No. 758,247. Patented April 26, 1904.

# UNITED STATES PATENT OFFICE.

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## PROCESS OF UNITING OR MATTING FIBERS TOGETHER.

SPECIFICATION forming part of Letters Patent No. 758,247, dated April 26, 1904.

Application filed November 28, 1903. Serial No. 183,059. (No specimens.)

*To all whom it may concern:*

Be it known that I, GUSTAV GOLDMAN, a resident of Baltimore, Maryland, have invented a new and useful Process of Uniting or Matting Fibers Together, which invention is fully set forth in the following specification.

This invention relates to the art of treating fibrous material for the purpose of uniting the fibers into a mass.

In my application, Serial No. 171,288, filed August 29, 1903, I have described a process of uniting fibers which, broadly stated, consists in introducing between the fibers a dry finely-divided binding material and then treating said binding material so as to convert it into an active means for uniting the fibers together, and in my application, Serial No. 174,815, filed September 26, 1903, I have described and claimed a process for a like purpose, which consists in introducing between the fibers a plurality of dry finely-divided materials of a character which may be caused to react chemically so as to form a new material which shall itself constitute the binder for uniting the fibers. The present application relates to the same general class of inventions—viz., that of introducing between the fibers the binding material in dry form and then subsequently treating the material to cause it to act as a binding agent for uniting the fibers; and, more specifically, it consists in the employment of a resin as such binding material, the resin being in a finely-divided state, whereby it may be caused to readily penetrate between the fibers. The brittleness of the resin is modified or diminished by the introduction of some suitable tempering agent. A great variety of such agents will suggest themselves, the essential feature being that said agent shall be one which is capable of being reduced to a finely-divided state in a dry form, to the end that it may be readily introduced between the fibers, together with the resin. The proportions of resin and the tempering agent employed may be varied greatly without departing from the spirit of the invention, and these proportions will to a large extent depend upon the particular result desired to be obtained. One of the tempering agents which has been employed with great success is soap dried and powdered and mixed with the resin, the whole being employed in powdered or other finely-divided form. The particular character of soap employed for this tempering of the resin may be varied, and sodium resinate or resin soap has been found particularly advantageous for this purpose, the sodium resinate and the resin being mixed in a finely-divided form and then introduced between the fibers in any suitable manner, or the resin and the sodium resinate may be dusted or otherwise introduced between the fibers separately. Furthermore, resin before introduction among the fibers may be mechanically mixed with metallic bases (whether oxids or hydrates) or with suitable salts of any metal which forms an insoluble compound with resin. Manifestly resin and the metallic bases or metallic salts may be mixed before introduction, as above indicated, or they may be introduced separately between the fibers. After the same have thus been introduced between the fibers, as by being dusted therein, the union of the above substances and resin may be brought about by any suitable means, as by the application of heat, whereby resin and the bases or salts act to form an insoluble binder for the fibers, and, again, the resin mixed with soda insufficient in quantity when treated to convert the entire mass of resin into a sodium resinate may be introduced in a finely-divided form among the fibers and then treated with heat and pressure, so as to cause the soda and some part of the resin to react, forming a sodium resinate which, together with the excess of resin not entering into combination with the soda, would serve to bind the fibers together, the function of the sodium resinate thus formed being to temper the excess resin, which will serve as a waterproofing for the tempering agent, or, if desired, resin, together with an insoluble metallic resinate, may be prepared and after being dried and powdered may be dusted or otherwise introduced between the fibers of the fibrous mass and then converted into an active binder for uniting the fibers together by heat either in the presence of moisture or not, as desired, or by heat and pressure. One of the most desirable forms consists in dusting in any powder formed of a mixture of a soluble resin-

ate and a salt of the heavy metals—such as aluminium, zinc, or of the alkaline earths—which metal transforms the soluble resinate into an insoluble resinate, and then treating the same by suitable means, as by heat or steam, or both, and causing a reaction of the two compounds, whereby there is formed an insoluble resinate constituting an active binder for uniting the fibers. In some cases it is desirable to mix with the resin or with the resinates above indicated some inert substance, such as bone-black, the function of which is to prevent the caking or solidifying of the resin or of the resinates before their introduction between the fibers. A convenient means of introducing the binding materials between the fibers is a dusting apparatus, such as described in my application, Serial No. 174,816, filed September 26, 1903, and there is sometimes a tendency of the resin or of the resinates above mentioned to cake or solidify in the reservoir of the apparatus before their introduction between the fibers, and the inert substance, such as bone-black, acts to prevent this caking action, while at the same time it is not employed in such proportions as to injuriously affect the action of the resin or resinates as a binding agent. One of the very great advantages of the employment of resin and of all of the resinates (except those of potassium and sodium) as a binding agent lies in the fact that the binders thus constituted are practically waterproof and are, therefore, not liable to deterioration in the presence of moisture.

