July 25, 1967 K. NÄGLER ETAL 3,332,625

TURBO NOZZLE SPRAYDAMPER

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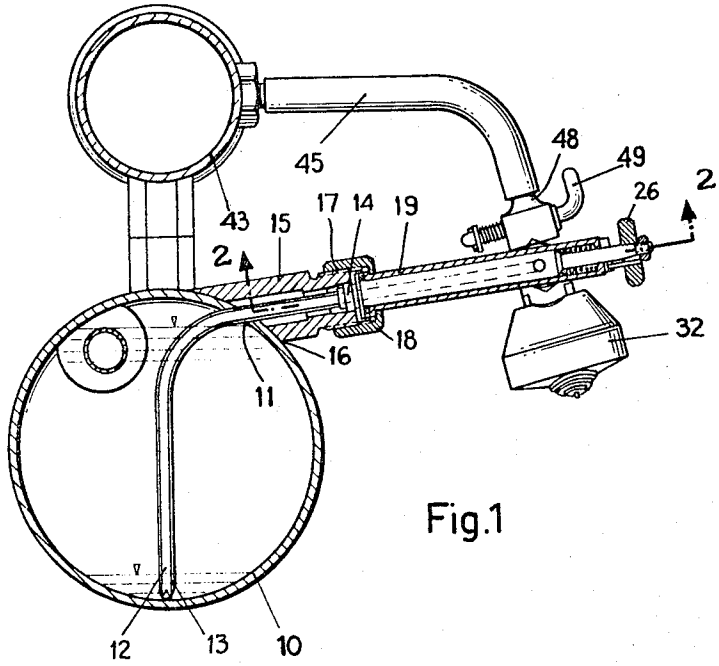


Fig.1

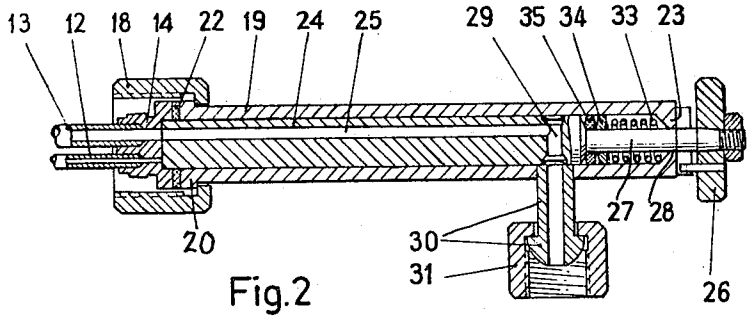


Fig.2

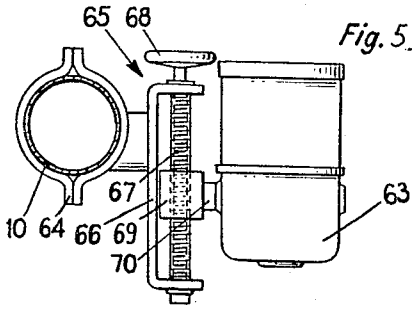


Fig. 5.

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Fig. 3.

