METHOD OF FELTING FIBROUS GLASS

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The present invention relates to a novel method for forming an interfelted mass of glass wool in which the individual fibers, which because of their original long and fine nature inherently tend to lie parallel to a particular plane or surface upon which the fibers are accumulated, are caused, nevertheless, to partially depart from this inherent parallelism and interfelt throughout the mass of glass wool, to the end that the mass may attain mass integrity and tensile strength in all directions including directions transverse to the original plane or surface of inherent parallelism.

This application is a continuation-in-part of my copending application, Serial No. 117,589, filed December 24, 1938, now Patent Number 2,206,059 of July 2, 1940.

An object of the invention is to produce an interfelted product of glass wool having not only mass integrity and tensile strength in all directions but which is high in heat resisting and heat insulating quality. In order to procure a high insulating value from a product having long fibers, it has been found advantageous to lay the fibers predominantly transverse to the direction of heat flow. When the fibers are laid transverse to the direction of heat flow, the heat is prevented from flowing through the mass with the same ease as when the fibers are laid parallel to the direction of heat flow. It is an object, therefore, to provide a product in which the longer fibers predominantly do not lie in the direction of heat flow but have their major components extending in directions transverse to the direction of heat flow.

Another object of the invention is to provide a mineral wool mass having the foregoing characteristics which is flexible and resilient, so that when walked on or otherwise compressed or flexed, it will yield but will spring back substantially to its former shape and position when released. The so-called masses of mineral or rock wool hereinafter and at present in general use, have serious objections as they lack the desirable features above noted which characterize the present invention. Such masses are generally a molded product and in view of the shortness of the fibers derive substantially all of their strength from the binding material. As a result, the products are solid, rigid and inflexible. When such material is stressed or bent, solid portions of it crack off and break away, and when the material is walked on or compressed, the mass merely crumbles and cannot resume its former shape or position. Moreover, in forming pipe coverings of this material, the product has to be formed into two separate solid blocks which are generally hinged together along their longitudinal edges. If one of these halves is bent open, the material refuses to flex but merely breaks off in large pieces. An aim of the present invention is to overcome the above noted objections and difficulties and produce a felted mass which may be flexed and bent to a reasonably high degree and which does not crack off into large pieces.

Another object of the present invention is to provide an interfelted, bonded mass of glass wool of light density, the density being of the order of magnitude of about 3 to 15, and preferably about 5 to 7 pounds per cubic foot, and having great strength although replete throughout with a multiplicity of dead air spaces.

Another object of the invention is to provide a felted mass of the foregoing characteristics, having a predetermined thickness and density, depending on the particular use to which it is to be put, as, for example, stove or refrigerator insulation, wall boards or the like.

Another object of the invention is to provide a felted mass of the foregoing characteristics in which a large portion of the glass fibers may remain long and reticulated and mutually interlaced and extending in all directions.

A further object of the invention is to produce mats of the foregoing characteristics having various binders suitable for various specific uses and in particular for use as a high temperature heat insulation product.

A further object of the invention is to provide methods of interfelting a conventional glass wool mat having long fibers in substantial parallelism, the said methods producing an interfelting without causing the mat to tear apart or become weak or infirm, and without causing the individual fibers to break up into a mass of short fibers such as conventional rock wool or the like.

In the accompanying three sheets of drawings, three modifications of a method and apparatus for forming a conventional glass wool mat and thereafter causing it to be interfelted and bonded;

Fig. 1 is a fragmentary elevational and diagrammatic view shown partly in section of an apparatus for forming a conventional glass wool mat and thereafter causing it to be interfelted and bonded;

Fig. 2 is a plan view of the interfelting apparatus shown in Fig. 1;

