METHOD FOR DISPERSING AN IMMISCIBLE FIGMENT IN VISCOSE SOLUTION

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METHOD FOR DISPERSING AN IMMISCIBLE PIGMENT IN VISCOSE SOLUTION

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The present invention relates to a method for uniformly distributing an immiscible pigment in a viscous solution whereby the solution can be extruded to form filamentous threads, fibers, and the like having uniformly modified characteristics.

It is known according to Dutch Patent No. 21,749 to mix liquid or solid substances in spinning solutions by adding them in the feed lines to the spinning machines. This mixture is passed through finely perforated plates and thence to a tank which may be formed by increasing the cross-section in the feed line. This tank is provided with a mixing device of the impeller type which rotates at a sufficiently high rate of speed to effect a thorough dispersion. The substance to be added may be first mixed with a small quantity of the original spinning solution and this mixture introduced into the feed lines. However, this process has certain objections particularly in the case of substances that are difficult to suspend in a finely divided state.

Another conventional method of mixing the substances with spinning solutions is to circulate the same through a pipe system and maintain the rate of circulation higher than the rate at which it is discharged so that a certain amount of the circulating mixture is always contacting a fresh supply of the solution containing the additive agent. (See U. S. Patent No. 2,136,201 and Dutch Patent No. 18,811.) Although this circulation has a favorable influence on the distribution, it is not entirely satisfactory to produce a uniform suspension and thereby an end product of the desired characteristics.

It is therefore an object of the present invention to provide an improved process whereby immiscible pigments can be continuously introduced into a viscous spinning solution and distributed uniformly throughout the said solution in a confined mixing zone, and a portion of the mixture then drawn off continuously from said zone.

It is another object of the invention to uniformly disperse immiscible pigments in viscous spinning solutions by circulating a spinning solution containing a suspended substance through a confined mixing zone which consists of a primary and an overlapping secondary ring main, the rate of circulation in the secondary ring main being substantially higher than in the primary ring main and the direction of circulation in the zone of overlap being opposite to the direction of circulation in the remainder of the primary ring main.

Other objects and advantages of this invention will be apparent upon consideration of the following detailed description when considered in conjunction with the accompanying drawing, wherein the single figure represents a diagrammatic form of an apparatus that can be successfully used for carrying out the process. In the following description it will be noted that the drawing is very schematic in view of the fact that the pipe lines, gear pumps, etc., are of the conventional type and it is their particular arrangement and co-action that comprise the present invention. Whereas the same system can be successfully employed for modifying the characteristics of various types of viscose solutions by adding the required immiscible substances, the description of the drawing will be confined to the preparation of a viscose-carbon black mixture for the production of so-called black, spun viscose thread.

Referring to the drawing, the numerals 1, 2, 3, 4 and 5 indicate branch lines for conducting a viscose-carbon black mixture to a spinning machine (not shown) by means of spinning pumps 6, 7, 8, 9 and 10. The branch lines are fed from a primary ring main 11, and the circulation of the mixture is effected by means of a gear pump 12. Fresh viscose containing no carbon black is conducted from a source, not shown, through a conduit 13 into the primary ring main 11. A concentrated suspension of carbon black in viscose is prepared in an auxiliary tank 14 from which the suspension passes through conduit 15 and is forced into the primary ring main by means of gear pump 16 at a point between the primary ring main circulating pump 12 and the junction of viscose conduit 13 and primary ring main 11.

A secondary or auxiliary mixing ring main 17 is provided between the pump 12 and the branch lines 1, 2, 3, 4 and 5. Gear pump 18 in the secondary ring main 17 forces the viscose in the direction shown by the arrows, viz., in a counter-clockwise direction, so that the flow through that portion of primary ring main 11, which overlaps or is common to both the primary and secondary ring, is in the opposite direction to the flow in the remainder of the primary ring main 11. (For the direction of flow of the mixture, see the arrows in both the primary and secondary ring mains.)

It will be seen from the above that the apparatus according to the invention generally consists of a primary ring main provided with the proper connections for supplying the viscous liquid and the substances to be added, discharge lines to the spinning machine and a pump for circulating the mixture. The apparatus is specifically characterized by at least one auxiliary or secondary ring main provided with a circulation pump and connected to the primary ring main.