One method of procedure embodying the present invention which has been found particularly effective is as follows: Powdered resin is mechanically mixed with an aluminium resinate, also in powdered form, and this mechanical mixture is then dusted in among the fibers while said fibers are in a fluffy condition—as, for example, when they come from the doffer of a carding-machine—after which the fibers, with the dusted mixture of resin and aluminium resinate among them, are subjected to the action of heat for the purpose of fusing the powdered mixture, thus causing it to act as an effective agent for binding the fibers together. Preferably the heat is applied by passing the fibers between heated rollers either in the presence of steam or not, as may be found desirable. Pressure may be applied to the mass of fibers while the binding material is in a fused or plastic condition, and preferably this is accomplished by adjusting the heated rollers between which the fibers are passed. Manifestly, however, if found desirable, the heat might be applied in other ways than by the employment of the heated rollers and the pressure subsequently applied while the binding material is yet in a soft or fused condition. The preferred form, however, is that wherein the heat and the pressure are simultaneously applied through the medium of hot rollers, between which the fibers are both heated and compressed. The amount of pressure applied will determine to a large extent the compactness of the felted mass, and such pressure is therefore varied, depending upon whether the ultimate product is desired to be of a compact nature or whether it is desired to remain more or less open and fluffy in character. This process has been found to produce a matted mass of fibers the cohesion of which as a matted mass is not at all deleteriously affected by moisture—such as perspiration, for example—when the mass of fibers is employed for pads for garments and the like.

As is clearly set forth in my application, Serial No. 171,288, above referred to, the process is not limited to the treatment of any particular class of fibers and is equally applicable to mineral, vegetable, or animal fibers or to mixtures of these.

When treating animal fibers or mixtures containing any considerable proportion of animal fibers, it has been found advantageous to supply the heat for fusing the binder in the presence of moisture, and this is particularly true where a light springy resilient mass of fibers is desired. This is accomplished by placing the fibers, with the finely-divided binder among them, between belts, one or both of which is a moisture-carrying belt, and then passing the whole between heated rollers. The heat of the rollers serves to convert the moisture of the belt or belts into steam, which penetrates the mass of the fibers and serves as a vehicle for the introduction of heat. When treating vegetable fibers, such as cotton, the process should be practiced without the introduction of moisture, unless it is desired to unite the fibers in a compact non-resilient mass.

While the binding materials are herein described and claimed as being in a "dry" condition, it is not meant thereby to state that said binding materials are in a condition wholly and positively free from all traces of moisture. It is sufficient for the purposes of this invention if the binding materials be so far free from moisture as to permit them to be introduced between the fibers in a finely-divided form.

Having thus described the invention, what is claimed is—

1. The method of binding fibers together which consists in introducing between the fibers resin in a dry form, and then converting said resin into an active binder for the fibers.

2. The method of binding fibers together which consists in introducing between the fibers resin in a dry finely-divided condition, and then subjecting the same to heat, thereby fusing the resin and converting it into an active binder for the fibers.

3. The method of binding fibers together which consists in introducing between the

fibers resin and a tempering material both in a dry finely-divided condition, and then converting the resin together with the tempering material into an active binder for the fibers.

4. The method of binding fibers together which consists in introducing between the fibers resin and a tempering material both in a dry finely-divided form, and then subjecting the resin and tempering material to the action of heat, whereby they are converted into an active binding agent for the fibers.

5. The method of binding fibers together which consists in mixing dry finely-divided resin and a dry finely-divided tempering material, then introducing this mixture between the fibers, and then converting said mixture into an active binding agent for the fibers.

6. The method of binding fibers together which consists in mixing dry finely-divided resin and a dry finely-divided tempering material, then introducing this mixture between the fibers, and then subjecting the same to the action of heat, whereby the same is converted into an active binder for the fibers.

7. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and dry finely-divided aluminium resinate, and then converting the same into an active binder for the fibers.

8. The method of binding fibers together which consists in mixing finely-divided resin and finely-divided aluminium resinate, then introducing this mixture between the fibers in a dry finely-divided state, and then converting the mixture into an active binder for the fibers.

9. The method of binding fibers together which consists in mixing finely-divided resin and finely-divided aluminium resinate, then introducing this mixture between the fibers in a dry finely-divided state, and then subjecting the same to the action of heat, whereby the same is converted into an active binder for the fibers.

10. The method of binding fibers together which consists in introducing dry finely-divided resin and dry finely-divided soap between the fibers, and then converting said soap and resin into an active binder for the fibers.

11. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and dry finely-divided metallic soap, and then converting said resin and metallic soap into an active binding agent for the fibers.

12. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and dry finely-divided insoluble soap, and then converting said resin and soap into an active binding agent for the fibers.

13. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and dry finely-divided soap and then subjecting said resin and soap to the action of heat, whereby they are converted into an active binding agent for the fibers.

14. The method of binding fibers together which consists in introducing between the fibers resin and a dry finely-divided metallic soap, and then subjecting said resin and metallic soap to the action of heat, whereby they are converted into an active binding agent for the fibers.

15. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and a dry finely-divided insoluble metallic soap and subjecting said resin and insoluble soap to the action of heat, whereby they are converted into an active binding agent for the fibers.

16. The method of binding fibers together which consists in introducing between the fibers resin in a dry finely-divided condition, and then subjecting the same to heat and to pressure, whereby the same is converted into an active binder for the fibers.

