

Feb. 15, 1955

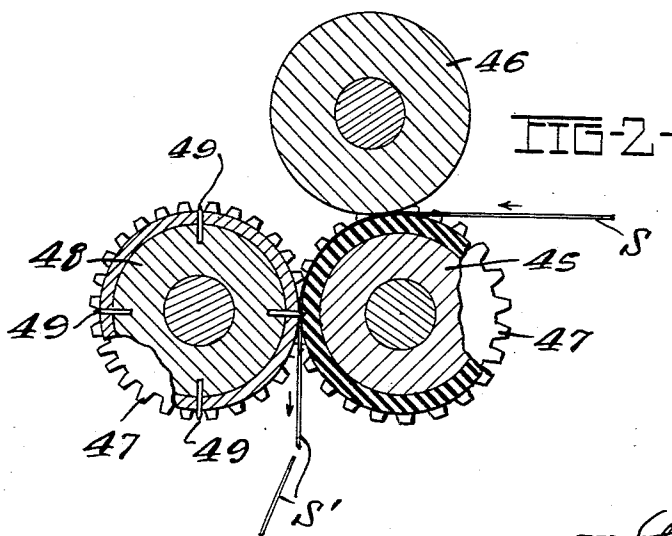
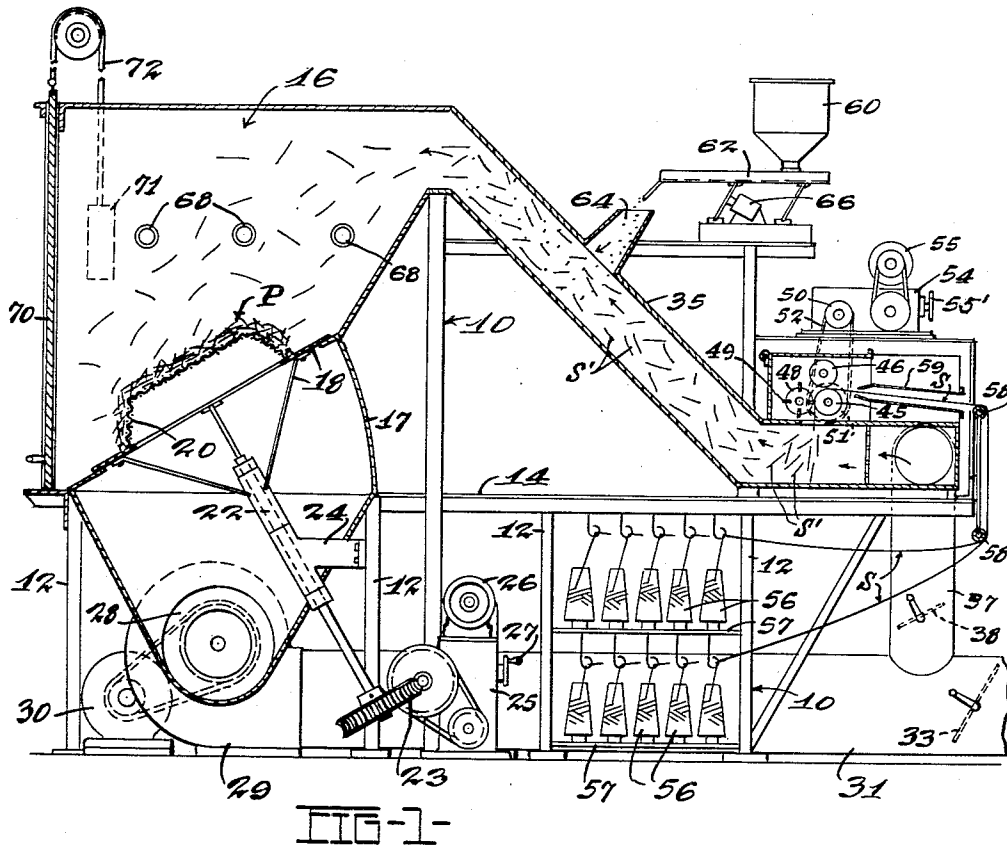
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2,702,261

