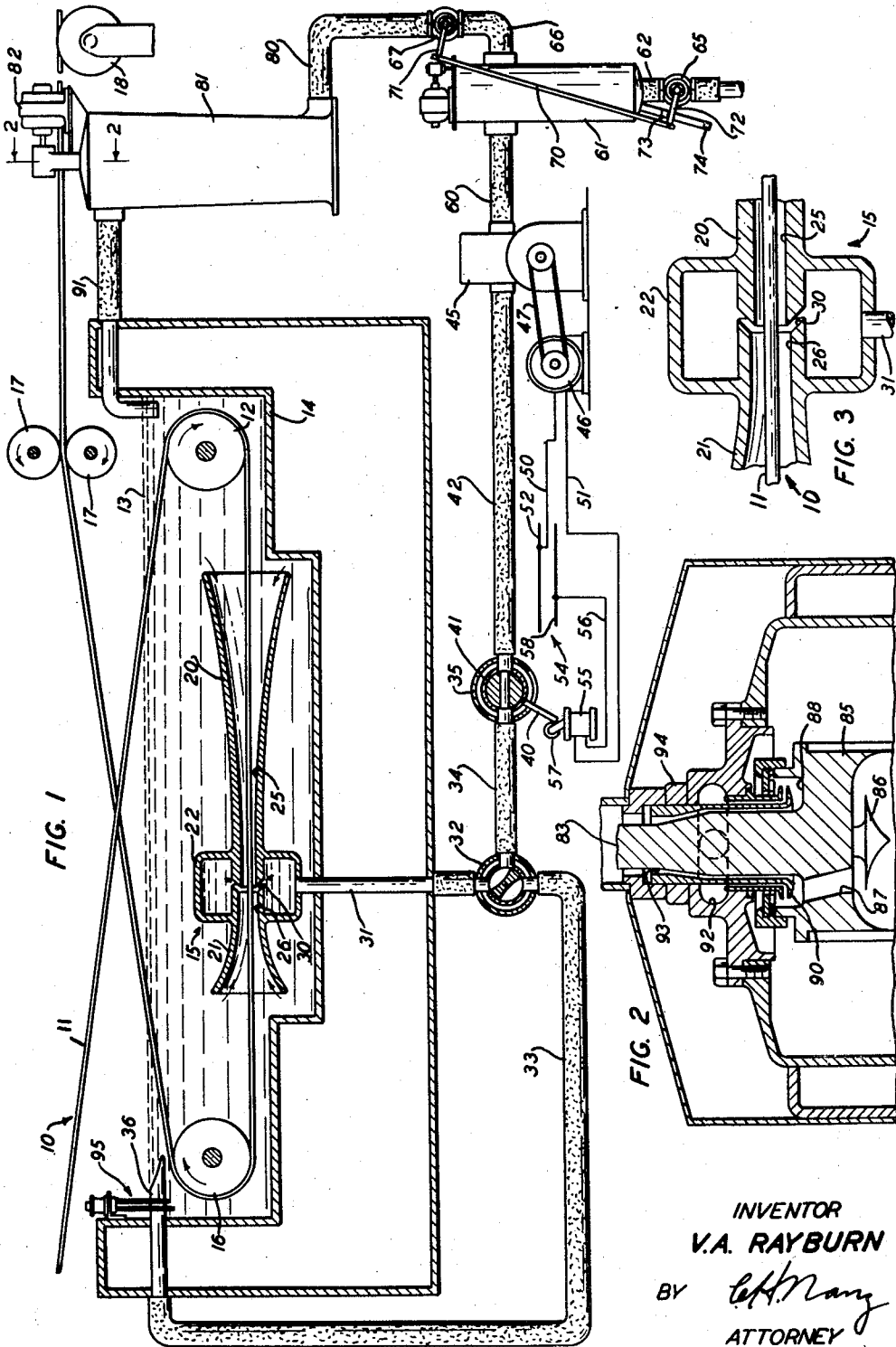


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IMPREGNATING APPARATUS

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## IMPREGNATING APPARATUS

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This invention relates to impregnating apparatus, and more particularly to apparatus for impregnating textile coverings of insulated conductors.

In the manufacture of some types of conductors, insulation, such as, for example, a vulcanized compound including rubber or a synthetic rubber-like material, is formed over a conductor and hygroscopic textile strands, such as, for example, cotton strands, are braided, knitted or sewed over the insulated conductor. The conductor thus covered is advanced through a bath of molten asphalt or other saturating material to impregnate the textile covering on the insulated conductor.