17. The method of binding fibers together which consists in introducing between the fibers resin and a tempering material both in a dry finely-divided condition, and then subjecting the same to heat and to pressure, whereby the same is converted into an active binder for the fibers.

18. The method of binding fibers together which consists in mixing dry finely-divided resin and a dry finely-divided tempering material, then introducing this mixture between the fibers, then subjecting the same to the action of heat and to pressure, thereby converting said mixture into an active binding agent for the fibers.

19. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and dry finely-divided aluminium resinate, and then subjecting the same to the action of heat, whereby the same is converted into an active binder for the fibers.

20. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and dry finely-divided aluminium resinate, and then subjecting the same to the action of heat and of pressure, and thereby actively binding the fibers together.

21. The method of binding fibers together which consists in mixing powdered resin and powdered aluminium resinate, then introducing this mixture between the fibers in a dry finely-divided state, then subjecting the same to the action of heat and of pressure, whereby the same is converted into an active binder for the fibers.

22. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and dry finely-divided soap, and then subjecting said resin and soap to the action of heat and of pressure,

whereby they are converted into an active binding agent for the fibers.

23. The method of binding fibers together which consists in introducing between the fibers resin and a dry finely-divided metallic soap, then subjecting said resin and metallic soap to the action of heat and of pressure, whereby they are converted into an active binding agent for the fibers.

24. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and a dry finely-divided insoluble metallic soap, and then subjecting said resin and insoluble soap to the action of heat and of pressure, whereby they are converted into an active binding agent for the fibers.

25. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided soap, then introducing this mixture between the fibers, and then converting said soap and resin into an active binder for the fibers.

26. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided soap, then introducing this mixture between the fibers, and then converting said soap and resin into an active binder for the fibers by the action of heat.

27. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided soap, then introducing this mixture between the fibers, and then converting said soap and resin into an active binder for the fibers by the action of heat and of pressure.

28. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided metallic soap, then introducing this mixture between the fibers, and then converting said mixture into an active binding agent for the fibers.

29. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided metallic soap, then introducing this mixture between the fibers, and then converting said mixture into an active binding agent for the fibers by the action of heat.

30. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided metallic soap, then introducing this mixture between the fibers, and then converting said mixture into an active binding agent for the fibers by the action of heat and of pressure.

31. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided insoluble soap, then introducing said mixture between the fibers and then converting said mixture into an active binding agent for the fibers.

32. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided insoluble soap, then introducing said mixture between the fibers, and then converting said mixture into an active binding agent for the fibers by the action of heat.

33. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided insoluble soap, then introducing said mixture between the fibers, and then converting said mixture into an active binding agent for the fibers by the action of heat and of pressure.

34. The method of binding fibers together which consists in introducing between the fibers resin in a dry finely-divided condition, and then subjecting the same to heat in the presence of pressure, whereby the same is converted into an active binder for the fibers.

35. The method of binding fibers together which consists in mixing dry finely-divided resin and a dry finely-divided tempering material, then introducing this mixture between the fibers, then subjecting the same to the action of heat in the presence of pressure, thereby converting said mixture into an active binding agent for the fibers.

36. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and dry finely-divided aluminium resinate, and then subjecting the same to the action of heat in the presence of pressure, and thereby actively binding the fibers together.

37. The method of binding fibers together which consists in mixing finely-divided resin and finely-divided aluminium resinate, then introducing this mixture between the fibers in a dry finely-divided state, then subjecting the same to the action of heat in the presence of pressure, whereby the same is converted into an active binder for the fibers.

38. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and dry finely-divided soap, and then subjecting said resin and soap to the action of heat in the presence of pressure, whereby they are converted into an active binding agent for the fibers.

39. The method of binding fibers together which consists in introducing between the fibers resin and a dry finely-divided metallic soap, then subjecting said resin and metallic soap to the action of heat in the presence of pressure, whereby they are converted into an active binding agent for the fibers.

40. The method of binding fibers together which consists in introducing between the fibers dry finely-divided resin and a dry finely-divided insoluble metallic soap, and then subjecting said resin and insoluble soap to the action of heat in the presence of pressure, whereby they are converted into an active binding agent for the fibers.

41. The method of binding fibers together which consists in mixing dry finely-divided

resin and dry finely-divided soap, then introducing this mixture between the fibers, and then converting said soap and resin into an active binder for the fibers by the action of heat in the presence of pressure.

42. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided metallic soap, then introducing this mixture among the fibers and then converting said resin and metallic soap into an active binding agent for the fibers by the action of heat in the presence of pressure.

43. The method of binding fibers together which consists in mixing dry finely-divided resin and dry finely-divided insoluble soap, then introducing said mixture between the fibers, and then converting said mixture into an active binding agent for the fibres by the action of heat in the presence of pressure.

44. A fibrous mass, the fibers of which are bound together by resin tempered with aluminium resinate.

45. A fibrous mass, the fibers of which are bound together by a binder containing resin and an aluminium resinate.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

GUSTAV GOLDMAN.

Witnesses:

MANNIE A. RICE,

S. T. CAMERON.