June 6, 1944. E. C. GEIER ET AL 2,350,504

YARN

Filed July 16, 1943

Fig. 3.

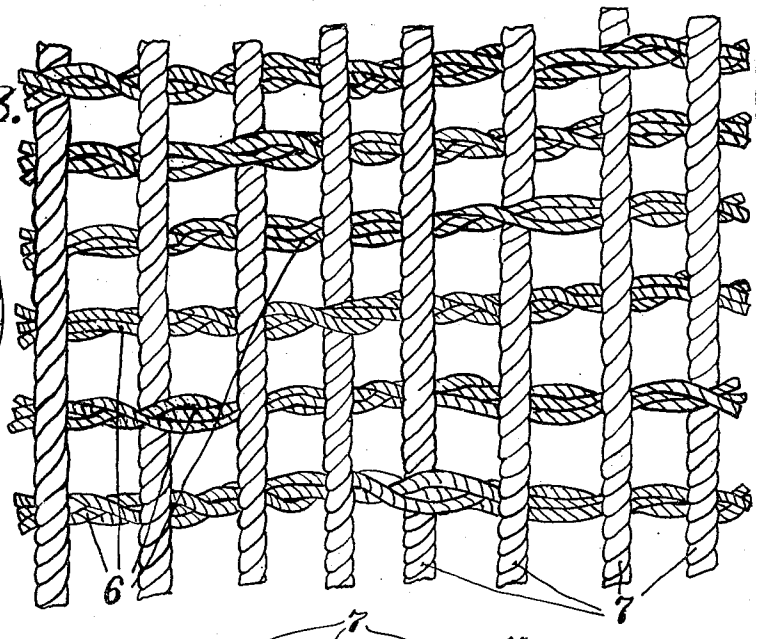
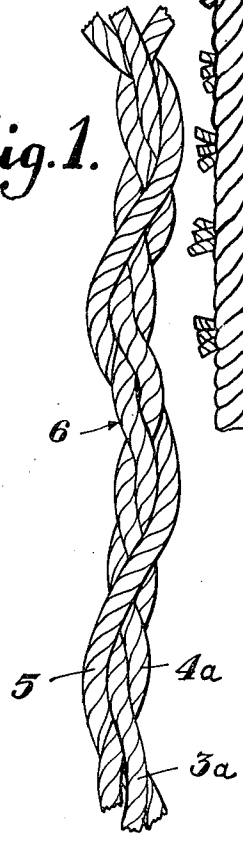


Fig. 1.



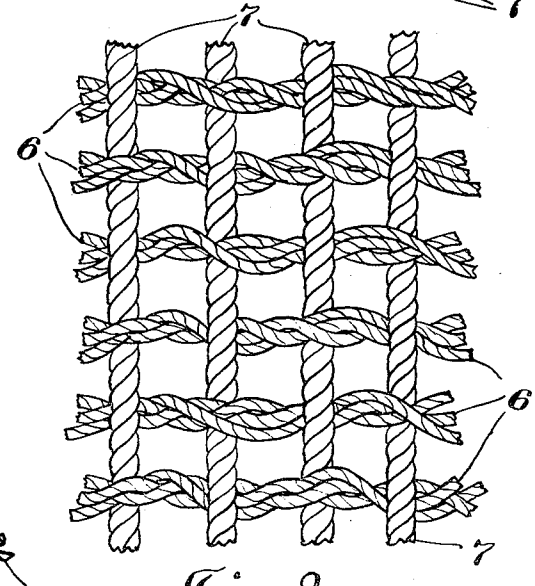
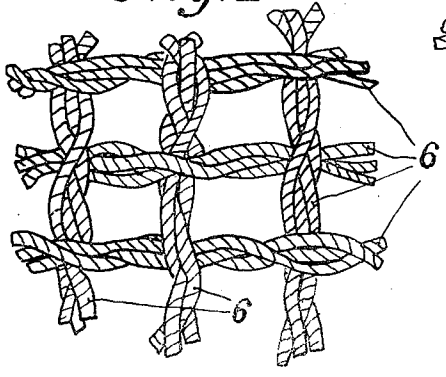


Fig. 2

Fig. 4



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YARN

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New York, N. Y.

Application July 16, 1943, Serial No. 494,946

4 Claims. (Cl. 57—139)

This invention relates to yarns and fabrics and methods of manufacturing the same.