Fig. 3 is an end view shown partly in section of the same apparatus, the section being taken at the line 3—3 of Fig. 1.
Fig. 4 is a diagrammatic side elevational view partly in section of a modified embodiment of a portion of the apparatus adapted to juxtapose a plurality of layers of glass wool mats or webs and cause interfelting of the fibers thereof; Fig. 5 is a diagrammatic elevational view shown partly in section of an apparatus for forming a glass wool felt and a modification of the interfelting means; Fig. 6 is a plan view of the modified embodiment of the felting apparatus shown in Fig. 5; Fig. 7 is an end view of the same modification illustrated in Figs. 5 and 6, the section being taken on the line 7—7 of Fig. 5; Fig. 8 is a fragmentary diagrammatic side elevational view partly in section and similar to Fig. 5, showing an apparatus for forming glass wool felt and a further modification of the interfelting means; Fig. 9 is a plan view of the modified embodiment of felting apparatus shown in Fig. 8; Fig. 10 is a sectional view taken substantially along the line 10—10 of Fig. 9, and Fig. 11 is an enlarged sectional view taken substantially along the line 11—11 of Fig. 8.

With reference to conventional methods of making insulating material of the general type hereinbefore mentioned, when short hairy fibers are used such as those produced in the common rock wool or mineral wool operations, the fibers are commonly so short that it is impossible for them to interlace and mesh with one another to produce substantial mass integrity and inherent strength. For this reason various bonding agents are commonly intermixed with such materials, these bonding agents being products such as asphalt or the like, which more or less completely fill the interstices between the fibers and in any event cause a rigid high density product to be produced such as a cement product or board.

On the other hand, when mats comprising long fibers are produced, such as those mats formed by the deposition of long, fine, glass fibers, the inherent arrangement of these fibers is more or less completely parallel to the surface upon which the fibers are accumulated or disposed. There is little, if any, departure from the original parallelism. The fabric can readily be cleft or separated along surfaces parallel to the fibers without material resistance from the mat itself. In other words, the mat inherently lacks mass integrity and tensile strength in directions transverse to the mat. I have found, however, that by means of the present method as described fully hereinafter, it is possible to produce a mat which utilizes the inherent orientation of the fibers and yet which possesses mass integrity and strength in all directions throughout the mass.

One of the features of the present invention is the production of insulating material comprising a mass of long mineral wool or glass fibers which lie predominantly in a plane or surface transverse to the direction of heat flow through the material but in which a large portion of the fibers have departed from parallelism with said plane and have been caused to interweave and interlace with the fibers which remain parallel with said plane. There is thus produced a feltable mass having strength and mass integrity in all directions including the said transverse direction. Another feature of the present invention is the production of a heat insulating material which, while being interfelted, is, nevertheless, laminated to such a degree that it possesses a high degree of flexibility, yieldability and strength in all directions and also possesses a high degree of insulating value.

Another feature of the present invention relates to a process of felting a mat in which there is produced a series of successive short relative movements between the upper and lower surface portions of the mat, the movements being more or less in the direction of the surface of inherent parallelism. When layers of fibers parallel to a particular plane are juxtaposed and then caused to slide upon one another in a particular direction for a short distance, the fibers of each of these layers tend to interfelt and depart to a certain extent from the initial parallelism. If these layers are again given another short relative movement, they are permitted to further interfelt and further depart from their initial parallelism to the surface. If the individual movements, however, are excessive, the mat is merely torn apart without accomplishing the desired purpose. More agitation without intelligent guidance, therefore, is not sufficient, the movements or impulses are repeated for a sufficient number of times, it is possible to cause a thorough interfelting, which I have so termed, having in mind a mass of fibers interlaced and extending in all directions including directions transverse to the original inherent parallel surface, although having components of direction predominantly parallel to the original parallel surface.

I have found that while repeated movements or impulses cause an interfelting action, it is generally preferable to produce these movements or impulses in the same direction or in more or less the same effective direction as brought out more fully hereinafter. When laminations or layers of fibers arranged in parallel planes are juxtaposed to one another and caused to slide upon one another in a particular direction for a short distance, the fibers of each of these laminations tend to interweave, interfelt and depart from the initial parallelism. If these laminations are then moved back again to their original positions, the individual fibers tend in part to resume their initial positions and regain substantial parallelism to the principal surface.