METHOD FOR PROCESSING MINERAL FIBERS

Filed Aug. 30, 1950

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

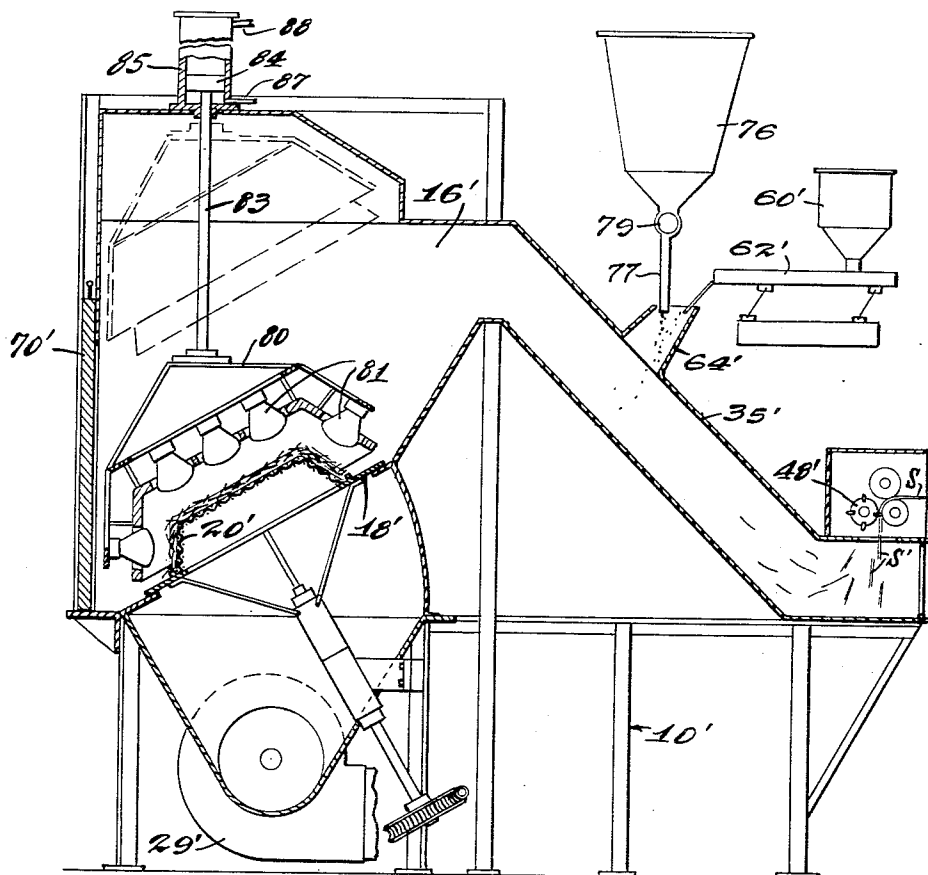


FIG-3-

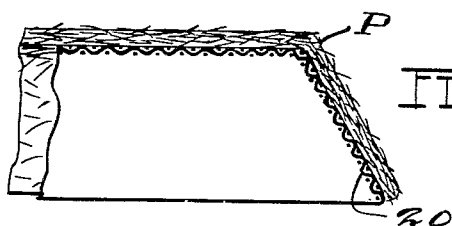


FIG-4-



FIG-5-

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3 Sheets-Sheet 3

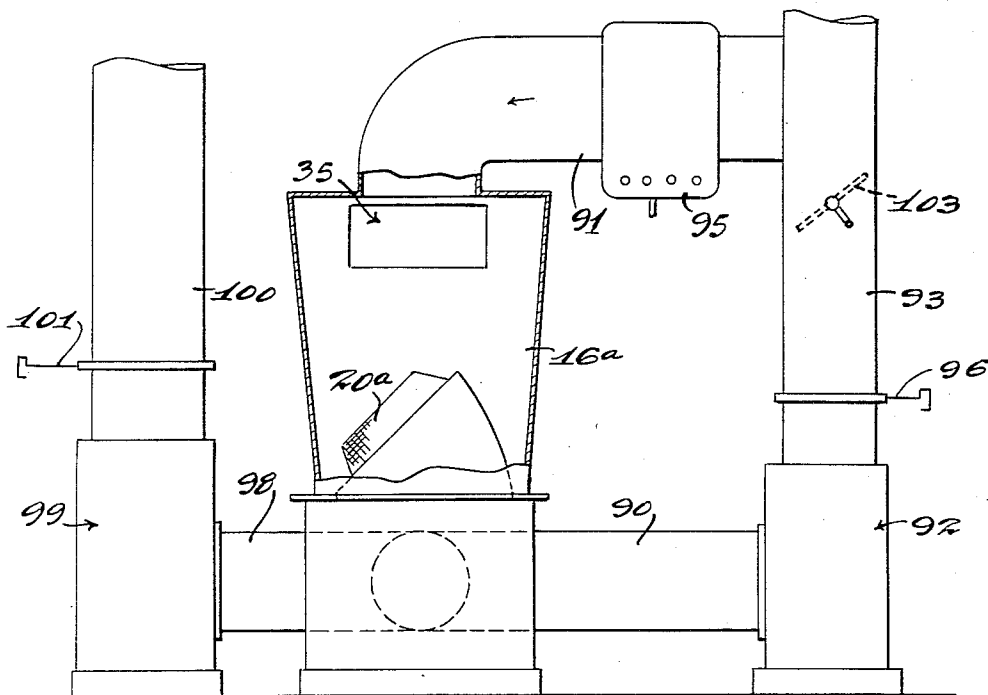


FIG-6-

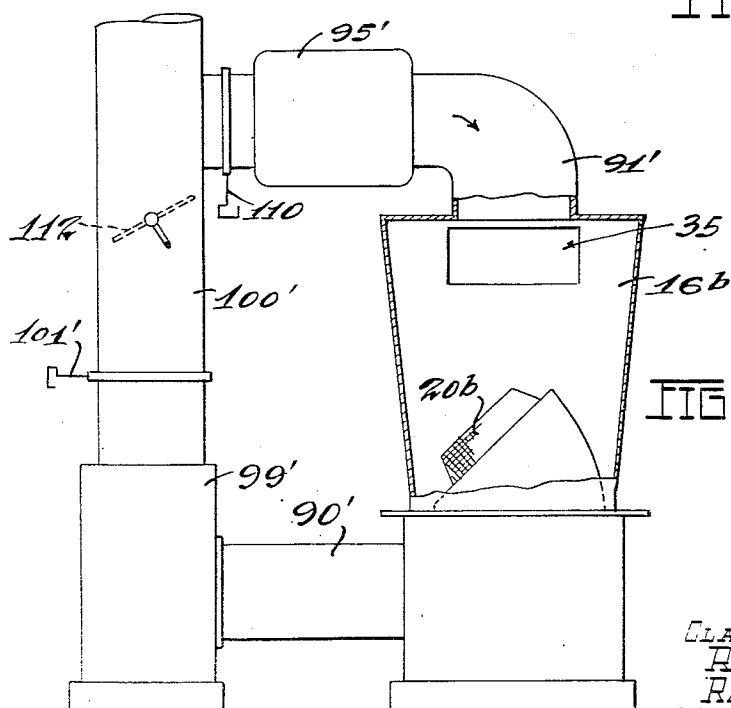


FIG-7-

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2,702,261

METHOD FOR PROCESSING MINERAL FIBERS

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Application August 30, 1950, Serial No. 182,318

