Feb. 16, 1943. W. F. ASTLEY 2,311,356

ASBESTOS INSULATING UNIT OR YARN

Filed Feb. 15, 1941

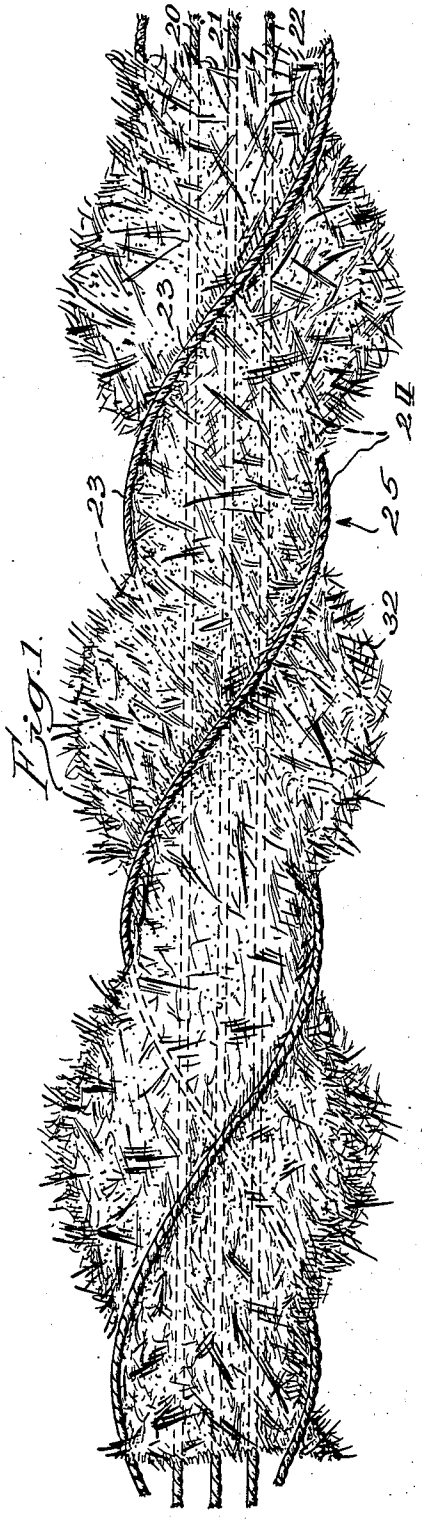


Fig. 1.

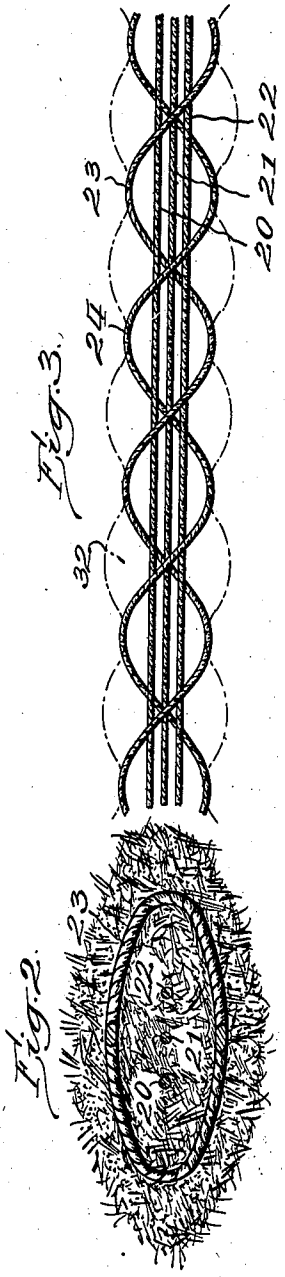


Fig. 3.

Fig. 2.

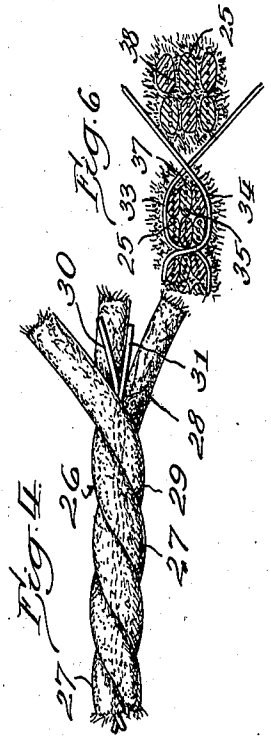


Fig. 6.

