April 9, 1957 H. J. McDERMOTT 2,787,980

LIQUID APPLICATOR FOR RUNNING STRAND

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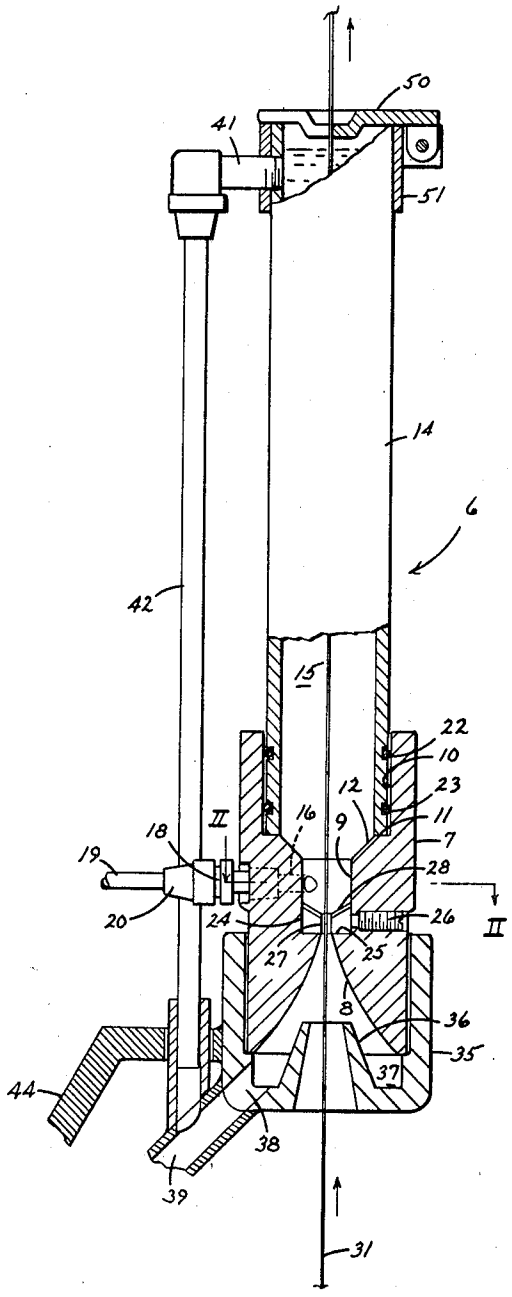


Fig. 1

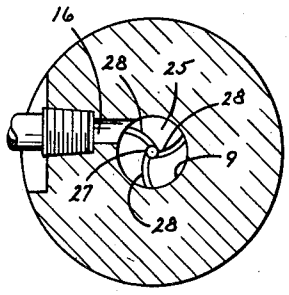


Fig. 2

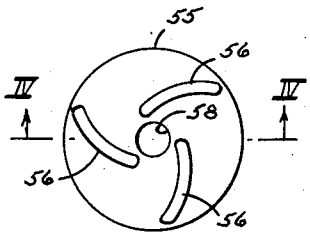


Fig. 3

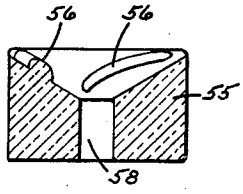


Fig. 4

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LIQUID APPLICATOR FOR RUNNING STRAND

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16 Claims. (Cl. 118—405)

This invention relates to improvements in devices for applying liqid to stretched or taut sections of upwardly-running strants. The invention is particularly applicable to devices of the general nature described in Patent No. 2,642,035 constituting a unit adapted to be mounted along an unsupported section of a strand traveling between points of support of any of a wide variety of types of textile strands for carrying out the function of flooding a short portion of the path of the strand with liquid, then conducting the used liquid away from the region of application to drainage facilities.