5 Claims. (Cl. 154—101)

This invention relates to method and apparatus for processing mineral fibers or filaments and more especially to method and apparatus for forming, conveying or orienting masses of comparatively short lengths of strands of fibers and individual fibers into predetermined configurations or preforms for many and various industrial uses.

It has been a recent practice to form glass fibers into predetermined shapes or configurations for use as reinforcing mediums in plastic or resin molded articles. One method of this character involves the formation of mineral fibers from heat softenable material such as glass by attenuating streams of the molten material to form fine fibers which are collected in strand form and the strand wound upon a spindle or tube to form a package in a manner conventional in the textile industry in winding yarns. The wound packages are then split lengthwise and the mass of split strands of the package spread on a movable conveyor and carried into a spirally shaped cutting knife which chops up the strand mass, the chopped strands being collected in a suitable bag or container. Subsequently the chopped strands are deposited on another conveyor where they are subjected to the action of a series of mechanical pickers or separating devices.

During the formation of a continuous strand prior to its being wound in package form, a suitable binder or adhesive is applied to cause the fibers of the strand to cohere in order to facilitate handling and winding of the strand. The strand is wound at a very high linear speed so that there is usually insufficient time for the binder to "set" or harden on the strand prior to its being wound in a package. Such condition aggravates coherence of the convolutions of strand on the package such that after the strand mass has been processed through the chopping device, the resulting product is usually a mass of some individual strands and a large number of groups of severed strands or tangled clumps.

The use of such a mixture from the chopping device is wholly unsuitable, as a preform or mat formed of such mixture would be nonuniform in character because of the presence of concentrated clumps or groups of chopped strands in certain zones and scarcity of reinforcement in other zones. Hence, mechanical pickers have been used in an endeavor to pick apart or separate the cohering groups or tangled clumps of chopped strands to obtain a more homogeneous mixture of individual or separated chopped strands in the preform.

This practice has not been entirely satisfactory as the mechanical pickers tend not only to pick or separate cohering strands but also to open up and separate individual fibers from the strands. If the mixture is subjected to the picking devices for too long a period of time the resulting mixture contains too many individual or separated fibers so that the strength factor of the mixture as a reinforcing medium is greatly impaired. On the other hand, if the chopped strands are subjected to the pickers for too short a period of time the clumps or groups of cohering strands will not be separated.

Hence, there is a lack of control in arrangements heretofore used for obtaining a mass of chopped strands suitable for producing preforms for reinforcing purposes. Again the mass of strands from the strand package being fed into the spiral chopping device results in chopped strands of varying lengths, a condition which vitally affects the ability of the picking devices to separate cohering strands as well as to impair the formation of a reinforcing preform as the longer fibers are not readily

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adaptable to formation into various preform configurations.

Such methods and apparatus for producing preforms of mineral fibers have been very expensive by reason of the several successive independent steps or operations necessary to condition the strands for the ultimate purpose of reinforcement for molded articles and the repeated handling of the materials through successive operations necessitates considerable hand labor in producing preforms of mineral fibers.

The present invention embraces the provision of a method of correlating and establishing continuity of several steps or operations in processing strands of mineral fibers into an assembled or preform configuration whereby reinforcing preforms suitable for incorporation in resin or plastic molded articles may be economically produced in which an accurate control of the character of the strand or fiber assembly may be maintained.

An object of the invention is the provision of a method of conditioning or processing strands of mineral fibers involving the correlation of operational steps in a particular sequential relation whereby the number of operations are reduced to a minimum with a consequent reduction of manual handling of materials and wherein the apparatus is capable of sustained operation with a minimum of attention on the part of the operator.

An object of the invention is the provision of a simple, yet effective method and apparatus for producing severed strands of mineral fibers such as glass fibers into predetermined controlled lengths, conveying and collecting the cut strands at a suitable station and concomitantly applying a medium for augmenting the mass integrity of the collected strands when assembled into preform configuration, the invention embracing the establishment of a zone for effecting the curing of the medium of the fibrous mass.

Another object of the invention is the provision of apparatus for continuously carrying on a series of operations of a method involving severing strands of mineral fibers to predetermined controlled lengths in a manner avoiding the formation of tangled groups or clumps of cut strands, conveying the strands to a collecting zone, and applying an adhesive to the assembled strands and curing the adhesive after the strands are assembled in predetermined shape to maintain such configuration during further processing.

Another object of the invention resides in the provision of a method for continuously supplying strands or linear groups of mineral fibers to a means for reducing the continuous strands to predetermined short lengths, the fiber reducing or severing means being of a character whereby highly accurate control of the lengths of cut strands may be maintained and the coherence or tangling of cut strands entirely eliminated.

