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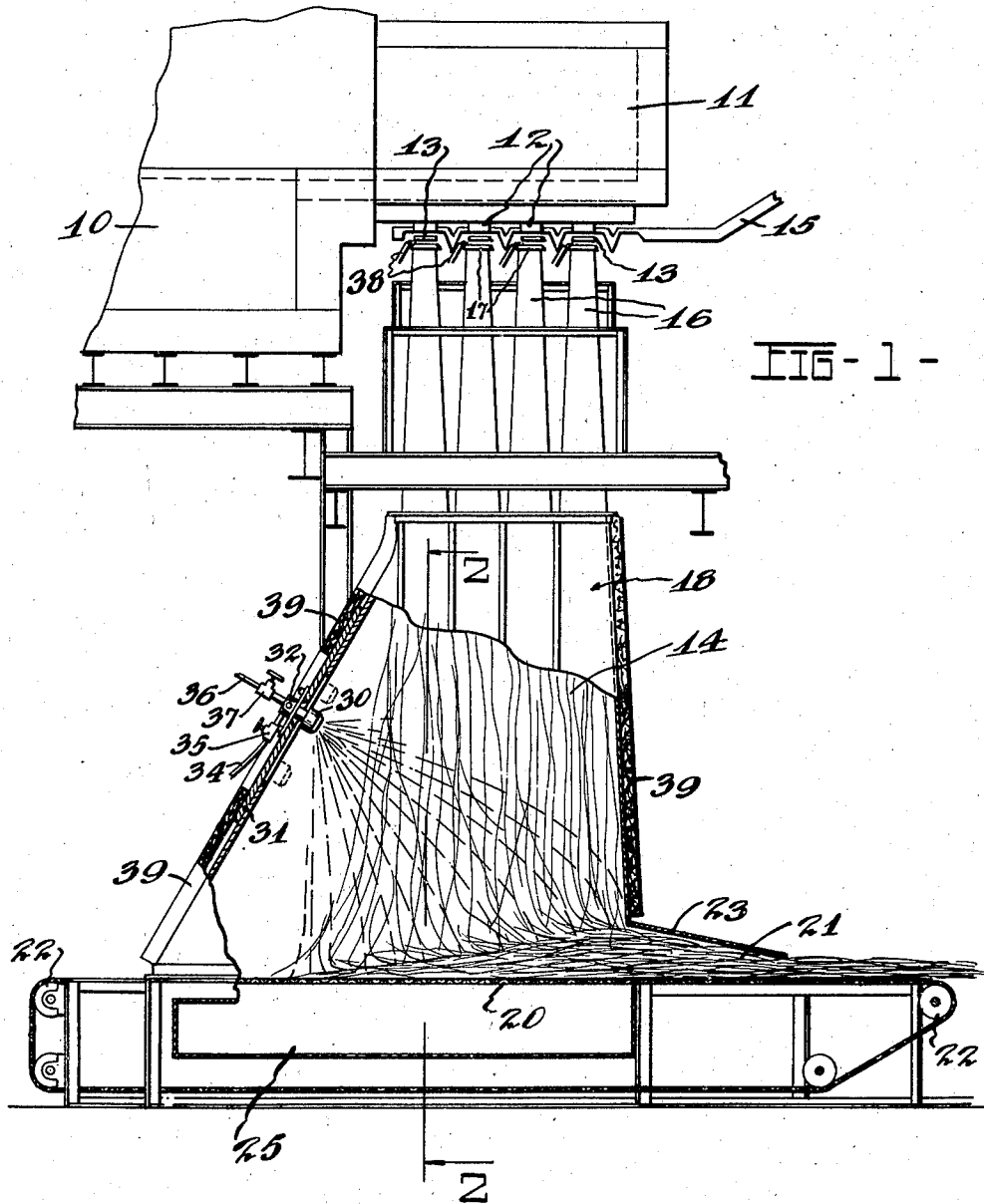
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METHOD FOR APPLYING COATINGS TO FIBERS IN MAT FORM

