Patented Aug. 14, 1934 1,970,426

UNITED STATES PATENT OFFICE

1,970,426

PAPER MAKING PROCESS

Harold L. Levin, Rutherford, N. J., assignor, by mesne assignments, to The Patent and Licensing Corporation, New York, N. Y., a corporation of Massachusetts

No Drawing. Original application January 22, 1930, Serial No. 422,550. Divided and this application November 9, 1932, Serial No. 641,927

21 Claims. (Cl. 92—21)

This invention relates to a novel method of producing fibrous compositions containing thermoplastic or waterproofing material, such as bitumen or other heat fusible substances.

The principal object of the invention resides in the production of a loosely matted homogeneous mass of fibre and relatively soft heat fusible material that can be formed into thermoplastic articles by felting or forming the mass in a dry state or by felting it in a wet state by means of known fibre-board forming mechanism or known suction or pressure molding equipment.

It has heretofore been proposed to subject fibrous material and a binding agent such as coal tar pitch or asphalt, both in dry and solid condition, to the action of a shredding machine to produce an intimate mixture of the fibre and binder, which mixture is formed into desired shape, as for example, roofing shingles, by compression. The process as thus proposed is dependent upon the use of binders which are hard and brittle, and in order to produce a substantially waterproof body, it was necessary to heat the mixture after formation into a mat, and impregnate the mat with fluid bitumen. It has not, however, heretofore been possible to produce a mass of loosely matted fibrous material and relatively soft bitumen or other binder, in such form as to permit ready formation of the mass into sheets by felting the same on standard types of forming equipment.

According to the invention a homogeneous, loosely matted mass of fibre and heat fusible material is produced by subjecting fibrous material of various kinds and heat fusible substances, at normal temperature to a mechanical disintegrating action, whereby the fibrous material is reduced to a condition in which the fibres are largely individualized, and the heat fusible substance pulverized, so as to form an adherent coating upon these individualized fibres. The disintegration of the fibrous material, in the presence of the heat fusible substance, according to the invention, is to be distinguished from a mastication or kneading action which results in a mass that is characterized by extreme cohesion of the masticated fibres and an entire absence of voids between the fibres.

The mechanical disintegrating action according to the invention, is preferably accomplished by mechanism generally termed an impact hammer mill, in which the material to be disintegrated is struck rapidly repeated shattering blows by a battery of revolving hammers while the material is suspended in air, the resultant disintegrated fibres being removed from the zone of impact by air suction from a draft fan. The extent or degree of disintegration thus effected by the hammer mill action may be regulated as desired by means of a screen or foraminated plate of suitable mesh positioned at the discharge end of the mill so that only fibres which have been disintegrated to the desired extent will be removed under the air suction, while the remainder is retained within the mill there to be subjected to the further action of the revolving hammers.

In one embodiment of the invention fibrous sheet material impregnated with asphalt of 110–160° F. melting point may be defibrated and the fibres thereof brought to a more or less individualized condition at normal temperatures by subjecting the sheet material to a hammer mill action as above described, the resultant disintegrated fibres being withdrawn from the air collecting system in the form of a loosely compacted or fluffy fibrous mass exhibiting only a slight tendency to cohere. Any fibrous material combined with sufficient binder to provide the requisite degree of thermoplasticity with cohesion when the defibrated mass is subjected to pressure, aided by heat if necessary, may be employed in carrying into practise this embodiment of the invention. Thus, asphalt saturated felt carrying a surface coating or coatings of asphalt with or without surfacings of mineral grit may be treated according to the invention in a hammer mill. In this case the asphaltic coating and the mineral surfacing become pulverized under the action of the mill and form with the individualized fibres a homogeneous mass that can be formed into thermoplastic products, by means such as herein described.

