H. F. WEISS.

COMPOSITE INSULATING MATERIAL.

APPLICATION FILED JUNE 2, 1919.

1,336,403. Patented Apr. 6, 1920.

Fig. 1,

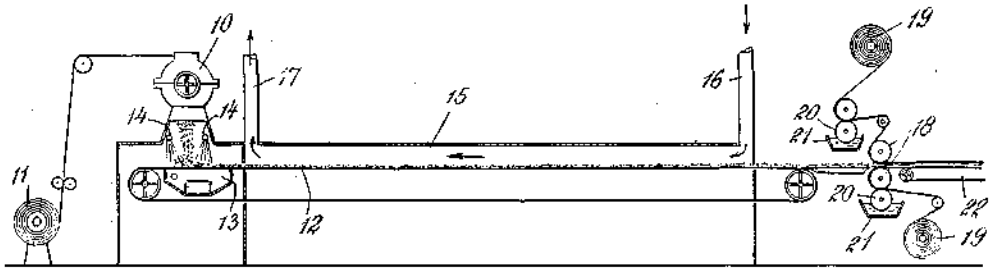


Fig. 2,

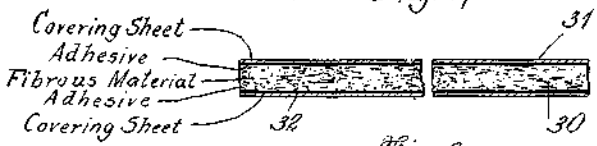


Fig. 3,

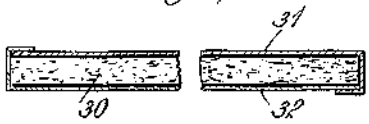
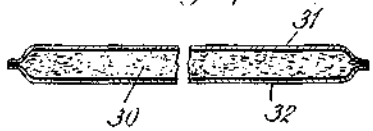


Fig. 4,

Fig. 5,



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COMPOSITE INSULATING MATERIAL.

1,336,403. Specification of Letters Patent. Patented Apr. 6, 1920.

Application filed June 2, 1919. Serial No. 301,218.

To all whom it may concern:

Be it known that I, HOWARD F. WEISS, a citizen of the United States, residing at Madison, in the county of Dane, State of Wisconsin, have invented certain new and useful Improvements in Composite Insulating Materials; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to composite insulating materials, and has for its objects the provision of an improved method of making the same, as well as the provision of a new article of manufacture resulting from the practice of the method of the invention.

Fibrous material confined between sheets of paper, or the like, is extensively used as a heat insulating medium, particularly in building construction. It has heretofore been the general practice to sew the fibrous material between the inclosing sheets of paper. This sewing of the fibrous material between the sheets of paper has heretofore been necessary because the fibers themselves are not cemented or fastened to each other in such a manner that they form a felt or sheet, and unless the inclosing sheets of paper were sewed, there would be no way in which the sheets of paper could be kept in place. The sewing is objectionable, first, because it is expensive; second, because it perforates the paper, thereby admitting moisture to the fibrous material, and third, because the thread frequently breaks off in the process of manufacture, thus materially reducing the speed and capacity of the manufacturing apparatus.

In my application for Letters Patent of the United States, Serial No. 237,446, filed May 31, 1918, I have described a method of producing a felt or mat of fibrous material, in which the fibers are connected or fastened together so as to form a fabric of fibers in heterogeneous arrangement and cemented together with adhesive material. I have found that a felt or mat in which the fibers are cemented or fastened together as described in the aforementioned application is admirably adapted as the fibrous body of a composite insulating material. Thus, I have discovered that such a mat or felt of fibrous material can be securely confined between two inclosing sheets of fabric, such as paper, a film of asphalt, rubber or the like, by coating either the fibrous mat or the fabric sheet with a suitable adhesive, whereby the fibrous mat is cemented to and securely fastened between the inclosing sheets of fabric.

Numerous adhesive agents are available for cementing the fibrous mat between the inclosing sheets of fabric. I have found sodium silicate, asphalt, coal tar pitch, and the like, suitable adhesives for this purpose. Asphalt and pitches, such, for example, as coal tar pitch, are extremely desirable adhesives for this purpose, because they render the inclosing fabric moisture and water proof, in addition to cementing the same to the fibrous mat.

