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S. W. ALDERFER

2,321,726

METHOD OF MANUFACTURING THREAD

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Fig.-1

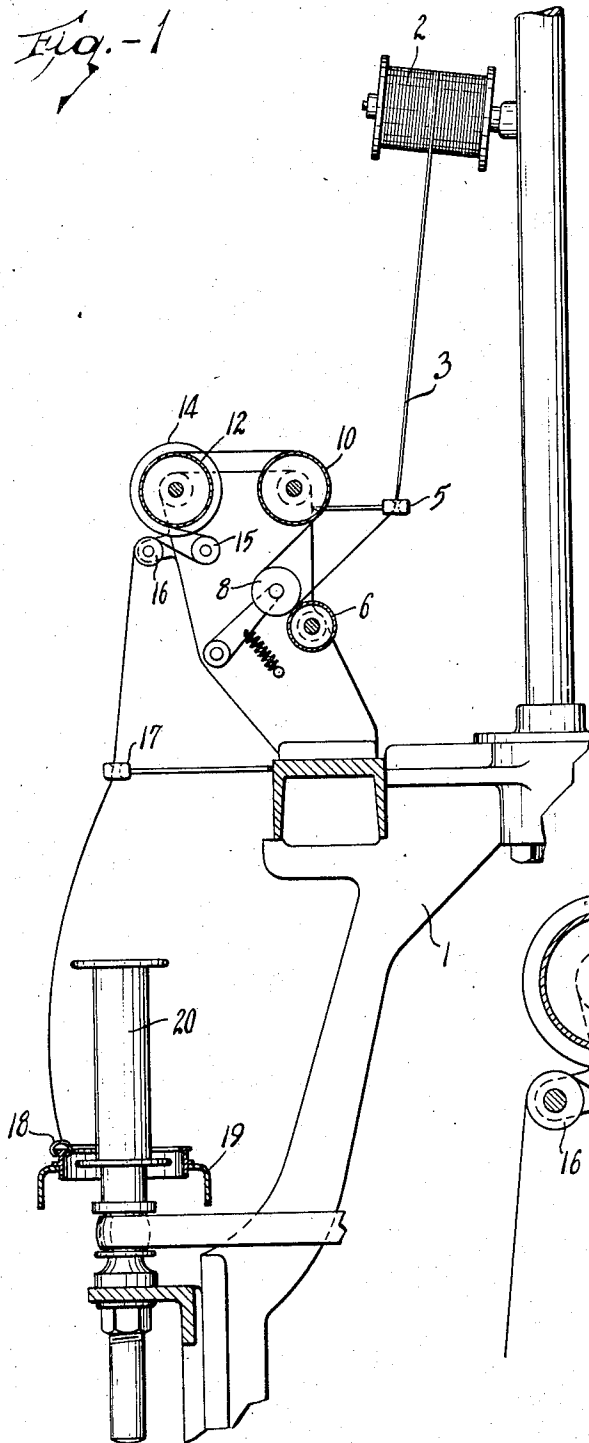


Fig.-2

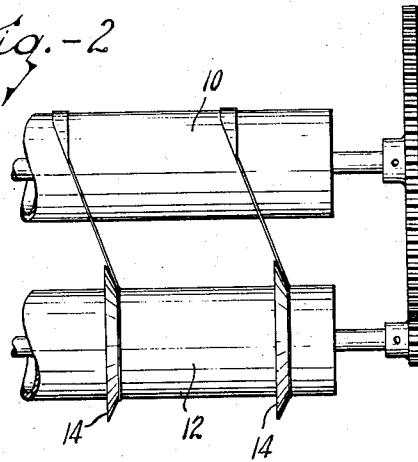


Fig.-3

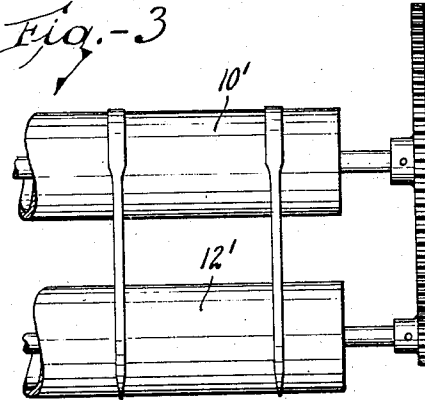
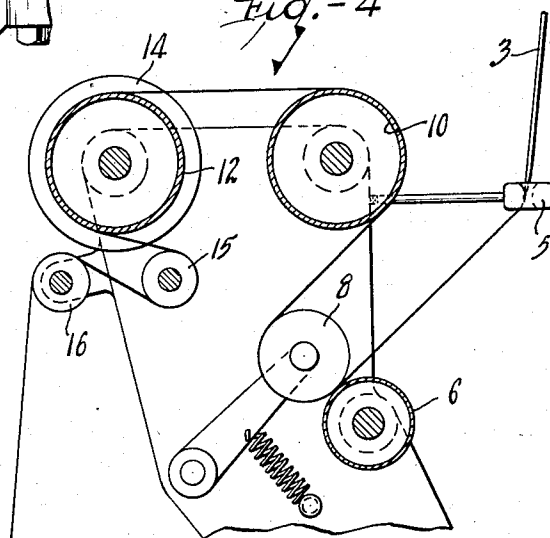