However, if successive impulses are given to the juxtaposed laminations in the same direction or at least in the same effective direction, as brought out more fully hereinafter, the fibers do not resume their original positions but continue to interfelt and intertwin and depart to a predetermined degree from the original parallelism. The result is that the original laminations are caused to be interfelved and a certain portion of the juxtaposed fibers are caused to intertwin and increase the mass integrity of the mat in the direction transverse to the original surface of parallelism. However, the fibers, and particularly the longer fibers, remain predominantly in orientations approaching more or less closely their original parallelism so that the original laminations are not necessarily entirely removed and the benefits derived from arranging the major portion of the fibers and particularly the longer ones transverse to the heat flow are retained. Many of the shorter fibers thus extend in directions transverse to the major faces of the mat and thus serve to add strength in these directions leaving longer fibers principally lying in planes parallel to the major faces and serving to retain the strength of the mat in these directions.

The successive impulses or short relative move-
ments in the same direction between two adjacent laminations may be produced by several methods, as brought out more fully hereinafter.

Another important feature of the present invention is the discovery that the use of a large amount of water or other suitable liquid throughout the mass of fibers materially assists in the interfelting action. For this purpose I preferably drench the fibers with a large amount of binder solution prior to the interfelting action. The liquid performs two principal functions, (1) It lubricates the fibers and permits them to slide past one another during the interfelting action, and (2) the forcible removal of the liquid from the fibrous mass, as, for example, by centrifugal force, causes displacement of the fibers from their original orientation. Thus, the mere fact that the fibrous mass has been drenched with a suitable liquid facilitates the interfelting and consequently increases coherence of the interfelting as a whole and the forcible removal of the liquid in itself causes interfelting.

The liquid, which may be caused to fill the interstices between the fibers originally, may weigh as high as ten or more times as much as the fibers, owing to its heavy concentration throughout the mass. As the liquid is removed from the mass of fibers either by centrifuging, suction, or other suitable means, it causes the fibers and particularly the shorter fibers, to be displaced from their original position and approach an alignment in the direction of removal of the water. When the liquid is removed in the direction transverse to the original inherent parallelism, the fibers tend to align themselves in the transverse direction and thus facilitate an interfelting of the mass.

In carrying out my invention, it is possible to produce articles of planar form for various uses as, for example, stove insulation, refrigerator insulation, wall board and the like, or any other desired insulating material.

Referring now to the drawings, Fig. 1 shows an apparatus for producing glass wool mats and a method of forming them into an interfelting mass. A glass melting and refining tank or forehearth is shown in which a head of glass is maintained. The molten glass flows continuously through feeders in the floor of the furnace in a multiplicity of small streams which are acted upon by vigorous blasts of air. The streams of glass are enveloped by the downward blast of steam or other gas supplied by the blowers and are thereby continuously drawn out to fine fibers or filaments.

Spaced below the feeder of which there may be a plurality, are vertically disposed spouts. The steam blasts from each blower are thus directed downwardly through the spouts, carrying with them the attenuated fibers. The spouts are preferably of streamline formation, the walls of each spout being downwardly divergent and having their upper marginal portions curved to provide a flared mouth. The spouts are preferably 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 and a considerable volume of air is drawn in and intermixed with the steam.

The lower ends of the spouts open into an expansion hood or chamber which is also preferably of streamline construction and forms an accumulating chamber within which the fibers from the spouts are laid upon and intermatted on the reticulated conveyor belt to form a mat.
The operation of this device is such that the mat, in passing between the juxtaposed belts 45 and 46, is interfolded and partially compressed. As the mat 31 passes between the belts 45 and 46, the upper belt 46 is given a horizontal circular movement preferably of about ½ inch diameter or so, in a plane parallel to the surface of the mat. The space between the belts is gradually tapered from the charging end to the discharge end of the line so that, for example, if a 4 inch glass wool mat soaked with binder were fed in at one end, it may be felted into a mat of, say, about 1 inch in thickness according, of course, to the degree of interfleting and the density desired.

The relative circular movement between the two belts causes an interfolding between the parallel layers or fibers whereby a certain portion of the fibers lying parallel to the surface of the mat are caused to depart from the original parallelism and are caused to interwove and interlace with the adjacent layers to produce an interfelted mass.