In producing the fibrous mat in accordance with the method described in my aforementioned application, the fibrous material is first subjected to a shredding operation in order to separate the fibers, which are then deposited upon a suitable support to form a flocculent layer of the shredded fibers. The shredded fibers are treated with an adhesive to cement them together, and I have found it convenient to apply the adhesive in the form of a spray, either during the deposition of the shredded fibers on the support, or immediately after the flocculent layer of the fibers has been formed.

By suitably selecting the adhesive for cementing the fibers together, the resulting fibrous mat can be rendered fireproof, ratproof and moistureproof. The adhesive may, for example, consist of a solution of sodium silicate, or sodium silicate may be incorporated with the adhesive as a fire resistant agent. Ammonium sulfate may also be incorporated in the adhesive as a fire resistant agent. Water resistant glue may also be employed as the adhesive for cementing the fibers together. A water resistant glue for the purpose may be made by adding bichromate of potassium to animal glue and exposing the mixture to strong light. A solution of tar or pitch in a volatile solvent, such as benzol, or the like, can also be used as the adhesive. Thus, for example, I have found that a solution of coal tar pitch, or asphalt pitch, in carbon tetrachlorid is a satisfactory adhesive for the purposes of the invention. By incorporating barium car-

bonate or beta naphthol, or other suitable chemicals, in the adhesive or in the fabric the resulting fibrous mat can be made rat and vermin proof.

The moisture resisting properties of the fibrous mat or felt may be advantageously improved by sizing the fibers themselves before depositing them on the support. For this purpose a water resistant size should be employed. I have found insoluble soap a very satisfactory water resistant size. The sizing of the fibers may be done in any convenient manner, as, for example, by immersion in a body of the sizing agent. Where an insoluble soap is used as the size, it is advantageous to form the sizing agent *in situ* by adding alum, or a similar precipitating agent, to a solution of soluble soap in which the fibers to be sized are immersed.

Various sources of fibrous materials are available for the purposes of the invention. Animal fiber, such as hair, vegetable fibers and even mineral fibers may be used. In general, however, I prefer to employ wood fiber, and because of their low cost, the usual waste products of paper making operations are especially desirable as the source of fibrous material. Tree bark is an advantageous source of fibrous material. Thus, spruce, balsam, fir and redwood barks, and in general any bark having an appreciably long fiber, may be used. Japanese swamp moss is also suitable for the purposes of the invention. Ground wood pulp and mechanically made fiber may also be utilized as a source of fibrous material.

As explained in my aforementioned application, the fibrous material is subjected to a shredding operation prior to its deposition on the support. The purpose of this operation is to separate the fibers into individual particles, and I have throughout this specification and the appended claims employed the term "shredding," and its derivatives, in a generic sense, to describe the operation of so treating the fibers that each fiber is substantially free from any other fiber. In practice a shredding engine will usually be most satisfactory for this purpose, but the desired result may be secured in other ways, as, for example, by brushing or combing. For example, a stiff wire brush revolving at a high rate of speed and coming in contact with a piece of fibrous material will separate the fiber into individual particles.

In Figure 1 of the accompanying drawing, there is diagrammatically illustrated in elevation one form of apparatus for carrying out the invention, but the showing is purely diagrammatic and is given merely to facilitate a complete understanding of the invention. For this reason, the precise structural details of the apparatus are omitted, as forming no part of the present invention.

Figs. 2, 3, 4 and 5 of the drawing illustrate various modifications of the new article of manufacture resulting from the practice of the method of the present invention.

Referring to Fig. 1 of the drawing, there is shown a shredding engine 10, for separating the fibers into individual particles. In this figure the fibrous material is fed into the shredding engine in the form of a sheet which is unwound from a roll of fibrous material 11. The fibers of which the roll 11 is composed are preferably coated or filmed over with a water resistant size, which sizing operation will take place before the fibers are formed into the sheet.

The shredding engine 10 is arranged to discharge the shredded fibers on to a belt conveyor 12, preferably of the form of a screen conveyor. The fibrous material is thus shredded in the engine 10, and, falling through the discharge thereof, the shredded fibers are deposited on the conveyor 12 to form a flocculent layer of the desired thickness. I find it desirable to subject the shredded fibers to a slight suction during and directly after their deposition on the conveyor 12. To this end, a suction chamber 13 is arranged below the shredding engine 10, and directly beneath the supporting screen surface of the conveyor 12. The conveyor 12 may be in the form of a screen of suitable mesh, or its supporting surface may be composed of a suitably perforated or foraminated material, so that the fibers deposited on the conveyor may be subjected to the action of the suction applied beneath the conveyor.

