Aug. 5, 1958 H. A. HOWARD 2,845,687

PREPARATION OF HAIR OR OTHER FIBRES FOR UPHOLSTERY OR OTHER PURPOSES

Filed Oct. 25, 1955 3 Sheets-Sheet 1

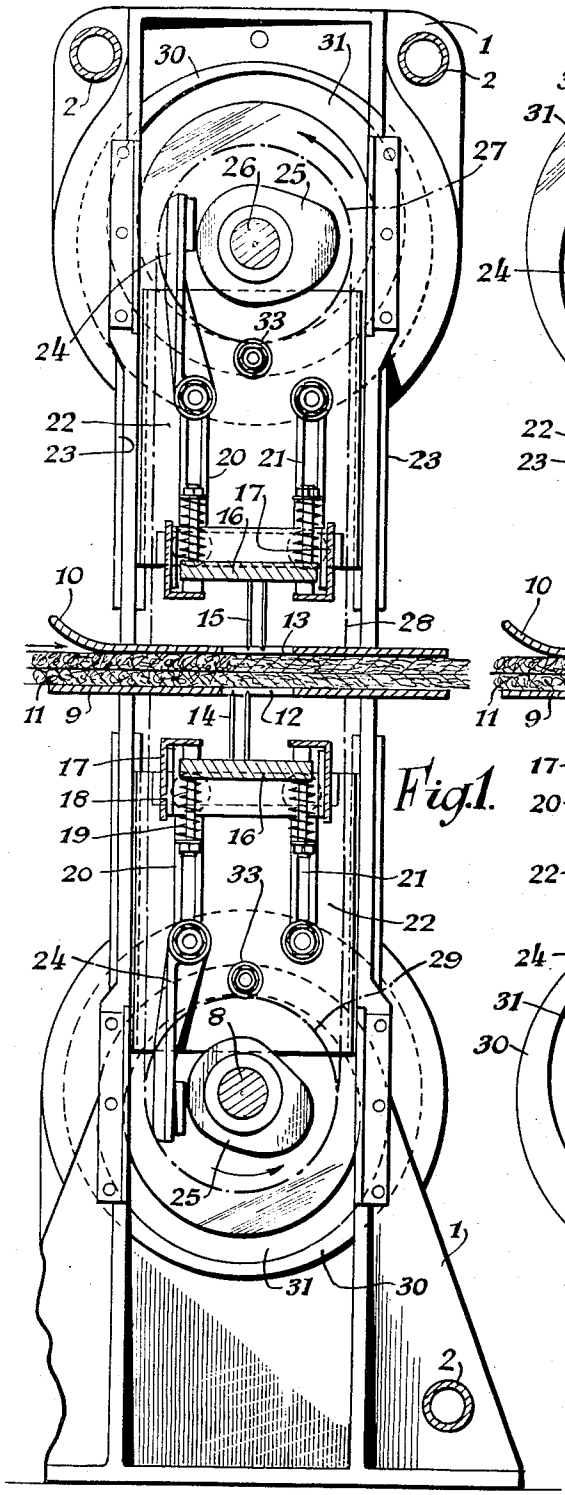


Fig. 1.

Fig. 2.

