

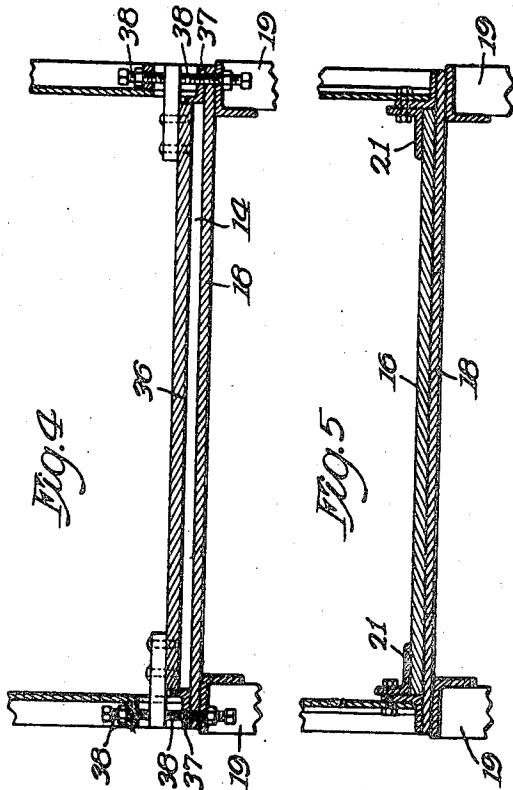
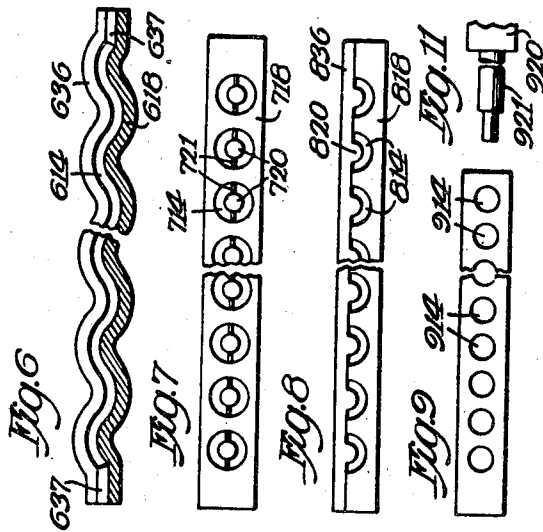
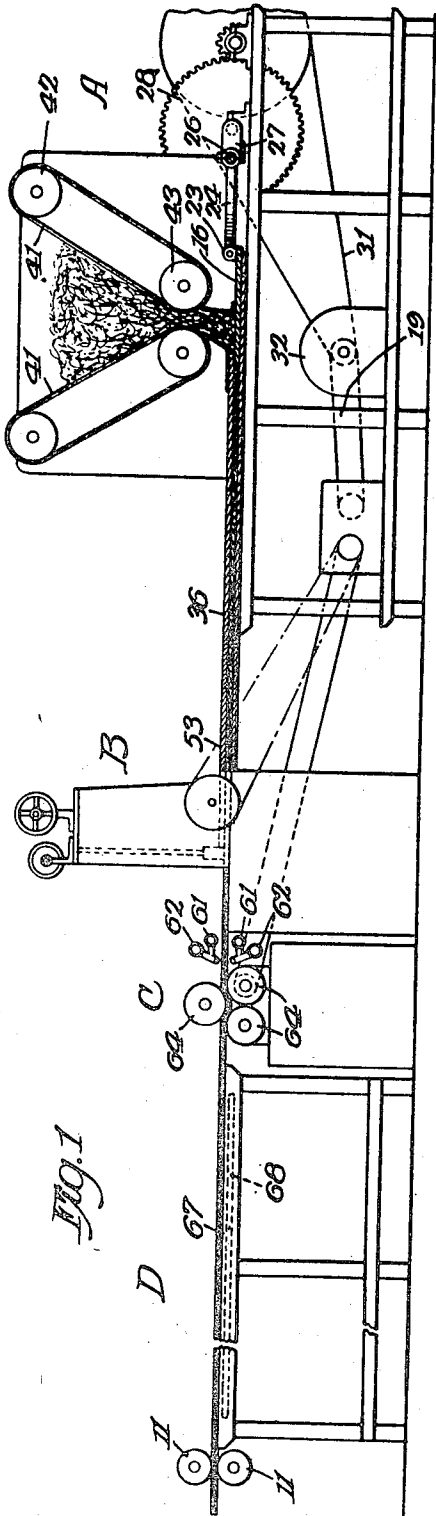
Aug. 10, 1948.