Filed June 22, 1936

2 Sheets-Sheet 1



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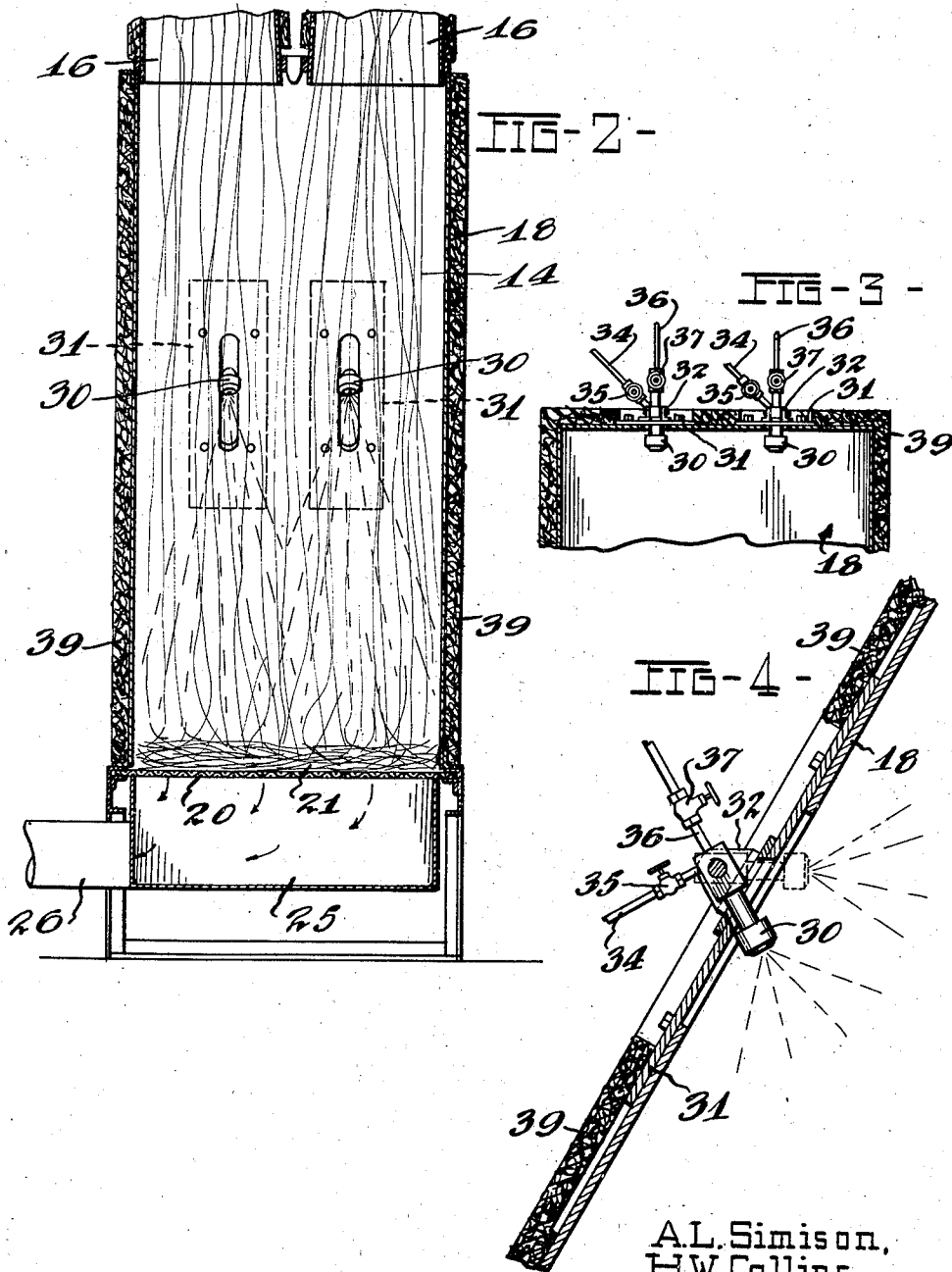
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UNITED STATES PATENT OFFICE

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METHOD FOR APPLYING COATINGS TO
FIBERS IN MAT FORM

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2 Claims. (Cl. 154—2)

The present invention relates to a method and apparatus for forming a mat of fibrous material and for applying a coating to the fibers uniformly throughout the mat.

In the manufacture of mats of fibrous material such as glass wool mats or bats or the like, it has been found advantageous to apply a coating material such as an oil or other suitable substance in liquid or plastic form to the fibers. In the conventional methods of application, it has been customary to apply the coating material in the form of a spray at the point of formation of the fibers and to depend upon the application of the oil to the fibers while carried by a gaseous vehicle.