It is an important part of the invention that the flow of the liquid in that part of the line which coincides with the primary ring main, is opposite to the direction of flow in the remaining part of the primary ring main. Furthermore, according to the process the rate of flow of the mixture to the spinning machine through the branch
The rate of circulation through the primary ring main is lower than the rate of circulation through the auxiliary ring line. For example, the flow through the primary ring main should be at least twice as high as the quantity of spinning solution consumed by the spinning machine, and the flow through the auxiliary line should be at least four times as high as the quantity consumed by the spinning machine. In the practical application of the process it has been found particularly suitable to effect a flow through the auxiliary ring line 8 or 6 times higher than that of the flow through the primary main. The combined effect of the opposite direction of flow and the relatively higher rate of circulation in the secondary main is to cause the well mixed spinning solution to commingle with the partially mixed spinning solution to produce a very uniform distribution of the substance within the liquid.

The point where the pipes 13 and 15 come together and from that point downstream through the pump 12 may be regarded as an input zone for the material to be mixed. That input zone, as indicated by changes in high pipe 18 and straight through the point Q to a point of division P. From the point P some of the material goes to the discharge zone and the remainder is recycled through point Q as indicated by arrows in the drawing.

Although the circulating pumps are preferably of the positive displacement type, such as a gear pump, other types of pumps may be employed for the same purpose.

In many instances it is desirable to control the temperature of the mixture circulating through the pipe system, because many spinning solutions are susceptible to heat change. Accordingly, this invention lends itself particularly well to such temperature control, for means can be provided for heating or cooling of the liquid in the secondary ring main, which may preferably be isolated from small size piping. This, plus the circulation of the liquid at high velocities, is conducive to good heat exchange.

The invention is applicable to all types of processes in which immiscible substances are uniformly dispersed through the body of spinning solutions such as viscose, cellulose acetate, casein, artificial resins, etc., and in wet as well as in dry spinning. Many types of substances are suitable for use in the process, e.g., those which are already finely divided, or which can be finely divided, in the form of an emulsion. However, the invention is particularly suitable for the addition of those types of substances which do not form stable mixtures and which are difficult to distribute evenly in a finely divided state.

Among these types of substances are the pigments such as titanium dioxide, carbon black (particularly gas carbon black), pigment-like organic nitrogen compounds for animalizing the solution, emulsifiable substances such as oils, for example, liquid paraffin, fats, fatty and oil derivatives, artificial resins, particularly in the form of polymerization or condensation products, natural resins, latex, soaps, etc. In the case of adding solid substances such as the pigments, it is often desirable to suspend or emulsify them in a small quantity of the original spinning solution, and sometimes it is necessary to add an emulsifying or dispersing agent to facilitate the pre-mixing.

The pre-mix can then be introduced into the system herein disclosed by adding it to the auxiliary tank (4). The following example will serve to illustrate one mode of operation of this system to produce a spinning solution of viscose-carbon black.

Example.—The total consumption of viscose-carbon black mixture was adjusted at 5 cc. per minute, and the rate of circulation in the primary ring main was adjusted to 4 V cc., while that in the secondary ring main was adjusted to 17 to 24 V cc. per minute. In the pre-mixing tank, viscose and carbon black were mixed in such a proportion that about 30% of carbon black, based on the weight of the cellulose, was suspended in the viscose, and was supplied to the primary ring main in a predetermined quantity to bring the carbon black content to about 2.4% in the spinning solution that was supplied to the spinning machine. The viscose solution obtained in this manner was extremely homogeneous and samples of the rayon spun from this mixture exhibited no color differences.

The quantities given above are only by way of illustration, as it is clear that in the practical operation of the system, changes can be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A process for uniformly dispersing an immiscible pigment in a viscose solution which comprises continuously introducing viscose and pigment into an input zone, continuously delivering the mixture from the input zone to a discharge zone, continuously withdrawing a portion of said viscose-pigment mixture from said discharge zone, continuously returning the remaining portion from said discharge zone to the input zone, and during the delivery of said mixture from said input zone to said discharge zone, increasing the homogeneity of said mixture by dividing the flow of mixture at a point downstream from the input zone and upstream from the discharge zone into two streams, and returning one of said streams to a point upstream from the point of division but downstream from the input zone.

2. A process for uniformly dispersing immiscible pigment in a viscose solution which comprises continuously introducing viscose and pigment into an input zone, continuously delivering the mixture from the input zone to a discharge zone, continuously withdrawing a portion of said viscose-pigment mixture from said discharge zone, continuously returning the remaining portion from said discharge zone to the input zone, and during the delivery of said mixture from said input zone to said discharge zone, increasing the homogeneity of said mixture by dividing the flow of mixture at a point downstream from the input zone and upstream from the discharge zone into two streams, and returning one of said streams to a point upstream from the point of division at a rate of flow greater than the rate of flow of the mixture from the input zone to the discharge zone.

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