Hygroscopic textile coverings have moisture and air in the interstices thereof, and the moisture is volatilized by the molten impregnating material as the covered conductors are advanced through the bath. The volatilized moisture and the air form bubbles in and around the textile coverings, and the bubbles stick tenaciously to the surfaces of the textile coverings thereby forming barriers against impregnation of the coverings by the saturating material. In the past, it has been necessary either to soak the covered conductors in the bath for relatively long periods of time to permit the bubble barriers to disperse, or to remove the barriers by mechanically agitating the covered conductors, as by scraping, to remove the bubble barrier. Where long soaking is employed, there is a possibility that the hot saturating material will overcure, soften, or do both to the insulating compound. Long soaking also tends to loosen the textile coverings on the insulated conductors while in the bath so that the coverings tend to slip with respect to the conductors. Where mechanical agitation is used to remove the bubble barriers, there is danger of abrading the textile coverings, and "sleeving" the loosened coverings. That is, the coverings are broken completely away from the insulated conductors and are slid along the conductors. Furthermore, mechanical agitation does not remove bubbles from the innermost interstices of the coverings, which inhibit impregnation of the inner regions of coverings.

An object of the invention is to provide new and improved impregnating apparatus.

A further object of the invention is to provide new and improved apparatus for removing air and steam entrapped in the interstices of and around textile coverings of insulated conductors and impregnating the coverings with asphalt, or the like.

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An apparatus forming one embodiment of the invention includes a container for holding impregnating material, a double entry suction device submerged in impregnating material in the container, means for guiding an article to be coated through the suction device, and means for creating a low pressure in the suction device so that a region of low pressure is produced about the article as it is advanced through the suction device. The low pressure creating means is a high suction, positive displacement pump, and the material drawn from the suction device by the pump is forced through a filter and a defoamer, after which it is returned to the container.

A complete understanding of the invention may be obtained from the following detailed description of an apparatus forming specific embodiment thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a partially sectional view of an apparatus forming one embodiment of the invention;

Fig. 2 is an enlarged, fragmentary, vertical section of the apparatus, and

Fig. 3 is an enlarged, fragmentary, vertical section of a portion of the apparatus.

Referring now in detail to the drawings, an insulated conductor 10 covered by a hygroscopic textile covering 11 is advanced over a guide sheave 12 immersed in molten impregnating material, such as asphalt or the like, retained in a heated tank 14. The covered conductor 10 is advanced through a suction device 15, and around a guide sheave 16 submerged in the impregnating material. The conductor 10 is drawn continuously through the apparatus by means of a pair of wiping rolls 17—17 and a capstan 18.

The suction device 15 includes an elongated entry bellmouthed tube 20 and a shorter exit bellmouthed tube 21, which is substantially shorter than the entry tube 20. The tubes 20 and 21 are arranged in re-entrant positions with respect to each other and communicate at the adjacent ends thereof with an annular manifold 22 formed integrally with the bellmouthed tubes 20 and 21. The entry tube 20 tapers to a long throat portion 25, which has an internal diameter only slightly larger than the external diameter of the covered conductor 10. A throat portion 26 of the exit tube 21 is aligned with the throat portion 25 of the entry tube 20, and is shorter than and has an internal diameter slightly larger than the internal diameter of the throat portion 25. The adjacent

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ends of the tubes 20 and 21 are bevelled complementarily and form a frustoconical passage 30 therebetween, the entrance portion of which points in the direction of travel of the conductor through the tubes 20 and 21.

A steam-jacketed conduit 31 connects the interior of the annular manifold 22 to a steam-jacketed three-way valve 32, which is connected by a steam-jacketed conduit 33 to a skimming nozzle 36 in the tank 14, and by a steam-jacketed conduit 34 to a steam-jacketed, manually operable valve 35. The valve 32 may be selectively actuated to connect either the conduit 31 or the conduit 33 to the conduit 34. A handle 40 of the valve 35 is connected for movement with a key 41 of the valve 35.