In operating upon materials containing asphalt or other soft heat fluxible material it is advisable to introduce small quantities of materials such as sodium silicate, clay or soap solution to the mass being treated in the mill in order to prevent blocking of the screen through which the disintegrated material is withdrawn from the mill, this expedient being particularly advantageous when a screen or foraminated plate of fine mesh is employed. Where the fibrous material to be disintegrated is deficient in the quantity of binder necessary to provide an ample degree of thermoplasticity, the deficiency of binder may be supplied by the addition of binder in solid condition to the hammer mill simultaneously with the introduction of the

fibrous material thereto. The added quantities of binder will thus become pulverized and uniformly combined with the disintegrated fibres. If desired, the deficiencies of binder may also be corrected by separately pulverizing the binder in an impact hammer mill and thereafter admixing the same with the separately disintegrated fibrous mass.

In another embodiment of the invention, scrap rubberized fabric, and asphalt of 180 to 220° F. melting point, in the form of solid chunks, slabs, or chips may be fed simultaneously, to a hammer mill and subjected to the action thereof, whereby to disintegrate the fabric into individualized or discrete fibres, and pulverize the asphalt and rubber, so that the latter may coat the fibres and be combined homogeneously in the resultant loosely compacted mass as it issues from the hammer mill.

Likewise linoleum scrap together with asphalt as above described may be subjected to hammer mill action for the production of a fluffy mass which may be formed into sheets, blocks or articles of various shape, containing a substantial content of linoxyn.

The defibration according to the invention may be applied to raw unfelted fibre, as bagasse, cornstalks, wood, leather, woven fibre as for example cloth rags, burlap, etc., or to felted fibrous material not previously associated with a binder, as for example paper, felt, insulation board, etc. Where these materials are employed, the binder content will be supplied preferably by pulverizing the binder, as for example asphalt, rosin, cumar resin, pitch, etc., in the hammer mill simultaneously with the disintegration of the fibrous material in the mill.

An important feature of the invention resides in its adaptability for the treatment of waste accumulating in various manufacturing processes, such as in the roofing, boxtoe, paraffin or other waterproofed paper industries, and the conversion of such waste into a wide range of useful products.

Thus, the disintegrated fibrous mass and its contained bitumen or other thermoplastic material may be formed into suitable products by felting the mass either dry or in water suspension, with or without admixture of other fibres and fillers. Thus, for example, the material from the air separating system can be fed directly onto a foraminated forming base and subjected to a felting action by air suction through the base. Likewise it may be felted under the action of a vibratory screen or hair felting equipment such as is employed for producing hair-felt bats. In some instances it may be necessary to protect the foraminous forming mold during the molding operation by treating the latter with soap solution, sodium silicate or clay suspension having a lower surface tension against the screen than the binder in the fibrous mass.

The disintegrated mass of fibre and bitumen withdrawn from the hammer mill may likewise be felted in aqueous suspension by passing the same over a standard form of fibre board forming mechanism. Should the disintegrated fibrous mass when brought into aqueous suspension in this type of operation produce a stock which is too free for practical formation, the stock may be rendered less free or slowed down by mixing therewith a more intensely beaten fibrous stock of any suitable character. The asphaltic content of the mass to be felted in this way may likewise be increased by adding thereto any desired proportions of asphalt or other binder either in pulverized form or in the form of an aqueous emulsion thereof. The asphalt binder thus brought into the mass may be precipitated onto the fibres by means of a suitable fixing agent, as, for example, aluminum silicate at its iso-electric point.

Another means of forming felted products from the material defibrated in accordance with the invention is to mold the mass from an aqueous suspension by means of standard suction or pressure molding equipment. Thus, the fibrous material in aqueous suspension admixed if desired with other fibres such as ground wood or news stock may be formed on molds under suction or by pressure to produce irregularly shaped objects, such as containers or the like.

The products formed in any of the foregoing ways from the mass of disintegrated fibrous material and binder produced by the hammer mill action may be subjected to heat or pressure or both, in order to increase the cohesiveness of the material, to attain any desired degree of compaction and to form the finished product in any desired shape. Thus, by means of suitably shaped male and female dies, embossed roofing elements, flooring tiles, conduits, advertising signs, and similar irregularly shaped objects may be produced.

