L. T. FREDERICK.

COMPOSITE PRODUCT.

APPLICATION FILED AUG. 10, 1918.

1,318,742.

Patented Oct. 14, 1919.

Fig. 1

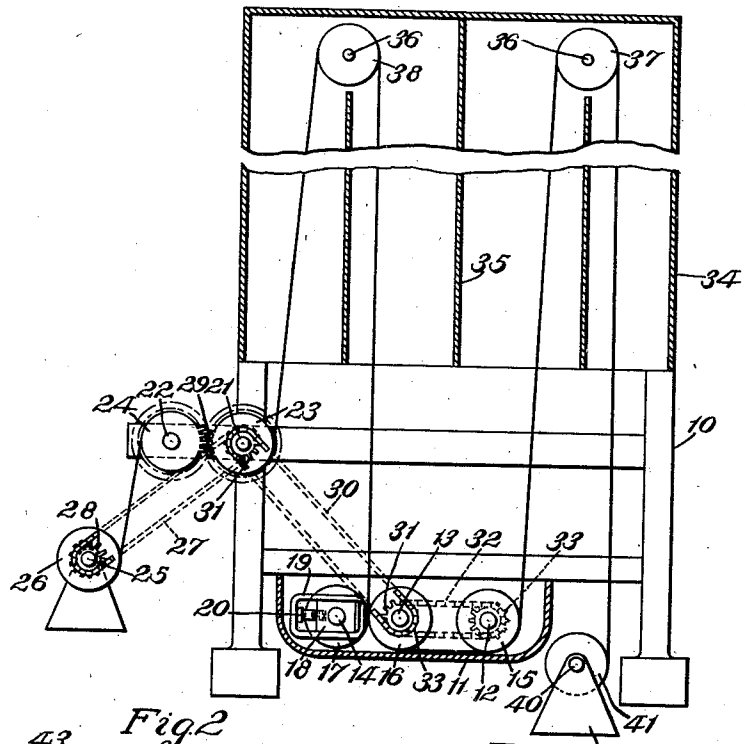


Fig. 2

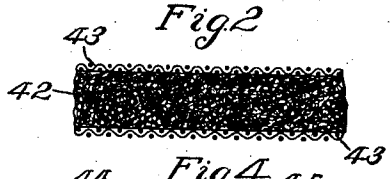


Fig. 3

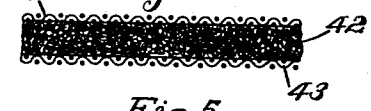


Fig. 4

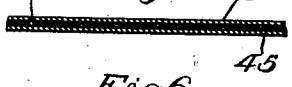


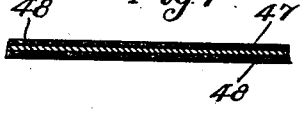
Fig. 5



Fig. 6



Fig. 7



WITNESSES:

W. S. Reece

W. H. Woodman.

INVENTOR

Louis T. Frederick

BY

ATTORNEY

UNITED STATES PATENT OFFICE.

LOUIS T. FREDERICK, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

COMPOSITE PRODUCT.

1,318,742. Specification of Letters Patent. Patented Oct. 14, 1919.

Original application filed March 9, 1918, Serial No. 221,427. Divided and this application filed August 10, 1918. Serial No. 249,321.

To all whom it may concern:

Be it known that I, LOUIS T. FREDERICK, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Composite Products, of which the following is a specification, this application being a division of application Serial No. 221,427, filed March 9, 1918.

My invention relates to composite plates and molded articles of the type in which the body of the plate or article is made up of a fibrous material associated with a suitable binder, such, for instance, as a phenolic condensation product that is capable of transformation, under the action of heat and pressure, to an approximately insoluble and infusible body.