A steam-jacketed conduit 42 leads from the valve 35 to a pump 45, which may be driven by an electric motor 46 through a belt 47. The pump 45 is a well known high suction, positive displacement type of pump. Conductors 50 and 51 are connected to the motor 46, and the conductor 50 is connected to a conductor 52 of a power line 54. The conductor 51 is connected to a limit switch 55, which is connected by a conductor 56 to a second conductor 58 of the power line 54. An arm 57 of the switch 55 is positioned in the path of the arm 40 of the valve 35. When the valve 35 is open, the arm 40 engages the arm 57 of the limit switch 55 and holds the limit switch 55 closed so that the motor 46 is energized. When the valve 35 is closed, the arm 40 is moved away from the arm 57 of the switch 55, and the switch 55 opens, whereby the motor 46 is deenergized.

A steam-jacketed conduit 60 connected to the exit of the pump 45 is connected to a steam-jacketed motor driven, self-cleaning filter 61 of a suitable type. The filter 61 serves to strain oversized particles from material forced there-through, which particles collect in the bottom of the filter 61. A drain pipe 62 connected to the bottom of the filter 61 serves to drain the oversized particles from the filter 61 when a valve 65 is opened.

A steam-jacketed conduit 66 connects the exit of the filter 61 to a steam-jacketed valve 67. A link 70 fastened pivotally to an actuating arm 71 of the valve 67 and to an actuating arm 72 of the valve 65 serves to synchronize the operations of the valves 65 and 67. The actuating arm 72 is movable between a position abutting a stop 73 and a position abutting a stop 74. When the arm 72 is in a position abutting the stop 73, the valve 65 is closed and the valve 67 is open. When the link 70 is actuated to move the arm 72 to a position abutting the stop 74, the valve 65 is opened to flush oversized material strained from the impregnating material through the drain pipe 62, and the valve 71 is closed so that the full force of the pump 45 is directed toward forcing the material through the drain pipe 62 to flush the filter 61. Normally however, the valve 65 is closed and the valve 67 is open so that the material filtered by the filter 61 flows through the conduit 66, the valve 67 and a steam-jacketed conduit 80 to a steam-jacketed centrifugal defoamer 81, which is driven by an electric motor 82.

The motor 82 rotates a shaft 83 at a high rate of speed, and a hollow cylinder 85 is rotated by the shaft 83. The filtered material flows up the interior of the hollow cylinder 85 through passages, of which a passage 87 is shown, into a cup 88. When the cylinder 85 is rotated at a high rate of speed, the nonfoamy portion of the ma-

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terial flows upwardly, as viewed in Fig. 2, at the outer portion of the interior of the cylinder 85 and the foamy portion thereof flows upwardly along the central portion of the hollow cylinder 85 and is forced around a deflector 86, which aids in breaking the bubbles forming the foam. As the material is forced upwardly in the cup 88, the nonfoamy portion is forced against the outer portion of the cup 88 and the foamy portion is positioned in the inner portion of the cup 88. An annular nozzle 90 projecting into the outer portion of the cup 88 receives the nonfoamy portion of the liquid, through which nozzle this portion of the liquid is forced by centrifugal force into an annular passage 92. The air from the foamy portion of the material is drawn out of the centrifuge through an annular exhaust passage 93.

The defoamed material is forced by the centrifugal force of the defoamer into and through an exhaust passage 94 to a steam-jacketed conduit 91, which slopes toward the tank 14 so that material flows into the tank by gravity. The exit end of the conduit 91 is immersed in the bath of impregnating material so that the defoamed material does not splash into the bath and bubbles are not formed therein. A level control 95 of standard construction serves to actuate an alarm whenever the supply of impregnating material becomes too low or too high.

In the operation of the apparatus described hereinabove, the covered conductor 10 is advanced over the sheave 12 into the entry bellmouthed tube 20. The path of the covered conductor from the point where it enters the bath 13 of the hot impregnating material to the suction device 15 is long enough to insure that any moisture in the covering 11 is boiled into vapor bubbles by the hot impregnating material prior to the time the suction device 15 is reached. These vapor bubbles form in and around the textile covering and any air in the covering also forms bubbles in those regions.

