

[72] Inventor **John J. Quackenbush**
Monroe, Conn.
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 [73] Assignee **National Distillers and Chemical Corporation**
New York, N.Y.

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Primary Examiner—William D. Martin
 Assistant Examiner—Raymond M. Speer
 Attorney—Allen A. Meyer, Jr.

[54] **APPARATUS FOR COATING ELONGATED FILAMENT WITH PLASTIC**
5 Claims, 2 Drawing Figs.

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 FB, 232; 118/308, 69, 310, 325, 405, 309, 419,
 420, 69

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ABSTRACT: Elongated filaments, such as yarn, thread, string and rope are moved through an elongated tube having an internal diameter greater than the exterior diameter of the filament. An inlet connection to the tube is connected to a source of dry plastic powder which is blown into the inlet and the tube while the filament is moving through the tube. The powder coats the filament and the filament is moved into a curing oven in which the plastic powders melt and coalesce on the filament with the plastic subsequently being cooled to produce a plastic-coated filament having good water-resistant qualities, a glaze finish and additional strength.

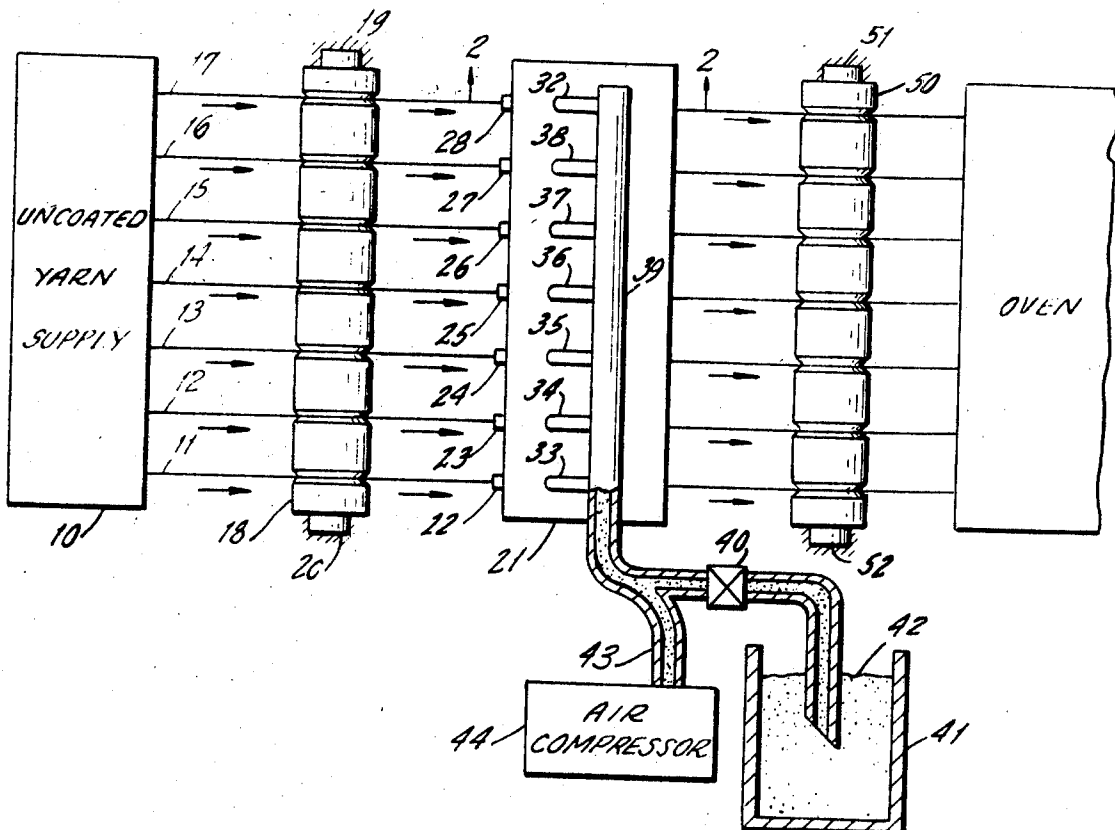


FIG. 1.