This method of application we have found to have serious disadvantages and limitations. The oil in spray form consists of a multiplicity of drops or globules which have diameters relatively large in comparison to the fibers which are to be coated. Although the atmosphere may be filled with a multiplicity of individual drops or globules, nevertheless, the fibers in their rapid passage through the atmosphere do not collect a uniform and complete coating of the material over their surfaces. The impingement of the drops or globules against the fibers is relatively haphazard and erratic.

If it is attempted to increase the concentration of globules or drops in the atmosphere by increasing the force of the spray or the number of sprays, the application of coating is too heavy and tends to collect on the walls of the retaining vessel where it accumulates and interferes with the production of mats or bats. The accumulation of a viscous coating on the side walls tends to congeal and catch glass wool which becomes saturated with more viscous coating. The agglomeration of glass wool and oil which forms finally drops off into the mat, causing a bad spot. It was thus difficult to actually apply a uniform coating and form a homogeneous bat.

It has also been attempted to apply a coating to the glass fibers in mat form by applying the oil directly to the finished mat. However, this method has some of the foregoing disadvantages of poor distribution of coating material on the individual surfaces of the fibers and also the disadvantage of non-uniform distribution of oil throughout the cross-section of the mat.

A further disadvantage of prior methods of coating application was the great wastage of coating substance and inefficiency of application. Only a small proportion of coating sub-

stance actually was effectively applied, the remainder was wasted.

The conventional methods have the foregoing as well as other limitations and shortcomings which it is an object of the present invention to overcome.

Another object of the present invention is to produce a mat of intertwined and interlocked fibers, particularly of glass wool or the like which are individually coated, uniformly and substantially completely, over their surfaces.

It is another object of the present invention to provide a method and apparatus for producing a felted mass of fibrous material in which the individual fibers throughout the cross-section are each coated uniformly, without heavy and thin spots of application of the coating substance. It is also an object of the present invention to avoid wastage of the coating material and to assure a substantially complete application of all the coating material which is used.

It is a further object of the invention to reduce the size of the individual particles of coating substance in their application to the end that they may more uniformly coat the fibers, and particularly fibers having the fine diameters of fine glass wool.

Another object of the invention is to provide a method and apparatus for applying a coating surface to fibrous material which does not condense and/or stick to the side walls of the application chamber.

It is also within the contemplation of the invention to produce a mat in as dry condition as possible.

Other objects and advantages of the present invention will become apparent from the following description taken in conjunction with the drawings in which:

Fig. 1 is an elevational view partly in section of an apparatus for forming a mat of glass wool fibers and illustrating our method of applying a uniform coating to the fibers;

Fig. 2 is a cross-sectional elevation end view taken along the line 2—2 of Fig. 1;

Fig. 3 is an enlarged fragmentary sectional view showing particularly the spray nozzles; and

Fig. 4 is an enlarged fragmentary section view showing a spray nozzle and means for adjusting the same.

Referring particularly to Fig. 1, a glass melting and refining tank 10 is provided with a forehearth 11 within which a head of glass is maintained. The glass flows continually through feeders 12 in the floor of the boot in a multi-

plidity of small streams which are acted upon by blowers 13. The issuing streams of glass are enveloped in the downward blast of steam or other gas supplied by the blowers and are thereby continuously drawn out into fine fibers or filaments 14. Electric current is supplied through connections 15 to electrically heat the individual feeders 12.

Spaced below the individual feeders 12 are vertically disposed spouts 16. The steam blasts from each blower are thus directed downwardly through the spouts 16, carrying with them the attenuated fibers 14. The spouts 16 are of streamlined formation, the walls of each spout 15 being downwardly divergent and having their upper marginal portions 17 curved to provide a flared mouth. The spouts 16 are of the Venturi type, the shape and arrangement being such that a draft of air is induced from the drawing force of the steam blast so that a considerable volume of air is drawn into and intermixed with the steam. These may be constructed and operated in the manner illustrated and described in the co-pending application of Dale Kleist and Games Slayter, 25 Serial No. 43,072, filed October 1, 1935. This construction produces a strong downward draft free from excessive turbulence or eddy currents and the usual back drafts by which part of the forming fibers may be carried upward through the upper end of the spout.

