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PROCESS OF PRODUCING MATS OF GLASS FIBERS

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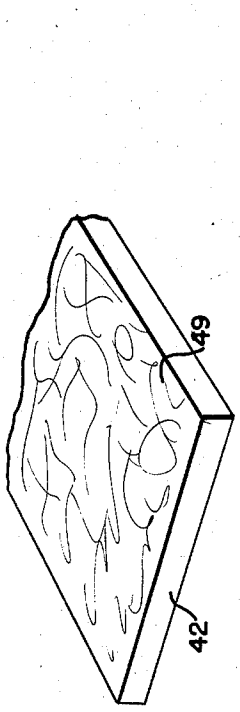


FIG.-2

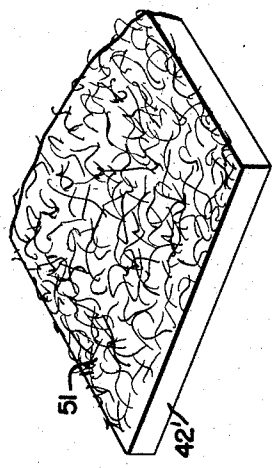


FIG.-3

FIG.-1

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PROCESS OF PRODUCING MATS OF GLASS FIBERS

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14 Claims. (Cl. 19—156)

This invention relates to the production of fibrous siliceous products and more particularly to the production of sheets and mats of glass fibers, the surfaces of which products are substantially free from the fuzziness normally characteristic of such articles.

It is known to feed glass filaments into a hot gaseous blast, the heat of which blast softens the filaments while the rapidly moving gases of the blast draw out the softened material into fibers of short lengths. Customarily the blown fibers are collected on a screen or belt moving transversely to the blast and the collected fibers form a mat-like layer on the collecting means, the thickness of which layer is readily regulated by governing the speed of the screen or belt. Such products heretofore have exhibited a surface which is fuzzy in appearance as the collected fibers are unoriented, and apparently the ends of the fibers protrude from the surface to create a fuzzy cottony appearance.

It is a primary object of this present invention to describe a novel method for the attainment of substantially smooth surface finishes on sheets and mats formed by collecting blown fibers as described hereinbefore.

It is an important object of the present invention to describe a novel sheet or mat-like product produced by the collection of blown fibers and the surfaces of which product are substantially free of fuzziness.

It is a particular object of the invention to describe a novel method for the production of a blown fibrous product which method in substance effects an orientation of the fibers and at the same time achieves an improved dispersion of the fibers to permit the attainment of products of greater surface area with a given weight of the fibers.

These and other allied objects of the invention are attained in a highly efficient manner by introducing into the gaseous blast which attenuates the heat softenable filaments and carries the same to the collecting means, the vapors of a volatilizable inorganic salt and then collecting the blown fibers. The effect of the introduction of the vapors of the salt into the gaseous blast carrying the fibers is to both increase the dispersion of the fibers in the blast and to orient the fibers somewhat so that the ends thereof lie substantially in the plane of the finished mat or sheet and do not substantially protrude therefrom.

The effect which the vapors of the salt exert on the fibers is not completely understood but may be due to electric charge effects, surface tension effects, adhesion of vapors to the fibers flowing in the gas blast, or a combination thereof; in any event the salt itself appears to some extent in the finished product and for many purposes soluble salts are preferable as they may be washed from the sheet or mat without disturbing the novel surface condition thereof. In other instances, as where the sheet or mat is to be treated with an aqueous solution in normal processing for the production of fibrous glass articles, the soluble salt is preferred as it

is automatically delected from the product in the usual processing.

The salts particularly useful in the invention are those which are fusible and which create a high vapor pressure without undergoing decomposition. Nitrates, some phosphates and halides, particularly those of the monovalent metals and the lighter divalent metals, fuse at reasonable temperatures without premature decomposition. Thus sodium nitrate has a melting point of 308° C. and boils at 380° C., but undergoes decomposition on boil and accordingly the temperature when such salt is employed should be materially below the boiling point. Potassium metaphosphate undergoes a transfusion in the salt state at about 450° C. and melts at 798° C., the boiling point being about 1320° C.; magnesium chloride melts at about 712° C. and boils at 1412° C.; in general however the halides of the alkali metals are to be preferred and of these sodium chloride is most desirable, as it is readily available, cheap, water soluble and is most satisfactory in the practice of the invent.on. However other halides as listed below are within the contemplation of the invention:

Composition	Melting Point, ° C.	Boiling Point, ° C.
Sodium iodide	651	1,300
Potassium chloride	790	1,500
Potassium iodide	723	1,330
Lithium chloride	614	1,360
Lithium bromide	547	1,265

The invention will be more fully understood by reference to the following detailed description and accompanying drawing wherein:

Figure 1 schematically illustrates apparatus useful in the practice of the invention;

Figure 2 illustrates the product of this invention; and

Figure 3 illustrates the product of the prior art.