The circular motion made possible by the mat, it will be noted, causes any two juxtaposed points upon respective layers of fibers to receive impulses or relative movements in only one direction, that is to say, as one point is moved in a circular motion relative to a second juxtaposed point, the second point passes the first points in only one direction. When passing back in the other direction, it will be noted that the second point is at a distance from the first point, this distance being comparable to the diameter of the circular motion. It has been found that mats of glass wool given this type of motion are caused to interfelt and produce a fibrous mass having an interfelted appearance in which the individual fibers in parallel layers are caused to interfelt and intermat to a predetermined degree.

The binder which is added to the mat is preferably a dilute solution, say, 1 to 10% of a suitable binder such as starch, bentonite, casein, dextrin, agar agar, gelatin, rubber, asphalt, etc. The solution of binder performs two principal functions, (1) it serves as a lubricating medium between the fibers during the interfeting action, and (2) after the binder is applied, it may be dried, leaving the binder coating the fibers and binding interadjacent fibers preferably at points of intersection, whereby a flexible porous mass is produced. The binder solution, being dilute, permits the binder to be distributed uniformly throughout the mass and when the liquid has been evaporated a relatively small amount of binder remains. I have found that a small amount, such as 1 to 10% binder, and preferably about 2 to 5% binder, is sufficient for most purposes.

Referring more particularly to Figs. 5 to 7, another embodiment of the present invention is disclosed in which a planar interfolded board or cake of glass wool may be produced. In this embodiment the method and apparatus for forming a mat of glass wool includes a mat 31, another suitable mat forming means such as a series of rollers 33 which are inter-connected by chains or interconnecting links 34 in endless formation. Each of the rolls 35 is also provided with its outer extremity being in the links with outwardly extending lugs 36 which engage with the gear teeth 86 of sprocket wheels 87. The sprockets 81 are keyed to shafts 88 and 89 which revolve in bearings 89 of the framework 90. The shaft 89 being near the discharge end of the device is preferably provided with suitable driving means such as a motor 91. Driving connection between the motor 91 and the shaft 89 may be made through a pulley 82, drive belt 83 and gear box 84, the latter being actuated directly by the motor 91. The pulley 81 is also provided with a driving means such as the motor 85, gearing within the gear box 86, the interconnecting drive belt 87 and the pulley 88. If preferred, both the belt 80 and the rollers 83 may be driven by other suitable means or by the same motor or power unit.

The motor 91 advances the rollers 83 over the mat 31 in the same direction as the mat is moving although at a speed preferably greater than that at which the belt 80 is traveling. This causes each roller 83 to impart to the material forming the mat a wave-like or ruling movement, each wave advancing relative to the mat.

By regulating the speed of the rollers relative to the speed of the mat 31, it is possible to regulate the number of times the mat receives a ruling action. It will be noted that with the arrangement, it is possible to provide a machine which takes up little room and yet applies to the mat any reasonable predetermined number of impulses, wave-like motions or ruling actions, as desired.

The rolling movements upon the mat 31 cause the upper surface of the mat to advance a short distance forward relative to the lower surface of the mat. One factor assisting in the interfeting of the glass fibers is a small node or swelling which forms in front of and precedes the roller 83 in its passage across the mat, this node causing the fibers to be raised a certain extent and permitting adjacent lines of fibers to interlace and interfelt more completely. In this connection it is noted that the solution apparatus serves to provide successive relative movements in the same direction between adjacent layers of fibers, all of which lie originally substantially parallel to the principal surface of the mat. As these successive movements in the same direction are given to the mat, a large portion of the fibers, starting particularly at the ends thereof or loops therein, are caused to interlace and interfelt and provide a mass integrity and strength to the mat in the direction transverse to the principal surface thereof. After the mat has been interfelted, it is conveyed through a drying oven 100 which serves to remove the water present in the solution and thus permits the binder present in the original solution to solidify and cause the adjacent fibers to be held together in a mat.