To the best of my knowledge, prior to this time, bodies of the above mentioned type have usually been composed of a closely-matted calendered material, such as paper, and a proper binder or of a woven material, such as duck, and a binder. These materials, while well adapted for use in the making of certain types of plates and other bodies, are not suitable for other desired uses, particularly the making of relatively thin and more or less flexible plates. This is due to the fact that thin plates formed of paper or fabric, impregnated with a phenolic condensation product, as a binder, are relatively brittle and are liable to surface cracking or opening under bending strains.

One of the objects of my present invention resides in the provision of an improved material for forming plates and other articles of such character that thin plates may be made having greater strength and flexibility than plates now made from other materials. To accomplish this, I employ, as the fibrous element, a textile material in loosely matted form, cotton batting being the most suitable material for the purpose because of the regular arrangement of its fibers as compared to the indiscriminate arrangement of fibers in other materials, as for instance, raw cotton. However, carded or combed fibrous matter, in which the relatively loose fibers have been brought into a more or less uniform and regular relative arrangement, are equivalents of cotton batting and are comprehended by my invention.

Another object of my invention is to provide an improved method of cheaply, rapidly and uniformly impregnating cotton batting with a binder, which is preferably a phenolic condensation product.

In order to insure a clearer understanding of my invention, I will first describe, in a general way, the construction of a suitable form of apparatus which may be employed in impregnating cotton batting.

In the drawings, Figure 1 is a diagrammatic elevational view, partially in section, of one form of apparatus which may be employed; Fig. 2 is a fragmentary, sectional view through a sheet of cotton batting to be treated; Fig. 3 is a corresponding view showing approximately the compression of the cotton-batting sheet after it has been impregnated with the binder; Fig. 4 is a fragmentary sectional view of a thin plate formed by combining treated cotton batting with treated sheets of paper; Fig. 5 is a fragmentary sectional view showing another form of thin plate formed by combining cotton batting with a fabric; Fig. 6 is a fragmentary sectional view of a thin plate formed from cotton batting alone, and Fig. 7 is a corresponding view of a thin plate formed by applying cotton batting to the surfaces of a sheet of treated paper.

One form of apparatus which I may employ includes a frame 10 which supports a pan 11. Within the pan 11 are journaled spaced parallel shafts 12, 13 and 14 to which are fixed rolls 15, 16 and 17, respectively. The rolls are preferably of equal diameter and are disposed in a single horizontal plane, the rolls 15 and 16 being considerably spaced from each other, while the roll 17 is adjustably mounted in close relation to the roll 16. Any suitable means may be provided for adjustably mounting the roll 17, such as journaling its shaft in bearing blocks 18 that are slidable toward and away from the shaft 13 in guides 19. Adjusting screws 20 serve as means for holding the bearing blocks against movement away from the shaft 13.

Also supported by, and journaled in, the frame 10, in parallel spaced relation and at a level above the shafts 12, 13 and 14, are shafts 21 and 22, to which are secured feed rolls 23 and 24 which are spaced slightly from each other, as shown. Another shaft

25 is provided with a detachable takeup roll 26.

Power is supplied to the various rolls in any suitable manner and from any suitable source. For instance, the power may be applied to the shaft 21 and transmitted from this shaft to the shaft 25 by means of a sprocket chain 27 and sprocket wheels 28 fixed to these shafts. Power may also be supplied from the shaft 21 to the shaft 13 by a sprocket chain 30 and sprocket wheels 31 carried by the shafts 21 and 13. A sprocket chain 32 and sprocket wheels 33, carried by the shafts 12 and 13, serve to transmit power from the shaft 13 to the shaft 12.

Supported by the frame 10, above the mechanism just described, is a relatively high drying tower 34 closed at its top, open at its bottom and divided into a series of vertical chambers by spaced vertical partitions 35, alternate partitions terminating short of the top of the tower so that a continuous circuitous passage is provided from the top to the bottom of the tower. Parallel shafts 36, mounted in the upper portion of the tower in line with the upper ends of certain of the partition walls, carry idler rolls 37 and 38.

The frame, adjacent to the pan 11, also carries brackets 39 to detachably receive the spindle 40 of a supply roll 41.