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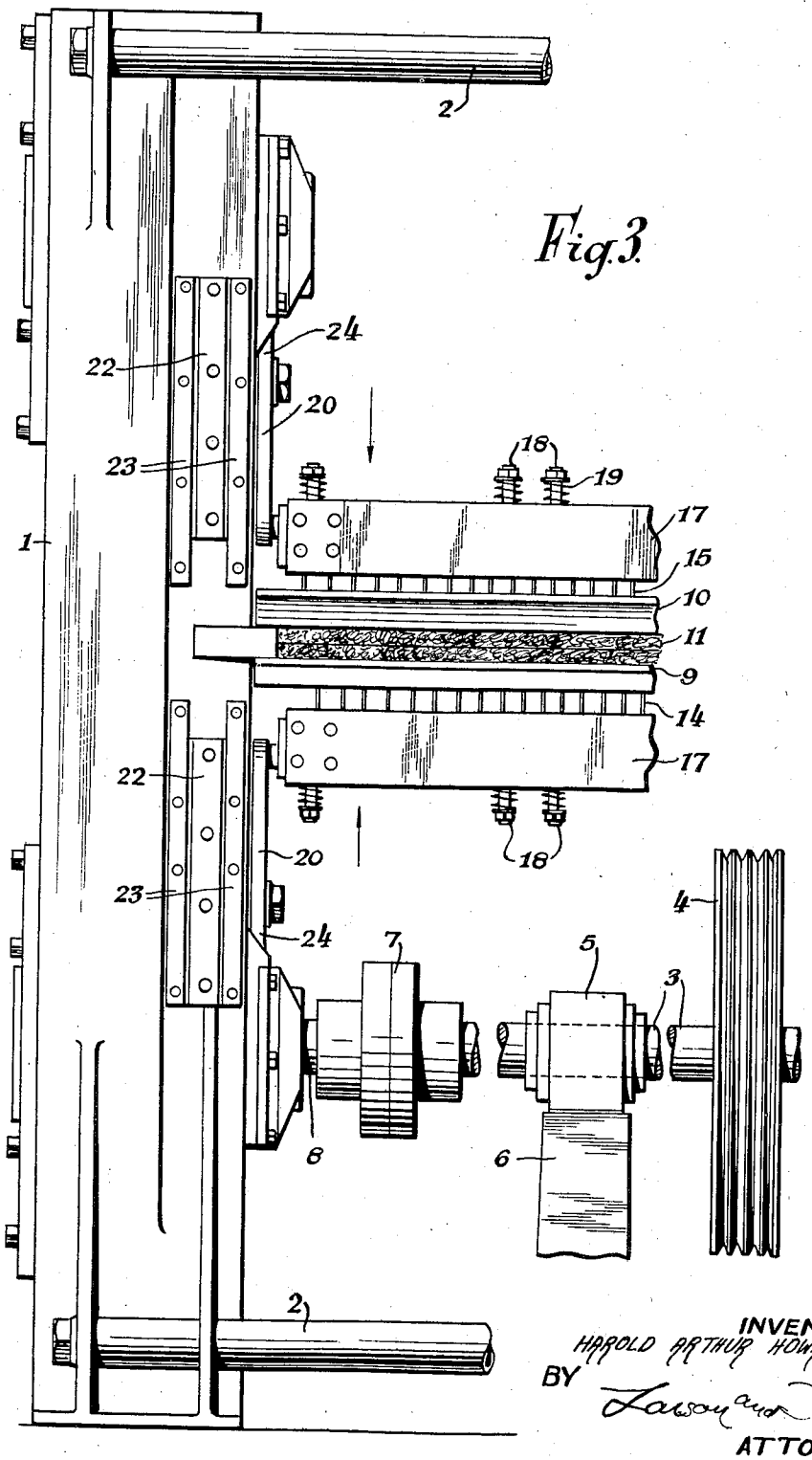


Fig. 3.