Fig. 4.

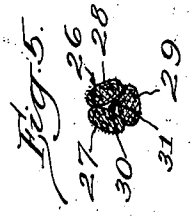


Fig. 5.

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ASBESTOS INSULATING UNIT OR YARN

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14 Claims. (Cl. 57—144)

The present invention relates to asbestos insulating yarns or units, and is particularly concerned with insulating units adapted to be used as weft members for weaving insulating blankets or for fillers, or other insulating units having a high insulating value and forming a part of an insulating structure of a flexible nature.

The present application is a continuation-in-part of my prior application, Ser. No. 188,720, filed February 4, 1938, for Heat insulating materials and methods of making the same.

This application is filed in response to a requirement for division in my prior application, above-mentioned, which relates specifically to the insulating blanket disclosed therein; and the present application relates particularly to the insulating units or yarns of which such a blanket is constructed.

The machines for making such insulating units have been previously covered by my prior patent, No. 2,191,875, issued February 27, 1940, and the method of making such insulating yarns or rovings has been covered by my prior application, Ser. No. 318,759, filed February 14, 1940, on Methods of making insulating yarns or rovings.

One of the objects of the invention is the provision of an improved asbestos insulating unit, also called a yarn, or a roving, which is capable of withstanding very high temperatures, and which is adapted to be constructed, if required, without the necessity for including with loose fibers, the percentage of cotton, or other combustible fibers which are usually included in order to give the fibers a better tensile strength.

Another object of the invention is the provision of an improved insulating unit of asbestos fibers, so constructed that the fibers may be maintained in a loose and opened condition to form a mass of high volume and low weight, which has a maximum insulating value.

Another object of the invention is the provision of improved insulating units of asbestos or the like, which have a high insulating efficiency, a low weight, and which are exceedingly durable, and are adapted to maintain these desirable characteristics in spite of vibration or other deteriorating influences.

Another object of the invention is the provision of an improved insulating unit adapted to be used for the weaving of insulating blankets and other flexible insulating structures, which is capable of being used at higher temperatures, such as, for example, fibers of Amosite asbestos, which are thoroughly carded and opened so as to increase their insulating value, and which are also so arranged that insulating units have sufficient tensile strength, so that they may be coiled loosely in a barrel or other container, from which they may be drawn by the weaving machine in the course of their use in constructing insulating blankets or other flexible insulating structures.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawing in which similar characters of reference indicate similar parts throughout the several views.

Referring to the single sheet of drawings accompanying the specification,

Fig. 1 is an enlarged elevational view of an insulating unit constructed according to the invention;

Fig. 2 is a sectional view, such as that taken on a plane passing through Fig. 1, at right angles to the axis of the unit;

Fig. 3 is a diagrammatic illustration of the arrangement of the fibers and cords or yarns, which aid in securing the parts of the insulating unit together in Fig. 1;

Fig. 4 is a fragmentary side elevational view, greatly enlarged, showing the structure of the asbestos cords or yarns, which are used as core yarns, or which are spirally wrapped about the fibers to confine them slightly, as shown in Fig. 1;

Fig. 5 is a transverse sectional view of the core or yarn of Fig. 4, taken on a plane at right angles to the axis of the core or yarn;

Fig. 6 is a fragmentary sectional view, taken on a plane extending parallel to the warp threads and at right angles to the weft insulating units of a blanket constructed out of the insulating units of the invention.

The insulating units constructed according to the invention have been called "yarns" in the art, and have also been called "rovings." These terms may be used indiscriminately by many persons skilled in the art. I would call this insulating unit a chenille roving, and its structure should be carefully distinguished from rovings of the type in which the fibers are twisted into a tight compact mass, somewhat similar to a rope, because the fibers of the present insulating unit extend at random in all directions and are in a loose, untwisted, open and fluffy condition, having a maximum insulating value.

The insulating units of the present invention may be stated to have no predetermined shape, and they comprise the carded and opened asbestos fibers in the form of "sliver," which is the form having the highest volume, the lightest

weight, and the greatest insulating value. Although the insulating unit of which the insulation is made is shown as an elongated member, its shape is very irregular, and it comprises the asbestos fibers in the form of sliver and sufficient interlacing threads, cords, or strands to confine this sliver in the form of a blanket, but not sufficient to prevent the fibers of one unit from intermingling with those of another so that the fibers of the adjacent units of this insulating material practically intermingle and become a part of other adjacent insulating units.