Fig.-4



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METHOD OF MANUFACTURING THREAD

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9 Claims. (Cl. 57-168)

The present invention has as its object a method for the manufacture of threads or cord which may be used for a variety of purposes. Its particular object is to manufacture a thread which is elastic to a more or less predetermined degree which has a distinctive lustre or sheen resulting in a thread which, when woven or knitted, creates fabrics of unusually beautiful appearance and utility. The resultant thread is stronger and more elastic than silk and may be used with better results for stockings and other garments. In certain adaptations of the invention, it is possible to obtain a thread in which the high lights are diffused so as to create a very attractive appearance. The new thread may be knitted or woven on standard machines used for that purpose and the fabric has a softer "hand" than silk, rayon or other like materials which are in commercial use.

Heavier cords or threads may likewise be made and have many uses for which they are better suited than known materials.

The thread is preferably made from sheets or films of rubber hydrochloride, rubber chloride, or combinations of these two materials, and while these are the best known or preferred materials, it will be understood that other elastic or semi-elastic materials which may be developed and which will react similarly are not excluded from the operation of the invention. Sheeting made from vinyl chloride or vinyl chloride derivatives or from cellulose acetates or similar compounds may likewise be employed. It is necessary that the materials become sticky and self adhesive upon the application of heat and that they be more or less stretchable.

The specific rubber materials named above are preferred because of their inherent elasticity which is utilized in securing the results set forth and also because they will soften by the application of heat and become slightly tacky so as to adhere during the twisting and rolling operations. These materials also, when treated as will be described, give a balanced thread which has no tendency to kink or twist upon itself. This is a desirable property which facilitates weaving or knitting operations. It is not intended that the invention be restricted to rubber materials, and when the term "rubber-like materials" is employed, it is not intended to exclude the larger range of materials as indicated.

The drawing forming a part of the application illustrates the best known or preferred method of making this new thread and shows two adaptations of the invention, but it will be under-

stood that the apparatus may be modified and that exact adherence to the details of the process is not essential.

In the drawing:

5 Fig. 1 is a side elevation of an apparatus such as may be employed for the purposes set forth, it being understood that this view illustrates only one complete unit and that in commercial adaptations of the invention many of these units may be mounted in a single spinning machine.

10 Fig. 2 is an enlarged plan view showing the means by which the material is heated, stretched and rolled under tension prior to the twisting or spinning operation.

15 Fig. 3 is a modification of the device shown in Fig. 2, in which the rolling before twisting is omitted.

Fig. 4 is an enlarged view of the elements shown in Fig. 1.

20 In the operation of the invention, sheets of the material selected are cut into narrow strips or ribbons which are then progressively stretched while being subjected to sufficient heat to soften and render the material tacky or adhesive. At the same time the rubber is stretched or elongated so as to reduce its width appreciably whereby very fine threads may be produced. The combined operation of heating and stretching produces a softer and more pliable product than is obtained by either step singly. In the preferred process the softened, heated and elongated strip is rolled upon itself which increases its tensile strength and produces a round strand or ply.

25 The strands thus formed, either with or without rolling, are twisted while still soft, warm and tacky to make the finished thread.

In the apparatus shown, the spinning frame is indicated at 1 in which are supported the spools, one of which is indicated at 2, on which the ribbon of material is wound. The spools may be replaced by a long beam extending over the spinning frame on which a plurality of ribbons are wound. From the spools the ribbon of material 3 passes through an eye 5 and thence in contact with the first roll 6, which is preferably a feed roll, against which the ribbon of material is held by the spring-actuated pressure roll 8. From the roll 8 the ribbon passes to the driven roll 10 of a pair of rolls which are heated and thence to the second heated driven roll 12. The roll 10 is driven at the same surface speed as the feed roll 6 and the rolls 10 and 12 are driven at different surface speeds according to the degree of stretch which it may be desired to impart to

the heated, tacky ribbon, and if the ribbon is to be rolled, the roll 12 is provided with a conical flange 14 which acts upon the edge of the ribbon to roll it upon itself to form a round strand. As shown in Fig. 2, the flanges 14 should be offset along the roll 12 so that the ribbon will pass in a diagonal direction to its prevailing line of travel during the rolling operation. If the ribbon is not to be rolled, the rolls 10' and 12' are arranged as shown in Fig. 3 in which the flanges 14 are omitted from the roll 12.