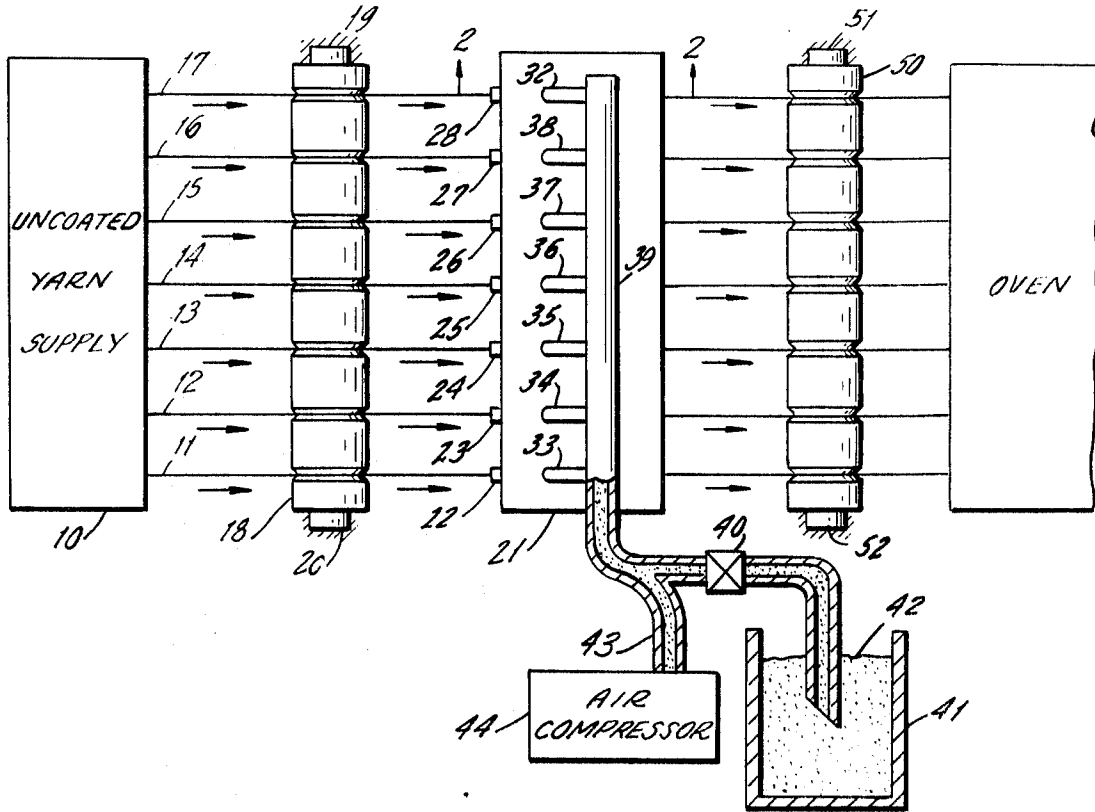
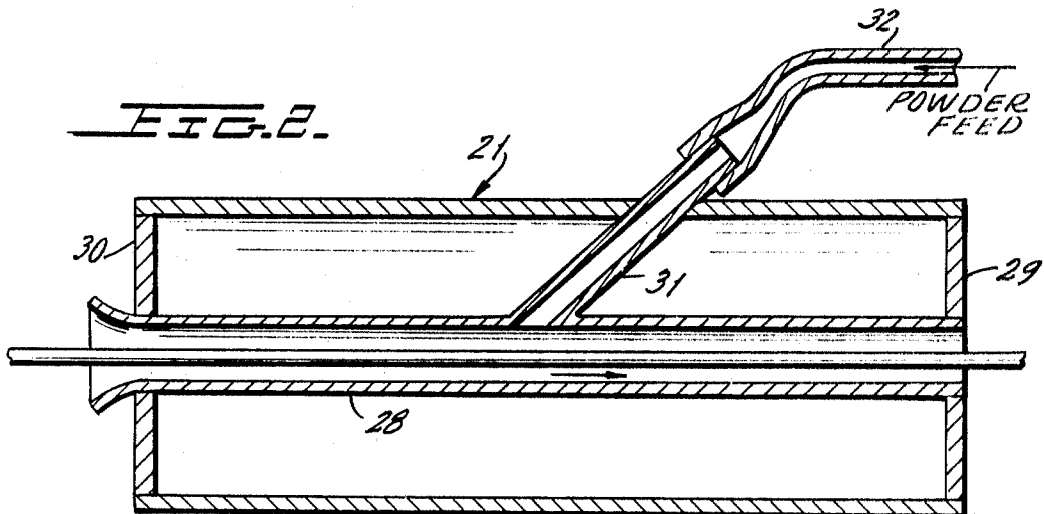


FIG. 2.