A. C. FISCHER
METHOD AND APPARATUS FOR COMPACTING
FIBROUS MATERIAL

2,446,644

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2 Sheets-Sheet 1



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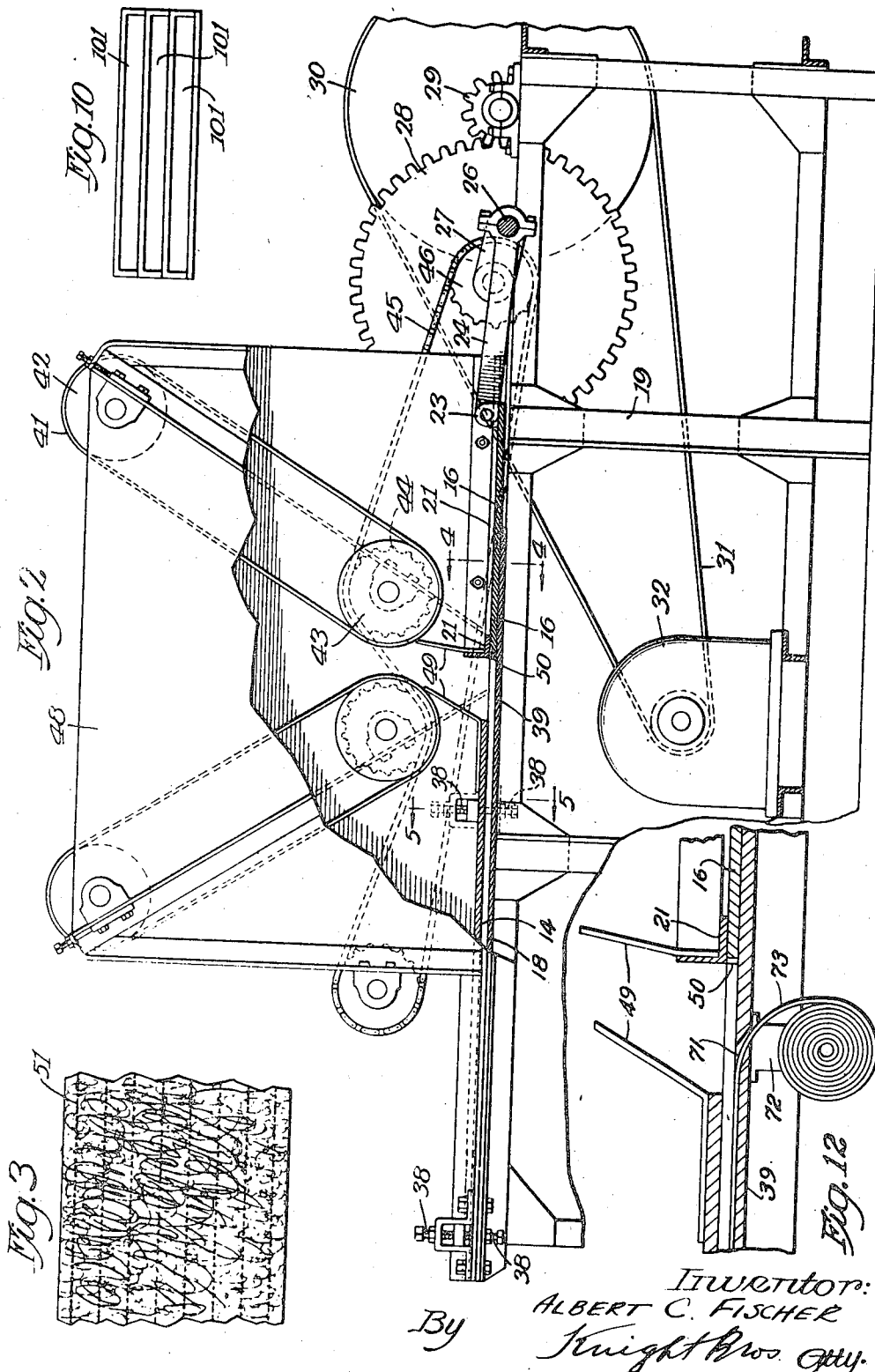
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METHOD AND APPARATUS FOR COMPACTING FIBROUS MATERIAL

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8 Claims. (Cl. 154—1)

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This invention relates to compacting apparatus and the method in which it is used. In its illustrated form the apparatus includes means for compacting plastic substances or fibrous material such as straw into sheets or other articles of special shapes, and for securing the fibers in such products together either by stitches or by an adhesive, or both. The apparatus can also be used with plastic substances or mixtures or anything which can be made to retain its shape sufficiently after compacting. The invention is particularly useful in compacting fibrous or plastic masses upon a flexible foundation.