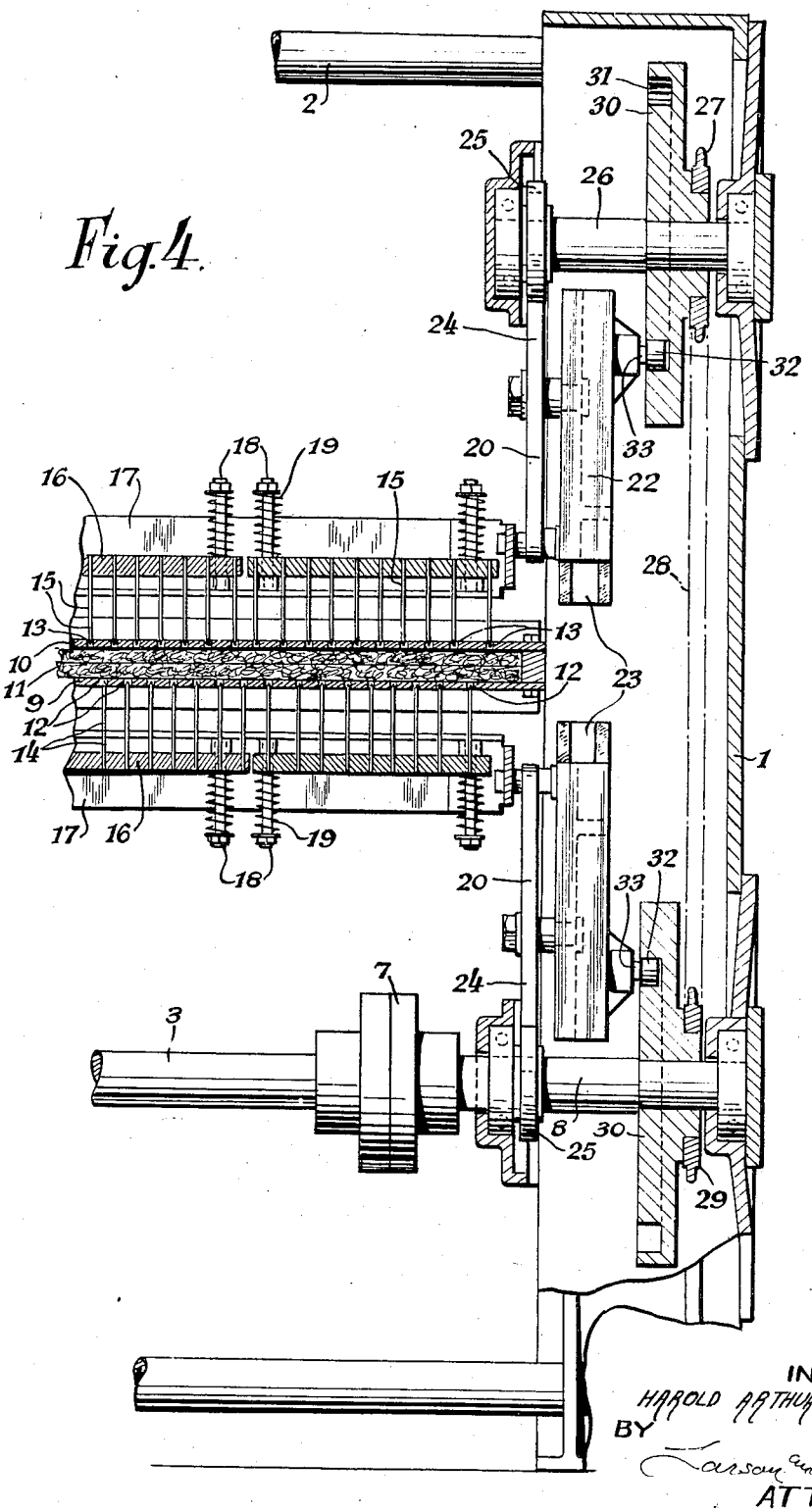
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Fig. 4.



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PREPARATION OF HAIR OR OTHER FIBRES FOR UPHOLSTERY OR OTHER PURPOSES

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Application October 25, 1955, Serial No. 542,740

Claims priority, application Great Britain October 28, 1954

8 Claims. (Cl. 28—4)

This invention relates to the preparation of hair or other fibres for upholstery or other purposes. The invention is concerned with the manufacture of material known as rubberized hair, for the preparation of which, a layer of curled hair in a loosely associated condition is held by the hair being coated, preferably before but possibly after preparation of the layer, with a flexible, hair-sheathing and interconnecting, adhesive material such as rubber deposited from rubber latex. Other materials than hair and rubber may be used, for example any relatively long upholstery fibre and plasticized polyvinyl chloride as the coating material, but the invention will be described as applied to rubberized curled hair.