INVENTOR.
JOHN J. QUACKENBUSH

BY *Allen A. Meyer, Jr.*
Allen A. Meyer, Jr.
ATTORNEY

APPARATUS FOR COATING ELONGATED FILAMENT WITH PLASTIC

This invention relates to a process for coating elongated filaments with a plastic, and more specifically relates to a novel method and apparatus for coating fibers, yarn, thread, and the like, in order to provide a glaze finish, water-resistant qualities and additional strength to the filaments.

The coating of filaments, such as yarn, with plastic materials is well known. In the past, these coatings were generally applied to the yarn by a wet coating process which is difficult to control, and requires drying in a relatively slow curing process which evaporates moisture. The wet coating process also creates problems due to shrinkage and the resins used are relatively expensive.

In accordance with the present invention, the filaments are moved through an elongated hollow cylinder which is centrally connected to a source of a powdered thermoplastic medium which is carried into the elongated tube by a suitable flow of a carrier gas. The dry powder deposits upon the filament to be coated, with the filament and powder coating being carried into an oven for melting and coalescing the dry powder into a filament coating with the melted coating being subsequently hardened by cooling.

By using a dry coating process, control of the coating is relatively easily obtained by controlling the particle density applied to the fibers while the curing operation is simplified, since there is no need, when using thermoplastic particles, to evaporate moisture in order to set the plastic. Moreover, shrinkage of porous-type filaments is also avoided.

Accordingly, a primary object of this invention is to provide a novel apparatus for coating filaments with plastic which uses a dry powder plastic product.

Yet another object of this invention is to provide a novel plastic coating apparatus and method for coating elongated filaments which is inexpensive and can be operated at relatively high speeds.

Still another object of this invention is to provide a novel apparatus for coating filaments with a plastic glaze finish, and to impart water resistant-qualities to the filaments and increase the strength of the filaments without causing uncontrolled shrinkage of the filament.

These and other objects of this invention will become apparent from the following description when taken in connection with the drawings in which:

FIG. 1 is a schematic top view, partially in cross section, of the novel coating apparatus of the present invention.

FIG. 2 is a cross-sectional view of FIG. 1 taken across section line 2-2 in FIG. 1, and illustrates a single coating tube in detail.

Referring now to FIGS. 1 and 2, the apparatus consists of a suitable filament supply 10 which could typically comprise a plurality of reels of yarn or other suitable filaments, with FIG. 1 illustrating seven parallel yarn elements 11 to 17 which are each moved in the direction shown by the arrows. Each of yarns 11 to 17 are carried over suitable rollers, schematically illustrated by a common wrap around roller 18, which is rotatably mounted in schematically illustrated pivots 19 and 20, and then enter the coating chamber 21 which is the subject of the present invention.

The chamber 21 contains a plurality of elongated hollow metallic tubes, such as tubes 22 to 28, which receive yarn elements 11 through 17, respectively. Each of tubes 22 to 28 are constructed in an identical manner, and are typically illustrated in cross section in FIG. 2 for the case of tube 28. It will also be seen in FIG. 2 that the tube 28, which may have a length of about 10 inches and an internal diameter of about one fourth inch, is supported at either end by being suitably secured in the end walls 29 and 30 of the support enclosure. Clearly, each of tubes 22 to 28 are disposed parallel to one another and in a common plane.