Referring more particularly to Fig. 4, I have illustrated an apparatus adapted to juxtapose a plurality of mats of glass wool fibers preparatory to forming them into a felted planar mat or board by a process and apparatus such as those illustrated in Figs. 1 to 7. In this apparatus a plurality of mats or webs 266, which have been formed on a suitable forming machine such as illustrated in Figs. 1 or 5, are fed in over supporting means or chutes 266. The
supporting members 200 prevent the mats or webs 200 from pulling apart or otherwise disintegrating. The mats or webs as they advance beyond the supports 200 are brought into juxtaposition with one another between the coating belts 200 and 210 which lie on each side of the juxtaposed mats. Spray heads 210 are mounted over the juxtaposed mats or webs 200 and cause a large amount of preferably dilute binder solution to drench and thoroughly soak the mass of glass wool fibers. A trough 210 underlies the belt 200 to collect and conserve the excess liquid which may run through the mat. The juxtaposed layers 210, after having been drenched with a suitable liquid, may then be fed into one of the interfiling apparatuses illustrated in Figs. 1 to 7.

When interfiling a plurality of juxtaposed layers, the fibers of the individual layers are caused to interfilt with the fibers of adjacent layers to produce a coherent mass of glass wool fibers, in a similar manner to that illustrated and described hereinabove or as more fully brought together herein in connection with the other embodiments.

After interfiling by any of the mechanisms disclosed herein the product may be dried, baked, or otherwise treated as desired in accordance with the type of binder employed in order to bond adjacent fibers together and form a strong flexible coherent mass.

Referring now to Figs. 8 to 11 inclusive, a still further embodiment of the invention is shown involving a somewhat different method of causing interfiling of the fibers in the mat produced according to the fiber-forming apparatus shown in Figs. 1 or 5. The forming apparatus per se, including the refining tank or forehearth 20, the feeders 22, spouts 20, hood 40 and other associated parts, is substantially the same as the apparatus shown in the preceding figures and identical reference characters have been assigned thereto. The mat 31 is soaked or impregnated with a binder, the surplus of which drains into the trough 44 as previously described. The mat advances from the conveyor 30 and passes successively in between several pairs of interfiling rolls designated successively at a, b, c and d, each pair consisting of an upper roller 100 and a lower roller 102, the character and movements of which will be described presently.

Referring now to Fig. 10, it will be seen that each of the lower rollers 102 is disposed on a shaft 103 supported in a framework 104 by means of stationary bearings 108 on opposite sides of the framework. The rollers 102 are formed with a series of relatively wide ribs 105 threading the mat 31 and each mat 31 is subjected to lateral shifting thereon under the impulses applied by the upper rollers 100.

The upper rollers 100 are arranged in pairs, those associated with the rolls a and b constituting one pair, and those associated with the rolls c and d constituting the other pair.

The upper rollers 100 are each mounted on shafts 110 (see also Fig. 9) which are supported at opposite sides of the framework in pivotable or swiveling bearing blocks 112 which are mounted for limited turning movement about a vertical axis in a pair of the three cages 114 which are pivoted medially of their ends upon vertical shafts 116 mounted in the framework 104. The cages 114 are suspended or floated between upper and lower springs 118 and 120 respectively, adjusting means 116 in the form of metal blocks provided to regulate the normal elevation of the cages 114 and vary the pressure exerted upon the mat 31 by the various pairs of rollers 100, 102.

Each oppositely disposed pair of cages 114 is designed to support the pairs of adjacent upper rollers and it will be seen that upon turning movement of the cages 114 about the vertical axes of the shafts 116, one upper roller of each pair will be moved transversely in one direction, whereas the other roller of the pair will be moved in the opposite direction.

The cages 114 on opposite sides of the framework 104 are normally disposed substantially in alignment with the inner ends thereof opposing each other. These latter inner ends of the cages 114 project into recesses 122 formed in a transversely shiftable block 124. The block 124 is connected as at 126 to the inner end of an eccentric arm 128, the other end of the arm being attached to an eccentric 130 provided on a shaft 131 (see also Fig. 6) journaled in bearings 132 mounted in the framework 104.

Referring now specifically to Fig. 8, the eccentric shaft 131 is driven through a belt connection 134 from a driven shaft 135 of a gear reduction device 136 which is in turn driven by an electric motor M. The gear reduction device 136 is provided with a second driven shaft 140 having a belt connection 142 leading to the shaft 103 upon which the first lower roller in the series is mounted. Motion imparted to this latter lower roller 102 is transmitted to all of the other lower rollers in the series by means of various belt connections designated generally at 144, connecting the shafts 103 in unison.