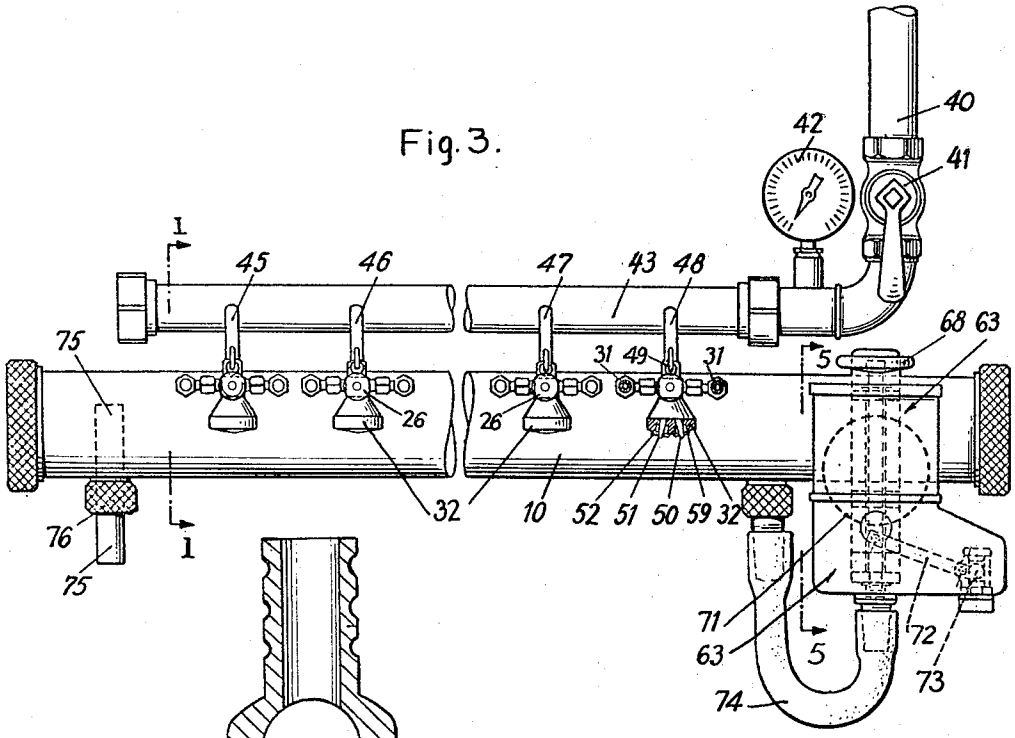


Fig. 4.

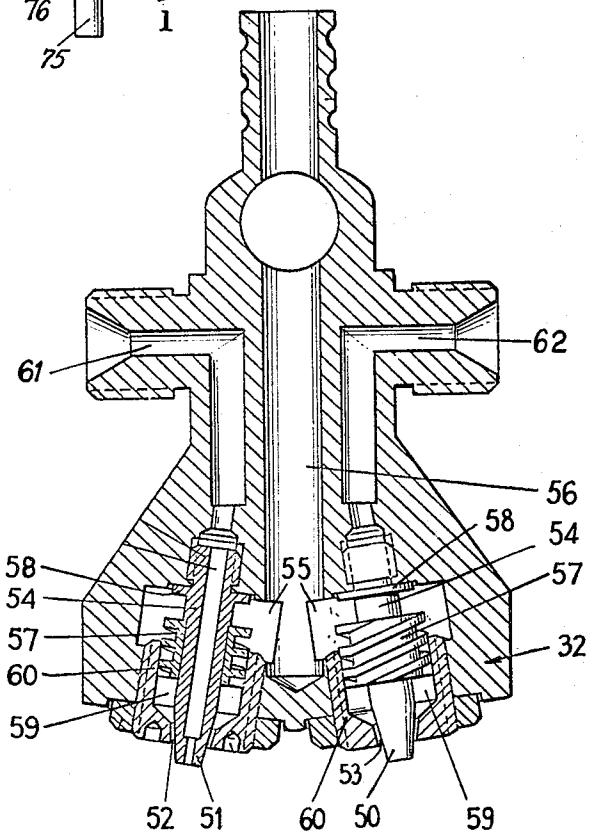
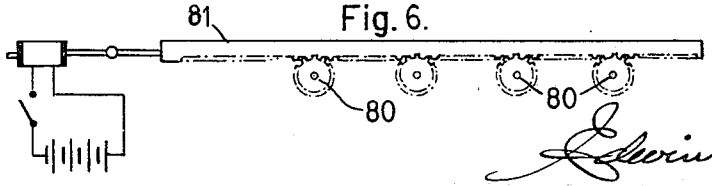


Fig. 6.



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TURBO NOZZLE SPRAYDAMPER

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12 Claims. (Cl. 239—344)

ABSTRACT OF THE DISCLOSURE

A spray damping device arranged to apply a predetermined quantity of moisture to an advancing web of fibrous material by rotation of a valve member to control the amount of water introduced in the form of a spray to the web from a source of supply in lieu of stopping operation of the machine to change jet nozzles.

The invention relates to a device for spraying and applying liquid media such as water or liquid chemical agents to traveling dry fiber material, especially paper webs, cardboard, wool, cotton, linen, or the like, with the device which is especially suited for arrangement on a paper machine, comprising a set of spraying nozzles preferably disposed transverse to the traveling direction of the web, which are fed from a liquid dispenser tube to which an air supply tube is connected.