An important aspect of the latter function is to prevent the loss of liquid by drainage thereof downwardly or backwardly with respect to the section of strand advancing into the applicator because of the desirability of reclaiming the liquid for the heat stored therein and/or dissolved materials carried thereby, or because of the need to maintain the liquid free from contamination by other liquids or materials used in earlier applied processing steps. It is also desirable to prevent material used in other processing steps from being contaminated by the liquid being administered through such an applicator and in general to promote good housekeeping by preventing the drainage of unwanted liquid onto other equipment. Although applicators, such as disclosed by the above mentioned patent, are satisfactory as long as operating conditions are maintained which do not result in excessive discharge of liquid through the aperture by which the strand enters the applicator, it is found, for example, when a certain head pressure of the liquid supported within the applicator has been reached, that the flared surface provided below the strand-receiving aperture of the applicator fails to lead the liquid passing downwardly through the aperture away from the strand for drainage along the surface of a drainage system provided.

An important object of the present invention is to provide a device for applying a liquid to an upwardly-running strand that is substantially more effective than the prior art devices in preventing the drainage of liquid therefrom along a strand passing through the device. It is another object of the invention to provide an applicator constructed as a unit having a common drainage system for that liquid which overflows a liquid treatment chamber thereof and also for the liquid which is discharged from the strand-receiving aperture of the applicator. It is also an object to provide an applicator that may be readily assembled and taken apart in accordance with a simple design that will result in a low manufacturing cost of the applicator. Another object is to provide an applicator in accordance with the foregoing objects that is easily laced. Other objects, features, and advantages will become apparent from the following description of the invention and the drawing relating thereto in which—

Fig. 1 is an elevation view, partly in section, illustrating one embodiment of the invention;

Fig. 2 is a view taken along line II—II of Fig. 1;

Fig. 3 is a top view of a modified insert that may be used in the apparatus of Fig. 1; and

Fig. 4 is a section view taken along line IV—IV of Fig. 3.

Briefly stated, the invention provides a device or applicator for applying a liquid to a fixed section of a path traversed by a running strand, such a device comprising an elongate upwardly-extending liquid treating or applying chamber and having a strand-receiving aperture extending through the bottom surface of the chamber and spiral flutes or grooves extending laterally from the aperture along the bottom surface, and an inlet duct extending through a lateral wall of the chamber adjacent the bottom surface. That is to say, the bottom surface of the chamber comprises adjacent helical sections of which at least one section is raised or axially offset with respect to an adjacent section. In a preferred embodiment, the inlet duct is aligned in substantially tangential relation to the inner lateral surface of the chamber with the flutes or grooves extending in the same angular direction with respect to the axis of the aperture, while also extending spirally inwardly toward the aperture, as the angular direction in which the duct extends toward the chamber.

Considering now the apparatus illustrated in Fig. 1 in detail, an applicator **6** comprises an annular base block **7** having a flared or trumpet-shaped surface **8**, a bore **9**, a counterbored surface **10**, an annular shoulder surface **11**, and a frusto-conical surface **12** connecting the bore **9** and the shoulder surface **11**. Other parts of the applicator are a tube **14** extending in telescopic relationship within the counterbored surface **10** with the end of the tube **14** in engagement with the annular surface **11**. The tube **14** is sealed with respect to the base block to prevent leakage between the tube and the surface **10** by a pair of rings **22** and **23** which fit partly within annular grooves extending in the outer surface of the tube. The tube **14** constitutes a substantial portion of the lateral wall of the chamber **15** in which liquid is applied to a strand passing through the applicator. The liquid, however, is supplied to the chamber through a duct **16** extending in a lateral direction through the lateral wall of the base block **7**. The duct **16** is counterbored for threaded relation with a nipple **18** to which a supply tube **19** is secured by a coupling **20**. The duct **16** enters the small pocket or chamber defined by the bore **9** in a direction that is generally tangential to the lateral cylindrical surface of the bore so that liquid entering the bore from the duct **16** travels in a circular path within the bore.