The mass of disintegrated fibre and binder may also be applied to and molded directly upon a reenforcing sheet or base of paper, or other suitable support or veneer to form a composite structure in which the major portion of the thickness of the product is composed of the disintegrated fibrous composition, the whole being then compressed to any desired degree and molded to any suitable or desired configuration.

Sound and heat insulating structures may be formed from a mass of disintegrated fibre and binder produced by the hammer mill action, either by direct application of the material to the surface to be insulated, or by preforming the insulating structure to a suitable contour, with or without a supporting and reenforcing membrane. The material is admirably suited for this purpose owing to the ease with which the insulating value may be regulated by varying the degree of compaction of the fibrous mass. The insulating structures thus produced may be sealed against permeation of air or moisture by applying to one or both surfaces thereof a suitable coating, as for example, asphalt, asphalt emulsion, or the like. By the use of the expression "in a substantially dry condition", as employed herein and in my claims, I intend to define and be restricted to, fibrous materials having a "dryness" not exceeding the moisture content of the fibrous materials herein specifically identified; that is to say, my claims are intended to be restricted to fibrous materials which are conventionally known as "dry" and which, therefore, have the capability of being individualized and to assume a fluffy or loosely compacted mass when undergoing a shredding operation, as contradistinguished with aqueous pulp containing at least 40% moisture.

This application is a divisional of my copending application Serial No. 422,550, filed January 22, 1930.

I claim as my invention:

1. The method of manufacturing a fibrous product which comprises shredding fibrous ma-

terial containing not more than 10 per cent moisture with a solid fusible binder to produce an intimate mixture, suspending said mixture in water, and forming a fibrous product from the wet pulp thus produced.

2. The method of manufacturing a fibrous product which comprises shredding a mixture of cellulosic fibrous material containing not more than 10 per cent moisture, filler and a solid fusible binder to produce an intimate mixture, suspending said mixture in water, and forming a fibrous product from the wet pulp thus produced.

3. The method of manufacturing a fibrous product which comprises shredding fibrous material containing not more than 10 per cent moisture with a solid fusible binder to produce an intimate mixture, beating a suspension of said mixture in water, forming a moist web from the pulp suspension produced and forming a product from said web.

4. In the herein-described process of manufacturing a fibrous product, the combination of steps which comprises shredding fibrous material containing not more than 10 per cent moisture with a solid fusible binder to produce an intimate mixture and suspending said mixture in water.

5. In the herein-described process for manufacturing a fibrous article, the step which comprises shredding a mixture of fibrous material containing not more than 10 per cent of moisture, a solid fusible binder, and filler to produce an intimate mixture.

6. An article of manufacture comprising an irregular intertangled mass of fibers and irregularly dispersed discrete particles of a fusible binder, said particles of binder adhering to said fibers and being adapted for subsequent fusion to bind the fibrous mass together in the fixed form ultimately desired.

7. In the herein described process of manufacturing a fibrous product, the combination of steps which comprises shredding fibrous material in a substantially dry condition with a solid fusible binder to produce an intimate mixture, suspending said mixture in water and forming a fibrous product from the wet pulp thus produced.

8. In the herein described process for manufacturing a fibrous article, the steps which comprise subjecting the fibrous material in a dry condition, together with a solid fusible binder, to a hammer mill shredding action whereby to form a loosely matted homogeneous mass of individualized fibre and to pulverize the solid fusible binder and cause the same to be intimately associated with the fibre.

9. In the herein described process for manufacturing a fibrous article, the steps which comprise subjecting fibrous material in a substantially dry condition, together with a solid fusible binder to a hammer mill shredding operation whereby to produce a fluffy fibrous mass containing discrete pulverized particles of said solid fusible binder and in thereafter forming a fibrous product therefrom.

10. In the herein described process for manufacturing a fibrous article, the steps which comprise subjecting the fibrous material in a substantially dry condition and in the presence of a solid fusible binder, to a hammer mill shredding operation and continuing such operation until the dry fibrous material has assumed a fluffy condition and the solid fusible binder has been pulverized into discrete particles and uniformly combined with the disintegrated fibres and in thereafter forming a fibrous product from the mass thus produced.