Devices moistening webs of paper and the like are known which are provided with a transversely extending row of atomizing jets that are positioned across the web of paper. These jets apply the moistening solution to the web of material in a very finely atomized form as it traverses therebeneath. With one known arrangement, the liquid to be sprayed is delivered to a liquid dispenser which extends across the web of material. The liquid in the tube is kept under atmospheric pressure at any desired, adjustable level. In such an organization, suction tubes are arranged to project into the liquid dispenser tube at spaced intervals, these tubes being adapted to extend to the atomizing jets. Leading from an air dispenser tube, which also extends across the web of the fibrous material, are short lines with an air regulation control tap. These lines lead to the atomizing heads. The air in such a system is under a very low pressure of about 0.05 to 0.2 atmospheres.

Furthermore, in this known system regulation of the atomized, as well as the sprayed, liquid mass is possible by means of the pressure on the air being supplied and the state of the liquid in the liquid dispenser tube. Thus, with an increase in the liquid level, as well as with an increase in the pressure under which the air is delivered to the atomizing jets, the mass of sprayed liquid increases. Also, with this type of arrangement, one can achieve a maximum regulation range of about 1:6 (i.e. 1 part fluid to 6 parts air). Moreover, the amount of liquid being atomized and applied to the web of material will be determined by the number of jets being used. Accordingly, with such a device, one must change the entire jet assembly. Disregarding the fact that this operation takes time during which the machine lies idle, a number of jet assemblies must be available in stock and of which only one assembly can be maintained in operation at any given time. Because these jets must be made with great precision, they are expensive and holding them in storage can be quite costly.

It has, of course, been shown particularly with atomizing fixtures working under very low pressure that the distance by which the suction tubes extend into the liquid dispenser tube and from which they lead to the atomizing jets exerts an influence upon the mass of fluid atomized.

With an increase in the diameter of the suction tube, the mass of liquid sprayed increases. Hereby, it is not, however, required that the entire length of the suction tube possess the sometimes desired cross-section from the end that sticks into the liquid dispenser tube right up to the atomizing jet. It suffices, rather, if a substantial portion of the entire length has the determined cross-section.

Accordingly, the primary object of the invention is to provide an arrangement whereby the fluid to be emitted from the jets may be controlled without the necessity of substitution of other jet elements.

Still another object of the invention is to provide improved means for controlling the spray being emitted from the jets without idling the machine to change jets.

A still further object of the invention is to provide a selector-control means which may be operated in any convenient manner to vary the fluid emitted from the jets.

Another object of the invention is to provide a rotatable longitudinally aperture reciprocable valve which is interposed between and cooperates with a plurality of suction tubes and the selector-control means.

A further object of the invention is to provide suction tubes the internal diameter of which cover a complete range of sizes thereby facilitating introduction of the fluid from the reservoir to the jets through any one of the sizes selected.

Another further object of the invention is to provide a selection of available tubes of varying widths (i.e. diameters) and the provision of a selector located between the suction tube and the jet fixture, said selector being adapted for opening one or several of the suction tubes simultaneously.

With the selection of a specific suction tube width, the atomized liquid mass can be finely induced within a definite limit into the liquid dispenser tube by means of the air pressure and liquid level. The various widths of suction tubes are selected purposefully so that the pertinent adjustment ranges desired at the time somewhat overlap or are contiguous with one another; thus, the maximum working range of the entire arrangement is obtained. The dimension of this total range depends then upon the number of individual suction tubes and simultaneously permits selection from the available number of suction tubes as desired.

For practical improvements of the invention, the suction tube apertures which branch off the liquid dispenser tube serving as liquid reservoirs are arranged in a circular arc, and the selector-control means comprises a rotary slide valve provided with an eccentric linear bore which empties into an intersecting cross channel on the jet side. This cross channel is connected to an annulus which leads to the jets. With this arrangement, the individual suction tubes, whcih extend to a short distance above the floor of the reservoir, run parallel to one another and open into the end cap of the suction tube that has been fitted with separate bores in an arc which correspond to the various suction tube widths.