One end of each of the shafts 103 is formed with a relatively wide spur gear 150 thereon. Similarly, an end of each upper shaft 110 is provided with an equally wide spur gear 152 thereon meshing at all times with the corresponding spur gear 150. The widths of the gears 150 and 152 are such that the two gears will at all times remain in mesh despite the limited shifting movement of the upper shaft 110 relative to the lower shaft 103. Thus it will be seen that rotation of the lower shaft 103 in one direction will cause its corresponding shaft 110 to be rotated in the opposite direction.

From the foregoing description it will be observed that as the eccentric shaft 131 rotates in one direction the block 124 is reciprocated transversely of the apparatus. Such reciprocal movement of the block transmits lateral reciprocation to the various pairs of upper rollers 100, alternate rollers moving in the same direction. The rollers 100 during such shifting movement remain substantially parallel to a fixed axis since they are in effect the opposite sides of a collapsible parallelogram-like structure. Such lateral shifting of the rollers is accompanied by a relatively small longitudinal component of movement inasmuch as the ends of the cages 114 in the respective movements describe relatively small arcs. The magnitude of these arcs however is nevertheless sufficient to cause a significant drawing together and separation of the rollers of each pair to the time the block 124 is reciprocated. In this manner interfiling of the fibers in the mat is enhanced.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as...
various changes therein are contemplated. For example, while I have shown four pairs of rolls, in turn arranged in pairs of two each, additional pairs of rolls may be provided together with means for shifting the upper rollers relative to the lower ones. Only insofar as the invention has particularly been pointed out in the claims is the same to be limited.

Claim 1: The method of forming an interfelted mass of glass fibers which comprises depositing a plurality of long attenuated glass fibers upon a surface and causing them as they are deposited, to build up into a mat in which said fibers all lie criss-crossed with one another and predominately parallel with said surface, and then applying short relative movements between opposite outer surfaces of said mass in a plane substantially parallel with both said surfaces while maintaining the mat at a substantially fixed thickness to cause said fibers to tend to depart from the original predominant parallelism and interfelt with one another throughout the mass.

2. The method as claimed in claim 1 in which said movements are all substantially in the same direction.

3. The method of interfeltling a mat of long attenuated glass fibers in which said fibers lie predominately parallel to the surface of said mat and criss-crossed with one another, which comprises applying a lubricant to said mass or mat, and then holding said mat to a substantially fixed thickness while applying a number of short relative movements between opposite outer surfaces of said mat substantially in a direction parallel with both said surfaces to cause the fibers to depart from their original predominant parallelism to the face of said mat and reticulate with one another and thereby producing a mass having a high degree of coherence, mass integrity and flexibility.

4. The method as claimed in claim 3 in which said movements are all in substantially the same direction.

5. The method of interfeltling a mat of long attenuated glass fibers in which said fibers lie predominately parallel to the surface of said mat, and criss-crossed with one another, which comprises applying a lubricant to said mass or mat, and then applying a number of short relative movements between opposite outer surfaces of said mat all in substantially the same direction and substantially in a direction parallel with both said surfaces while maintaining said mat at a fixed thickness to cause the fibers to depart from their original predominant parallelism to the face of said mat and reticulate with one another and thereby producing a mass having a high degree of coherence, mass integrity and flexibility, said lubricant being a dilute solution of binder, and drying said lubricant and thereby causing adjacent fibers to be bonded together at their points of intersection.

6. The method of producing a coherent mass of glass fibers which comprises juxtaposing a plurality of layers of glass wool mats, said mats composed of a multiplicity of long attenuated glass fibers extending criss-crossed with one another and predominately parallel to the face of the mat, drenching said juxtaposed layers with a dilute binder solution, applying to said juxtaposed layers a series of short relative movements with respect to one another to cause the fibers of adjacent layers to interlace and interfelt with one another and thereby producing a coherent mass, and then drying said binder solution and causing the binder to bond adjacent fibers together.

