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SUSPENSION LOOP DRYING APPARATUS

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Fig.1.

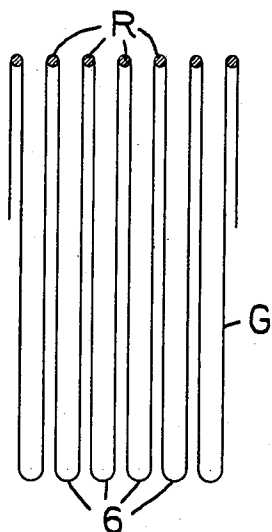
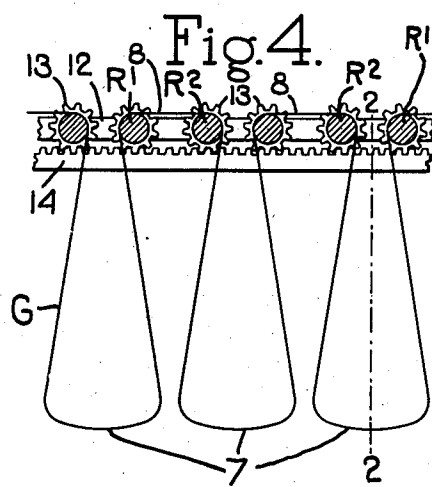
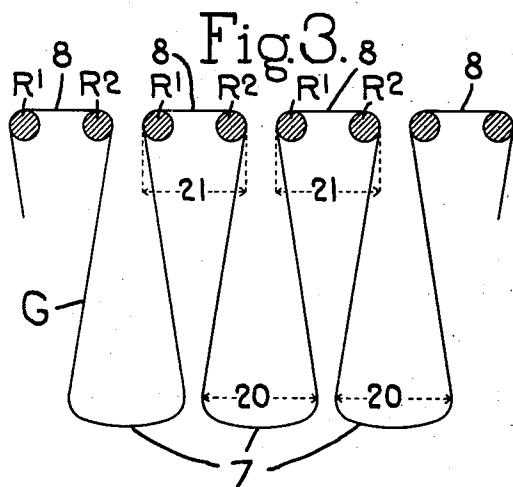
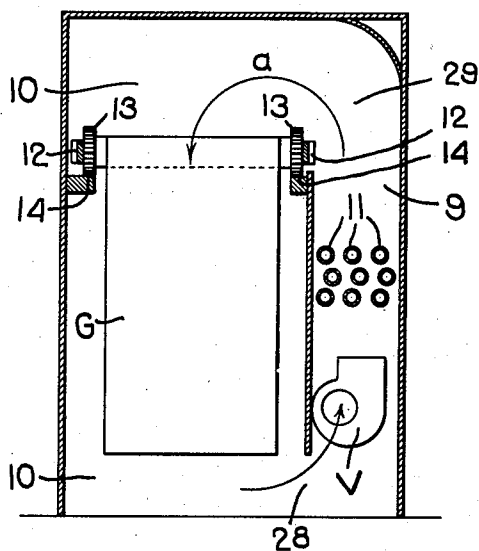


Fig.2.



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## UNITED STATES PATENT OFFICE

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## SUSPENSION LOOP DRYING APPARATUS

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2 Claims. (Cl. 34-12)

This invention relates to drying material, such as fabric, in web form and it has for its object to provide improvements by which the drying of the web material may be greatly facilitated.

One very common way of drying fabric and other web material is to festoon the web material over supporting rods in a drying chamber so that the material hangs on said rods in loops or festoons. It is also more or less common to provide means for directing currents or jets of heated drying medium into the loops of the festooned web from the top.

In accordance with the present invention, the web material is festooned over the supporting rods in a special way so that the loops of the festoons are relatively short and the fabric will present straight portions between adjacent loops, and the heating or drying medium is delivered into the upper ends of the loops under sufficient pressure to expand the lower end of each loop to an extent approximately equal to the length of the straight portion of the fabric between adjacent loops. Experiments have shown that with this arrangement a maximum drying effect is produced and the output of the drying apparatus is considerably increased.

In the drawing,

Fig. 1 illustrates a diagrammatic view showing an ordinary way of festooning fabric or web material while it is being dried;

Fig. 2 is a somewhat diagrammatic view illustrating an apparatus by which my invention may be carried out, said view being taken stationary on the line 2-2, Fig. 4;

Fig. 3 is a view showing the manner in which the web material is festooned over the supporting rods in accordance with my invention.