Fitted on the end of the suction tube cap is an adjustable rotary slide valve the eccentric bore of which can be brought into alignment with the individual bores of the end cap. The rotary slide valve bore, then, is at least as large as the largest suction tube diameter. The length of the gauged suction tube from the end that sticks into the liquid dispenser tube to the end cap suffices completely in obtaining the desired effect. The portion of the rotary slide valve that joins the suction tube does not have any effect upon the quantity dispensed regardless of the fact that it may possess a greater diameter than the

suction tube opposite which it may be at the time. From this eccentric linear bore, the liquid can flow through the cross channel into the annulus; and from there, independent of the position of the rotary slide valve, flow through the annulus to the atomizing jet.

The bore in the suction tube cap may be arranged so that the bore of the rotary slide valve can be, with appropriate improvement of the end, selectively connected with several bores simultaneously with the result that the sum of the cross sections of the individual bores becomes effective.

The rotary valve can be actuated by a small hand wheel and arranged to be locked in separate positions. On the other hand, it is also possible to make the rotary slide valves of the collective heads move simultaneously by means of a common mechanical drive.

The present invention makes it possible, by using the effect of the suction tube width, to obtain several times the range of former devices in spraying liquid mass without changing the atomizer jets. Thus, without anything additional, the total adjustment range of sprayed liquid mass per unit of time of 1:50 can be achieved where known comparable devices offered far less.

Other objects and advantages will become apparent upon a further reading of the following detailed description taken in conjunction with the drawings, in which:

FIG. 1 is a side view of the improvement of this invention partially in elevation and partially in cross-section;

FIG. 2 is an enlarged cross-sectional view on line A–B of FIG. 1;

FIG. 3 is a front elevational view partially in phantom lines of one transversely extending spray head assembly showing a series of spray jets one of which is in cross-section;

FIG. 4 is a cross-sectional view of one jet head;

FIG. 5 is a side elevational view on line 5—5 of FIG. 3; and

FIG. 6 is a diagrammatic showing of electrical means for actuating the spray heads from a remote control station.

Turning now to the drawings and considering first the view in FIG. 1, there is shown a liquid reservoir or chamber **10** the wall of which is suitably provided with longitudinally spaced perforations at **11** with each thereof being adapted to receive therethrough the upper extremities of suction tubes **12** and **13** and to the end of which are applied an apertured capping nipple **14**. Reinforcing neck portions **15** are rigidly secured to the reservoir as at **16** thus enshrouding the offstanding exit end portions of the suction tubes **12** and **13** with each neck portion including a free end onto which a screw cap **18** is screwed.

A longitudinally bored stud **19** is provided at one end with an annular flange **20**. Between the annular flange and capping nipple **14** is a seal **22**.

From an examination of FIG. 2, it will be observed that rotatably and slidably positioned within sleeve **19** is a tubular valve member **24** provided with a longitudinally extending eccentrically disposed passageway **25** which is adapted to be aligned with either of the suction tubes **12** or **13**, by means of a knob **26** which is affixed to the reduced extremity **27** of the tubular member **24** that projects through bore **28**. A transversely extending passageway **29** permits communication between the longitudinally extending passageway **25** and nipple **30** to which is secured a flanged threaded member **31** that is, in turn, adapted to support the atomizing head **32**. A spring **33**, which surrounds the reduced portion of extremity **27**, abuts the necked portion **23** at one end and its opposite end applies force through the thrust washer **34** and an O-ring **35** against the valve member **24**.

Referring now to FIG. 3, air under pressure from a compressor (not shown) is introduced through tube **40** and cut-off valve **41** past the manometer **42** into an elongated air distribution tube **43** which, as illustrated in the drawing, is fed from one end of the tube. With particularly wide papermaking machines, it is advisable to feed the air in from several points, for example, into both ends of the tube **43**.

On the air distribution tube **43**, flexible hose means **44**, **45**, **46** and **47** are fastened onto nozzles (not shown). The number of such connections is optional and is dependent upon the area which has to be sprayed at any given time. However, for an obvious reason it is advantageous to arrange the hose connections at predetermined equal distances from one another with the hoses being each connected by a hose nozzle **48** to an air control means **49** that is connected, in turn, with the jet head **32**, the being best shown in cross-section in FIG. 4.