The suction of the pump 45 draws the material into the entry bellmouthed tube at a relatively high rate of flow. The conductor 10 as it passes through the tube 20 draws the impregnating material through that tube by fluid friction to increase the rate of flow of the material into the tube 20. The velocity of the impregnating material, and hence the velocity pressure thereof, increases as it approaches the constricted throat portion 25 of the tube 20 due to the taper of the tube 20. The static pressure of the material being drawn through the entry tube progressively decreases as the material flows from the large entrance portion of that tube to the throat portion 25 thereof because of the increase in velocity pressure thereof, as in the throat portion of a Venturi tube. The decrease in the static pressure of this portion of the material causes the bubbles of air and vapor to expand. The friction between the inner periphery of the entry tube 20 and the material retards somewhat the flow of the impregnating material relative to the periphery of the covered conductor, whereby the material wipes the bubbles and tends to break them up into smaller bubbles and dislodge them from the covering 11. This action is augmented by the decrease in static pressure of the material. The breaking up of the bubbles into smaller bubbles also tends to dislodge the bubbles from the covering 11. Thus, the wiping action of the material in the entry tube 20 and the decrease in static pressure thereon tend to

break the barrier of bubbles away from the covering 11 and remove the barrier.

The suction head of the pump is high enough to create a flow of material through the exit bellmouthed tube 21 to the manifold 22. The entrance of the frustoconical passage 30 is directed somewhat in the same direction in which the conductor 10 is advanced through the suction device 15 so that the flow of the material through the exit tube 21 is somewhat greater, and that though the entry tube 20 is somewhat less than it would be if the passage 30 were directed radially with respect to the tubes. This is to compensate for the effect of the conductor's movement in augmenting the flow of the material through the entry tube 20 and decreasing the flow in the exit tube 21 so that the flow of the material through the tube 21 balances that through the tube 20.

The exit tube 21 is considerably shorter and slightly larger in diameter than the entry tube 20, the passage 30 is directed toward the tube 21 and the apparent density of the portion of the material flowing through the tube 21 is greater than that of the air and vapor laden portion flowing through the tube 20 because of the bubbles in the last-mentioned portion. These factors cause the momentum of the portion of the material in the tube 21 to be equal to but opposite to the momentum of the portion of the material in the tube 20 despite the momentum imparted to the portion of the material in the tube 20 and that taken from the portion of the material in the tube 21 by the movement of the covered conductor 10. Thus, the stream of material in the tube 21 balances the stream of material in the tube 20 to stop its movement with the conductor, so that all of the material from the tube 20 flows through the passage 30. Also, the portion of the material in the tube 21 prevents escape into the bath proper of the bubbly or foamy portion of the material in the tube 20, whereby these bubbles are removed from the bath. The fact that the throat portion 26 of the tube 21 is larger than the throat portion of the tube 20 permits the foamy material flowing from the tube 20 to expand at the juncture of the two orifices, that is, at the passage 30. All the material being drawn through the entry tube 20 is drawn through the frustoconical passage 30 by the pump 45, and all the vaporized moisture and air in this portion of the impregnating material and the portion of the textile covering 11 adjacent to the passage 30 are drawn through the passage 30. Thus, the barrier of bubbles in and around the covering is completely removed from the bath.

The portion of the material flowing through the tube 21 flows counter to the direction of the covered conductor 10 so that there is a strong wiping action by this portion of the material on the covering 11. This wiping action aids in impregnating the covering and in dislodging any bubbles on the portion of the covering near the passage 30 in the suction device 15.

The covered conductor 10 is advanced from the suction device 15 over the sheave 16 and out of the bath 13, and the covering 11 is thoroughly impregnated as the conductor is so advanced. The covering has been completely freed of moisture and air so that the impregnation thereof may take place rapidly. This portion of the path of the conductor is the impregnating portion thereof and the portion of the path of the conductor from its entrance into the bath to the suction device 15

is the heating or vaporizing portion thereof. The impregnating portion of the path may be quite short due to the rapid impregnation. The vaporizing portion of the path should be somewhat longer than the impregnating portion so that all the moisture is vaporized into steam.

The total path of the covered conductor 10 in the bath 13 is quite short and the speed of the conductor therethrough is high, since long soaking of the covered conductor is not needed to dissipate the bubble barrier. The impregnating material may be kept at a much higher temperature than those ordinarily used in impregnating baths because of the short period of time each increment of the conductor is in the bath, which insures that the insulation on the conductor is not overcured or softened by the impregnating material and that the covering 11 is not damaged by long soaking. The high temperature of the material insures vaporization of the moisture in the cover and a high rate of impregnation, while the high rate of speed of the covered conductor permits surface heating of the covered conductor but substantially prevents heating of the interior regions of the conductor under the covering 11.