The present application is a continuation in part of our copending United States patent application, Serial No. 468,986, filed December 14, 1942, relating to heat resisting materials.

This patent application describes yarns and fabrics which have a great resistance to heat and which are composed of threads of glass combined with asbestos threads.

It was found that the combination of glass threads with asbestos threads produces yarns and fabrics which have excellent heat resisting properties and are suitable for various purposes which cannot be attained with ordinary textile fabrics or fabrics consisting solely of glass or asbestos.

Practical experience has shown that the combination of glass threads and asbestos threads into a single heat resisting yarn presents considerable difficulties.

Glass threads are provided with smooth surfaces and asbestos threads strip back or slide off these smooth surfaces, with the result that the threads are separated and the uniformity of the yarn cannot be attained.

An object of the present invention is the provision of a method of combining glass threads and asbestos threads into a single yarn which will be compact and uniform in composition and which may be conveniently used for weaving heat resisting fabrics.

Another object is the provision of heat resisting fabrics having great flexing capacities and great tensile strength composed of uniform yarns consisting of glass and asbestos threads.

A further object is the provision of a yarn which is so formed of asbestos and glass threads that the advantageous properties of these materials are combined in the best possible manner.

Other objects of the present invention will become apparent in the course of the following specification.

It is a matter of general knowledge that asbestos yarns and fabrics do not possess sufficient strength when used as dust collectors and may be damaged by metallic oxide deposits and the like. Glass threads, while being sufficiently strong, are not flexible to the required extent and break when flexed.

A combination of glass and asbestos into a single yarn may in certain instances compensate for the above described drawbacks of the individual threads, although certain combinations of these threads were found to be entirely inadequate for weaving purposes.

Numerous experiments carried out with a very large number of glass and asbestos threads in a large variety of combinations, showed that the advantageous qualities of asbestos and glass can be brought out in a single yarn only if the throwing or twisting of the glass and asbestos threads is carried out in a specific manner.

In accordance with the present invention, the sliding of asbestos threads is eliminated, and a yarn having excellent heat resisting and flexing properties is produced, provided that such yarn is formed of two threads of asbestos or glass which are twisted together a somewhat greater number of turns than a subsequent twisting which is carried out after the addition of a third thread.

The preferred twisting ratio was found to be seven turns of two threads in one direction, and five turns of three threads in the opposite direction.

It was found that when asbestos and glass threads are twisted or thrown in this manner, the sliding of asbestos in relation to glass is eliminated entirely, and a very strong yarn is produced which has great heat resistance and a great flexing capacity as well as a very high tensile strength.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawing showing by way of example, preferred embodiments of the inventive idea.

In the drawing:

Figure 1 illustrates diagrammatically a yarn made in accordance with the principles of the present invention.

Figure 2 is a diagram illustrating a fabric composed in part of yarns illustrated in Figure 1.

Figure 3 is a diagram illustrating a six shaft satin fabric the filling of which is composed of the yarn illustrated in Figure 1.

Figure 4 is a diagram illustrating a fabric composed solely of yarns illustrated in Figure 1.

Figure 1 shows a yarn which consists of three threads **3***a*, **4***a*, and **5**.

The threads **3***a*, and **4***a*, are composed preferably of the same material although they may consist of different materials. Consequently, the threads **3***a*, and **4***a* may consist of fiber glass, or asbestos, or the thread **3***a* may consist of asbestos, while the thread **4***a* may be made of glass.

It is advantageous to provide the threads **3***a* and **4***a* with a preliminary twist before they are twisted together.

In the example illustrated, each of the threads **3***a* and **4***a* consist of fiber glass, size 225 1/0. Each of these threads has an initial twist of 1.6 turn Z. Obviously, this initial twist may be carried out in the opposite direction.

The two threads **3***a* and **4***a* are twisted seven turns S and then a third thread **5** is added to the two threads.

The thread **5** may consist of asbestos, size

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3510 and is provided with an initial twist 15 turns Z. Thereupon, all three threads, 3*a*, 4*a*, and 5 are twisted or plied five turns Z twist.

It is apparent that the above described yarn which is illustrated in Figure 1, has been given solely by way of example and that the turns may be varied within certain limits.

For instance, the first two threads 3*a* and 4*a* may be plied with a Z twist and then three threads may be plied with an S twist.

It is even possible to use the same type of twist, namely, S or Z, for two threads as well as for three threads, although experience has shown that opposite twists produce the best results.