As an essential feature of the present invention, the applicator comprises an insert **24** which seats within the bore against a shoulder surface **25**. The insert may seat loosely and be secured within the bore by means, such as the set screw **26** which engages its outer periphery. The insert **25** (shown in top view in Fig. 2) has spiral grooves **28** extending from a central aperture **27** thereof. The grooves are formed in accordance with the general definition of a spiral, i. e., a path which extends around an axis while continuously receding therefrom. The axis, in this case, coincides generally with the path of the yarn **31** through the applicator as illustrated. The insert may have one or more of such spiral grooves for practice of the invention in accordance with its principles of operation. However, more than one groove is preferred and the three grooves shown are quite satisfactory.

The purpose of such grooves is to impart to the liquid which drains through the aperture **27** a rotary or whirling motion providing centrifugal force which causes the liquid as it reaches the flared surface **8** to follow and drain downwardly along the flared surface. This behavior of the liquid passing downwardly out of the chamber **15** can be obtained regardless of the head pressure maintained in the chamber by provision of adequate spiral

surfaces adjacent the aperture **27**. The upper surface of the insert **25** comprising the portions between the grooves form preferably a frusto-conical surface of revolution which also helps to create the swirling action in the liquid as it enters the aperture **27**.

To those skilled in the art it will be obvious that a base block **7** may be manufactured with the insert integral with the block. However, present experience indicates that the insert is more conveniently provided as a separate piece which may be inserted within the block **7** and secured as shown.

The structure of the applicator **6** includes also a cup-like receiver **35** having an internal annular dam **36** which forms or defines an annular pocket **37** into which liquid drains from the flared surface **8** and passes outwardly of the cup **35** through a drainage aperture **38** into a drainage duct **39**. The tube **14** is provided with an overflow duct **41** connected with a tube **42** through which liquid may pass from an interior top region of the tube into the drainage duct **39**. The entire applicator as shown in Fig. 1 may be supported by a bracket **44** attached to the cup. The base block **7** fits loosely within the cup **35** and is held there by gravity comprising its own weight and that of the other portions of the applicator and the weight of the liquid supported within the tube **14**. A closure or lid **50** is secured to the upper end of the tube **14** in hinged relation with a collar **51**. This collar is secured about the external periphery of the tube by the tube **41** which extends through an aperture therefor of the collar. The closure **50** is slotted as shown for passage of the strand **31** from the device. Thus an unobstructed path is provided for the strand entirely through the applicator **6**.

The rotary currents induced in the liquid escaping from the lower portion of the liquid-treating chamber may be obtained by spiral ridged surfaces as well as by the grooved surfaces of the insert **25** hereinbefore described. Shown in Figs. 3 and 4 is an insert **55** having the general shape of the insert **25** but having spiral flutes **56** instead of grooves as provided in the insert **25**. These flutes influence liquid descending along the generally frusto-conical upper surface of the insert in essentially the same manner as do the grooves of the earlier described insert. They may be provided in any number and height necessary to overcome the tendency of liquid to be discharged through the aperture **58** without rotary motion as the result of increased head pressure in the treating chamber **15**.

It is preferable in both embodiments shown, although not strictly necessary, that the duct **16** enter the bore **9** in a direction that is substantially tangential with respect to the diameter of the bore. When the duct enters the bore in such a manner or to one side of its axis, the flutes or grooves of the insert provided extend with respect to the aperture thereof while extending radially inwardly toward the aperture in the same angular direction as that in which the inlet duct extends tangentially toward the chamber.

While preferred embodiments of the invention have been shown and described, it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A device for applying a liquid to a running strand having an elongate chamber and a flared annular surface spaced endwise from each other; one end of the chamber being adjacent to, and connected with, the smaller end of the flared surface by an aperture; the device having an unobstructed path extending through the aperture, the chamber, and the flared surface for passage of a strand through the device; the chamber having an interior end surface surrounding the aperture comprising adjacent sections extending in spiral relation to the aperture; at least one of said sections being raised with respect to an adjacent section; and a duct for supplying a liquid to the chamber.

2. A device for applying a liquid to a running strand having an elongate chamber and a flared annular surface spaced endwise from each other; one end of the chamber being adjacent to, and connected with, the smaller end of the flared surface by an aperture; the device having an unobstructed path extending through the aperture, the chamber, and the flared surface for passage of a strand through the device; the chamber having an interior end surface surrounding the aperture, said end surface comprising a section extending in spiral relation to the aperture and in axial relation to an adjacent section of the remainder of said end surface; and a duct for supplying liquid to the chamber.