Sprayers 14 are suitably arranged for spraying the shredded fibers with an adhesive agent as they are deposited on the conveyor 12. The sprayers 14 serve to discharge the adhesive either directly upon the fibers deposited upon the conveyor or outwardly in the form of a spray or mist through which the fibers fall. These sprayers may be placed directly under the discharge of the shredding engine 10, or to one side thereof, either arrangement proving satisfactory. In either case the adhesive serves to bind or cement the fibers together, but I have found that when these fibers fall through a mist or spray of the adhesive, a somewhat firmer mat or felt containing fewer loose fibers is produced. In some instances it has also been found desirable to deposit a very thin layer of dried fibers upon the conveyor before the application of the adhesive agent, to provide a cushion, which will act to prevent the fibers from sticking to the conveyor.

The layer of shredded fibers deposited on the conveyor 12 is borne along by the conveyor to a drying chamber 15. A suitable drying medium may be passed through the chamber 15 for the purpose of drying the layer of shredded fibers carried along by the conveyor 12. The chamber 15 is thus repre-

sented as having an entrance conduit 16 and an exit conduit 17 for passing a drying or heating medium, such as heated air, through the chamber 15. When using an adhesive which dries or sets quickly, the drier can, if desired, be entirely omitted, but its use is preferred.

The mat or felt of fibrous material, formed in the manner just described, is next confined or inclosed between sheets of fabric in order to produce the insulating material of the invention. The fibrous mat or felt, after passing through the heating chamber 15, is accordingly passed between two rolls, 18, over which are passed sheets of paper, or the like, from the feed rolls 19. In Fig. 1 of the drawing, I have shown coating rolls 20 coöperating with troughs 21, containing a liquid adhesive agent, for coating with adhesive material one surface of each sheet of the inclosing fabric. The two sheets of inclosing fabric are thus coated on their adjacent surfaces with adhesive material when they pass over the rolls 18, and the pressure produced by the rolls 18 is sufficient to secure the fastening or cementing of the inclosing sheets of fabric to the fibrous body mat. Thus, the completed insulating material passes from the rolls 18 on to a conveyor 22, whereafter it is wound into a roll or disposed of in any desired manner.

The finished product produced in the manner hereinbefore described comprises a body portion of fibrous material, in which the fibers are cemented or fastened together, confined or inclosed between sheets of fabric, which are themselves cemented to the fibrous body portion. In Figs. 2, 3, 4 and 5 of the drawing, the fibrous body portion of the insulating material is represented by reference character 30, and the sheets of the inclosing fabric are represented by reference characters 31 and 32. Where it is desired to inclose the side edges of the insulating material, the fabric sheets 31 and 32 may be folded over to form a seal at the sides of the insulating material. Thus, in Fig. 3, the upper fabric sheet 31 is folded over one edge of the insulating felt and secured to the lower fabric sheet 32 in any suitable manner, while the lower fabric sheet 32 is similarly folded over the other edge of the insulating felt and secured to the fabric sheet 31. As shown in Fig. 4, the edges of the insulating felt may be sealed by a strip of fabric 33, folded over the edge and secured to both the top and bottom inclosing sheets in any suitable manner. In Fig. 5, I have shown the edges of the insulating felt sealed by compressing a relatively narrow strip along each edge thereof. This operation may be conveniently performed before the adhesive coating on the sheets 31 and 32 has dried or set.

As the shredded fibers drop from the discharge of the shredding engine 10 on to the screen conveyor 12, they arrange themselves in a loose heterogeneous mass, with the fibers extending in all three cubical dimensions. The suction applied through the chamber 13 is so regulated as not to form the fibers in too firm a mass. The adhesive agent, sprayed on these fibers by the sprayers 14, serves to fasten the fibers together in such a manner that the resulting felt or mat of fibrous material is a coherent fabric from which the individual fibers are not easily dislodged. It is this coherent property of the fibrous body portion of my improved insulating material, which enables me to cement thereto covering sheets of paper, or the like, thus entirely eliminating the necessity of sewing the covering sheets together and to the fibrous material.

