United States Patent [19]

Richter

[11] **3,913,838**

[45] **Oct. 21, 1975**

[54] **CLOG-PROOF LIQUID DISTRIBUTION DEVICE**

[75] Inventor: **Johan Christoffer Frederik Carl Richter,** St. Jean Cap Ferrat, France

[73] Assignee: **Xerox Corporation,** Stamford, Conn.

[22] Filed: **Aug. 23, 1974**

[21] Appl. No.: **500,015**

[30] **Foreign Application Priority Data**

Aug. 30, 1973 Sweden 73117756

[52] **U.S. Cl.** **239/225;** 239/246; 239/561; 239/601

[51] **Int. Cl.²**... **B05B 3/00;** B05B 1/14; A62C 31/02

[58] **Field of Search** 239/225, 559, 567, 246, 239/561, 601

[56] **References Cited**

UNITED STATES PATENTS

1,717,904	6/1929	Abernethy	239/284
1,876,389	9/1932	Bird et al.	239/284 X
2,161,865	6/1939	Hobstetter et al.	239/450
2,859,064	11/1958	Nelson	239/246 X
3,737,101	6/1973	Johnson	239/225

Primary Examiner—Lloyd L. King

Attorney, Agent, or Firm—Robert J. Bird

[57] **ABSTRACT**

A clog-proof liquid distribution device for use in a mixing container for supplying treatment liquid to a comminuted material flowing through the container. The device is disposed for axial rotation in a substantially cylindrical container so that the hollow supply shaft extends longitudinally in the container and at least one arm extends radially outward therefrom, transverse to the direction of flow of the material. The arm contains a chamber which receives the liquid from the hollow shaft and distributes it through a plurality of orifices to a plurality of wedge-shaped nozzles fanning outward towards the rear of the arm in the direction opposite the direction of rotation of the arm. The orifices can be varied in size along the arm so as to permit varying amounts of liquid to be supplied to the material to effect substantially uniform treatment thereof.

4 Claims, 3 Drawing Figures

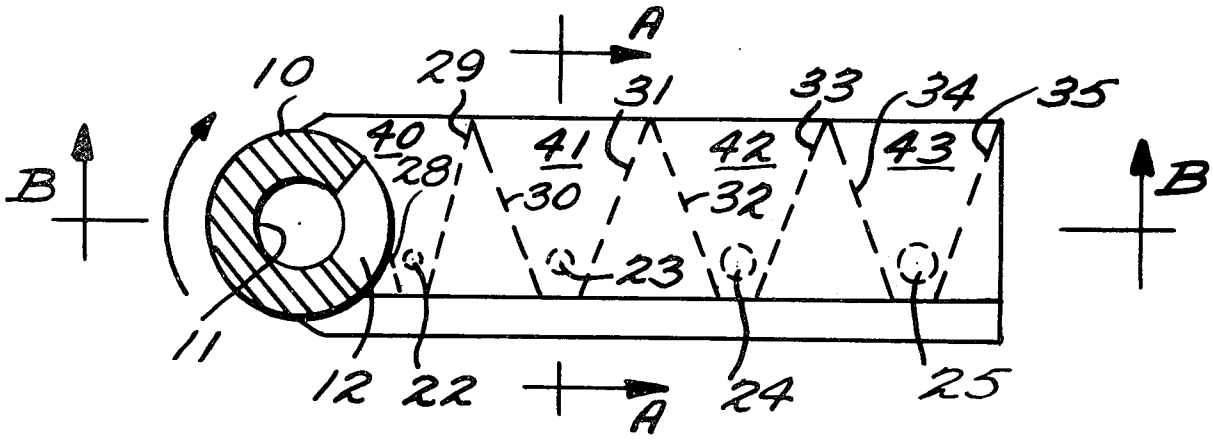


Fig. 1.

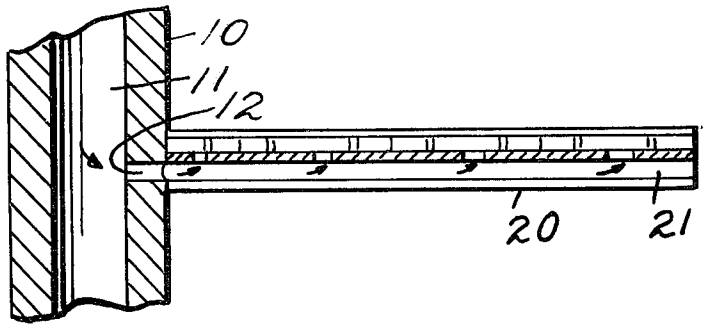


Fig. 2.