In the preferred adaptations of the process, a very substantial elongation is imparted to the ribbon of stock between the rolls 10 and 12, it being desirable to move the roll 12 at several times the surface speed of the roll 10. The exact extent of elongation imparted by the rolls 10 and 12 will depend upon a variety of factors, namely: the size of the original ribbon, both as to width and thickness; the size of the ultimate thread which is to be produced; and the extent of elasticity which is desired to be retained in the completed thread, for when the finished thread is cool its elastic properties are affected by the degree of heat and stretch which is applied during the operation. During the time that the ribbon is acted upon by the rolls 10 and 12 (or 10' and 12'), the ribbon is heated to the desired degree, depending upon the character and composition of the material and the results which may be sought. The degree of heat will also depend upon the degree of elongation or stretching which is imparted. Where the ribbon is rolled upon itself the tacky condition of the rubber will cause the convolutions of the ribbon to adhere to one another in the strand and the product, as it leaves the rolls 12 or 12', will be sufficiently tacky to cause the material to adhere to itself during the subsequent twisting or thread-making operation. In any event, the degree of stretch should be below the breaking point of the ribbon or thread at the temperature of operations and for certain results should be at or slightly below the elastic limit of the material.

From the roll 12 (or 12'), the ply or strand passes around tension rolls 15 and 16 through an eye 17 and thence to the traveler 18 mounted on a ring 19 on the spinning frame. Then the material passes to the usual spool or spindle 20 which is revolved and the ring is raised and lowered in accordance with usual spinning practices. This operation imparts the desired twist to the thread, and as this operation is performed while the strand is still warm, the finished thread retains the twist which is thus imparted to it, and as a result of the successive operations, a perfectly balanced, strong thread of high lustre is obtained.

It is noted that while the material in strip form is not clear but somewhat cloudy, the combined operation of heating and stretching removes the cloudy appearance and gives a clear thread. Within operative limits it has been found that with higher temperatures the material becomes clearer. Also it will be observed that by following the essential steps of the process, threads of high tensile strength may be obtained, and if the proper requisites are observed as to size of the ribbon, stretch and twist, threads of any degree of fineness may be secured.

While not in any way confining the operation of the invention to the details now to be set forth, the following will indicate steps which will

result in a fine, strong, elastic thread of approximately 100 deniers.

A ribbon or strip of rubber hydrochloride or rubber chloride approximately $\frac{3}{8}$ nds of an inch wide and .004 of an inch thick is elongated six times passing from the roll 10 to the roll 12. This ribbon is rolled upon itself by the flange 14 so that the strand or yarn as it leaves the roll 12 is from .004 to .005 of an inch in diameter. During the stretching and rolling operation, the material is heated between 125° and 250° F. which gives the requisite clearness and tackiness to the material so that it will adhere both in the convolutions imparted by the flange 14 and also in the twisting operation imparted at the spinning frame. It is then twisted upon itself by the spinning operation to any desired degree, $2\frac{1}{2}$ turns per inch would be a low and 30 turns per inch would be high. An average twist of 10 times per inch will give uniformly satisfactory results. The degree of twist is regulated by the relative speed of the spindle and linear travel which is imparted to the ribbon.

The thread produced by the process illustrated in Fig. 2 is composed of a single strand of ribbon which is first rolled upon itself and is then twisted. In commercial adaptations the thread made by either process may be used as a single yarn or it may be combined with like threads in any desirable cable construction.

What is claimed is:

1. A process of making thread comprising forming a ribbon of a rubber-like material, rolling said ribbon upon itself to form a strand, and twisting the strand upon itself to form the thread.

2. A process of making thread comprising forming a ribbon of material which will become tacky upon heating, heating the ribbon so that the material becomes tacky, rolling the ribbon while tacky upon itself to form a strand, and then twisting the strand to form the thread.

3. A process of making thread comprising forming a ribbon of material which will become tacky upon heating, rolling the ribbon upon itself to form a strand, twisting the strand to form the thread, and heating the material during the rolling and twisting operations so that the material is tacky and adhesive.

4. A process of making thread comprising forming a ribbon of material which will stretch and become tacky upon heating, heating the ribbon to render its surface tacky, stretching the ribbon and rolling it while under tension and tacky to form a strand, and twisting the strand to form the thread.

5. A process of making thread comprising heating the material, stretching the material, rolling it upon itself while tacky and under tension, and then twisting the material while warm and tacky to form the thread.

6. A process of making thread comprising heating a ribbon of rubber-like material until it becomes warm and tacky, simultaneously stretching the ribbon and rolling it upon itself to form a strand, and then twisting the strand while warm and tacky to form the completed thread.

7. A process of making thread comprising heating a ribbon of rubber-like material until it becomes warm and tacky, simultaneously stretching the ribbon to substantially its elastic limit and rolling it upon itself to form a strand, and then twisting the previously stretched strand

while warm and tacky to form the completed thread.

8. A process of making thread comprising forming ribbons of thermoplastic material, rendering the surface of the material tacky, rolling 5 said ribbons upon themselves to form strands, and twisting the strands together to form a thread.

9. A process of making thread comprising forming ribbons of material which will stretch and become tacky upon heating, heating the ribbons, rolling the ribbons upon themselves to form strands, stretching the material, and thereafter twisting the strands together to form a thread.

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