The suction created by the pump 45 is sufficiently high to draw any moisture and air in the textile covering 11 on the conductor 10 out of the interstices in the textile covering 11 into the manifold 22. The bubbles and the impregnating material are drawn from the manifold by the pump 45 and are forced through the filter 61 and into the defoamer 81, which removes the bubbles from the material, and forces the material to the tank 14. The capacity of the defoamer 81 is such that it thoroughly defoams all the material pumped thereto by the pump.

The filter 61 filters out any oversized particles, which sometimes are formed by congealing of the material, and is particularly useful when a caking material, such as asphalt, is used as the impregnating material. The material is constantly defoamed by the defoamer 81 so that any air and gas bubbles in the impregnating material are constantly being removed therefrom, and the air and gas bubbles are prevented from entering the bath proper. The temperature of the impregnating material is kept high enough to volatilize any moisture in the covering, which is hygroscopic, and the moisture is removed therefrom along with air and other gases.

To remove foam from the bath 13, as after prolonged shutdowns, the valve 32 may be actuated to connect the conduit 33 to the conduit 31. The foamy portion of the material, which rises to the surface of the bath, is drawn into the upwardly facing skimming nozzle 36 and is filtered and defoamed. The upwardly facing skimming nozzle draws the foamy portion of the material therethrough with minimum disturbance of the non-foamy portion of the material in the bath.

What is claimed is:

1. An apparatus for coating filaments, which comprises a container for holding a bath of coating liquid, means for advancing a filament through the coating liquid, a suction device through which the filament is advanced by the filament-advancing means, said suction device being immersed in the coating liquid and including a pair of bellmouthed tubes spaced slightly apart in alignment with each other and facing away from each other, and means for creating a suction head in the ends of the tubes nearest to

each other to draw the coating liquid through the tubes.

2. An apparatus for impregnating textile covered conductors with asphalt, which comprises a container for holding a supply of molten asphalt, a suction device immersed in the molten asphalt and including an elongated entrance bellmouthed tube, a relatively short exit bellmouthed tube and an annular manifold securing the tubes in aligned positions in which the small ends thereof are spaced slightly apart, the small ends of said tubes being bevelled complementarily to form a frustoconical passage therebetween, said passage being directed from the exit tube, means for creating a suction head in the annular manifold, and means for advancing a conductor having a textile covering thereover seriatim through the entrance tube and the exit tube.

3. An apparatus for coating filaments, which comprises a container for holding a bath of coating liquid, means for heating the liquid, means for advancing a filament through the coating liquid, a suction device through which the filament is advanced by the filament-advancing means and being immersed in the coating liquid, said suction device including a pair of bellmouthed tubes spaced slightly apart in alignment with each other and facing away from each other, means for creating a suction head in the ends of the tubes most adjacent to each other to draw coating liquid from the tubes and to draw any gases from the filament, means for filtering the coating liquid drawn from the tubes, and means for defoaming the coating liquid drawn from the tubes.

4. An apparatus for impregnating textile covered conductors with asphalt, which comprises a container for holding a supply of molten asphalt, a suction device including an elongated

entrance bellmouthed tube having a throat portion of a predetermined diameter, a relatively short exit bellmouthed tube having a throat portion of a diameter larger than that of the throat portion of the entrance tube and an annular manifold securing the bellmouth tubes in aligned positions in which the ends of the throat portions thereof are spaced slightly apart, the ends of the throat portions of the tubes being bevelled complementarily to form a frustoconical passage therebetween, said passage having an entrance portion and an exit portion, the entrance portion of said passage being directed toward the exit tube means for creating a suction head in the manifold to draw the asphalt through both of the bellmouthed tubes and the frustoconical passage, and means for advancing a conductor having a textile covering seriatim through the entrance tube and the exit tube.

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#### REFERENCES CITED

The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

Number	Name	Date
19,316	Thayer et al. ....	Feb. 9, 1858
275,859	Robertson .....	Apr. 17, 1883
1,028,827	Nehring .....	June 4, 1912
1,263,858	Cole .....	Apr. 23, 1918
1,338,624	Heppes et al. ....	Apr. 27, 1920
1,501,764	Flint .....	July 15, 1924
1,588,748	Koch .....	June 15, 1926
1,785,037	Martell .....	Dec. 16, 1930

#### FOREIGN PATENTS

Number	Country	Date
194,796	Great Britain .....	Mar. 19, 1923