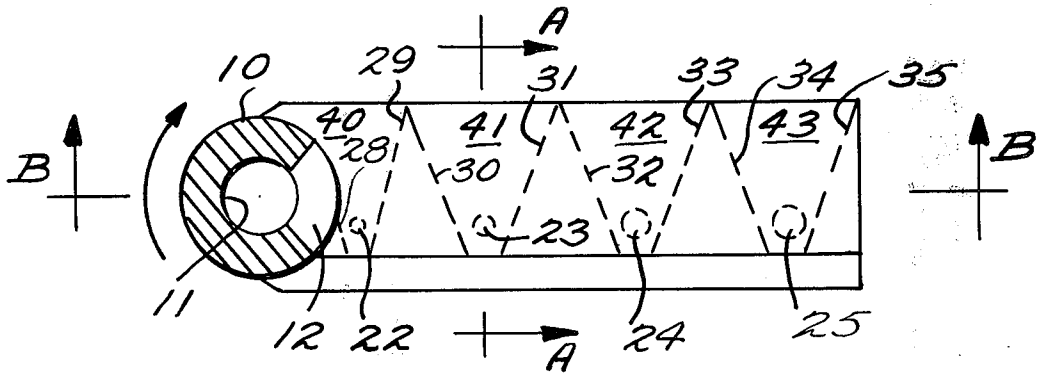
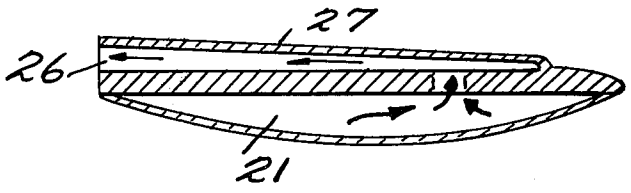


Fig. 3.



CLOG-PROOF LIQUID DISTRIBUTION DEVICE

The present invention relates to a device for distribution of liquid preferably over the cross-section of a standing, substantially circular container, through which finely comminuted material, e.g. cellulose pulp, untreated or more or less cooked chips, straw or similar material, is moving substantially continuously in the lengthwise direction of the container, to which finely comminuted material it is desirable for dilution, washing or for other treatment, e.g. of chemical type, to add a liquid quantity evenly distributed over the cross-section of the container.

During addition of liquid to finely comminuted material which for example, takes place by means of the arm 71 in the U.S. Pat. No. 3,078,703, it is of greatest importance partly that the liquid can be distributed evenly to the material and partly that the construction is such that one has the greatest possible safety for the finely comminuted material not plugging the liquid outlet openings. The present invention has as a main object to provide such a device by suitable construction and design of the arm and its hollow parts.

The distribution of liquid is accomplished mainly by distributing the liquid, which is to be added lengthwise in the device, by means of a number of suitable openings in the inside of the device and that the device has liquid outlet openings of relatively low height and relatively great width. An even distribution of the liquid over the container cross-section is also accomplished by means of the movement of the device through the finely comminuted material.

If the addition of liquid for any reason should stop and finely comminuted material flows into the openings and passageways for the liquid, the design must be such that at renewed starting the liquid passages will not remain blocked and the liquid must easily be able to clean out the material which has come into the liquid passages. This is accomplished by the present invention mainly by having the nozzle openings with a conical shape both heightwise and sidewise with the wider end of the openings at the outside.

The preferred embodiment of the invention shall be described in detail with reference to the drawing, in which

FIG. **1** shows a side elevation in cross-section taken along line B—B of FIG. **2**;

FIG. **2** shows a top plan view in partial cross-section of the preferred embodiment; and

FIG. **3** shows an enlarged cross-section of the preferred embodiment taken along line A—A of FIG. **2.**

The distribution device shown on the drawing consists of an arm **20** which e.g. by means of welding, is fastened to a rotatable and driven shaft **10** provided with at least one cavity **11.** The shaft can be considered to rotate centrally in a mainly cylindrical container (not shown) and having its axis of rotation disposed in the lengthwise direction of the container. The container can be completely or partly filled with finely comminuted material suspended in any liquid, e.g. cellulose pulp, and be either open or closed. The contents of the container can therefore be in a phase of treatment under pressure, a vacuum or at atmospheric pressure. Furthermore, the device is primarily intended for use during continuous conditions, i.e., when finely comminuted material is continuously being fed into one end of the container and continuously out of the other end. The arm **20** which by the rotation of the shaft is moving