Fig. 4 is a fragmentary sectional view showing the manner of supporting the rods on which the fabric is looped.

In Fig. 1 there is shown diagrammatically a well-known way of festooning fabric or other web material during the drying operation, and in said figure, R indicates parallel supporting rods which will preferably be mounted in a drying chamber and over which the fabric or web material G is festooned, thereby forming loops 6. It is a common practice to provide some suitable means for blowing heated air or other heated gaseous drying medium into the loop 6 from the top to facilitate the drying. In devices of this type, it has been assumed that the output of the drying apparatus could be increased by increasing the fabric content in the drying chamber and

one way to do this is to extend the length of the loops 6, but there is a limit to which the length of the loops 6 can be extended without injuriously affecting the fabric because of the weight of the loops.

Extensive experiments which have been made concerning the relation of the output of a drying apparatus to the length of the loops of the festooned web have shown that in any drying apparatus the decrease in the length of the loops of the festooned fabric from a maximum length, to a zero length that is, to a condition where the fabric extends straight across the supporting rods without any festooned arrangement, results in a decrease of only about 40 per cent in the amount of moisture evaporated from the web. A drying machine which has a capacity for a loop length of 3 meters and which evaporates for example, 100 kilograms of water per hour would still evaporate 60 kilograms of water per hour if the fabric were arranged with a 0 loop length, that is, if the fabric extended in a straight line across the supporting rods R. One reason for this is that the action of the current of drying medium on the fabric is more intensive when the fabric being acted on is held in a straight condition.

These experiments led to the conclusion that in the relationship of loop length and the current of drying medium delivered to the loops, an optimum must exist which produces the greatest output for a given space.

In accordance with my present invention the web or fabric G is supported in a ventilated drying chamber 10 in festoon form on spaced supporting rods indicated at R<sub>1</sub>, R<sub>2</sub>, in Fig. 3, but the festooning is done in such a way that there are loops 7 between certain only of the spaced rods and the fabric lies in a straight line as indicated at 8 over a plurality of spaced rods between each loop 7. The ventilation of the drying chamber 10 may be secured in any usual way by providing said chamber with a fresh air inlet and an outlet for saturated air. The inlet and outlet, however, are not illustrated herein as they are features commonly found in drying chambers. As shown in Fig. 3, there is a loop 7 between two adjacent rods, R<sub>1</sub>, R<sub>2</sub>, which are spaced from each other, and then the fabric or web extends from the rod R<sub>1</sub> over the next adjacent rod R<sub>2</sub>, which is spaced from said rod R<sub>1</sub>, and then there is another loop 7 formed between said rod R<sub>2</sub> and the adjacent rod R<sub>1</sub> to the right. Thus the fabric passes over two adjacent spaced rods R<sub>1</sub>, R<sub>2</sub>, and is then looped between the next two adjacent rods

and then passes over two other spaced rods before the next loop is formed in the festooned arrangement. The loops 7 may be comparatively short as compared with loops of maximum length above referred to. The rods  $R_1, R_2$  which support any festoon may be considered as a pair of rods, in which case the entire series of rods supporting the fabric may be described as comprising a plurality of pairs of rods with the rods of each pair spaced apart and supporting a loop of the festooned fabric and with the adjacent pairs of rods also spaced apart.

Any usual means are provided for delivering heated gaseous drying medium into the upper ends of the loops, and there is shown in Fig. 2 a blower V arranged in a heating chamber which communicates at its lower end with the lower end of the drying chamber 10 in which the web G is being dried as shown at 28, and also communicates with the upper end of the drying chamber, as shown at 29. 11 indicates heating pipes in the heating chamber over which the gaseous drying medium is forced by the blower V. With this arrangement the heated drying medium will be forced upwardly through the heating chamber 9 and then downwardly into the upper ends of the loops 7, as indicated by the arrow  $a$  in Fig. 2, and air will be drawn from the lower end of the drying chamber by the blower V and then again circulated through the heating chamber.