In the fabrication of molded articles reinforced with mineral fibers it is desirable in many such products to provide the reinforcement adjacent the surfaces of the article with individual or separated fibers to enhance the attractiveness of the molded article as the reinforcing materials are partially visible in a molded article having translucent or light transmitting characteristics.

An object of the present invention resides in the exercise of control of the mass of severed strands and fibers whereby a preform may be fabricated wherein the outer surfaces predominate in individual or separated fibers while the interior of the reinforcing mass is made up substantially of unopened or partially opened strands of fibers, the invention embracing a control of the strand severing means whereby regulation of the speed of the severing means may be utilized to vary the ratio of separated or individual fibers to stranded fibers in the collected mixture.

Another object resides in conditioning the continuous strands of attenuated glass fibers through the character and amount of adhesive or binder applied to the strands concomitantly with their formation whereby the cohesive factor or tendency of the fibers in the severed strands to remain in strand groups may be controlled to produce either unopened or integrated severed strands, a mixture of partially opened severed strands and individual fibers separated therefrom or substantially a mass of inde-

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pendent or individual fibers containing few partially opened or intact groups or severed strands of fibers.

Still another object is the provision of a support for the preform matrix arranged for relative movement to facilitate and enhance the distribution of the severed strands or fibers during the fiber collecting and assembling operation.

Another object of the invention is the provision of a method of fashioning preforms utilized as reinforcements for fabricated articles wherein strands of mineral fibers are conveyed from a supply to a severing means where the strands are severed to predetermined lengths, the short strands being continuously delivered to a station where they are collected upon a matrix, the method embodying a control of the number and character of the strands and the speed of a strand conveying and severing mechanism whereby the amount of severed strands of fibers deposited upon the matrix may be determined and controlled to establish uniformity of weight and thickness of the preforms.

The invention has for a further object the provision of method and apparatus for severing strand materials to comparatively short lengths and during transfer of the strands to a deposition zone, applying a suitable material to the moving strands as for example finely divided or powdered resin or other suitable binder or adhesive for the purpose of imparting a degree of mass integrity to the fibers or strands in the preform. The method and apparatus of the invention is readily suited for the application to the moving lengths of strands or fibers of one or more fillers in a manner such that the cut strands and filler material may be uniformly mixed or intermingled to enhance the homogeneity of the mass in the preform assembly.

Another object embraces the provision of a method and apparatus for processing mineral fibers and orienting them into a predetermined shape or configuration wherein a thermo-sensitive binder may be added, the method lending itself to the inclusion of means to soften, cure or effect a drying of the binder.

Another object of the invention is the provision of a method of processing and orienting lengths of fibers or strands into preforms including the incorporation of an effective resin or adhesive curing medium to establish coherence among the collected strands or fibers for the purpose of maintaining the general configuration of the preform upon its removal from the strand collecting matrix. The method and apparatus of the present invention may be utilized in a manner to apply a comparatively large amount of resin or filler material to the strands of fibers thus providing a full resin and filler complement oriented with the fibers in the preform configuration so that such preform may be readily transferred to a suitable mold and set or cured by heat, pressure or both to fabricate the preform into a finished reinforced rigid or semirigid article.

The apparatus of the invention is inclusive of means for automatically feeding and controlling the rate of feed of an adhesive or binder to the cut strands prior to their collection on the preform matrix and in this manner an efficient and effective control of the degree of mass integrity in the assembled preform is accurately maintained.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

Figure 1 is an elevational view partly in section of an apparatus for carrying out the method of the invention;

Figure 2 is a fragmentary semidiagrammatic elevational view illustrating a strand or fiber conveying and severing means;

Figure 3 is a view similar to Figure 1 illustrating a form of means for curing the preform constructions;

Figure 4 is an enlarged fragmentary view illustrating a matrix having a fibrous preform disposed thereon;

Figure 5 is an isometric view illustrating a typical preform manufactured by the method and apparatus of the invention;

Figure 6 is a semidiagrammatic view illustrating an

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arrangement for curing the adhesive or resin on the fibrous preform, and

Figure 7 is a semidiagrammatic view illustrating a modification of an arrangement for curing the adhesive or resin constituent of the preform.

The method and apparatus of the present invention are particularly adaptable for the processing and orientation of mineral fibers and especially strands of glass fibers for producing assemblages or units of fibers collected into a desired configuration or shape termed a preform. Preforms fabricated or assembled of relatively fine mineral fibers are particularly usable as reinforcing mediums or core structures arranged to be impregnated or embedded in a resin or a plastic material, the preform providing a medium for greatly increasing or augmenting the strength factor of a molded resin or plastic article without materially increasing the weight of the article. Furthermore, mineral fibers such as glass fibers are not readily subject to the destructive factors of oxidation and corrosion and hence provide a finished article which is strong and durable and will last for an indefinite period.

According to the present invention, the strands of fibers are severed or reduced to comparatively short lengths which are collected or deposited upon a suitable matrix or form in a manner to provide a fluffy mass of individual fibers and groups of fibers in substantially uncompressed condition. When preforms of this character are utilized as reinforcement means for molded articles, the fibrous mass and resin or plastic are placed in a mold and the composite mass compressed to desired thickness and cured to impart permanent set to the article.