This case is a continuation-in-part of my application Serial No. 80,465, filed May 18, 1936, and issued October 7, 1941, as Patent 2,257,738.

In my Patent No. 2,243,857, June 3, 1941, a large number of products were disclosed which could be made by compacting various substances or mixtures. The present case discloses in its broad aspects apparatus suitable for forming such products. An object of the invention is to provide suitable apparatus and a suitable method for forming such products.

Other objects and advantages of my invention will be apparent from the following description, taken with the drawings, in which:

Fig. 1 is a diagrammatic view of one preferred form of this invention,

Fig. 2 is a somewhat more detailed, though still largely diagrammatic view of the compacting unit forming a major part of this invention, some portions being broken away,

Fig. 3 is a fragmentary plan view of one form of product which may be made by this invention,

Figs. 4 and 5 are fragmentary vertical sectional views taken substantially along the lines 4—4 and 5—5 of Fig. 2,

Figs. 6 to 10 are views of modified forms of the compacting channels,

Fig. 11 is a fragmentary view of a plunger suitable for use with the channel of Fig. 9, and

Fig. 12 is a view corresponding to a portion of Fig. 2, and showing a different embodiment of the invention which comprehends the provision of a flexible support for the mat.

Although this invention may take numerous forms, only one has been chosen for illustration, except for the modifications of channel cross section to produce different products. In the preferred form of the invention illustrated in Fig. 1, the apparatus includes four units. Unit A is a compacting apparatus which is illustrated more fully in Fig. 2. Unit B is a stitching machine, the details of which are not shown since such ma-

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chines are available on the market. It is preferably a machine which, as shown in Fig. 3, simultaneously sews stitches along a plurality of parallel lines in the sheet material which is fed through the machine. Unit C is for applying a suitable adhesive or surface coating, the preferred form including the combination of spray guns and squeezing or kneading rolls. Unit D is a dryer which may be steam heated. The sheet material may be drawn from the drying table D by feed rolls 11 and may be carried to any desired point to be rolled up or cut into strips. Of course additional feeding rolls or other feeding means may be provided wherever needed or desired.

Referring now to Fig. 2, it is seen that the compacting unit A comprises the combination of a channel 14 having the cross section of the desired product, a plunger 16 adapted to reciprocate into and out of said channel, and feeding means for supplying straw or any other suitable material to a position in front of said plunger 16.

The plunger 16 may desirably comprise a plate which in the illustrated form is a simple flat plate for producing a flat sheet material. The plunger slides along a table top 18 which is supported by suitable framework 19. The plunger may also be guided by angle irons 21 suitably positioned above the plunger and preferably adjustable to permit substitution of plungers of different sizes. At the rear end of the plunger 16 may be provided one or more upstanding lugs 23 to which one or more connecting rods 24 may be pivoted. The other ends of said connecting bars are each pivoted to a suitable crank pin 26 on a crank shaft 27 which is driven by a gear 28 which in turn is driven by a pinion 29 and a wheel 30. The wheel 30 may be driven in any suitable manner as by a belt 31 and a motor 32.