Each of the tubes then has an extending portion, such as extending portion 31 of tube 28, which forms an angle of about 45° to the tube axis and an interior diameter of about one fourth inch. Tube 31 is then connected to a hose 32 or some other suitable conduit where the hose 32 and the hose members 33 to 38 for tubes 22 to 27 are connected to a common manifold tube 39. The manifold tube 39, which may have an interior diameter of about 2 inches, is then connected through a suitable valve 40 to a powder supply hopper 41 which contains a supply 42 of a powdered thermoplastic material. By way of example, the powder 42 may be a finely ground polyethylene powder having particle sizes of from 10 to 150 microns, such as the powder type FN-510-86, available from U.S. Industrial Chemicals Co.

A connection is then made to manifold 39 which includes connecting hose 43, which is connected to air compressor 44, which injects air flow into conduit 39 beyond hoses 32 to 38, thereby causing negative pressure to the right of valve 40, which is suitably opened, to carry powdered particles into hoses 32 to 38. Note that the powder density can be controlled by a combination of air compressor pressure and the control of valve 40 to obtain any desired powder density injected into the various coating tubes 22 to 28.

After the yarn members 11 to 17 leave the coating chamber 21, they are applied to a suitable tension wrap-roller 50 which may be a driven roller connected to some suitable drive motor (not shown), and which is rotatably supported in suitable bearings, schematically shown as bearings 51 and 52. The yarn is thereafter fed into a suitable oven which has a length and temperatures which are determined by the time and temperature and speed of yarn movement required to fuse the plastic particles on the filaments. The filaments are then moved out of the oven and are appropriately cooled to fix the plastic coating.

In a typical coating operation, using the 10 to 30 micron polyethylene powder type FN-510-86, the yarn elements 11 to 17 can move through the coating apparatus about 600 feet a minute. The yarn to be coated is a cotton yarn having a diameter of about one-sixteenth of an inch. The oven temperature is held at about 400° F. with the yarn moving through an oven length of about 100 feet. The powders fuse on the filament when the yarn temperature reaches from 245° F. to 310° F. Thereafter, the yarn is passed through a blast of cooling air (not shown) in order to solidify the plastic, and the yarn is then rolled into bobbins or on other suitable storage rollers.

Although this invention has been described with respect to its preferred embodiments, it should be understood that many variations and modifications will now be obvious to those skilled in the art, and it is preferred, therefore, that the scope of the invention be limited not by the specific disclosure herein, but only by the appending claims.

The embodiments of the invention in which I claim an exclusive privilege or property are defined as follows:

1. Apparatus for coating elongated filaments with plastic comprising a plurality of thin, elongated, hollow tubes disposed parallel to one another for receiving individual filaments, means for moving said filaments through said tubes at a predetermined speed, means for providing a source of dry plastic powder suspended in air, including a plastic powder supply hopper and an air compressor; a plurality of conduits, each of which is connected to a central portion of each thin, elongated, hollow tube, a common manifold connecting said source to said conduits, the said air compressor communicating with the common manifold at a point between said conduits and said hopper; supply means for supplying a continuous filament to one end of each tube and oven means receiving said filaments as they emerge from the opposite end of said tubes; whereby said filaments are coated with plastic powder as they pass through said tubes, and the plastic powder adhering to said filaments is fused into a single continuous coating in said oven.

2. The apparatus of claim 1, which includes a valve in said manifold between said compressor and said hopper.

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3. Apparatus for coating elongated filaments with plastic, comprising a plurality of thin, elongated, hollow tubes disposed parallel to one another for receiving individual filaments; means for moving said filaments through said tubes at a predetermined speed; a plurality of conduits, each of which is connected to a central portion of each thin elongated hollow tube; a common manifold, communicating near one end with said conduits, and near its other end with an air compressor and a plastic powder supply hopper, said air compressor communicating with said manifold at a point between said conduits and said supply hopper, said manifold having a valve between said compressor and said hopper; supply means for

supplying a continuous filament to one end of each hollow tube; and oven means for heating said filaments after they emerge from said tubes.

4. The apparatus as set forth in claim 1 which further includes cooling means adjacent said oven for cooling said coated filament when said filament leaves said oven.

5. The apparatus as set forth in claim 1 wherein each said conduit forms an acute angle to each said tube and injects powder into said tube, having an axial component of motion against the motion of said filament.

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