Referring more especially to Figure 1 there is illustrated a form of apparatus for carrying out the steps of the method of the invention. The apparatus is inclusive of a frame structure 10 including uprights or vertical supports 12 connected together at their upper ends by longitudinally extending members or runners 14. Supported upon the frame 10 is a plenum chamber 16 in which is disposed a relatively movable table or platen 18 preferably of circular shape forming a suitable mounting means adapted to carry a foraminous or screen-like matrix or form 20 which provides a fiber collecting station or medium upon which the mineral fibers or strands are collected or assembled in a fluffy or loose mat-like formation P termed a preform. The platen 18 carrying the matrix 20 is preferably movably supported and in the arrangement shown in Figure 1, the platen is supported by a skeleton frame mounted upon a shaft 22 adapted to be rotated by gearing 23 from a mechanism contained within a housing 25 and driven by a motor 26. The mechanism in the housing 25 is of a character arranged to vary or regulate the speed of rotation of the shaft 22, the platen 18 and the foraminous matrix 20 for purposes to be hereinafter explained. The speed changing mechanism contained in the housing 25 may be manipulated by a member 27 disposed exteriorly of the housing so as to vary or change the speed of rotation of the platen 18 and the matrix 20. The shaft 22 may be journaled upon a suitable bracket 24 or other means carried by the frame 10.

Means is provided for moving air through the plenum chamber and through the foraminous matrix 20. The zone beneath the platen 18 and the matrix 20 is enclosed by means of a shroud 17 which is in communication with a duct 28 connected with an air moving or suction producing device or fan 29 driven by a motor 30 which exhausts through a duct or tube 31. The exit of the tube 31 is provided with an adjustable valve or gate 33 for determining or controlling the extent of recirculation of air through the plenum chamber and matrix and the amount of air exhausted to the atmosphere.

The apparatus is inclusive of a duct or tube 35 into which cut fibers or strands of fibers are delivered in a manner hereinafter explained, the tube 35 being preferably canted or inclined upwardly as shown in Figure 1 and having its exit in the plenum chamber 16. The other end of the tube 35 is in communication with a duct 37 the latter provided with an adjustable valve or gate 38 for regulating the flow for air through duct 37 and duct 35.

Means are provided for conveying strands of mineral fibers S to a severing means for severing the fibers or strands into comparatively short lengths and introducing or entraining the cut strands or fibers in the air stream moving through the duct 35. The form of device for

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severing the strands of mineral fiber such as glass fibers into short lengths is inclusive of a strand tensioning or conveying roll 45, a pressure roll 46 adapted to engage the strands S and a strand or fiber severing means. As shown in Figures 1 and 2 there is provided a rotatable member 48 equipped with a plurality of peripherally spaced strand severing bars or knives 49 which project exteriorly of the cylindrical surface of the member. The rolls or members 45 and 48 are driven through suitable gearing 47 and by suitable pulleys 50 and 51 connected by a belt 52 with a variable speed changing mechanism contained within a housing 54 driven by a suitable motor 55. A control member 55' is provided for changing the variable speed mechanism for regulating the speed of the rolls 45 and 49. Mineral fibers or filaments in linear groups or strands are supplied to the strand severing means and in the embodiment illustrated in Figure 1, the strands are supplied from spools or cones 56 mounted upon a creel or frame 57, the strands S being directed to the strand conveying and severing mechanism by suitable members 58 and a guide duct 59.

When the valve 38 in the duct 37 is in open position and the suction producing device or fan 29 is in operation a moving air stream is set up in the chute or tube 35, the air moving at a sufficient velocity to entrain and convey the cut fibers or strands S' into the plenum chamber 16.

In producing preforms of glass fibers, it is desirable to impart some degree of mass integrity to the assembled strands of a preform so that the latter may be conveniently handled and transported for further processing without material disintegration or separation of the assembled fibers. The application of resin or adhesive to the strands may be accomplished in different ways. For example, the strands S at the time of their formation may be coated or impregnated with a resin or adhesive constituent or the resin or adhesive may be applied to the severed strands. A preferred form of applying a resin constituent in the latter manner is illustrated in Figure 1. The arrangement includes a hopper 60 supported above a trough-like member 62, the hopper adapted to contain a resin in powdered or comminuted form as, for example, a polyester resin which flows from the hopper 60 into the trough 62 to be subsequently discharged therefrom through a passage 64 in the tube 35 whereby the resin is deposited directly into the air stream upon the severed or cut strands or fibers entrained therein moving upwardly through the tube 35. The resin in powdered form is of a fineness or particle size which will readily adhere to the cut strands as they move through the tube 35. The feed chute or trough 62 for the resin or adhesive is adapted to be vibrated or agitated by a solenoid mechanism 66 or other suitable means to attain a continuous flow or discharge of resin into the entrance 64 whenever severed fibers are moving through the duct 35. The solenoid means 66 may be controlled by conventional electrical means (not shown) so as to regulate or vary the rate or speed of vibration of the trough 62 to control the rate and quantity of discharge of resin into the duct 35.

The apparatus is inclusive of means to cure or set the resin or adhesive complement on the assembled fibers of the preform on the matrix 20. As shown in Figure 1 a plurality of heating devices 68 preferably of electrically energized character are disposed in the plenum chamber so as to elevate the temperature in the zone occupied by the preform sufficiently to thermo-set or cure the resin constituent of the preform fiber assembly. The plenum chamber 16 is equipped with a door 70 for access to the chamber in order to remove the finished preforms from the matrix 20. In the form of apparatus shown, the door 70 is slidably mounted for vertical movement, the weight of which is substantially offset by means of a counterbalancing unit 71 connected to the door by a cable 72.