3. A device for applying liquid to a running strand having an elongate chamber, a flared annular surface spaced endwise from each other, and an aperture extending between a smaller end of the flared surface and the adjacent end of the chamber; the device having an unobstructed path extending through the aperture, the chamber, and the flared surface for passage of a strand through the device; the chamber having an interior end surface surrounding the aperture, said end surface comprising a section extending in spiral relation to the aperture and in axially offset relation to an adjacent section of the remainder of said end surface; and a duct for supplying liquid to the chamber.

4. A device for applying liquid to a running strand having an elongate chamber and a flared annular surface; one end of the chamber being adjacent to, and connected with, the smaller end of the flared surface by an aperture; the device having an unobstructed path extending through the aperture, the chamber, and the flared surface for passage of a strand through the device; the chamber having an interior end surface surrounding the aperture, said end surface comprising a section extending in spiral relation to the aperture and in axially offset relation to an adjacent section of the remainder of said end surface; and a duct for supplying liquid to the chamber extending thereinto from a lateral direction in substantially tangential relation to an inner lateral surface of the chamber adjacent said end surface; said spiral surface extending in the same angular direction with respect to the aperture, while extending inwardly theretoward, as the angular direction in which the duct extends toward the point of tangency with the chamber.

5. A device for applying liquid to a running strand having an elongate chamber and a flared annular surface of generally circular cross section, and an aperture extending between an end of the chamber and the smaller end of the flared surface; the flared surface extending in contiguous generally coaxial relation with the periphery of the aperture away from the chamber; the device having an unobstructed path extending through the aperture of the chamber and the flared surface for passage of a strand through the device; the chamber having an interior end surface surrounding said surface and comprising at least one section extending in spiral relation to the aperture and in axially offset relation with an adjacent section of the remainder of said end surface; and a duct for supplying liquid to the chamber extending thereinto from a lateral direction in substantially tangential relation to an inner lateral surface of the chamber adjacent said end surface; said spiral surface extending in the same angular direction with respect to the aperture, while extending inwardly theretoward, as the angular direction in which the duct extends toward the point of tangency with the chamber.

6. A device for applying liquid to a running strand having an elongate chamber and a flared annular surface; one end of the chamber being adjacent to, and connected with, the smaller end of the flared surface by an aperture; the device having an unobstructed path extending through the aperture, the chamber, and the flared surface for pas-

sage of a strand through the device; the chamber having an interior end surface surrounding the aperture; said end surface being disposed generally coaxially with the aperture and having a groove extending in spiral relation thereto; and a duct for supplying liquid to the chamber.

7. A device for applying liquid to a running strand having an elongate chamber and a flared anular surface; one end of the chamber being adjacent to, and connected with, the smaller end of the flared surface by an aperture; the device having an unobstructed path extending through the aperture, the chamber, and the flared surface for passage of a strand through the device; the chamber having an interior end surface surrounding the aperture, said end surface being disposed generally coaxially to said aperture and having a flute extending in spiral relationship thereto; and a duct for supplying liquid to the chamber.

8. A device for applying liquid to a running strand having an elongate chamber and a flared annular surface; one end of the chamber being adjacent to, and connected with, the smaller end of the flared surface by an aperture; the device having an unobstructed path extending through the aperture, the chamber, and the flared surface for passage of a strand through the device; the chamber having an interior end surface surrounding the aperture; said end surface comprising a plurality of sections extending in spiral relation to the aperture and in axially offset relation to intermediate sections of the end surface which space said spiral sections uniformly angularly about the aperture; and a duct for supplying liquid to the chamber.