through the material in the container, can, as FIG. **3** indicates, preferably have a shape which gives small flow resistance. The arm **20** consists in its radial direction mainly of a long, closed chamber **21,** into which liquid from the cavity **11** of the shaft **10** flows through at least one opening **12** in the shaft wall. In the upper part of the closed chamber **21** is arranged a number of holes which can vary in size and number and which in FIG. **2** are shown as numbers **22, 23, 24,** and **25.** Through these holes the liquid flows from the closed chamber **21** out into a number of nozzle-shaped chambers **40, 41,** 42, and **43.** Each of the chambers **40, 41, 42** and **43** consists of a wedge-shaped chamber both heightwise and widthwise; the sides of chambers being defined by **28, 29, 30, 32, 32, 33,** and **34, 35** respectively, and the top and bottom being defined by number **27** and the upper wall of chamber **21** respectively. In this way each nozzle has, in the direction of the liquid flow, an expanding cross-section both in heightwise and in sidewise direction. If for some reason, e.g. during a stop, finely comminuted material should penetrate into the nozzle-shaped chambers **40, 41, 42, 43,** a plug is easily built up due to the inwards decreasing cross-section which on the other hand later on during start up due to the outwards increasing cross-section of the walls is easily pushed out due to the flow of liquid.

The holes **22, 23, 24, 25** are, with regard to number and size, arranged so that the total cross-section of each nozzle is increasing in proportion to the nozzle distance from the container center in such a way that each nozzle shaped chamber **40, 41, 42** or **43** receives more liquid the greater distance it is situated from the rotating center of the shaft **10.** In this way, uniform distribution of liquid in the container to the comminuted material is accomplished.

Also, it is preferred that in utilizing the present invention that the fluid is ejected from each of the nozzle shaped chambers **40, 41, 42** and **43** at a velocity equal to the tangential velocity of each nozzle as it is rotated in the container but in the opposite direction of rotation of the chambers, so that the fluid is substantially at rest when it contacts the comminuted material. This guarantees the best possible even treatment of the material with the fluid. Still another advantage is obtained if the height of the nozzle openings is dimensioned so that during one revolution of the shaft the nozzles leave behind a liquid layer mainly of the same thickness as the height of the nozzles and which for each complete revolution of the shaft, and thereby also of the arm, constitutes a total quantity of liquid which corresponds to the nominal quantity which it is desired to add to the forward flowing, finely comminuted material during the time it takes for the shaft to rotate one revolution.

Naturally, the exact design of the above-described distribution device can be varied. For example, more distribution arms be used in the same container for the same or different liquids, different temperatures etc. Furthermore, different liquids can, by means of the same arm, be distributed at different radii by adding the liquids through separate lines of addition through the shaft and into the arm.

The invention is not limited to what has been described above but can be modified within the frame of the following claims.

What is claimed is:

1. An anti-clog device for even distribution of treatment liquid over the cross-section of a standing, mainly

circular container, through which finely comminuted material can be moved in the lengthwise direction of the container, said device consisting of at least one arm with nozzle openings arranged with partly streamlined cross-section, which arm is fastened to a driven, rotating shaft, through which liquid can be added, the liquid flows through an opening in the shaft into a chamber in the lengthwise direction of the arm, which chamber is built with a mainly horizontal top part provided with orifices, which the orifices open into a plurality of nozzles which widen toward the back part of the arm in both the widthwise and heightwise direction where each nozzle is ended in a narrow opening of relatively great width and small height and where two adjacent nozzles have openings located close to each other, so that the whole back side of the arm is substantially made up of nozzle openings.

2. A device according to claim **1,** wherein each nozzle is connected with the chamber in the lengthwise direction of the arm through one or more orifices with a cross-sectional area of a magnitude in proportion to the respective nozzle distance from the shaft, whereby

each portion of the comminuted material flowing through the container will be allotted approximately the same quantity of treatment liquid by the nozzles independently of the distance of the portion from the container shaft.

3. A device according to claim **2,** wherein the orifices cross-sectional areas are adjusted so that the liquid is leaving the nozzle openings with a velocity which approximately corresponds to the average tangential velocity of the respective nozzle opening but directed in the opposite direction.

4. A device according to claim **1,** wherein the nozzle openings have a height so that at one revolution of the shaft in the container the nozzles will leave behind a layer of liquid with the same thickness as the height of the nozzles, whereby the nozzles substantially cover the whole cross-section of the container and provide a total quantity of liquid corresponding to the nominal quantity it is desired to add to the finely comminuted material during the time it takes for the shaft to rotate one revolution.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,913,838 Dated October 21, 1975

Inventor(s) Johan Christoffer Fredrik Carl Richter

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Heading Page, Block [73], change "Xerox Corporation, Stamford, Conn." to --Kamyr Aktiebolag, Karlstad, Sweden--. Heading Page, Column 2, change "Attorney, Agent, or Firm - Robert J. Bird" to read --Attorney, Agent, or Firm - CUSHMAN, DARBY & CUSHMAN--.

Signed and Sealed this

twenty-seventh Day of *April 1976*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks