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TREATMENT OF WET SPUN PROTEIN PRODUCTS

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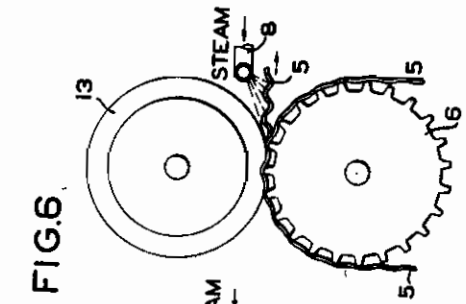

FIG.6

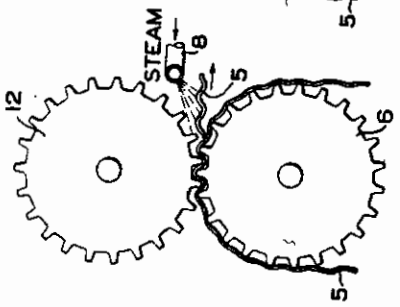

FIG.5

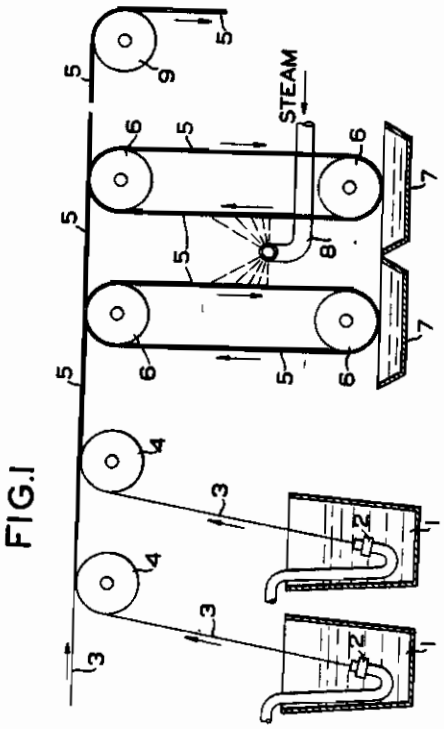

FIG.1

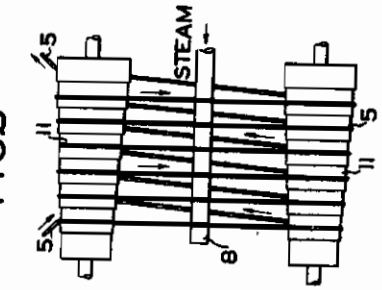

FIG.8

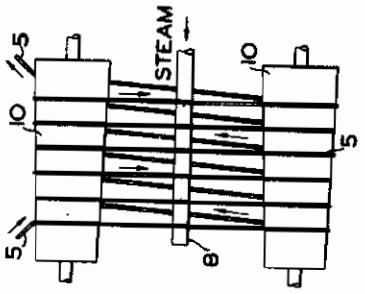

FIG.7

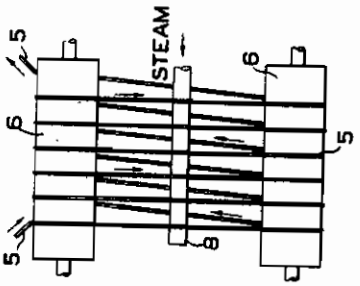

FIG.4

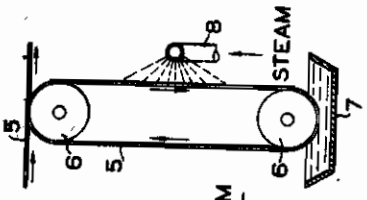

FIG.3

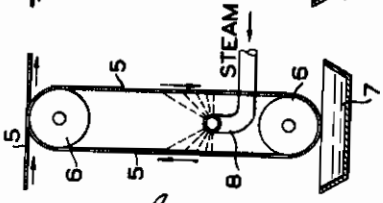

FIG.2

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ALIEN PROPERTY CUSTODIAN

TREATMENT OF WET SPUN PROTEIN PRODUCTS

George Stephan de Kadt, Leerwarden, Netherlands; vested in the Alien Property Custodian

Application filed February 19, 1941

This invention relates to a process for treating with water vapor or steam products which are obtained by extrusion of a protein solution, particularly solutions of casein and other globular proteins, prepared with the aid of alkali, into a coagulating bath, such as fibres, filaments, threads, bands, films and the like.

In my copending application Serial No. 257.029 I have described a process for minimizing the tendency to shrinkage of artificial fibres, threads and the like obtained by extrusion of a protein solution, which has been prepared with the aid of alkali, into a coagulating bath, according to which process the products are subjected to the action of steam or water vapor, if desired, in admixture with other vapors or gases, before the products are introduced into a hardening bath. By this process a considerable improvement of the mechanical properties of these products is obtained. It seems that this result is due to the fact that by the treatment with water vapor water condenses on the products, but I do not wish to be limited to any definite theory for the explanation of the phenomenon.

It is the object of my present invention to provide an improved and effective method for carrying out this treatment with water vapor of the products obtained by extrusion of protein solutions, particularly solutions of casein and other globular proteins, which have been prepared with the aid of alkali, into a coagulating bath.

Another object of my invention is the provision of a method of treating the extruded products under such conditions that the certainty of successful operation and improved results are assured.

Another object of my invention is to provide a method whereby improved results are obtained by a uniform and compensating treatment of the extruded products with diluted spinning bath.

Other objects and advantages of my invention will be apparent as it is better understood by reference to the specification and accompanying drawing, which illustrates diagrammatically an embodiment adapted for practice of my invention, it being understood that my invention is not limited to the details hereafter set forth or shown in the drawing.

