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ELECTROSTATIC FLOCKING

Filed Dec. 5, 1968

FIG 1

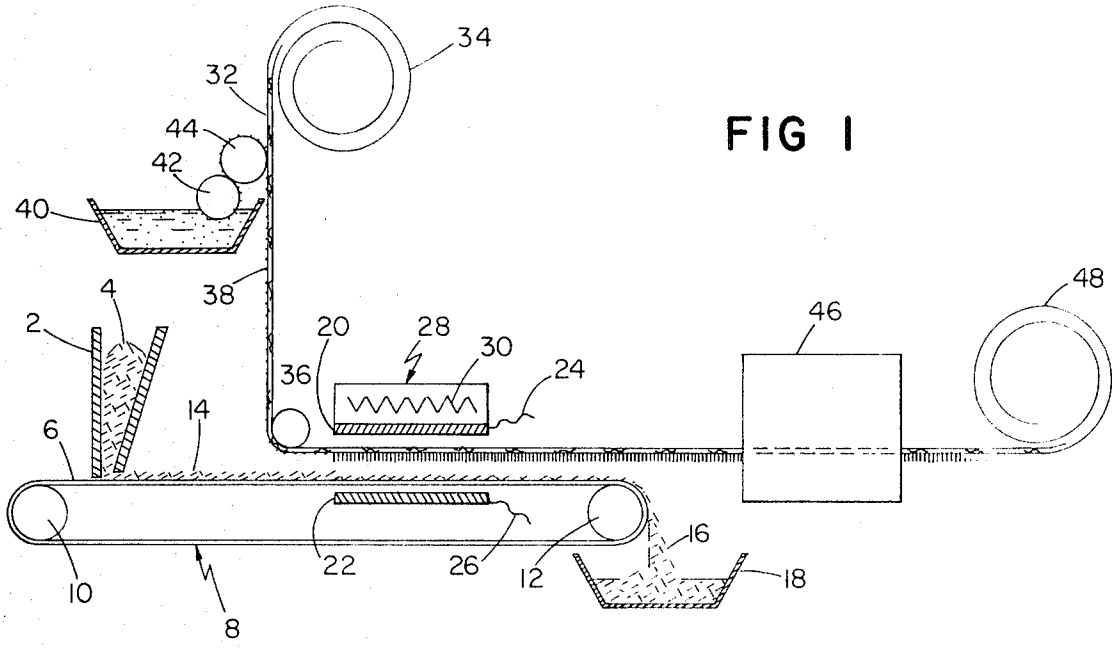
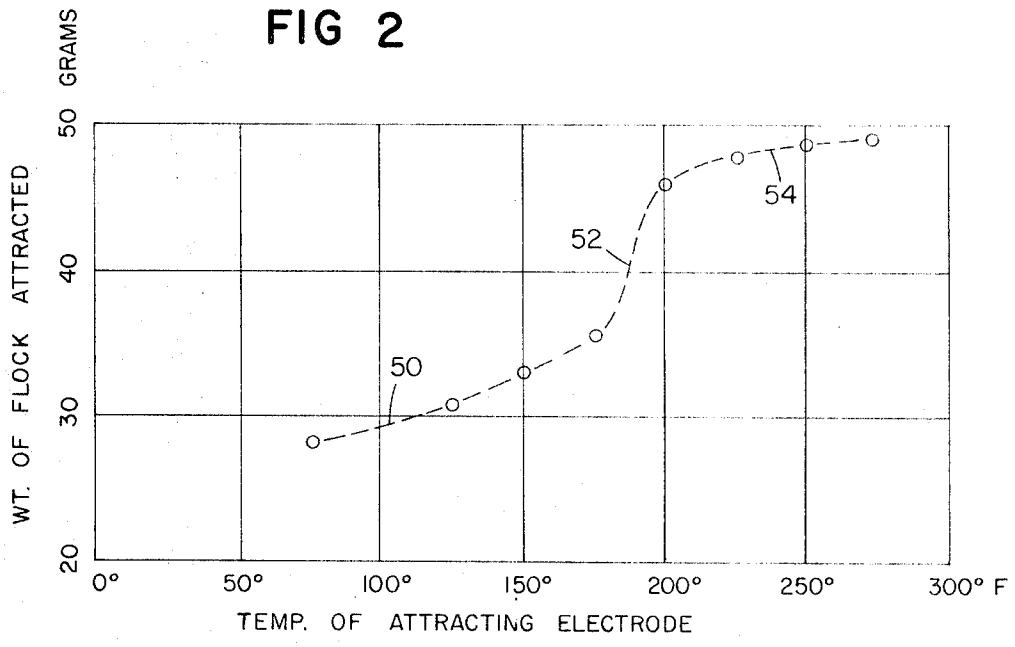


FIG 2



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ELECTROSTATIC FLOCKING

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ABSTRACT OF THE DISCLOSURE

In electrostatic flocking method means is provided for supplying heat to the attracting electrode in addition to any heat supplied by current due to the potential difference between the electrodes.