Whereas in the devices of the prior art an effort has been made to arrange the insulation units of which the material is constructed in such manner as to overlap joints, that is not necessary with the materials of the present invention, in which the fibers are so loosely confined in separate units that they practically intermingle and form a flat blanket of insulation having somewhat the form of a felt.

The present material may, however, be constructed of fibers which could not be so felted together or, if they were made into a felt according to the prior art, they would be so compact, dense, and tight that they would have only a fraction of the insulating value of the present materials.

The insulating fibers preferably employed in the present material consist of asbestos fibers, known to the trade as Amosite. In this form of the material it is adapted to be used for temperatures up to 750 degrees F. Other fibers which may be similarly treated and used in this material are specially processed mineral wool fibers, such as rock wool in any of its conventional forms, and when the material is constructed with mineral wool it may be used for temperatures from 750 to 1,000 degrees F.

The material is best understood by considering also its mode of manufacture, which will be described briefly. Amosite asbestos fibers are preferably employed, and such fibers are mined in the crude state in solid blocks, which may, for example, comprise fibers six inches in length, the fibers adhering together to make a block. The block is first placed in a distintegrator which breaks up the block and shortens the fibers so that most of them are about three-fourths of an inch to one inch in length, although some may still be two or three inches in length, and the fibers are given a thorough carding, which opens them and gives them a soft texture. The fibers, such as Amosite asbestos fibers, are first carded, shortened, and fluffed out, or opened by a carding machine, which may be of conventional construction, except that the fibers in the fluffed or open condition are deposited upon a conveyor belt, disposed at the bottom of a trough, so that there is a constant stream of the carded and opened fibers coming from the discharge end of the machine.

The method of making such yarns is described in my prior application, above mentioned, Ser. No. 318,795, and one form of machine is shown in my prior patent, No. 2,191,875, above mentioned.

One or more cords, threads, or strands of suitable material are then fed from spools on the machine longitudinally into the stream of opened and carded Amosite fibers, these threads or strands comprising the cords **20, 21, 22** in Fig. 1. The cords become immersed in the carded and opened fibers and emerge from the machine with it. At the point of discharge from the carding machine it is provided with a special arrangement which is adapted to wrap spirally about the loose Amosite fibers a plurality of insulating cords, such as the cords **23, 24** of Fig. 1, and the cords embrace some of the loose Amosite fibers and bind them to the cords **20—22**, but a large portion of the fibers, that is, most of the Amosite fibers, still hang loosely together and project beyond the spiral cords **23, 24** in such manner that the insulating unit of Fig. 1, which is indicated in its entirety by the numeral **25**, is of irregular shape.

Referring to Figs. 4 and 5, these are greatly enlarged disclosures of the cords, threads, or strands or yarns used for core yarns **20—22**, or for wrapping cords **23, 24**, for forming the insulating unit, yarn, or chenille roving; or these cords may also be used for the warp yarns of a blanket of which the insulating units described herein form the weft.

These cords, arranged as indicated by the numeral **26**, may comprise a plurality of separate twisted strands **27, 28, 29**, and of asbestos fibers, which may be spun or twisted in the same or opposite directions to the direction in which the strands have been spun or twisted. They are preferably twisted about one or more wires of steel, brass, or bronze **30, 31** for increasing the tensile strength of the cord; but in some embodiments of the invention the wires may be eliminated.

The separate strands of the cords **27—29** are preferably made of long asbestos fibers capable of withstanding the high temperatures to which the sheet insulation or blanket are to be subjected, and containing no combustible fibers; but in some commercial embodiments in which a high insulating value is required, but where the insulation is not to be subjected to excessive heat, a small percentage of cotton fibers may be included in the threads.

Referring to Fig. 1, the numeral **32** indicates the Amosite fibers which are held by the cords **21—24**, but are permitted to project beyond those cords in such manner as to be capable of intermingling with any adjacent insulating units of the same character.

Referring to Fig. 3, this is a diagrammatic illustration of the interlacing arrangement of the three internal longitudinal cords and the two spirally wrapped cords. In some embodiments of the invention more or less of these cords may be used, and cords may also be spirally wrapped in opposite direction, if desired, but a minimum amount of such wrapping cords if preferably employed.

It should be understood that the number of core yarns **20—22** depends upon the size of the insulating unit, yarn, or chenille roving. Where the finished yarn is to be small, only one core yarn may be used, or in slightly larger insulating units two core yarns may be used, or three, as illustrated in Fig. 3.