The strand severing device, the resin feeding means 62, the air blower or suction producing means 29 and the mechanism for rotating the preform matrix 20 in the plenum are electrically controlled by suitable relays and time delay switches whereby they are operated in proper sequential or timed relation so that each mechanism is rendered effective for the desired period to insure the performance of its function. As the circuits and electrical control mechanism are of conventional character it is deemed unnecessary to illustrate them.

In the operation of the method as carried out by the apparatus illustrated in Figure 1, the electrical circuits are brought into operation by means of a manual switch (not

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shown) under control of the operator, initiating the cycle of operations to fabricate a preform of cut fibers or strands of fibers on the matrix 20. The motor 30 is energized to bring the blower 29 into operation concomitantly with the energization of the motor 55 to initiate the operation of the strand severing or cutting device 48. If desired the blower 29 may be operated continuously without impeding the other steps of the method. The air control valve 38 is set at a predetermined position so as to attain a desired movement of air through the tube 35 to the plenum chamber 16 so that as the cut fibers or strands S' pass into the tube 35 adjacent the entrance they are instantaneously entrained in the air stream, conveyed upwardly and discharged into the plenum chamber 16. The resin feeding device 62 is brought into operation simultaneously with the actuation of the strand severing device so that powdered resin is delivered into the passage or station 64 and is picked up by the air stream and the moving strands in the tube 35. Due to the foraminous or perforated character of the matrix 20, which is being rotated by reason of the energization of the motor 26 concomitantly with the operation of the strand severing device 49, the air stream moving into the plenum chamber passes through the matrix 20, carrying the cut strands or fibers into engagement with the matrix 20. The latter functions in the manner of a filter preventing passage of the cut fibers or strands of fibers which build up on the matrix 20 to provide the preform fashioned to the shape of the matrix. Due to the rotation of the matrix and the relative angular position of its axis of rotation, the short length fibers and strands are deposited upon or collect on the matrix in substantially uniform thickness. Upon the preform attaining the desired thickness, the cycle of operations is interrupted either by automatic means or by manipulation of a manual switch intercalated with the circuits of the mechanisms and the flow of fibers to the matrix ceases. The heating devices 68 which may be electrically energized or of the gas flame type are then brought into operation, elevating the temperature of the air in the zone of the matrix 20 and preform P to cure or set the resin in the fibers. After the resin on the preform has been cured, the operator may remove the finished preform by opening the access door 70. The blower 30 may be continuously operated and recycling of a portion of the air through the apparatus may be accomplished through the regulation of the air valves 33 and 38, the valve 33 being in an air exhaust duct leading to the atmosphere.

While it has been found advantageous to utilize a moving gas or air stream as a medium for conveying the severed fibers away from the severing zone, it is to be understood that other forms of fiber conveying means as, for example, a mechanical conveyor of the endless belt type may be used if desired. The duct 35 may be made of any suitable material but it is desirable to employ a smooth lining thereof such as copper, aluminum, tin or a plated metal which offers a minimum of resistance to the movement of air and fibers there-through.

The speed of the fiber cutting or severing means 49 may be varied through adjustment of the speed changing mechanism contained in the housing 54 so as to vary the rate of delivery of severed fibers into the plenum chamber 16. The fiber or strand severing knives 49 may be spaced peripherally on the rotatable member 48 as desired, and a greater or lesser number of knives than those illustrated may be utilized. Each of the strands of fibers S conveyed to the strand severing means 49 usually comprises two hundred or more individual mineral or glass fibers and during the formation of the strands from attenuated fibers it is usual to twist the strand or to apply an adhesive material or resin to impart some degree of interadhesion or integrity in the strand to facilitate the handling and processing thereof without encountering straggling or isolated fibers which might otherwise become disengaged from the strand before severing. When the strands are reduced or cut into short lengths by the strand severing means illustrated in Figures 1 and 2, it is desirable that the groups of severed fibers or strands of fibers be partially or in some instances fully opened up, that is, conditioned so that some or all of the individual fibers are loosened from the groups so that a more homogeneous mass of partially opened groups of fibers and individual fibers may be obtained. This end result is especially desirable when the mass of severed fibers and groups of fibers

are utilized as a preform reinforcement for molded articles in order that the article be endowed with satisfactory strength characteristics throughout its entirety.

Several factors have been found to have a bearing upon the condition or facility of opening of the severed groups of fibers such as the speed at which the continuous strands move through the severing means, the diameter of the strand conveying roll 45 and the lengths of the severed fibers or strands. By way of illustration a strand conveyor roll 45, if made of a comparatively small diameter sets up extensive flexure of the individual fibers of the strands as the latter move in an acute arcuate path about a portion of the periphery of the roll whereby the fibers of the cut strands become readily separable. The radius of the arcuate path, whether the path is of sharp radius as when a small diameter strand conveyor roll is used, or a more gradual curvature as through use of a larger diameter strand conveyor, directly affects the amount of flexing of the individual fibers and hence is a factor affecting the extent of opening of the severed groups of fibers whereby many individual fibers are loosened and liberated from the groups. The lengths of the severed fibers dependent upon the peripheral spacing between adjacent strand severing knives also affects the extent of opening of the severed strands. Reducing the lengths of the severed strands results in more facile separation of individual fibers from the severed groups. The speed at which the continuous strands are moved through the severing device affects the extent of opening as at relatively high linear speeds of the strands, vibration of the fibers ensues which facilitates the separation of many of the individual mineral fibers from the severed groups. Thus by orienting and controlling the several factors above enumerated the extent of opening up of the severed strands or groups of fibers to separate or free individual fibers therefrom may be controlled so as to obtain a desired ratio of individual or separated fibers to the unopened or partially opened severed strands or groups.