The adhesive used for cementing the fibers together will usually be water resistant. Where the fibers themselves have been treated with a water resistant size, it will be evident that the fibrous body portion of the insulating material will be practically moisture and water proof. In those instances in which the adhesive is composed of a solution of asphalt, pitch or tar in a volatile solvent, it will be observed that the volatile solvent may be vaporized while the fibrous mat is passing through the drying chamber 15 and can be recovered by suitably treating the vapor passing from the chamber 15, through the exit conduit 17. The facility with which the fibrous body portion of my improved insulating material can be impregnated with a fire resistant compound, as well as with chemicals for rendering the mat rat and vermin proof, is one of the particular advantages of the invention.

Greatest cubical lightness and resiliency are secured by drying the fibers with a minimum of pressure on them and preferably with no pressure at all. Pressure applied to the fibers while they are moist produces a denser product than when the fibers are dried without pressure. A product dried with pressure on the fibers resembles a sheet of blotting paper. In this invention pressure on the fibers after they have been formed into the heterogeneous resilient fabric is kept at a minimum until after the fibers have been thoroughly dried.

What I claim is:

1. The method of manufacturing composite insulating material, which comprises forming a fibrous body portion in which the fibers are coated with a water resistant size and are cemented together by a water resistant adhesive, and inclosing the fibrous body portion between fabric sheets secured thereto by a water resistant adhesive; substantially as described.

2. The method of manufacturing composite insulating material, which comprises

shredding fibrous material, depositing the shredded fibers upon a support to form a layer of the desired thickness, treating the fibers with an adhesive to cement them together, drying the fibrous mat thus produced, and cementing to each surface of the fibrous mat so produced a sheet of fabric; substantially as described.

3. The method of manufacturing composite insulating material, which comprises shredding fibrous material, depositing the fibers upon a support to form a layer of the desired thickness, subjecting the layer of deposited fibers to suction, treating the fibers with an adhesive to cement them together, drying the mat thus produced, and cementing to each surface of the mat thus produced a sheet of fabric; substantially as described.

4. The method of manufacturing composite insulating material, which comprises forming a coherent fabric of fibrous material by depositing the fibrous material upon a support and treating the material with an adhesive to cement the fibers together, and subjecting the material to suction, and securing by adhesion a covering sheet to one or more surfaces of said fabric; substantially as described.

5. The method of manufacturing composite insulating material, which comprises forming a fabric of fibrous material by depositing the fibrous material upon a support and treating the material with an adhesive to cement the fibers together, and cementing a covering sheet to one or more surfaces of said fabric; substantially as described.

6. The method of manufacturing composite insulating material, which comprises forming a fabric of fibrous material by depositing the fibrous material upon a support and treating the material with a water resistant adhesive to cement the fibers together, and cementing a covering sheet to one or more surfaces of said fabric by means of a water resistant adhesive; substantially as described.

7. The method of manufacturing composite insulating material, which comprises forming a fabric of fibrous material by depositing fibers which have been subjected to the action of a water resistant sizing agent upon a support and treating the fibers with a water resistant adhesive to cement the fibers together, and cementing a covering sheet to one or more surfaces of said fabric by means of a water resistant adhesive; substantially as described.

8. As a new article of manufacture, a composite insulating material, comprising a fabric of fibrous material in which the fibers extend in all three cubical dimensions and are cemented together by an adhesive and a covering sheet secured to one or more surfaces of said fabric by an adhesive; substantially as described.

9. As a new article of manufacture, a composite insulating material comprising a fabric of fibrous material in which the fibers extend in all three cubical dimensions and are cemented together by a water resistant adhesive, and a covering sheet secured to one or more surfaces of said fabric by an adhesive; substantially as described.

10. As a new article of manufacture, a composite insulating material comprising a fabric of fibrous material in which the fibers extend in all three cubical dimensions and are cemented together by a water resistant adhesive, and a covering sheet secured to one or more surfaces of said fabric by a water resistant adhesive; substantially as described.

11. As a new article of manufacture, a composite insulating material comprising a fibrous body portion composed of fibers coated with a water resistant size and cemented together with a water resistant adhesive, and a covering sheet secured to one or more surfaces of said body portion by a water resistant adhesive; substantially as described.

12. As a new article of manufacture, a composite insulating material comprising a fibrous body portion impregnated with beta naphthol for rendering it rat proof, and a covering sheet secured to said fibrous body portion; substantially as described.

13. As a new article of manufacture, a composite insulating material comprising a fabric of fibrous material with the fibers cemented together in heterogeneous arrangement extending in all three cubical dimensions and a covering agent attached to one or more surfaces of said fabric; substantially as described.

In testimony whereof I affix my signature.

HOWARD F. WEISS.