The primary purpose of the air valve means **49** is to cut off any fluid from any particular spray head by throttling the air should that necessity arise. Turning now to the schematic view in FIG. 4, there is shown a jet head **32** with two water jets **50** and **51**, which are positioned at definite divergent angles to one another. The perimeters of these water jets **50** and **51** are surrounded by air jets **52** and **53**, the annular air spaces of each of which tapers toward the direction of the open end of the water jackets. The upper extremity of the jet head **32** is screwed into the flanged threaded member **31** as shown. Center sections of the water jets such as shown at **54** are surrounded by substantially circular air chambers **55** which, in turn, are connected with a longitudinally extending feeder canal **56** provided in the jet head.

The air rotor **57**, which has a spirally arranged configuration, causes the incoming air to be driven in a rotary motion and thus forces it along the exterior surface of the jacket of the water jets, whereupon the swirling air exits and rotates about the short nose or nozzle piece of the water jet. Here, the rotating air being emitted in a convergent stream merges again in front of the water jet and causes the desired suction effect on the liquid contained in the reservoir.

The spiral air rotors **57—57**, which telescope the water jets **50** and **51**, are adapted to float relative thereto between the shoulders **58—58** of the water jet and the enlarged cylindrical areas **59—59** provided in the jacket of the air jet **32** which is threadedly secured in the jet head and retained therein further by the cap screws **60—60**.

The water jets **50** and **51** are connected by their axially extending canal **56** to other intersecting canals **61**, **62** in the rear end of the jet head and thence to the flanged threaded members **31** which communicate with the suction tubes **12** and **13**.

The suction tubes **12** and **13** terminate a short distance from the bottom-most portion of the reservoir **10**. The diameter of the reservoir, which is considerably larger than the diameter of the air distribution tube, is adapted to support the jet heads as shown. The reservoir **10** is fed from only one side, as shown. However, when the width of the area to be sprayed exceeds certain dimensions, it is advisable to use a dual feed therefor as those skilled in this art understand.

The liquid supply furnished to the reservoir **10** takes place through the pressure equalization chamber **63** (FIGS. 3 and 5) which is fastened by means of a pipe clamping means **64** to the exterior surface of the reservoir by means of an adjustment device generally indicated at **65**.

The adjustment device **65** includes a bracket **66** within the apertured flanges of each end of which an elongated threaded member **67** is positioned, with the upper extremity being provided with a hand wheel **68**. When the threaded member is rotated by the hand wheel, it causes the nut member **69**, which is provided with a lug **70**, to be moved up or down along the axis thereof and to thereby raise and lower the pressure equalization chamber which is suitably attached to the lug **70**.

The pressure equalization chamber serves to alter the level of liquid in reservoir **10**. For this reason, the pressure equalization chamber has a ball float **71** which is connected by means of an actuating rod **72** to a valve

means **73** which, in turn, regulates the amount of incoming liquid.

The liquid flows from the pressure equalization chamber **63** through a hose **74** into reservoir **10**. The liquid level at any given time in the reservoir is governed by the level of the pressure equalization chamber with respect thereto. The reservoir is provided with an adjustable overflow pipe **75**, the control for which is achieved by means of a knurled threaded member **76**.

The position of the mouth of the liquid level pipe **75** which extends up into the reservoir, controls the level of the liquid therein. Thus, the liquid level is constantly maintained by adjustment of the pressure equalization chamber **63** with respect to the reservoir, with this adjustment being achieved by means of the adjustment arrangement described hereinbefore. When the liquid level in the reservoir is low, the pressure equalization chamber must be lowered; and when the liquid level therein is high, the chamber must be correspondingly raised. If the jet heads cease to emit spraying liquid, then the float operated valve **71**, through the medium of rod **72**, moves valve means **73** automatically to a previously determined higher position and in so doing allows the liquid level in the reservoir to rise to the level of the mouth of the overflow pipe **75**.