In accordance with my invention, the air is delivered into the loops 7 with sufficient force and under sufficient pressure so that the loops are ballooned at their lower ends, as best seen in Fig. 3. This ballooning of the loops places the fabric under some tension so that the entire length of the fabric is held taut, that is, both the fabric in the ballooned loops as well as the straight length 8 of the fabric will be held under some slight tension. As stated above, the loop 7 can be relatively short and best results are secured by delivering the heating and drying medium into the loops with sufficient force to expand the loops at their lower end to an extent approximately equal to the length of the straight portions 8 of the fabric. In other words, the dimension 20 of the expanded loop is approximately equal to the dimension 21 in Fig. 3. With this arrangement, the tension of the cloth in the loops 7 is approximately the same as that of the straight portions 8, and, therefore, the fabric receives the increased drying effect which results from delivering the drying medium against the fabric while it is held in taut condition. The action of the heating medium in ballooning the loops serves to maintain the fabric in the loops in a smooth condition.

With crepe fabrics, the shrinking of the fabric is augmented considerably by the slight shaking motion to which the loops are exposed by the action of the current of the gaseous drying medium.

The rods  $R_1, R_2$ , are connected by chains 12 by which said rods are moved through the drying chamber, thereby to convey the fabric from one end of the drying chamber to the other. Means are also provided for rotating the rods  $R_1, R_2$ , as they progress through the drying chamber, so that the fabric will be traveling over the rods and through the loops 7 as well as being transported bodily through the drying chamber. This rotation of the rods can be accomplished by providing each rod with a pinion 13 at each end

which meshes with a stationary rack 14 so that as the rods are moved bodily through the drying chamber 10 by means of the chains 12, said rods will also be rotated about their axes thereby feeding the fabric forward over the rods and through the loops.

An important thing which results from the arrangement shown in Fig. 3 is that the surface contact between the fabric and each rod is considerably reduced. If the fabric were festooned over every rod then the fabric would have contact with each rod throughout approximately 180° of its surface.

But with the arrangement shown in Fig. 3, the fabric has only about a 90° contact with each rod and as these rods are rotating and feeding the fabric forward, any portion of the fabric will be in contact with one of the rods for only a limited period of time. If any portion of the fabric remains in contact with any heated rod  $R_1, R_2$ , for any considerable length of time, such portion of the fabric will be subjected to a different drying action from other portions of the fabric which are dried solely through the action of the current of heated drying medium and as a result the portions of the fabric which were dried by contact with the rods may have a different appearance from the portions of the fabric dried solely by the action of the drying medium.

With the present invention, however, where the rods are rotated about their axes as they travel through the drying chamber, the portions of the fabric which are in contact with the rods are constantly changing and any portion of the fabric will have contact with the rods for only a limited time. This results in an evenly dried fabric which is free from any spots or uneven appearance due to the contact of the fabric with the supporting rods. The supporting rods  $R_1, R_2$ , may have a relatively large diameter and are so arranged that the length of the fabric from  $R_1$  to  $R_2$  is at least as great as the length of the portion of the fabric in contact with any rod. These improvements fulfill a double purpose. On the one hand, with a given fabric content in the drying chamber, the largest possible output is realized, while on the other hand, any defective appearance in the fabric is prevented by the rotary movement of the rods which feeds the fabric over the rods as the rods are moved bodily through the drying chamber.

I claim:

1. The method of drying material in web form which consists in supporting the web on a series of spaced parallel rods arranged in pairs in a drying chamber with the rods of each pair spaced apart and with the pairs of rods also spaced from each other, which web is festooned between the rods of each pair and extends horizontally in a straight line over the two adjacent rods of adjacent spaced pairs of rods, and delivering into the loops a gaseous heating and drying medium under sufficient pressure to cause the lower end of each loop to balloon sufficiently so that the legs of the loop are separated by a distance approximately equal to the length of the straight portion of the fabric between adjacent loops whereby the fabric is placed under a slight tension throughout its length.

2. An apparatus for drying fabrics comprising a drying chamber, a plurality of rods in the chamber for supporting the fabric in festoon formation, said rods being arranged in pairs with the rods of each pair spaced from each other and supporting a loop of the festooned fabric and

with the pairs of rods also spaced apart, the fabric extending in a straight line between the adjacent rods of adjacent spaced pairs of rods, and means for delivering into each loop at its upper end gaseous drying medium under sufficient pressure to cause each loop to balloon at

its lower end to a width substantially equal to the length of the horizontal straight portion of fabric extending between adjacent rods of adjacent spaced pairs of rods.

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