While the number of turns may be varied, experience has shown that the best possible results are attained when the twisting of the two threads consists of seven turns while the twisting of three threads consists of five turns. The yarn having these twists is easy to manufacture and the twists set permanently in such a manner, that the curling of the yarn and the opening-up of the threads are avoided.

While this proportion may be changed, it was found to be essential that the twisting of the two threads have a larger number of turns than the twisting of three threads, in order to avoid the slipping of asbestos upon glass yarn.

It is possible to vary the number of threads used in the combination yarn to adapt it to certain specific purposes. For example, six ends of fiber glass and two ends of asbestos yarn were found to be most suitable for special purposes.

The number of plies can be varied as well. For example, a combination of three yarns, each consisting of three ends of fiber glass and one end of asbestos yarn, can be plied together, and three yarns thus produced can be plied together again to produce a heavy cord.

In this manner, by varying the number of individual ends, the number of plies, the number of turns inserted, as well as the chosen direction of the twist, many combinations of threads of asbestos yarn and fiber glass can be obtained within the scope of the present invention.

The yarn manufactured in the described manner and consisting of a plurality of threads, at least one of which is asbestos while at least one other is glass, may be conveniently woven or knitted into fabrics which are exceptionally well suited for a variety of industrial purposes.

Experience has shown that an excellent fabric is produced when the filling consists of the described yarn 6, while the warp consists of fiber glass 7. This fabric is illustrated in Figure 2.

However, the warp of a woven fabric may be made of asbestos threads or the described yarn 6, while the filling may also consist of glass threads or asbestos threads.

Figure 3 illustrates a six shaft satin fabric, the filling of which is composed of the combination yarn 6, while the warp consists of fiber glass 7. Combination yarn 6 is predominently located upon one side of this fabric, while fiber glass 7 is exposed upon the other side.

It is also possible to prodce a fabric consisting solely of the combination yarn 6, as shown in Figure 4 of the drawing.

All of such fabrics have the advantageous properties of extremely high heat resistance and tensile strength and a great capacity of flexing. A particular advantage of the combination yarn 6 is that it absorbs easily, varnishes, resins and other chemicals. Furthermore, the fabrics composed of these yarns can be used as a base for laminated plastics having a high heat resistance.

The described fabrics are most advantageously employed in the aviation industry, for instance, as boots over landing gears, or in chambers of airplane guns, on ships as pipe laggings, in the electrical industry as insulators, and for a variety of other purposes.

It was found that a fabric consisting solely of the combination yarn 6 will satisfy most requirements but that great tensile strength is attained without sacrificing the faculty of high heat resistance when the warp is made of fiber glass. However, for some other purposes, better results may be attained if different combinations of the yarn 6 with glass and asbestos threads are utilized.

In general, it is apparent that the examples shown above are given solely by way of illustration and not by way of limitation and that the above described invention is subject to wide variations and modifications within the scope of the appended claims. All of such variations and modifications are to be included within the scope of the present invention.

What is claimed is:

1. A yarn consisting of at least three threads, at least one being a glass thread, at least one other being an asbestos thread, at least two of said threads being identical threads, said identical threads being twisted around one another in a single direction, said twisted identical threads and said remaining thread or threads being twisted around one another in the opposite direction, the number of turns in the first direction and the number of turns in the second direction being in the ratio of 7 to 5.

2. A yarn consisting of at least three threads, at least one being a glass thread, at least one other being an asbestos thread, at least two threads being identical threads, all of said threads being individually twisted threads, said identical threads being additionally twisted around one another in a single direction, said additionally twisted threads and said remaining thread or threads being finally twisted around one another in the opposite direction, the number of turns in the additionally twisted threads and the number of turns in the finally twisted threads being in the ratio of 7 to 5.

3. A yarn consisting of at least three threads, at least two being initially twisted glass threads and at least one thread being an initially twisted asbestos thread, said glass threads being additionally twisted around one another 7 turns per inch in any one direction and said asbestos thread and said additionally twisted glass threads being finally twisted around one another 5 turns per inch in the opposite direction.

4. A yarn consisting of at least three threads, at least two being an initially twisted asbestos threads, and at least one thread being an initially twisted glass thread, said asbestos threads being additionally twisted around one another 7 turns per inch in any one direction, and said glass thread and said additionally twisted asbestos threads being finally twisted around one another 5 turns per inch in the opposite direction.

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