Referring to the drawing there is shown at **1** in Figure 1 a refractory body having a supporting metallic casing **3** and an interior chamber **5**, the upper portion of which is partially closed by brickwork as at **7**. Supported within the chamber **5** is a crucible **9** also of refractory material adapted to contain a body of molten glass **11**, which in the present instance may be any glass within the stated range of compositions and which glass is heated by combustible gases passed through the ports **13** and burned in contact with the crucible **9** within the chamber **5**; the exhaust gases escape through the loosely spaced brickwork **7**.

The crucible **9** is provided with apertures in the base thereof through which filaments **15** are drawn over guide rolls **17** by drawing rolls **19** to be passed into a hot gaseous blast **21**. The glass drawn from the crucible **9** is replaced by fresh glass in the form of spheres **23** which pass a solenoid control gate **25** from hopper **27** in response to demand for glass indicated by the electrodes **29**, **31**. An electrical circuit arrangement suitable for the control of the flow of fresh glass to crucible **9** is described in my co-pending application Serial No. 387,260 filed October 20, 1953. However any other suitable means of feeding glass to the crucible **9** may be employed in the practice of this invention.

The filaments **15** pass in parallel relation into the hot blast **21** emanating from the burner **33** which is supplied through the inlet port **35** with combustible gases such as fuel gas and air which is substantially completely burned within the burner **33**.

The hot blast acting on the ends of the filaments across the guide **22** softens the filaments and causes them to be attenuated and blown through a conduit **37** to a collect-

ing screen 39 where a thin wide mat of fibers is attained. Suction apparatus indicated generally at 41 assists the deposition of the fibers on the screen to form mat 42.

In the practice of this invention as shown in Figure 1 conduit 37 is provided with an opening to which there is secured a nozzle of a suitable chamber 43 which chamber contains a heating coil 45 immersed in molten sodium chloride indicated at 47. The heating means for the sodium chloride is not critical and the heat may be applied through the submerged coils, by electrical system heating means, or any other suitable apparatus capable of providing the salt to be fused with a temperature sufficient to effect fusion. Such apparatus is known in the metal art wherein fused salt baths are commonly employed for hardening and tempering of metals.

The vapors of the sodium chloride are drawn from the chamber 43 rather rapidly as the gaseous blast passes longitudinally through the conduit 37 a suction effect being created at the opening to the chamber 43. The fibers flowing in the gaseous blast are contacted by these vapors and the mat 42 collected on the screen 39 will have a substantially flat surface condition such as that shown in Figure 2 at 49. This, it will be noted, is in direct contrast to the surface condition indicated at 51 in Figure 3 which represents the normal appearance of a mat collected of fibers which were not exposed to the vapors of the salt as in the practice of this invention.

The flat surface characteristic is particularly desirable where the product is in thin sheet form. Such sheets, when the fibers are collected at the screen as at 39, will exhibit no fuzziness even though the sheet be so thin as to bear the imprint of the screen configuration. Accordingly thin sheets formed in this manner are useful in the preparation of all glass paper.

A further benefit of the non-fuzzy surface characteristic is that particles of dust, and so forth, are not as readily attracted to the sheet or mat product of the invention.

It is also to be noted that efforts to employ such substances as plastic and materials such as vaporized metal were ineffective to produce the surface of invention described hereinbefore.

It is accordingly believed that an ionic effect is present at least to some extent which occasions the dispersion of the fibers and the orientation thereof to such an extent that fiber ends do not protrude from the product.

It is also to be noted that it is not necessary to introduce the vapors of the inorganic salt within the length of the conduit 37, but the same may be adequately introduced into the flow by positioning the source of the inorganic salt vapors adjacent the end of the conduit which is closer to the gas burner.