11. The herein described method of manufacturing a fibrous product which comprises the steps of subjecting fibrous material in a substantially dry condition to a shredding operation and continuing such operation until the fibres have been individualized and forming a loosely compacted and fluffy fibrous mass, distributing pulverized discrete particles of a solid fusible binder throughout the mass, suspending the mass in water and forming a fibrous product from the wet pulp thus produced.

12. The herein described method of manufacturing a fibrous product which comprises the steps of subjecting fibrous material while in a substantially dry condition to a hammer mill shredding operation and continuing such operation until the fibrous material has been individualized and has produced a loosely compacted and fluffy mass, distributing pulverized discrete particles of a solid fusible binder throughout the mass and in thereafter forming a fibrous product from the mass thus produced.

13. In the herein described method of manufacturing a fibrous article, the steps which comprise subjecting fibrous material in a substantially dry condition, together with a solid fusible binder, to a hammer mill shredding operation and continuing said operation until the fibres of the material have been individualized and a fluffy and loosely compaced mass has been produced comprising irregular. inter-tangled fibres having dispersed therethrough pulverized particles of said binder adhering to said fibres and being adapted for subsequent fusion to bind the fibrous mass together in the fixed form ultimately desired.

14. In the herein described method of manufacturing a fibrous article, the steps which comprise subjecting fibrous material in a relatively dry condition, together with a solid fusible binder to a hammer mill shredding operation while the material is suspended in air and continuing said operation until the fibrous material has been individualized and forms a fluffy loosely compacted mass having pulverized particles of said binder distributed therethrough and adhering to said fibres and in finally forming a fibrous product therefrom.

15. An article of manufacture comprising an irregular, inter-tangled mass of of fibres, and irregular, dispersed discrete particles of a fusible binder having a melting point of less than 300° F., said particles of binder adhering to said fibres and being adapted for subsequent fusion to bind the fibrous mass together in the fixed form ultimately desired, said composition being thermo-plastic at normal temperatures and said fibres being coated by the adherent films of the binder.

16. The herein described method of manufacturing a fibrous article which comprises the steps of subjecting a sheeted fibrous material in a substantially dry condition and containing a solid fusible binder to a shredding operation and continuing said operation until the binder has been pulverized and the fibrous material disintegrated to the extent of forming a fluffy mass, and in thereafter causing the subsequent fusion of the pulverized binder to bind together the fibrous mass in the fixed form desired.

17. In the herein described process for manufacturing a fibrous article, the steps which comprise shredding by a hammer milling operation, a mixture of fibrous material containing not more than 10% of moisture and solid fusible binder and filler to produce an intimate mixture.

18. The method of manufacturing a fibrous product which comprises disintegrating fibrous material containing not more than 10% moisture and a solid fusible binder to produce an intimate mixture, said disintegration being carried on in the presence of small quantities of anti-adhesive material in aqueous medium, suspending the disintegrating material in water, and forming a fibrous product from the wet pulp thus produced.

19. In the herein described process of manufacturing a fibrous product, the combination of steps which comprises disintegrating fibrous material in a substantially dry condition, together with a solid fusible binder in the presence of small quantities of an anti-adhesive agent in aqueous medium to produce an intimate mixture, suspending said mixture in water and forming a fibrous product from the wet pulp thus produced.

20. In the herein described process of manufacturing a fibrous product, the combination of steps which comprises shredding fibrous material in a substantially dry condition with a solid fusible binder to produce an intimate mixture, suspending said mixture in water and adding additional quantities of binder in discrete form to the mixture forming a fibrous product from the wet pulp thus produced.

21. In the herein described process of manufacturing a fibrous product, the combination of steps which comprises shredding fibrous material in a substantially dry condition with a solid fusible binder to produce an intimate mixture, suspending said mixture in water and adding further quantities of fibrous stock to the mixture, forming a fibrous product from the wet pulp thus produced.

HAROLD L. LEVIN.