The core yarns constructed according to Figs. 4 and 5 and utilized in Figs. 1–3, present a relatively rough, irregular outer surface, to which the fibers of the asbestos cover will cling more firmly than they will to a core formed of wire or cotton yarn, or other smooth materials. The core yarns which are formed merely by spinning strands and twisting the strands together are rougher than those which are made of drafted asbestos fibers, where the fibers are subjected to rubbing, while wet; and therefore a better adherence is secured between the spun core

yarns of the present invention, and the loose fibers forming the covering, than would be the case if the core yarns had been drafted.

I desire it to be understood also that in some embodiments of the invention the spirally extending cords may be omitted, or a lesser or greater number of spirally extending cords used. These cords may extend spirally in the same direction, or in both directions.

Referring to Fig. 6, this is a fragmentary sectional view, taken through a blanket constructed of the insulating units. In this example it was desired to make the blanket relatively thick and of high insulating value, and therefore those of the insulating units of Fig. 1 have been arranged side by side and indicated by the numeral **25** between each fold of the wrap threads **33, 34.**

Any number of such insulating units may be used, and the weft member illustrated is merely exemplary of one form of the invention.

The warp thread **33**, for example, starting at the left hand of Fig. 6, goes over the assembly **35** of insulating units **25** and under the assembly **36** of such insulating units, and so on. The warp thread **34**, which is spaced laterally slightly from the warp thread **33**, goes under the assembly **35** of insulating units **25**, and over the assembly **36** and so on through the fabric.

The result of this process is a felted blanket which has better insulating characteristics than any of the insulating materials of the prior art. The insulation may be constructed in any standard widths and thickness and, for example, one form of the insulation which is used for temperatures up to 750 degrees F. is constructed of Amosite fiber in rolls 50 feet long, 60 inches wide, and of standard thickness of one inch or three-fourths of an inch, and greater thicknesses may be constructed by building up the felt in layers which are secured together by interlocking threads. Such insulation is light in weight, weighing about twelve pounds per cubic foot, and it is less than half as heavy as rigid asbestos of the prior art of the same insulating value.

Another form of the insulation which is made of specially processed mineral wool, such as rock wool, is manufactured in twenty-five foot rolls of forty inch width, one and one-half inches thick, weighing twenty-four pounds per cubic foot. Such materials may be applied directly to heated surfaces, and where especially high temperatures are present the fabric just referred to may be used to withstand temperatures from 750 to 1,000 degrees F.

The method of making such insulating units, yarns, or chenille rovings of asbestos is fully described in my prior application on the method, Serial No. 318,795. The carded sliver of Amosite asbestos is deposited upon a conveyor and continuously conveyed toward one side of the carding machine, where it passes through a condensing funnel or funnels.

It is drawn through these funnels by the inclusion in the body of the sliver of one, two, or three longitudinally extending core threads or cords. After the insulating unit passes through the condensing funnel or funnels, if it is to be wrapped with spiral threads, this is then done by means of rotating spools arranged about the insulating unit so as to wrap the spiral cords about it as it emerges from the funnel.

In some embodiments of the invention this step of the method may be omitted.

Thereafter, the core yarns and loose insulating fibers are preferably subjected to the action of rollers for the purpose of pressing the loose fibers into intimate engagement with the rough exterior surface of the core yarn or yarns, or the yarns may be subjected to the action of alternately oscillating, forwardly moving aprons, which are well known in the art.

The resulting insulating unit has a minimum amount of tensile strength, as the threads or cords merely serve to hold it together sufficiently to permit its coiling in and to permit its subsequent removal from a barrel for use in weaving the blanket insulation of the type described in my prior application mentioned above.

The action of the condensing funnels and the feed rolls and the spiral threads is to bring the asbestos fibers into engagement with the core yarns, to which they adhere and form the insulating yarn or chenille roving. These core yarns have an irregular rough outer surface, and therefore have the tendency to facilitate adherence between the core yarns and the insulating fibers of Amosite sliver or ordinary asbestos of the chrysotile type.

The separate felt units of the class described may be woven into a continuous felt blanket, which has no place of separation or cracks, and the material has a substantially uniform insulating value over its entire area.

Such insulating material constructed of the present units will withstand vibration, and is permanently flexible and permanently efficient.

It will not sag, and it may be removed and reapplied without deterioration. It has a high degree of flexibility, strength and resiliency, so that it is not compacted by the application of severe abuse, such as foot traffic, which it withstands without injury.