It will be understood that this invention is susceptible to modification in order to adopt it to different usages and conditions and accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, introducing into said flow stream and into contact with the surfaces of the suspended siliceous fibers the vapors of an inorganic salt which fuses and vaporizes without decomposition selected from the group of alkali metal halides, alkali metal phosphates, and alkali metal nitrates, and collecting the coated fibers as a mat.

2. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, introducing into said flow stream and into contact with the surfaces of the suspended siliceous fibers the vapors of sodium chloride, and collecting the coated fibers as a mat.

3. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, introducing into said flow stream and into contact with the surfaces of the suspended siliceous fibers the vapors of potassium chloride, and collecting the coated fibers as a mat.

4. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, introducing into said flow stream and into contact with the surfaces of the suspended siliceous fibers the vapors of an inorganic salt which fuses and vaporizes without decomposition selected from the group of alkali metal halides, alkali metal phosphates, and alkali metal nitrates, collecting the metal coated fibers as a mat, and washing the fibers with water subsequent to collection in mat form.

5. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, introducing into said flow stream and into contact with the surfaces of the suspended siliceous fibers the vapors of sodium chloride, collecting the coated fibers as a mat, and washing the fibers with water subsequent to collection in mat form.

6. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, introducing into said flow stream and into contact with the surfaces of the suspended siliceous fibers the vapors of potassium chloride, collecting the coated fibers as a mat, and washing the fibers with water subsequent to collection in mat form.

7. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, providing a source of vapors of an inorganic salt which fuses and vaporizes without decomposition, directing said flow stream in aspirating relation with respect to said vapor source whereby the velocity of said flow stream is effective to draw said vapors into said flow stream and coat the surfaces of the fibers suspended therein, and collecting the coated fibers as a mat.

8. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, providing a source of vapors of an inorganic salt which fuses and vaporizes without decomposition selected from the group of alkali metal halides, alkali metal phosphates, and alkali metal nitrates, directing said flow stream in aspirating relation with respect to said vapor source whereby the velocity of said flow stream is effective to draw said vapors into said flow stream and coat the surfaces of the fibers suspended therein, and collecting the coated fibers as a mat.

9. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, providing a source of vapors of sodium chloride, directing said flow stream in aspirating relation with respect to said vapor source whereby the velocity of said flow stream is effective to draw said vapors into said flow stream and coat the surfaces of the fibers suspended therein, and collecting the coated fibers as a mat.

10. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, providing a source of vapors of potassium chloride, directing said flow stream in aspirating relation with respect to said vapor source whereby the velocity of said flow stream is effective to draw said vapors into said flow stream and coat the surfaces of the fibers suspended therein, and collecting the coated fibers as a mat.

11. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers,

providing a source of vapors of an inorganic salt which fuses and vaporizes without decomposition, directing said flow stream in aspirating relation with respect to said vapor source wherein the velocity of said flow stream is effective to draw said vapors into said flow stream and thereby coat the surfaces of the fibers suspended therein, collecting said coated fibers in mat form, and washing said mat with water after collection.

12. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, providing a source of vapors of an inorganic salt which fuses and vaporizes without decomposition selected from the group of alkali metal halides, alkali metal phosphates, and alkali metal nitrates, directing said flow stream in aspirating relation with respect to said vapor source whereby the velocity of said flow stream is effective to draw said vapors into said flow stream and thereby coat the surfaces of the fibers suspended therein, collecting said coated fibers in mat form, and washing said mat with water after collection.

13. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, providing a source of fibers of sodium chloride, directing said flow stream in aspirating relation with respect to said

vapor source whereby the velocity of said flow stream is effective to draw said vapors into said flow stream and thereby coat the surfaces of the fibers suspended therein, collecting said coated fibers in mat form, and washing said mat with water after collection.

14. The process of producing fibrous mats having substantially fuzz-free surfaces comprising the steps of, providing a gaseous flow stream of suspended siliceous fibers, providing a source of vapors of potassium chloride, directing said flow stream in aspirating relation with respect to said vapor source whereby the velocity of said flow stream is effective to draw said vapors into said flow stream and thereby coat the surfaces of the fibers suspended therein, collecting said coated fibers in mat form, and washing said mat with water after collection.

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