The present invention relates to the manufacture of pile fabric and more particularly a pile fabric floor covering wherein the pile forming fibres are secured to a backing by a layer of adhesive in which they have been deposited by an electrostatic field.

It has been known for some time to form pile fabrics by passing an adhesive coated backing material, together with a support carrying pile forming fibres, adjacent an electrode, and ordinarily between two electrodes, which are energized so as to produce an electrostatic field between them causing the fibres to be carried toward the adhesive coated surface of the backing material and embedded in the adhesive coating, the fibres being secured in the adhesive at one end only, and extending generally normal to the backing to form a pile surface. Such procedures have been termed electrostatic flocking. The present invention comprises an improvement on such procedures, and, while not confined thereto, has found particular application in the manufacture of pile fabrics suitable for use as floor coverings.

An object of the invention is to provide a process and apparatus for the manufacture of pile fabric by electrostatic flocking in which the application of the pile to the backing is effected more rapidly than in heretofore known procedures.

Another object of the invention is to provide such a process and apparatus whereby pile fabrics of increased pile density may be produced.

Other objects, features and advantages of the invention will become apparent from the following description of a process and apparatus illustrative of the invention, in which description reference is made to the accompanying drawing wherein;

FIG. 1 is an elevation of the apparatus, partly in section, and largely schematic; and

FIG. 2 is a graph illustrating the relationship between the weight of flock which is attracted to and embedded in the adhesive and the temperature of the attracting electrode.

In accordance with the invention, pile fabric is formed by coating a backing material with an adhesive in a tacky condition, supplying loose pile-forming fibre to the vicinity of the adhesive and positioning the backing and fibres adjacent an attracting electrode to expose the backing and fibre to an electrostatic field such as to deposit the fibres on the adhesive, the attracting electrode being maintained at a temperature elevated above the normal ambient temperature. Preferably the attracting electrode is maintained at a temperature in the range of 175° to 275° F. Preferably the process is conducted so that the backing in the form of a web is moved continuously between a pair of spaced electrodes, being coated with the adhesive as it approaches the electrodes and subjected after it leaves

the electrodes to treatment to set the adhesive. The invention also includes apparatus for applying fibre to an adhesive coated backing material which comprises an attracting electrode for creating an electrostatic field, means for supporting an adhesive coated backing material adjacent the electrode, means for supplying loose fibres to the vicinity of the backing material and means for heating the electrode. Preferably the means for heating the electrode is adapted and arranged to maintain the electrode at a temperature in the range 175–275° F.

Referring now to the drawing, the illustrative apparatus comprises means in the form of a hopper **2** for supplying the loose fibre **4** which is to form the pile. Beneath the hopper **2** is positioned the upper flight **6** of an apron conveyor **8** trained about the rollers **10** and **12** one or both of which is driven to move the upper flight **6** to the right as seen in FIG. 1. As the flight **6** moves beneath the hopper **2** a layer of fibre **14** is deposited on the conveyer to be carried through the apparatus. Any excess fibre not affixed to the backing fabric during the operation is received in a suitable receptacle **18** from which it may be returned to the hopper **2** for reuse.

The upper flight **6** with its charge of fibre **14** passes beneath the upper or attracting electrode **20** and above the other electrode **22**. Through conductors **24** and **26** a high voltage is applied to the electrodes to create an electrostatic field between them such as to attract the fibres **14** toward the attracting electrode **20**, as is well understood in the art. In accordance with the invention the attracting electrode **20** is provided with a heating element **28** containing a resistance heating coil **30**, for maintaining the electrode **20** at an elevated temperature, desirable thermostatically controlled within the range 175° to 275° F.