While the apparatus of Figure 1 illustrates the utilization of a supply of fibrous strands taken from spools or tubes, the method and apparatus of this invention is readily adaptable for processing strands of fibers in which the fibers may be formed or attenuated from streams of molten material such as glass, the attenuating force being the movement of the fibers by the conveyor roll 45, the attenuated fibers being directed or guided into strand formation immediately prior to directing the strands to the strand severing means. In this method of direct formation of strands by concomitant attenuation of the fibers, the amount of adhesive applied to the strands to lend mass integrity thereto may be reduced over that required when the strands are formed and collected upon spools or tubes, the strands subsequently taken from the spools or tubes for processing through the severing and fiber transferring means of the present invention. Furthermore, this method effects an economy by reason of reduction in labor, otherwise necessary in handling the spools of fibers and the space necessary to store the spools of strand material until they may be utilized for processing through the apparatus disclosed herein.

Figure 3 illustrates an apparatus embodying certain modifications of the apparatus illustrated in Figure 1. In this form the frame 10' supports a plenum chamber 16' and a duct 35' for conveying severed fibers to the plenum chamber which are cut from continuous strands of fibers by a severing device 48'. The apparatus includes a blower 29' for circulating air as a fiber or strand conveying medium through the duct 35' and plenum chamber 16' wherein the severed fibers are deposited upon a matrix 20' carried by a rotatable platen 18'. In this form of apparatus the resin contained in hopper 60' is delivered into the trough 62' which is vibrated or agitated to deliver the resin at a predetermined rate into the duct 35' through the passage 64'.

In certain types of preform it is desirable that the resin complement be supplemented with a filler constituent as, for example, flour, starch or other substantially chemically inert material. As illustrated in Figure 3 a container or hopper 76 may be provided, formed with a discharge channel or tube 77, the hopper adapted to contain a filler material which may be discharged into the passage 64' and into the duct 35' where it is

entrained in the air stream and by the severed fibers and carried into the plenum chamber 16'. A rotary feeding device 79 may be incorporated at the base of the hopper adapted to be actuated by a motor or other suitable means (not shown) for feeding filler material when the strand severing device 48' is in operation.

The apparatus illustrated in Figure 3 further includes a modification of means for curing the resin constituent in the assembled fibers on the preform matrix 20'. Disposed within the plenum chamber is a suitable relatively movable frame 80 which forms a support for a plurality of heating devices 81 which may be in the form of electrically energized heat lamps of conventional character utilized for curing the resin. The frame 80 carrying the lamps 81 is vertically movable so as to be elevated into the upper portion of the plenum chamber to the position illustrated in broken lines during the period that the fibers are being conveyed into the plenum chamber and deposited or collected upon the matrix 20'. Any suitable mechanism may be employed for moving the bank of curing devices 81 as for example a rod 83 equipped with a piston 84 adapted for reciprocation in a cylinder 85 into which pressure fluid such as compressed air may be alternately introduced through tubes 87 and 88 entering the cylinder beneath and above the piston 84, the direction of fluid flow depending upon whether the bank of heat lamps and frame 80 are to be elevated to an out-of-use position or lowered to curing position as shown in full lines in Figure 3. The plenum chamber 16' is provided with a suitable access door 70' to facilitate the removal of finished preforms from the matrix 20'. The mechanism for elevating or lowering the heat lamps 81 may be automatically controlled by electrically actuated valves (not shown) intercalated with the other mechanisms for carrying out the steps of the method.

Figure 6 illustrates a modified apparatus for establishing a curing temperature in the plenum chamber. As illustrated, a plenum chamber 16a of the same construction as the plenum chamber 16 is provided with an air outlet duct 90 and an air inlet duct 91. A blower 92 connected with the duct 90 is provided with a duct 93 which may exhaust at its upper end into the atmosphere but which is connected intermediate its ends with the duct 91, the latter being provided with a heating device 95 for heating the air passing through the duct 91. The duct 93 is provided with a gate or slide valve 96 to regulate or interrupt the flow of air through the plenum chamber 16a. The heating device 95 may if desired be of the type arranged to burn a gas and air mixture in which event the hot gases of combustion are circulated through the duct 91 into direct contact with the collected fibers to cure the resin on the fibers.

The plenum chamber is provided with a second outlet duct 98 which communicates with a blower 99 the latter having an exhaust duct 100 connected thereto. A suitable slide valve 101 is incorporated in the exhaust duct 100. The arrangement shown in Figure 6 is adapted for utilization with the apparatus disclosed in Figures 1 and 3. The arrangement of Figure 6 functions in the following manner: During the severing of the strands of fibers into short lengths, the blower 99 draws air upwardly through the strand conveying duct 35 which has its fiber delivering exit into the plenum chamber 16a as shown in Figure 6. With the gate 96 closed in duct 93 and with gate 101 open in duct 100 the blower 99 causes air movement upwardly through the duct 35 through the plenum chamber 16a where the fibers carried by the air stream are deposited upon the matrix 20a. The air passing through the matrix is conducted through duct 98, blower 99 and is exhausted into the atmosphere by way of the duct 100.