It is known to obtain uniform distribution of hair, in a relatively thick layer thereof, by the process known as lapping. For this, a bat of carded hair, emerging from a carding machine onto a slowly moving conveyor belt, is folded transversely in a long zig-zag so that several laps of the bat go to form the complete final layer. The effect of irregularities in distribution of hair within the bat upon the distribution in the final lapped-up sheet is thus reduced.

The greater the number of laps, of course, the better the average distribution in the layer. For example, if ten laps are made, so that ten thicknesses of the bat are superimposed to form a layer, a gap in the bat reduces the amount of hair at the corresponding part of the layer by only one-tenth. On the other hand, if the bat is lapped only twice, any gap reduces the amount of hair at the corresponding part of the layer by one-half.

Carding machines are usually capable of producing quite regular bats, as long as the weight of hair per square foot is reasonably high. When attempts are made to produce lighter bats, however, irregularities and gaps tend to be increased.

In the manufacture of the softer very open-textured grades of rubberized hair having a low weight of hair per square foot in the finished product, it is frequently possible to use only two laps to an inch thickness of the finished product, and even then, before or during carding, the hair must be "opened" or teased to a very high degree, to reduce the density to get the required low weight per square foot. The frequency of irregularities or gaps in the bat is then so high that two laps are not sufficient to obtain a satisfactorily uniform distribution of hair in the layer.

The purpose of the present invention is to enable normally carded regular bats, of relatively high density, to be used in making layers which have a low final density to give a desired "openness" and lightness of texture. For this purpose, I lap up a normal bat so as to produce a relatively dense layer, substantially heavier per square foot than is ultimately required, and then expand or stretch this layer to obtain the required low density or weight of hair per square foot.

It is clear that if the stretching were done merely by pulling the ends of the layer apart, the weakest parts of the layer would tend to stretch more than the stronger

ones, where the hairs were more thoroughly intertwined, and the result would be the appearance of gaps or tears. To avoid this, I provide, by the present invention, a method and apparatus for stretching only small portions of the layer at a time.

According to the invention, a method of reducing the density of a layer of loosely associated curled hair or like fibers, comprises spreading the fibers apart, in small portions of the layer successively, by means of at least two sets of needles or the like which are caused repeatedly to enter the layer close together, move apart within the layer for a short distance, so as to increase the separation of fibres engaged respectively by needles of different sets, and then withdraw from the layer.

To enable successive portions of a layer to be stretched, it is convenient for the layer to be conveyed past a position at which the needles operate and, according to a further feature of the invention, the layer is also moved bodily, during the spreading of the fibres, by the sets of needles being caused, while entered in the layer, to move laterally in the same direction but to a different extent as between one set of needles and another, so that the sets of needles entrain the layer in their movement as well as moving apart within the layer.

Apparatus for carrying out the method according to the invention, comprises a support for the layer of fibres, for example parallel plates forming a passage for the layer, two sets of needles extending transversely to the supports, for example on two bars opposed across a transverse series of slots in the support plates, and means, such as rotary cams and followers, for moving the two sets of needles simultaneously into the layer, relatively apart laterally within the layer and then out of the layer.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a vertical section through a machine for simultaneously stretching and conveying a layer of hair.

Fig. 2 is a partial vertical section, similar to Fig. 1, but showing a later position of the needles,

Fig. 3 is a front elevation of hair the machine, the other half being similar, and

Fig. 4 is a vertical section across the other half of the machine from that shown by Fig. 3.

The machine as shown comprises two main frame side pillars **1** interconnected by four tubular tie bars **2** to form a stable and rigid frame structure.

A transverse main driving shaft **3**, carrying a V-belt driven pulley **4**, is supported in a plummer block bearing **5** on a pedestal **6** and is connected at each end by a flange coupling **7** to an end shaft **8** journalled in the lower part of the respective side pillar **1**.