7. The method as claimed in claim 6 in which all of said movements are substantially in the same direction.

8. The method of producing a coherent mass of glass fibers which comprises juxtaposing a plurality of layers of glass wool mats, said mats composed of a multiplicity of long attenuated glass fibers extending predominately criss-crossed with one another and parallel to the face of the mats, drenching said juxtaposed layers with a dilute binder solution, and then giving said juxtaposed layers a series of short relative movements with respect to one another to cause the fibers of adjacent layers to interlace and interfelt with one another and thereby producing a coherent mass and then drying said binder solution and causing the binder to bond adjacent fibers together, each of said relative movements being caused by producing a node in said layers and causing said node to travel along the length of said layers.

9. The method of forming an interfelted mat of fiber of inorganic material from a mat from which the major portions of the fibers lie criss-crossed with one another and predominately parallel with a major face of the mat, which comprises permeating the mass with a lubricating fluid, applying short relative movements all in the same direction to opposite faces of the mass while holding the mat to a substantially fixed thickness and thereby causing the fibers to depart in some degree from their said original predominately parallel arrangement and interfelt with one another throughout the mass, and thereafter causing a modification of said portion of said lubricating material by which it is transformed to a binder and serves to bond the fibers together and give tensile strength and a degree of rigidity to the mass.

10. The method of interfeltling a mass of long attenuated glass fibers in which the fibers lie predominately parallel to the surface of the mass and criss-crossed with one another, which comprises compressing said mass, and applying short relative movements between the opposite outer surfaces of the compressed mass all in substantially the same direction and in a plane substantially parallel with both said surfaces to cause said fibers to tend to depart from their original predominant parallelism and interfelt with one another throughout the mass.

11. The method of interfeltling a mass of long attenuated glass fibers in which the fibers lie predominately parallel to the surface of the mass and criss-crossed with one another, which comprises compressing said mass, applying short relative movements between the opposite outer surfaces of the compressed mass all in substantially the same direction and in a plane substantially parallel with both said surfaces to cause the fibers to tend to depart from their original predominant parallelism and interfelt with one another throughout the mass.

12. The method of forming an interfelted mass of glass fibers which comprises juxtaposing a plurality of layers of glass wool mats to form a laminated mass of glass wool, said mats composed of a multiplicity of long attenuated glass fibers extending criss-crossed with one another, holding said juxtaposed layers in substantially fixed thickness while causing short relative movements between the outer surfaces of said mass in a direction substantially parallel with said surfaces,
whereby to cause the fibers in the layers to depart from their original position and interfelt with fibers in adjoining layers.

13. The method of forming an interfelted mass of glass fibers which comprises forming a loose mass of long attenuated glass fibers in which said fibers all lie criss-crossed with one another, and then applying short relative circular movements between the opposite outer major surfaces of said mass in a direction substantially parallel with both said surfaces to cause said fibers to tend to depart from their original position and interfelt with one another throughout the mass.

14. The method of forming an interfelted mass of glass fibers which comprises depositing a plurality of long attenuated glass fibers upon a surface and causing them as they are deposited to build up into a mat in which said fibers all lie criss-crossed with one another, advancing said mat in its plane and as it builds up and simultaneously applying short relative circular movements between the opposite outer major surfaces of said mat in a direction substantially parallel with both said surfaces to cause said fibers to interfelt with one another throughout the mat.

15. The method of forming an interfelted mass of glass fibers which comprises juxtaposing a plurality of layers of glass wool mats to form a laminated mass of glass wool, said mats composed of a multiplicity of long attenuated glass fibers extending criss-crossed with one another, advancing said mass in its plane and simultaneously causing short relative movements between the outer surfaces of said mass in a direction substantially parallel with said surfaces, whereby to cause the fibers in the layers to interfelt with fibers in adjoining layers.

16. The method of producing an interfelted mass of glass fibers which comprises advancing a loose mat of glass fibers in its plane, engaging opposite major faces of said mat with planar members and causing movement of said members in the direction of and at the same rate as the feeding movement of the surfaces of said mat, and causing a relative circular movement between said members as they advance to thereby cause relative circular movement between opposite faces of the mat to cause the fibers of the mat to interfelt with one another.