The spraying of the liquid is achieved with the aid of an air stream delivered to the air distribution tube **40** from a compressor (not shown). Should this entire air stream be throttled by means of the air control cock **41**, then the mass of liquid sprayed from each individual jet head decreases, but in order to obtain individual regulation of the mass of liquid sprayed from each individual jet head, the tap or air valve means **49** associated therewith is adjusted.

It will be apparent also that the manner in which the spray stream strikes the web of paper or similar material to be sprayed can be altered by changing the adjustment of the jets.

In another embodiment of the invention, as shown in FIG. 6, one can, for example, instead of using the hand wheel provide pinion gears **80** in lieu of the hand wheels that are adapted to engage with corresponding toothed portions of a rack **81** or other positioning rod means. Furthermore, magnetic switch means, including a relay and a source of electrical energy for actuation thereof, can be associated with the spray heads, and thus these can be also controlled from a remote control station.

The device, according to the invention, affords various control possibilities in many varied forms and precise direction of liquid to be sprayed over large work areas. This can not only be done with one spray head but with a series such as described herein as well. The practical, pressureless control of the liquid permits corresponding further control profiles for liquids to be sprayed so that the danger of stoppage in the canals caused by foreign matter deposits or the like is avoided.

That which is claimed is:

1. An improved spray device comprising a liquid containing reservoir, plural tubular suction means extending from said reservoir and including substantially aligned exit end portions terminating in a cap means, longitudinally extending apertured valve means provided with a bore adapted to be associated with said cap means, an atomizer head in communication with the bore in said longitudinally apertured valve means, a source of air supply for feeding air to said atomizer head and means operatively associated with said valve means for aligning the longitudinally extending bore thereof with either of said suction tubes.

2. An improved spray device according to claim **1**, wherein the bore in said valve means is displaced eccentrically relative to the longitudinal axis thereof.

3. An improved spray device according to claim **1**, wherein the means operatively associated with said valve means for actuation thereof includes a manually operated means.

4. An improved spray device according to claim **1**, wherein the means operatively associated with said valve means for actuation thereof includes a remotely controlled means.

5. An improved spray device according to claim **1**, wherein the source of air supply to be fed to the atomizer head is controlled by a second valve means.

6. An improved spray device according to claim **3**, wherein said manually operated means include lock means to prevent inadvertent displacement of said longitudinal bore of said valve means relative to said cap means.

7. An improved spray device comprising a liquid containing reservoir, plural suction means extending from said reservoir and including exit end portions terminating in a transversely extending cap means, a longitudinally bored rotary valve means in communication with said cap means, a sleeve means encompassing said valve means and including means for securing the same to the reservoir with the free end of said sleeve extending beyond and shrouding the rotary valve means, an atomizer head associated with said longitudinally bored valve means, a source of air supply in communication with said rotary valve means and said atomizer head and means operatively associated with said valve means for aligning the bore thereof with either of said suction tubes.

8. An improved spray device as claimed in claim **1**, wherein the atomizer head includes a longitudinally extending passageway and plural intersecting passageways communicating therewith terminating in spacedly arranged chambers, water jet means positioned in said chambers, air control means telescoping the water jet means and nozzle means to direct the air emitted from the air control means in a convergent stream in front of the water jet means.

9. An improved spray device as claimed in claim **8**, wherein the air control means includes means to create a rotary motion in the airstream prior to its being emitted from the nozzle.

10. A device for atomizing and applying liquid media to traveling dry fibrous materials, the combination comprising, an elongated reservoir, plural tubular suction means extending from said reservoir and including substantially aligned exit end portions terminating in a cap means, pressure equalization means for feeding liquid thereto, a series of longitudinally extending spacedly arranged first valving means adapted to communicate with the liquid in said reservoir, jet means associated with said first valving means, means for actuating said valving means, means for introducing pressurized air into each of said jet means, air control means carried by said jet means for withdrawing the liquid from said reservoir, and means operatively associated with said valve means for aligning the longitudinally extending bore thereof with either of said suction tubes.

11. A device as claimed in claim **10**, wherein a second valving means is adapted to control the pressurized air emitted to said jets.

12. A device as claimed in claim **10**, wherein said liquid reservoir is provided with an overflow control means adapted to maintain the liquid therein at a substantially constant level.

No references cited.

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