Its weight is approximately one-half of the weight of many of the block type materials of the prior art, and may, therefore, be used in many applications where light weight is an important factor. It will withstand higher temperatures than the materials of the prior art, when constructed with fibers of the preferred type, which may consist of Amosite fibers or mineral wool fibers, such as rock wool.

It is desired to point out that by "asbestos material" or "asbestos yarn" as used in the specification and claims is meant material or yarn formed entirely or substantially entirely of asbestos fibers.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of spun asbestos yarn having a relatively rough irregular surface, and a cover of loose asbestos fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having a spun asbestos core and a less compact asbestos cover surrounding the core.

2. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of spun asbestos ply yarn having a relatively rough irregular surface, and a cover of loose unspun asbestos fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having a spun asbestos core and an unspun asbestos cover surrounding the core.

3. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of asbestos yarn having a relatively rough irregular surface, and a cover of loose asbestos fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having an asbestos core and a less compact asbestos cover surrounding the core.

4. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of asbestos ply yarn having a relatively rough irregular surface, and a cover of loose unspun asbestos fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having an asbestos core and an unspun asbestos cover surrounding the core.

5. An asbestos insulating yarn comprising a core of asbestos yarn having a relatively rough irregular surface and a cover of loose asbestos fibers entirely surrounding said core and intimately engaging said irregular surface and a second asbestos yarn extending spirally about said loose asbestos fibers for the purpose of confining said loose asbestos fibers and forming a chenille yarn.

6. An insulating yarn comprising a plurality of core yarns, each core yarn comprising a core of asbestos yarn having a relatively rough irregular surface and a cover of loose asbestos fibers entirely surrounding said core and intimately engaging said irregular surface, said core yarns being arranged side by side to form an insulating yarn adapted to be used as a weft member.

7. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of asbestos yarn having a relatively rough irregular surface, and a cover of loose asbestos fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having an asbestos core and a less compact asbestos cover surrounding the core, the said core of asbestos yarn comprising a plurality of twisted strands of asbestos fibers.

8. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of asbestos yarn having a relatively rough irregular surface, and a cover of loose asbestos fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having an asbestos core and a less compact asbestos cover surrounding the core, the said core of asbestos yarn comprising a plurality of twisted strands of asbestos fibers, and said strands being twisted together in a direction opposite to the twist of the separate fibers in each strand.

9. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of mineral fibers in the form of a yarn having a relatively rough irregular surface and a cover of loose mineral fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having a mineral fiber core and a less compact mineral fiber cover surrounding the core.

10. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers which comprises a plurality of cores of asbestos yarn, said cores having a relatively rough irregular surface, and a cover of loose asbestos fibers entirely surrounding said cores and intimately engaging the irregular surfaces of said cores to thereby form a core yarn having a plurality of asbestos cores and a less compact loose asbestos cover surrounding the core.

11. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers which comprises a plurality of cores of asbestos yarn, said cores having a relatively rough irregular surface, and a cover of loose asbestos fibers entirely surrounding said cores and intimately engaging the irregular surfaces of said cores to thereby form a core yarn having a plurality of asbestos cores and a less compact loose asbestos cover surrounding the core, and a plurality of twisted asbestos yarns spirally wound about said loose asbestos fibers and effecting a partial confinement of said fibers to form a chenille yarn.

12. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of shortened and carded Amosite asbestos yarn having a relatively rough irregular surface, and a cover of similar but loose Amosite asbestos fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having an asbestos core and a less compact asbestos cover surrounding the core.

13. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of shortened and carded Amosite asbestos yarn having a relatively rough irregular surface, and a cover of similar but loose Amosite asbestos fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having an asbestos core and a less compact asbestos cover surrounding the core, said core of asbestos yarn comprising a plurality of strands of asbestos fibers twisted together.

14. An asbestos yarn capable of withstanding temperatures that are destructive to cotton fibers, which comprises a core of shortened and carded Amosite asbestos yarn having a relatively rough irregular surface, and a cover of similar but loose Amosite asbestos fibers entirely surrounding said core and intimately engaging said irregular surface to thereby form a core yarn having an asbestos core and a less compact asbestos cover surrounding the core, said core of asbestos yarn comprising a plurality of strands of asbestos fibers twisted together, and the fibers of each strand being twisted in a direction opposite the twist of said strands.

WILLIAM F. ASTLEY.