The backing fabric **32** is supplied as a continuous web from a supply roll **34** from which it is drawn downwardly and about a guide roll **36** from which it passes horizontally beneath the attracting electrode **20** and above the conveyor flight **6** with its layer of fibres **14** thereon. The backer **32** is provided with a coating of adhesive **38** from a reservoir **40**, as is well known in the art, by a pair of licker rolls **42**, **44**. As the adhesive coated backer **32** passes between the electrodes the electrostatic field causes fibres to be lifted from the conveyor flight **6** and attached to the backer by engagement of one end of the fibres by the adhesive.

After leaving the electrodes, the backer **32** with its adhesive coating and attached pile passes through any appropriate means for setting the adhesive, such as the oven **46**. Setting of the adhesive firmly secures the pile to the backing. Finally the pile fabric is wound up on a take-up roll **48**, by which the web of backing material **32** is drawn from the supply roll **34** and through the apparatus.

It surprisingly has been found that by maintaining the attracting electrode **20** at an elevated temperature the amount of pile fibre which is attracted to and secured to the backer under any given set of conditions is substantially increased, such increases running to as much as 75% or more of fibre by weight, and further that the pile density that can be produced, i.e., the amount or weight of pile per unit area of the backer, is substantially increased, the increases running to 10% or more. The result is that the time required to deposit the pile surface on the backer to any desired density is substantially reduced, and, irrespective of the time employed, the pile density may be increased.

FIG. 2 illustrates an instance showing the substantial increase in the amount of flock attracted and attached to the backing with increase of the temperature of the attracting electrode. The conditions under which the opera-

tion illustrated by this curve was carried out are as follows.

Distance between electrodes—3⅜ inches.
Voltage—25,000 volts.
Current—½ milliampere.
Effective area of attracting electrode—10" x 16".
Fibre length—0.160".
Denier—30.

The space between the electrodes equals 436 cubic inches.

Adhesive viscosity—30,000 centipoises.

Adhesive thickness—10 mils (0.010").

Duration of exposure of adhesive coated backing to electrostatic field—20 seconds.

Bottom electrode temperature—75° F.

As appears from FIG. 2, even slight heating of the attracting electrode, in the portion **50** of the curve, produced some improvement in the weight of fibre attracted. When the temperature was raised to 175° F. the improvement had become substantial. Upon raising the temperature further to 200° F. over the portion **52** of the curve there was a very large, non-linear, increase in the weight of attracted fibre. Further elevation of temperature above 200° F. produced, as portion **54** of the curve shows, still further improvement but such improvement was not as large, per unit increase in temperature, as occurred in the range 175°–200° F.

Using the same nylon fibre of 30 denier and 0.160" length it was found possible to obtain a pile density of about 20 ounces per square yard on a single flocked fabric. So far as is known, present apparatus and methods produce fabrics having a maximum fibre density of the order of 14–16 ounces per square yard.

The backing may be of any desired material. For floor covering use, woven or non-woven backings of jute or other fibres may be used.

While a resistance heater for the electrode has been shown in the illustrative apparatus, heating of the attracting electrode may be effected by any suitable means such as hot gas flame, infra-red heaters, and others.

The invention is applicable to fibres which may be employed in electrostatic flocking, such as fibres of nylon, polyesters, polypropylenes, and other synthetic fibres, and natural fibres such as wool.

The adhesive can be any suitable adhesive of which many are known in the art, such as water-based adhesive, solvent-based adhesives, epoxy resins, latices of natural or synthetic rubber, hot melt adhesives, etc. Those skilled in the art will select the adhesive in accordance with the conditions, e.g., the type of fibre used and the end use to which the pile fabric is to be put.

I claim:

1. In the method of forming a pile fabric which includes coating a backing material with an adhesive in a tacky condition, supplying loose pile forming fibers to the vicinity of the adhesive, positioning the coated backing and the fibers intermediate an attracting electrode and another electrode spaced therefrom with the fibres on the side of the backing opposite the attracting electrode, and impressing a high voltage potential difference on the electrodes to expose the backing and fibers to an electrostatic field to deposit fibers on the adhesive, the improvement which comprises supplying heat to the attracting electrode, in addition to any heat supplied by said potential difference, to maintain the attracting electrode at a temperature substantially elevated above the temperature the attracting electrode would assume in the absence of heat applied thereto other than by normal ambient conditions and by the influence of said potential difference.

2. The method of claim **1** wherein the temperature of the attracting electrode is maintained in the range 175° to 275° F.

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