9. A device as defined in claim 8 wherein said spiral sections of the end surface comprise spiral flutes.

10. A device as defined in claim 8 wherein said spiral sections of the end surface comprise spiral grooves.

11. A device for applying liquid to a running strand having an elongate chamber and a flared annular surface, one end of the chamber being adjacent to, and connected with, the smaller end of the flared surface by an aperture; the device having an unobstructed path extending through the aperture, the chamber, and the flared surface for passage of a strand through the device; the chamber having a radially-inwardly facing generally frusto-conical end surface surrounding the aperture and an open region immediately adjacent the aperture; said end surface comprising a section extending in spiral relation to the aperture and in axially offset relation to adjacent sections of the remainder of said end surface; and a duct for supplying the liquid to the chamber.

12. A device for applying liquid to a running strand having an elongate chamber and a trumpet-shaped surface; one end of the chamber being adjacent to, and connected with, the smaller end of the trumpet-shaped surface by an aperture; the device having an unobstructed path extending through the aperture, the chamber, and the trumpet-shaped surface for passage of a strand through the device; the chamber having an interior end surface surrounding the aperture, said end surface comprising a section extending in spiral relation to the aperture and in axially offset relation to an adjacent section of the remainder of said end surface; and a duct for supplying liquid to the chamber.

13. A device for applying liquid to a running strand having an elongate chamber, a flared annular surface, and an aperture extending therebetween; the chamber and said surface being circular in respective cross-sections and being disposed in coaxial relationship with the small end of the flared surface adjacent one end of the chamber; the device having an unobstructed coaxial path through the aperture of the chamber and the flared surface for passage of a strand along said path; the chamber having an interior generally annular end surface surrounding the aperture; said end surface comprising a section extending in spiral relationship to the aperture and in axial relation to an adjacent section of the remainder of said end surface; and a duct for supplying liquid to the chamber.

14. A device for applying liquid to a running strand having an elongate chamber and a flared annular surface; one end of the chamber being adjacent to, and connected with, the smaller end of the flared surface by an aperture; the device having a path extending through the aperture; the chamber and the flared surface for passage of a strand through the device; the chamber having an interior end surface surrounding the aperture, said end surface comprising a section extending in spiral relation to the aperture and in axially offset relation to an adjacent section of the remainder of said end surface; a duct for supplying liquid to the chamber; a liquid-collecting member for enclosing the larger end of the flared surface; said member having a central aperture including said path and a section defining the periphery of its aperture extending inwardly toward the first-named aperture in spaced relationship with the flared surface to form a liquid-collecting region between the flared surface and a radially outward surface of said member section; and drainage duct means extending through the member from a point adjacent the larger end of the flared surface.

15. A device for applying liquid to a running strand having an elongate chamber and a flared annular surface; one end of the chamber being adjacent to, and connected with, the smaller end of the flared surface by an aperture; the device having an unobstructed path extending through the aperture, the chamber, and the flared surface for passage of a strand through the device; the chamber having an interior end surface surrounding the aperture, said end surface comprising a section extending in spiral relation to the aperture and in axially offset relation to an adjacent section of the remainder of said end surface; a duct for supplying liquid to the chamber; means for orienting said device with the chamber extending upwardly from the flared surface; and liquid-collecting means surrounding said path extending in adjacent relationship with the entire periphery of the larger end of the flared surface.

16. In combination, a device for applying liquid to a running strand having an elongate chamber and a flared inner surface of circular cross section, the chamber and said surface being disposed in generally coaxial end-to-end relation with the smaller end of the surface adjacent an end of the chamber, the device having an aperture for connecting the adjacent ends of the chamber and the surface and having an unobstructed path extending through the aperture, the chamber, and the flared surface for passage of a strand through the device; an insert having a central aperture and a peripheral surface adapting it to fit within the end of the chamber nearest the flared surface with its opening in coaxial relation with said aperture, the surface of said insert which surrounds the opening and faces away from the flared surface being generally frusto-conical and concentric with respect to the opening for surrounding a region immediately adjacent the opening, said end surface of the insert comprising a section extending in spiral relation to the aperture and in axially offset relation to an adjacent section of the remainder of said end surface; and a duct for supplying liquid to the chamber extending through a lateral wall portion thereof adjacent to, and in axial offset relation to, the region of the chamber occupied by the insert.

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