining receptacle is indicated at 21 and the liquid level at 22. A rotating cylinder 23 coacting with a shroud 24 carries the liquid upward from the bath and into contact with the rapidly rotating spraying cylinder 25.

It should be understood with reference to both Figures 1 and 2 that the cylinder 17 or 25, as the case may be, is of substantial length, and the liquid elevating means is coextensive in length with the spraying cylinder, as illustrated in Fig. 3 with reference to the embodiment shown in Fig. 2.

In metallurgical industries it is often necessary to treat pulps with gases. In Figure 4 there is diagrammatically illustrated in cross-section a closed elongated chamber 35 whose lower portion forms a receptacle for the pulp to be treated.

The liquid level is maintained approximately at the line 36 by any suitable means. To lift the liquid and to agitate the liquid in the bath, use is made of belts 37, two being shown. Each belt runs on a pair of pulleys 38 and 39, the pulley 38 being near the bottom of the bath and the pulley 39 above the bath. The belt has a plurality of flights 41, and the upward moving run of the belt passes close to the shroud 42, so that the flights entrain the liquid and deliver it at the upper end of the shroud over an inclined plane guiding-surface 43.

The liquid so elevated flows in a thin stream into contact with the rapidly rotating spraying cylinder 44 which is co-extensive in length with the flights and with surface 43. There are two such cylinders symmetrically arranged in Figure 4. These cylinders rotate in opposite directions because the liquid approaches them in opposite directions.

In all of the embodiments illustrated the spray leaves the cylinder in a fan which will embrace over 180° of arc provided the speed of rotation is proper and provided the depth of penetration into the liquid is not too great. Generally stated, an increase in the depth of penetration tends to increase the coarseness of the spray and to diminish the dispersion. Increase in the speed of rotation of the spraying cylinder tends to increase the fineness of the spray, the subtended arc of dispersion and the intensity of the spray. These two factors can be coordinated to give almost any character of spray in any dispersion and intensity of the spray that may be desired.

In Figure 5 there are suggested certain types of adjustments which may be made to control these factors. Figure 5 shows how the structure of Figure 4 can be modified to include such adjustments. In Figure 5 the shroud 42a is vertically adjustable by releasing the nuts 45. As indicated, these nuts are applied to bolts which pass through vertical slots permitting contemplated adjustment. The guiding surface 43a is hinged at 46 to the upper margin of the shroud 42a and its inclination may be adjusted by releasing the nut 47 which is associated with a bolt and slot arrangement as indicated. This makes it possible to adjust the interval between the sur-

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face 43a and the rotating spraying cylinder 44a and also adjust the inclination of the surface 43a.

Where suspensions characterized by rapid settling of the solid particles are to be sprayed, it is desirable to increase the inclination because that increases the speed of flow and the consequent agitation of the flowing stream. In most cases, however, it is sufficient to provide means to adjust the penetration of the spraying cylinder into the flowing stream and nothing more. In many cases even this adjustment is unnecessary because the device can be designed for stable conditions under which the device will operate.

A number of the embodiments of the inventive concept have been described with the idea of emphasizing the general principles involved and the various ways it can be applied.

As already explained an important function of the liquid elevating device when used with suspensions of solids, is the idea of maintained agitation. Some of the devices operate directly in the bath of liquid to produce agitation. Others do so only in a minor degree. It is a fact, however, that the pumping of the liquid over the sustaining surface and its return to the valve implies quite active agitation, and in many cases it is expedient to circulate an excess of liquid simply to secure agitation in this way. In such case the interval between the spraying cylinder and the sustaining surface is increased so that a greater quantity of liquid can be circulated without entailing too deep penetration of the cylinder into the flowing stream.

Some embodiments of the invention, notably that shown in Figure 5, can produce agitation by the direct action of the flights and by the circulation of an excess quantity of liquid. To accommodate the latter the inclined surface 43a is made more steep and more widely spaced from the cylinder 44a.

What is claimed is:

1. The method of supplying a liquid, or a suspension of solid particles in a liquid, to a sprayer of the type comprising a smooth cylinder rapidly rotated on a horizontal axis, which method comprises forming the liquid or suspension as a uniform shallow stream substantially coextensive in width with the length of the cylinder, upon a sustaining surface and then flowing said stream upon said surface in a direction transverse to the axis of the cylinder into contact with the lower side of the cylinder; and rotating the cylinder in such direction that the motion of its contacting surface is counter to the direction of flow of the stream.

2. The method of supplying a liquid, or a suspension of solid particles in a liquid, to a sprayer of the type comprising a smooth cylinder rapidly rotated on a horizontal axis, which method comprises flowing the liquid or suspension by gravity in a uniform shallow stream substantially coextensive in width with the length of the cylinder, upon a sustaining surface and in a direction transverse to the axis of the cylinder into contact with the lower side of the cylinder; rotating the cylinder in such direction that the motion of its contacting surface is counter to the direction of flow of the stream; and controlling the character of the spray by adjusting the inclination of said surface.

3. The method of supplying a liquid, or a suspension of solid particles in a liquid, to a sprayer of the type comprising a smooth cylinder rapidly rotated on a horizontal axis, which method comprises flowing the liquid or suspension by gravity

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in a uniform shallow stream substantially coextensive in width with the length of the cylinder, upon a sustaining surface and in a direction transverse to the axis of the cylinder into contact with the lower side of the cylinder; rotating the cylinder in such direction that the motion of its contacting surface is counter to the direction of flow of the stream; and controlling the character of the spray by adjusting the inclination of said surface and the rate at which the liquid or suspension is supplied thereto.

4. The method of supplying suspensions of solids in liquids from a bath thereof to a sprayer of the type comprising a smooth cylinder rapidly rotated on a horizontal axis, which method comprises, elevating the suspension continuously from the bath and causing it to flow by gravity in a uniform stream substantially coextensive in width with the length of the cylinder upon a sustaining surface and in a direction transverse to the axis of the cylinder into contact with the lower portion of the cylinder and back to the bath, the quantity flowing in the stream exceeding the quantity which can be sprayed by the cylinder and the inclination of the sustaining surface being such as to cause turbulent flow, whereby the solids are kept in suspension in said stream.

5. In an apparatus for spraying liquids, the combination of a cylinder mounted to rotate about its axis, said axis being substantially horizontal, a support having a surface approximately coextensive with the length of the cylinder opposed to the cylinder at the bottom thereof, said surface being parallel with the cylinder, and spaced

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a short distance therefrom to form throughout substantially the entire length of the cylinder a slender throat, said surface having a supply area in front of the throat arranged to guide liquid sustained thereby to the throat and having, behind the throat, a discharge area so formed that liquid tends to flow over it by gravity out of and away from the throat; means for forming on said supply area a layer of liquid moving towards said throat and of a depth not less than, and not materially more than, the height of the throat, and means for varying the thickness of said layer within said limits.

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