After the required quantity of fibers has been deposited upon the matrix 20a, the gate 101 is closed rendering the suction of blower 99 ineffective to move air through the plenum chamber. The gate 96 is then opened and with the heater 95 in operation, the blower 92 initiates movement of the hot gases of combustion or heated air through duct 91 into the plenum chamber 16a into contact with the collected fibers or strands. Thus a zone of elevated temperature adjacent the preform is provided for curing the resin complement in the fibrous preform configuration on the matrix 20a. The blower 92 is effective to recirculate some of the hot gases dependent upon the position of the regulating damper 103 incor-

porated in duct 93. After the resin has been cured the gate 96 may be closed and the finished or cured preform removed from the matrix. The cycle may then be repeated in the manner described.

Figure 7 is a modified form of apparatus illustrated in Figure 6. In this form the plenum chamber 16b is connected by means of a duct 91' with an exhaust duct 100' the latter in communication with a blower 99' which exhausts air from the plenum chamber 16b through duct 90'. The duct 91' is provided with a sliding or gate valve 110 and the duct 100' is provided with a gate valve 101'. During the operation of the fiber severing and conveying means as illustrated in Figures 1 and 3 the blower 99' withdraws air from the plenum chamber 16b which provides the moving air stream in the strand conveying duct 35 whereby the entrained fibers are delivered into the plenum chamber through duct 35. During this operation the gate 101' is opened and the gate 110 is closed. After the fibers have been collected on the preform matrix 20b the gate 110 is opened and the damper 112 adjusted whereby the hot gases of combustion from the heater 95' are directed through duct 91' into the plenum chamber 16b and into contact with the preform to cure the resin constituent in the preform. After sufficient heat is applied in this manner to cure the resin, the gate 110 may be closed, the finished preform removed from the plenum chamber 16b and the cycle repeated as described.

In certain types of strand reinforced resinous molded article and more especially those employing translucent or light transmitting resin, it is desirable that the reinforced preform have its surface portions composed principally of separated or individual cut fibers while the interior predominates in cut strands. This may be substantially accomplished by changing the speed of the continuous strand conveyor and severing knife-carrying rolls 45 and 48 during the operations of producing a preform. For example, initially the strand severing means may be driven at relatively high speed by shifting the speed changing mechanism through manipulation of the control member 55' so that the cut strands are opened up or disintegrated to individual fibers which are collected in a layer on the matrix 20. The control member 55' may then be actuated to substantially reduce the speed of rolls 45 and 48 whereby the cut strands remain substantially intact and are collected on the layer of separated fibers on the matrix 20 to form the interior body of the preform. When the preform body has attained a desired thickness, the control member 55' is again shifted to high speed position to provide the uppermost surface of the preform with separate or individual fibers. When a preform fabricated in this manner is incorporated in a molded article, the surface zones are predominately individual fibers with the reinforcing cut strands encased in the interior.

From the foregoing it will be seen that through the utilization of the method and apparatus of the invention strands of fibers from a supply or strands of fibers taken directly from a fiber forming bushing are conveyed to a severing means, the severed strands and individual severed fibers being instantly conveyed to and collected upon a matrix to produce a preform. The resin component intermingled with the fibers when cured imparts sufficient integrity to preserve the general shape of the preform in normal handling operations but does not materially reduce the fluffy and resilient character of the preform.

We claim:

1. A method for preparing preformed reinforcing masses for plastic molded articles comprising feeding a plurality of continuous separate, multifilament strands parallelly along a predetermined path, resiliently supporting said strands with an unbroken, smooth, resilient

surface during their movement along such path, pressing spaced sharp knives transversely against all of said strands to sharply deflect said strands laterally beyond the normal line of such surface to sever said strands in sections having fibers of uniform lengths, feeding the severed lengths of strands into an enclosed space, providing a foraminous matrix of predetermined shape within said space, rotating said matrix on an axis generally perpendicular to its major face and flowing a current of air from the point of introduction of said severed lengths of strands through said foraminous matrix.

2. A method for preparing preformed reinforcing masses of short heterogeneously matted glass fiber strands for plastic molded articles comprising feeding a plurality of laterally spaced, continuous multifilament glass fiber strands parallel to each other along a predetermined arcuate path, resiliently grasping said strands at one point on said path between co-acting rotary feeding means, resiliently supporting said strands throughout their movement through such path by the unbroken surface of one of said means, pressing a sharp knife transversely against said strands on a line extending radially to such path and circumferentially spaced from the line of resilient grasping of said strands to sharply deflect said strands within the normal arcuate path of movement for severing said strands, releasing the severed lengths of strands into an enclosed space, rotating a foraminous matrix of predetermined shape at a remote point in such enclosed space and flowing a substantial current of air from beyond the point of release of said severed lengths of strand to and through said foraminous matrix.

3. A method according to claim 2 in which the current of air is flowed from the point of release of the severed lengths of strands to the location of the foraminous matrix through an upwardly inclined path.

4. A method according to claim 3 in which a potentially adhesive resinous material is introduced into the current of air and onto the severed lengths of strands carried thereby between the point of release of the strands into the enclosed space and the location of the foraminous matrix.

5. A reinforcement for plastic and resinous molded articles, said reinforcement comprising a shaped body of intermatted haphazardly positioned short lengths of multifilament glass fiber strands substantially free of separated individual fibers, said mass being substantially free of clumps of adhered strand sections.

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