I have found that the above mentioned treatment with steam or water vapor can be carried out in a particularly good manner by making the water vapor to act on the products while they are moving over at least one vertically arranged pair of horizontal rollers. If desired, the steam or water vapor may be mixed with other vaporous or gaseous substances influencing the properties of the products, e. g. having a hardening action, such as for instance ammonia, methanal, sulfur dioxide, alcohol, carbondioxide, etc.

In carrying out my invention I prefer to immerse the bottom roller into a bath, for it has appeared that a spinning bath diluted by condensed water vapor and having an acid concentration of approximately two thirds of that of the spinning bath drops down from the rollers. In using e. g. a spinning bath containing 6% of acetic acid and 20% of sodium sulfate the first bath dropping down from the rollers contains approximately 4% of acetic acid and 16% of sodium sulfate. The layer of spinning bath diluted by the condensation of the water vapor surrounds the thread bundles and exerces a uniform and compensating influence, which is not the case with a horizontal arrangement of the pairs of rollers, which causes formation of drops and accumulation of liquid at the bottom side of the thread bundles.

As I have described in my copending application Serial No. 257.029 the steam or water vapor may be made to act on the products by directing a steam jet to the products, but the rollers over which the products are passed according to my present invention may also be arranged in a room in which a damp and more or less warm atmosphere prevails, which is preferably obtained by blowing steam into the room. It is not necessary to obtain a high temperature by means of the water vapor since the favorable action already is effected at a temperature as low as approximately 40° C.

I have further found that a uniform impregnation of the thread with the diluted spinning bath can be obtained in a still better manner by immersing the bottom roller in the diluted spinning bath. It will be obvious that in carrying out the treatment with water vapor on a number of pairs of rollers the acid and salt concentration decreases gradually.

In treating the freshly spun threads care has to be taken that by the action of the water vapor and the condensation caused thereby the decreasing of the salt concentration is not too large, because in that case the threads will swell again. On the other hand it is of importance to remove as much as possible residual spinning bath, particularly the acid, in order not to soil the hardening baths. To this purpose a salt solution, e. g. containing sodium sulfate in an amount of e. g. 10–15% can be used as a bath in which the rollers revolve.

I have found that the presence of some meth-

anal is not objectionable, so that according to my invention from an economical viewpoint use of the spent hardening bath which apart from salt, e. g. 10–15%, still contains 0,1–0,3% of methanal is even preferable.

According to my invention it is also possible, however, to use the washing water with which the liquids of the hardening baths are washed from the threads. In some cases it is recommendable to dissolve first a small amount of salt in this washing water, since it is desirable that its salt content corresponds to that of the hardening baths, which in the case of sodium sulfate contain about 10% of salt. Obviously, however, also other salts and other quantities may be used.

In the drawing:

Fig. 1 is a diagrammatic side view of an embodiment for carrying out the process according to the invention;

Fig. 2 is a diagrammatic side view of a pair of rollers with another arrangement of the steaming device;

Fig. 3 is a diagrammatic side view of a pair of rollers comprising a bottom roller revolving in a bath;

Fig. 4 is a diagrammatic front view of a pair of rollers around which the threads are conducted several times;

Fig. 5 is a diagrammatic side view of a curling device comprising a profiled top roller of the pair of rollers, which cooperates with a profiled third roller;

Fig. 6 is a diagrammatic side view of a curling device comprising a profiled top roller of the pair of rollers, which cooperates with a third rubber roller;

Fig. 7 is a diagrammatic front view of a pair of conical rollers for stretching the thread;

Fig. 8 is a diagrammatic front view of a pair of staged rollers for stretching the thread.

According to Fig. 1 the protein solution is extruded into spinning baths 1 through series of spinnerettes 2, the singular thread bundles being drawn away by drawing rollers 4. The combined thread bundles 5 are passed over vertically arranged pairs of horizontal rollers 6 and the liquid dripping from the threads and the rollers is collected in baths 7. From the perforated tube 8 arranged between the two pairs of rollers steam is blown on the moving threads which over a dosing roller 9 are conducted to a cutting device not shown.

Fig. 2 illustrates how the steam pipe 8 may be arranged between the rollers of one pair and Fig. 3 shows the embodiment in which the bottom roller 9 is revolving in the bath 8.

In order to avoid a large number of pairs of rollers the threads may be wound some times around the rollers, which embodiment is illustrated by Fig. 4 in which the numerals indicate the same parts as in the Figures 1–3. In this case the threads may be separated with the aid of thread guides or other means.

According to my invention the products can be fixed in a curled condition by carrying out the treatment with steam simultaneously with a curling treatment, for instance by means of a curling device comprising at least one profile roller. This may be carried out by using as top roller of the pair a profile roller cooperating with a third roller. Fig. 5 shows how the top roller 6 of a pair of rollers is a profiled roller cooperating with an additional profiled roller 12. A thread 5 passes between the rollers 6 and 12 is treated with steam from the tube 8. Fig. 6 shows a similar curling device consisting of the profiled top roller 6 of the pair of rollers, which cooperates with a rubber roller 13 pressing the thread 5, while steam is supplied by the pipe 6.

If during the treatment with water vapour some tension is maintained, the thread is stretched because by its plasticity a kind of flow process is caused by the tension. This flow process in the thread may in this manner be used for stretching the thread, whereby not only its strength is increased, but especially more meters of thread are spun. By using a number of pairs of rollers this stretching can be carried out best by giving every subsequent pair of rollers a higher speed than the preceding pair. In using a limited number of pairs of rollers the same result can be obtained by application of conical or staged rollers. Fig. 7 shows how the thread is passed several times around a pair of conical rollers 10 and Fig. 8 illustrates how the same result may be obtained by using staged rollers 11.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

GEORGE STEPHAN DE KADT.