In operation, the adhesive or binder with which the material is to be impregnated, such, for instance, as a relatively heavy solution of a phenolic condensation product, is placed in the pan 11 to such depth that the lower portions of the rolls are submerged. Heat may be supplied to the tower by any suitable means, not shown, such as gas burners disposed throughout its length or steam coils suitably located within the tower. A roll 41 of the material to be treated is placed upon the spindle 40 and a number of tapes are connected at their ends to the outer end of the material. The opposite ends of the tapes are then passed upwardly through the tower, over the idler roll 37, downwardly out of the tower, beneath the spaced feed rolls 15 and 16, upwardly between the feed roll 16 and the adjustable compression roll 17, through the tower over the idler roll 38, downwardly through the tower, beneath the feed roll 23, over the feed roll 24 and to the takeup roll 26 to which they are attached.

Power being applied to the roll 23 and, consequently, to the feed rolls 15 and 16 and to the rolls 24 and 26, the tapes are drawn through the machine and wound upon the takeup roll 26, the sheet material of the supply roll 41 being drawn through the machine after them.

As the sheet material passes upwardly and downwardly through the tower on its way to the rolls 15 and 16, it is heated, and any moisture which it may contain is driven off. As the sheet material passes beneath the feed rolls 15 and 16, it is submerged in the liquid contained in the pan and thoroughly impregnated with such liquid, an excess of the liquid being absorbed by it. As the material passes between the feed roll 16 and the pressure roll 17, the surplus liquid is forced from it so that, as it leaves these rolls, it contains only a predetermined percentage of the impregnating liquid, the amount being determined by suitable adjustment of the pressure roll 17. The material so impregnated is again passed upwardly and downwardly through the heating tower so that the solvent of the impregnating liquid is driven from it and the material is thoroughly dried. The material is then advanced, by the feed rolls 23 and 24, to the takeup roll 26 upon which it is wound. This apparatus may be employed for impregnating various sheet materials, such as paper and woven fabrics and also for impregnating cotton batting, as will be further explained. The phenolic condensation product, deposited on the cotton batting by the above described treatment, is in an intermediate state of curing, being solid, but still capable of being first softened and then hardened by suitable application of heat and pressure.

The cotton batting which I preferably employ is supplied in the form of rolled sheets, which are disposed between retaining sheets of some cheap woven fabric, such as cheese cloth. Because of the cheese-cloth backing or retaining sheets, the cotton batting may be fed directly from its roll through the impregnating apparatus above described, the cheese-cloth sheets serving as supports for the cotton during the impregnating. If batting sheets, having no woven-fabric backing, are employed, tapes may be stitched to opposite sides at suitably spaced transverse intervals, the tapes being extended throughout the length of the sheet and serving as supports for it and as a means for drawing the sheet through the apparatus.

Fig. 2 illustrates a sheet of cotton 42, retaining sheets 43 of cheese cloth, as they appear before treatment, while Fig. 3 illustrates the same sheets as they appear after treatment, the cotton being more or less compressed.

The cotton batting, so prepared, may be employed in making sheets of various kinds and also in various molding operations. For instance, in Fig. 4 is illustrated, upon an enlarged scale, a composite sheet consisting of an intermediate layer of cotton batting 44 and surface layers of one or more thicknesses of impregnated paper 45. In Fig. 5 is illustrated another form of sheet consist-

ing merely of the intermediate layer 42 of cotton batting and its backing sheets 43 of cheese cloth. Plates may be formed by stacking up the laminations and subjecting the stacked body to the combined action of heat and pressure to first soften and then harden the phenolic condensation product with which the materials are impregnated. The sheet shown in Fig. 5 is, therefore, nothing more nor less than the impregnated sheet shown in Fig. 3 after it has been subjected to heat and pressure to harden the phenolic condensation product forming the binder.

In Fig. 6 is illustrated a modified form of sheet in which cotton 46 alone is employed, the cheese cloth being removed prior to the application of heat and pressure to the impregnated sheet of cotton. In Fig. 7 is shown a sheet comprising one or more layers of paper 47 and one or more covering layers of cotton 48. Obviously, only one face of the paper may be provided with this cotton covering if desired.