The channel 14 may be formed in part by the table top 18 and in part by a top plate 36 which may be adjustably positioned between the vertical flanges of angle irons 37 which form the sides of the channel. Adjustability of the plate 36 and therefore of the cross section of the channel 14 may be obtained by screws 38 screwing through suitable support members in the framework 19. Of course the bottom plate 18 and the top plate 36 may be of any desired thickness and may be reinforced at various points and may each be made up of a plurality of separate plates. If separate plates are used for the top plate 36, these may be separately adjustable. For some purposes such an arrangement is preferred, since it is desirable to have a portion of the channel con-

stricted to oppose the movement of the material therethrough, but it is not necessary that the whole channel be thus constructed, and in fact it is desirable for many materials that the portion of the channel in which the plunger reciprocates be of uniform cross section longitudinally so that the plunger will operate in said channel smoothly and with just enough clearance to have the desired effect. This clearance may be so slight that straw or other material is cut off by the plunger, but when straw is used it will usually be preferred to leave enough clearance so that the loose ends of the straw will extend along the top surface of the plunger so as to nest the successive charges of straw or secure thorough intertwining and matting of the various straws. If desired, a recess may be formed in the receiving portion 39 of the table top just outside of the entrance to the channel so that loose ends of the straw will also extend along the under face of the plunger.

The feeding apparatus may be of any illustrated form, but is illustrated as embodying a pair of wide belts 41 carried by suitable rollers 42 and 43, which latter may be driven through sprocket wheel 44, chain 45, and sprocket wheel 46 keyed on the end of crank shaft 47 or otherwise driven at a relatively slow speed. Side plates 48 may be provided at the ends of the belts 41 to retain the material on the belts and cooperate with the belts to form a hopper. Guide plates 49 may be provided below the belts in the positions shown to direct the fed material to the position where it will be picked up by the plunger and compacted. The belts 41 will urge the material downwardly with sufficient force to insure its being caught by the end of the plunger, and if necessary a recess may be provided in the bed 39 below the level of the plunger to facilitate this action. Other feeding apparatus may be used to supply the material in special conditions, as intermeshed in a thin layer; or with the fibers all parallel. Also different materials may be fed in succession to produce a striped or variegated effect. Or different materials may be fed continuously at different transverse positions.

The plunger 16 may be provided with a plurality of pegs 50 along its front end for increasing the interlacing or nesting of the fibers and thus provide a sheet which is more firm than would otherwise result from the compacting alone. For some purposes the sheet thus resulting may need no further treatment, especially if the fibrous material supplied to the compacting unit is mixed with some adhesive or plastic material; or with any material which is cohesive, such for example as clay or earth.

Many materials will be somewhat elastic and after being compacted will spring back when the plunger is withdrawn. If the expansion should be enough to be objectionable retaining bars or teeth could be inserted into the channel 14 in front of the piston as it is withdrawn.

The sheets formed in this manner may be of any desired width and thickness, but they probably will not be over two inches thick, and usually will be much thinner than that.

From the compacting unit A the compacted sheet passes to a stitching machine B. This machine may be any conventional type stitcher. Whatever machine is used, it is preferably one which forms a plurality of parallel lines of stitches in the material fed through it. Thus, if there are eight stitching heads on the machine, the finished product will resemble that shown in Fig. 3 in which the straw or other fibers will be inter-

twined with one another, though extending predominantly transversely of the sheet, and these fibers will be secured together by the longitudinal lines of stitches 51. Of course these stitches could conceivably be applied by hand.

It may be best to keep the sheet compacted until it has been stitched, and to this end the plate 36 may be continued as shown at 53, to or even through the stitching machine B, suitable slots being provided to permit the stitching machine to operate.

Beyond the stitching machine the sheet may be treated with any cementitious material or an adhesive such as any suitable glue or with any coating material such as shellac, paint, varnish, plaster, or the like. Such materials may be applied in any suitable way, as by running the material through a loop extending down into a vat or by spraying it with spray guns 61 which may be supplied from suitable compressed air and treating material through headers 62. From the spray guns 61 the sheet may be passed between squeezing and kneading rolls 64. Any loose material such as mineral granules or fibers, or vegetable or animal material, or fillings, or electrolytic deposits may be applied as by sprinkling on an adhesive or cementitious undercoat.

The sheet may finally be dried in any suitable manner as by passing it over a drying rack 67 provided with any suitable heating means such as steam pipes 68.

In some instances it may be desired that the fibers should not be intertwined as shown in Fig. 3. For example, to provide a thatched roof, the straw or other fibers may be cut to the desired length and fed to the compacting unit A in parallel relationship. The plunger 16 will then press the straws or fibers through the channel 14 in a continuing parallel relationship, in which relationship they will be sewn by the stitching machine B. It should be noted that such a thatch type of sheeting will not be waterproof in itself unless it is especially treated, but it will nevertheless be very desirable as a decorative and protective covering for roofs already waterproof.