Across the middle of the machine and supported by their ends half-way up the side pillars **1** is a vertically-spaced pair of horizontal support plates **9** and **10** which form a wide horizontal passage for a layer of hair **11**. The front border of the upper support plate **10** is curved up to provide a lead-in for the layer of hair which, as indicated, consists of two laps or superimposed bats. Normally the hair in the layer will have already been coated with rubber latex, or other adhesive, but will enter the machine with the adhesive still in a fluid state. The layer of hair entering the machine could however be dry and be treated with adhesive after leaving the machine.

The support plates **9** and **10** have, across the middle of each, a row of slots, numbered **12** in the lower plate **9** and **13** in the upper plate **10** (see Fig. 1), to allow a lower set of needles **14** and an upper set of needles **15** to enter the layer of hair between the support plates.

The mechanism for moving the needles is the same for each set of needles and is duplicated in each pillar so that there are four similar mechanisms. The only

difference in operation is that the two upper mechanisms give the upper set of needles **15** a lateral movement of substantially twice the length of the lateral movement which the lower mechanisms give to the lower set of needles **14**. Consequently, only one assembly of the mechanism will be described, the same reference numbers being used as far as possible on the corresponding parts of the other mechanisms.

The needles are set in a bar **16** carried by a channel-section beam **17**. The bar **16** has holes through which extend, as sliding fits, studs **18** fixed in the web of the beam **17** and around each stud a coiled compression spring **19** bears on the bar **16** to urge it against the bases of the studs **18**. The bar **16** is thus mounted to move with the beam **17** but can yield perpendicularly thereto to avoid serious damage to the machine in the event of the needles fouling one of the support plates **9** or **10** or meeting any other obstruction to their movement.

The beam **17** is carried at each end thereof by a pair of swinging links **20** and **21** pivoted to the beam and to the face of a sliding carrier plate **22** mounted to slide vertically in fixed guides **23** on the respective side pillar **1**. One of the beam-suspending links **20** is extended beyond its carrier plate pivot to form a cam-follower **24** for a rotary lift cam **25** to effect swinging of the beam relatively to the carrier plate and thus produce lateral movement of the set of needles.

In each upper mechanism, the cam **25** is fixed on a cam-shaft **26** which carries a sprocket wheel **27** for a driving chain **28** from a sprocket **29** on the end **8** of the main driving shaft **3**. For each lower mechanism, the shaft end **8** serves as the cam-shaft.

The cam-shaft also has fixed on it a cam disc **30** in the face of which is cut an eccentric circular cam groove **31** in which is engaged a roller follower **32** carried by a stud **33** fixed on the back of the carrier **22**.

The operation of the mechanism is as follows:

When the main shaft is driven to rotate the cam-shaft, **8** or **26**, the cam disc **30**, through its eccentric groove **31** and the follower **33**, simply reciprocates the sliding carrier plate **22** with a constant stroke up and down in its guides **23**. This movement alone would simply move the beam **17** towards and away from the respective support plate **9** or **10** and thus move the needles into and out of the full depth of the hair layer **11**.

During reciprocation of the carrier **22** however, the cam **25** is also rotating and its lift is shaped and positioned to wipe the follower **24** to swing the beam **17** relatively quickly in one direction, to the right as viewed in Figs. 1 and 2, each time that the beam is closely approaching the respective support plate **9** or **10** and effect a slower return of the beam during the remainder of the stroke of the carrier plate. The vertical movement of the follower **24**, with the reciprocation of the carrier plate, is allowed for in the design of the cam **25**. This swinging of the beam **17** superimposes on the vertical movement of the needles a lateral movement while they are substantially fully entered in the hair layer **11**, both sets of needles being simultaneously moved laterally in the same direction.

The lift of the upper cam **25** is however greater than that of the lower cam **25** so that the lateral movement of the upper set of needles **15** is approximately twice that of the lower set of needles **14**. The two sets of needles thus conjointly entrain the hair layer **11** in their lateral movement but the upper set of needles moves faster and further laterally than the lower set from which it therefore moves further apart within the hair layer causing local stretching thereof.