The lower ends of the spouts 16 open into an expansion hood or chamber 18 which is also of streamlined construction and forms an accumulating chamber within which the fibers from the several spouts 16 are laid upon and transmitted on the reticulated conveyor belt 20 to form a mat 21. The blast is thus permitted to expand a predetermined degree which gradually reduces its velocity and avoids excessive turbulence. The conveyor belt is supported on rollers 22 and continually advances, carrying the mat 21 forward as it is formed. At the front end of the hood 18 is a skirt 23 which overlies the mat 21 and tends to compact it to a predetermined depth as the mat emerges from the hood 18.

Arranged below the belt 20 and in register with the hood 18 is an exhaust chamber 25 which leads into an exhaust outlet 26 (see Fig. 2) for the steam and other gases from the hood 18. If it is desired, suction may be applied to the outlet 26.

Mounted at the back end of the hood 18 are one or more adjustable spray gun nozzles 30. As shown more particularly in Fig. 4, a slidable mounting 31 is preferably provided to permit the spray to be adjustably positioned and directed relative to the mat 21. A pivoted mounting 32 may also be provided to enable the spray to be accurately positioned relative to the mat 21 in accordance with the force of the blast from the blowers 13 and other variable factors. It will be noted that the nozzles 30 are aimed at that portion of the belt on which the mat 21 is being formed as will be brought out more fully hereinafter.

Leading into the back end of the nozzle 30 is a coating supply conduit 34 which may be adjustably regulated by valve 35. A steam pressure supply or gas under pressure and temperature is also admitted to the spray nozzle through conduit 36 which is adjusted by valve 37. A fuller discussion of the operation of the spray nozzle will be set forth hereinafter.

Temperature conditions in the hood have been found important. For this purpose gas jets or 75 burners 38 may be provided in proximity to the

mouths of the spouts 16. The induction of gases caused by the steam blow draws the flame from the burner into and down the spout 16.

In order to maintain the temperature within the hood 18 insulation 39 of glass wool bats or equivalent heat insulation is laid over the walls. This has been found particularly useful in preventing coating material from condensing or accumulating on the walls as will be brought out more fully hereinafter.

The streamlined hood permits the steam to expand, cool and decelerate. In this manner the fibers emerge from the blower and pack themselves neatly and uniformly into a mat. The major portion of the steam and vapor carried down from the blower passes out through the reticulating belt 20 at the back end or tail of the hood, leaving the individual fibers to felt or mat themselves on the belt more or less directly below the feeders 12.

We have found that a uniform coating may be applied to the individual fibers by applying the coating substance during the formation of the mat itself. As illustrated in Fig. 1, the mat 21 forms on the belt 20 in a tapered formation which simultaneously exposes all portions of its cross-section. Each stratum, so-called, of the mat has a particular place during its formation on the belt at which it is uncovered and exposed to the atmosphere above. For example, the lower stratum of the mat is formed at the back end of the hood, whereas the upper stratum is formed near the front end. Each stratum is exposed for approximately the same length of time before being covered up by an overlying stratum. Of course, by the use of the term stratum, it is not intended to imply that distinguishable zones of fibrous material necessarily form. However, the invention would be applicable to either type of mat formation.

The present invention contemplates the provision of the spray nozzles which are mounted in such a position and aimed in such a direction that the spray of coating substance will be projected uniformly over the entire tapered cross-section. Substantially all of the coating substance is deposited by means of a filtering action through the unfinished mat. The included gases pass through the mat and exhaust at the outlet 26.

If the nozzle 30 is pointed too far upwardly, the coating substance will tend to settle mostly on top of the mat 21 and leave the bottom insufficiently coated. On the other hand, if the nozzle is pointed too far back, the top is left insufficiently coated and the bottom is excessively soaked. By an arrangement which permits the spray to impinge upon the entire exposed cross-section of the mat simultaneously during its formation, we have found that it is possible to apply the coating uniformly throughout the mat and deposit substantially all of the coating material on the mat by means of a filtering action.

Various coating substances for a mat of fibrous materials have been proposed. As examples, oils, greases, soaps, fatty acids, waxes, cellulose acetate, rubber or rubber compounds, or mixtures thereof. Particularly mixtures of oil and fatty acids have been found useful in coating glass wool. In their application the fatty acids such as stearic acid or the like coact with and neutralize the free caustic soda on the surface of glass fibers and permit the oils to wet and uniformly coat the fibers. An end product of this reaction is a soap. Ammonium salts may also be used for this purpose since they behave as acids and liber-

ate ammonia. Soaps may be added as emulsifying agents to reduce the oils to colloidal size particles.