Thin sheets consisting of cotton, as the main body or material, are superior, in many respects, to those composed of woven fabric, paper or combinations of woven fabric and paper. The cotton batting is cheaper than woven material and takes up the phenolic condensation product employed as a binder more effectively than either woven or calendered materials. The sheets are particularly strong, as the fibers of the matted cotton batting are closely interlaced, and uniform strength, in all directions, is assured. This is not the case with woven materials or calendered materials, such as paper, in which the strength crosswise of the sheet is almost always less than the strength lengthwise. Furthermore, thin sheets constructed of cotton batting, impregnated with a phenolic condensation product, are relatively flexible, as compared with sheets formed of woven fabrics or papers and are not liable to surface cracking. If added strength or body is desired, paper or woven fabric plates having one or both faces covered with cotton batting may be employed, as the cotton-batting coatings will prevent surface cracking even when the plates are bent to a considerable extent. For this reason, thin sheets of cotton batting or cotton batting combined with sheets of paper or woven fabric are suitable as coverings for planes and rudders and similar parts of airplanes. This is particularly true because the sheets are moisture proof and are not affected by light or heat.

In addition to forming sheets, in whole or in part, of impregnated cotton batting, such material may also be employed in the manufacture of molded articles, the treated cotton batting, either with or without its supporting sheets of cheese cloth, being cut to the desired shape and size for molding or being chopped into pieces and packed into a shaped mold so constructed that the contained body of treated cotton may be subjected to heat and pressure to cure it in the form of the desired article.

Although I have illustrated a preferred form of apparatus for impregnating the cotton batting and also several different forms of sheets which may be constructed from it, it will be understood that I do not restrict myself to the use of any particular apparatus or to any particular sheet construction but reserve the right to make any changes, either in the treatment of the cotton or the method of employing it, which may fall within the scope of the appended claims.

I claim as my invention:

1. A material comprising carded fibrous material interposed between sheets of fabricated material and impregnated with a resinous condensation product, in an intermediate state of curing.

2. A material comprising carded fibrous material interposed between sheets of woven material and impregnated with a binder in an inert state but adapted to be rendered active.

3. A material comprising cotton batting interposed between sheets of woven material and impregnated with a resinous condensation product, in an intermediate state of curing.

4. A material comprising cotton batting interposed between sheets of woven material and impregnated with a binder in a dry, inert state but adapted to be rendered active.

5. A material comprising carded fibrous material reinforced with woven material and impregnated with a resinous condensation product, in an intermediate state of curing.

6. A material comprising carded fibrous material reinforced with woven material and impregnated with a binder in an inert state but adapted to be rendered active.

7. A process of preparing material that comprises passing a sheet of fibrous material while reinforced with a sheet of woven material through a solution of a binder, subjecting the composite sheet to pressure to remove surplus liquid and expelling the solvent from the sheet.

8. A process for preparing material comprising passing fibrous material while interposed between sheets of fabricated material through a solution of a binder, subjecting the composite sheet to pressure to remove surplus liquid and expelling the solvent from the sheet.

9. A process for preparing material comprising heating fibrous material while interposed between sheets of woven material, passing the heated composite sheet through a solution of a binder, subjecting the sheet

to pressure to remove surplus liquid and expelling the solvent from the sheet.

10. A material for use in making sheet and molded articles that comprises carded fibrous material impregnated with a phenolic condensation product in an intermediate state.

11. A material for use in making sheet and molded articles that comprises cotton batting impregnated with a phenolic condensation product in an intermediate state.

12. A molded article comprising cotton batting and a heat hardened resinous condensation product as a binder.

13. A composite article comprising layers of woven fabric and of cotton batting and a heat hardened phenolic condensation product as a binder.

In testimony whereof, I have hereunto subscribed my name this 20th day of July, 1918.

LOUIS T. FREDERICK.