At each cycle of movement, the needles engage and stretch successive narrow bands of the hair layer as they move the layer bodily step-by-step through the passage between the support plates **9** and **10**.

Whilst the invention has been described as applied to the stretching of rubberised hair, it will be understood that a layer of other suitable fibres, with or without an adhesive coating, could be treated in the same way. Also the means for engaging the layer need not be separate needles as illustrated but could be long-toothed combs or like layer-penetrating devices.

I claim:

1. A method of reducing the density of a layer of loosely associated fibres, which comprises spreading adjacent fibres apart in the direction of the plane of the layer by actuating at least two relatively movable sets of mutually parallel layer-penetrating members simultaneously to penetrate the layer perpendicularly to the plane of the layer, to be located laterally close together in the layer, move relatively apart laterally and maintaining parallel relationship within the layer for a short distance, so as to increase the separation in the plane of the layer of fibres engaged respectively by layer-penetrating members of different sets thereof, and then withdraw from the layer.

2. A method according to claim 1, in which said sets are actuated repeatedly and relative movement of the layer as a whole in the plane of the layer is effected so that at each repeated actuation of said sets the layer-penetrating members penetrate a successive unspread portion of the layer.

3. A method according to claim 2, in which said relative movement of the layer as a whole is effected by actuation of said sets to move in the same direction in the plane of the layer whilst said members are in said layer but to a different extent as between one set and another.

4. Apparatus for reducing the density of a layer of loosely associated fibres, by spreading adjacent fibres apart in the direction of the plane of the layer, comprising an aperture support for, and parallel to the plane of, said layer, at least two adjacent relatively movable sets of mutually parallel layer-penetrating members directed perpendicularly through the apertures in said support, and means for cyclically moving said sets simultaneously perpendicularly towards said support, to pass said members through said apertures, relatively apart in a direction parallel to said support, to increase the separation of the members of one set and another whilst maintaining mutually parallel relationship of said members, and then perpendicularly away from said support.

5. Apparatus according to claim 4, in which said means for cyclically moving said sets comprises, for each said set, a carrier mounted to reciprocate perpendicularly to said support, parallel pairs of links pivotally connected respectively, about axes parallel to said support, on the one hand to said carrier and on the other hand to said respective set to mount said set to swing on said carrier with a motion parallel to said support, means for reciprocating said carrier and means for swinging said set on said carrier in synchronism with reciprocation of said carrier.

6. Apparatus according to claim 5, in which said means for reciprocating said carrier and for swinging said set comprises a rotary cam-shaft, an eccentric circular cam on said cam-shaft, a follower on said carrier engaged with said eccentric circular cam, a lift cam on said cam-shaft and an extension beyond its carrier pivot of one of each pair of said links in the form of a follower for said lift cam.

7. Apparatus for reducing the density of a layer of loosely associated fibres, by spreading adjacent fibres apart in the direction of the plane of the layer, comprising a pair of multiple-apertured, vertically-spaced, horizontal support plates forming between them a horizontal passage for said layer, a parallel pair of beams extending closely across and respectively above and below said support plates and parallel thereto, a set of mutually parallel layer-penetrating needles on each said beam directed vertically through the apertures in said support plates, a vertically slidable carrier for each end respectively of each said beam, parallel pairs of links pivotally connected respectively, about horizontal axes, on the one hand to each said carrier and on the other hand to

the respective end of the respective beam to mount each beam to swing with a horizontal parallel motion on two of said carriers, and cam and follower means for synchronously reciprocating said carriers and swinging said beams to repeatedly actuate said sets of needles to move cyclically close together vertically into said layer, relatively apart laterally and horizontally within said layer, whilst maintaining mutually parallel relationship, and vertically out of said layer.

8. Apparatus according to claim 7, in which said cam and follower means is arranged to swing both said beams to move both said sets of needles simultaneously in the same direction horizontally in said layer but to different extent as between one set of needles and the other to effect relative movement of the layer as a whole.

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