In the application of a coating substance to the surface of the fibers, a spray composed of relatively large individual drops or globules has serious short-comings. We have found, however, that the coating substance may be effectively and efficiently divided by means of an emulsion which reduces the coating substance to small sized particles comparable to the size of the fibers. The emulsion may be sprayed in a pressure spray gun and then the occluded water may be evaporated away.

The aqueous emulsion of oil, fatty acids, soaps and/or other suitable ingredients are introduced through the conduit 34 to the back end of the spray nozzle 30. Steam is transmitted through the conduit 36 to atomize this emulsion. Sufficient heat in the steam and/or surrounding atmosphere may be applied to evaporate the water and leave only oil drops of colloidal size to deposit on the glass wool fibers. The steam in the conduit 36 may be superheated to accomplish this. If the temperature within the forming hood 18 is maintained sufficiently above 212° F., there will be little or no water deposited on the glass wool fibers and the glass wool pack will be dry and in good condition. Substantially all of the water will be in steam form which readily passes through the mat 21 or passes out through the tail of the hood unobstructed.

The relatively high temperature conditions in the forming hood may be obtained and maintained by using superheated steam to blow the wool and/or allowing the hot products of combustion from a gas flame from the burners 38 to be drawn into the spout 16 with the steam from the blowers 13.

In this connection we have also discovered the advisability of insulating the walls of the forming hood to maintain the walls themselves at an elevated temperature. The insulation 39 around the outside of the forming hood 18 is provided for this purpose. If the walls of the hood 18 are cold, they will form condensing surfaces for the steam and oil or other coating substance within the hood. Liquids condensing on the side walls tend to catch and accumulate stray ends of glass wool which form an oily agglomeration and finally drop off and damage the mat 21. By maintaining the side walls and hood 18 at elevated temperatures, we have overcome this difficulty.

The mat of glass wool resulting from our process of coating application has improved qualities in uniformity of surface coating which increase its life, flexibility and durability. Moreover, a high efficiency of oil application is obtained. Whereas heretofore but a small percentage of the sprayed coating substance was actually distributed over the surface of the fibers, we have achieved an application of upwards of 85% to 95% of the coating substance. The present invention eliminates much wastage and enables substantially

all of the coating substance to be recovered and reach its proper destination.

Variations and modifications may be resorted to which are within the scope and spirit of the present invention.

We claim:

1. The method of producing a mat of fibrous material, comprising attenuating a plurality of long, fine, glass fibers by means of a high pressure gaseous blast, conveying said fibers by said blast to a predetermined exposed area of a traveling foraminous conveyor moving in a transverse direction across the path of said blast, and thereby permitting the fibers to deposit and accumulate and form a mat upon said area in such manner as to continually present a momentary cross-sectional surface of said mat across the entire thickness of said mat, said blast passing through said area and through said conveyor, and simultaneously directing under positive pressure a coating substance to said mat from a region spaced above and in proximity to said mat, said coating substance being aimed and directed substantially uniformly over said area and the spray pattern of said coating substance being substantially coextensive with said exposed deposited area, whereby the binding material is incorporated uniformly throughout the thickness of said mat, and said coating substance is applied under sufficient pressure so that its deposition is not interfered with by the movement or turbulence of said vehicular gaseous blast.

2. The method of producing a mat of fibrous material, comprising attenuating a plurality of long, fine, glass fibers by means of a high pressure gaseous blast, conveying said fibers by said blast to a predetermined exposed area of a traveling foraminous conveyor moving in a transverse direction across the path of said blast, and thereby permitting the fibers to deposit and accumulate and form a mat upon said area in such manner as to continually present a momentary cross-sectional surface of said mat across the entire thickness of said mat, said blast passing through said area and through said conveyor, simultaneously directing under positive pressure a coating substance in the form of an aqueous emulsion to said mat from a region spaced above and in proximity to said mat, said coating substance being aimed and directed substantially uniformly over said area and the spray pattern of said coating substance being substantially coextensive with said exposed deposited area, whereby the binding material is incorporated uniformly throughout the thickness of said mat, and said coating substance is applied under sufficient pressure so that its deposition is not interfered with by the movement or turbulence of said vehicular gaseous blast, and applying sufficient heat to said aqueous emulsion to cause the aqueous phase thereof to evaporate, leaving the coating substance distributed over said fibers.

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