The pegs 50 may be omitted in forming this thatched roofing, but if they are small and positioned away from the top or bottom surface of the plunger 16, they will probably be desirable since they will not undesirably distort the appearance of the finished product.

In some instances it may be desired to make a laminated product in which a fibrous material or mixture is secured to a preformed base sheet such as a woven fabric or a paper felt or the like. This can be accomplished by feeding such a preformed sheet through the channel 14 with the material that is being compacted. This may be done by providing an opening in the receiving portion 39 of the table top 18 and passing the preformed material through said opening and through the channel 14. In that case of course the top of the table top 18 should be spaced sufficiently below the bottom of the plunger 16 to allow room for the preformed sheet. The preformed sheet may either be drawn off a roll positioned immediately below the bed 39 or may be drawn from a remote source of supply. Such an arrangement is shown in Fig. 12, wherein the bed 39 is provided with a slot 71. The roller frame 72 is mounted on the underside of the table for supporting revolvably a roller carrying the flexible web 73 which may be of any suitable material. The web may be fed by the pull of the finished mat, or feeding means for the roller

may be provided therefor. With such an arrangement, the flexible backing is stitched together with the compacted straw to obtain a highly useful and self sustaining product.

If desired, an additional overlay may be provided for the top of the straw mat following the application of the adhesive.

If it should be desired to form several narrow sheets instead of one wide sheet, this may be accomplished by placing longitudinally extending division walls in the channel 14 or possibly by simply inserting slitting knives in said channel beyond the position to which the plunger 16 is thrust. Another way of accomplishing the same result is to provide the plunger with projecting knives which sever the fibrous material along longitudinally extending lines as it is compacted.

The material may also be divided along transverse lines by inserting transversely extending separating bars or plates which will pass through the channel 14 with the compacted material. A combination of the longitudinal divisions or slitters and the transversely extending divisions will result in separately formed slabs which may be of a suitable size for shingles or other covering material.

Instead of being flat, the compacted sheet may be corrugated by providing a channel 614 of corrugated cross section as shown in Fig. 6. Such a channel may be built up from a plurality of members 618, 636, and 637, as seen in Fig. 6, or it may be cast in one piece as may most other special forms. The plate 618 has been shown in section to indicate that if desired it can be extended to form the bed 39. Of course the channel and the resulting sheet may be given any other cross sectional shape, and the plunger will be shaped with a cross section corresponding to that of the channel 614.

There are many other shapes and many other corresponding products that may be made by a compacting unit such as that shown in Fig. 2. When it is not practical to use the stitching machine B with the products formed by the compacting unit, the material supplied to said unit will probably comprise a mastic or cementitious mixture which will retain its shape well after extrusion from the channel 14. Among the products which can be formed are pipes, pipe halves, bars, and the like, for which suitable channel blocks have been illustrated in Figs. 7, 8 and 9.

In Fig. 7 the channel block 718, which may be built up of two halves if desired, is provided with a plurality of longitudinal channels 714 which have been illustrated as circular in cross section, although they could be square or could have any other cross sectional shape. Within each of the channels 714 is positioned a core 720 which may be supported by short knife-edged fins 721. The cores 720 are preferably tapered to a point at their ends to facilitate the feeding of the fibrous material into them. The plunger of course would include a plurality of plunger elements, each of approximately the size of the passage 714 which would press the material into these passages. The plunger elements may be annular and extend beyond the beginning of the cores 720, or they may be solid, the cores 720 being positioned entirely beyond the stroke of the plunger. With the channel member shown in Fig. 8, there are a plurality of channels 814 semi-circular in cross section and formed in a base plate 818. A top plate 836 may be provided which is either flat to form half rounds, or is

provided with core-like ribs 820 to form half pipes. It should be realized that all of these special shapes may be used individually or joined together to form mats, or, in the case of half pipes and the like, joined in pairs to form pipes or pipe coverings or the like.

In Fig. 9 is shown a channel member similar to that shown in Fig. 7 except that the channels 914 are smaller in diameter and the cores 720 have been omitted. The channels in Figs. 7, 8 and 9 may be closer together if desired. A channel member such as shown in Fig. 9 would form solid bars or rods, and the channels 714 may be provided with any desired cross section, such as square or round. It should be understood that in every instance where a channel of special shape is provided, the plunger should be correspondingly shaped. Thus, for the Fig. 9 channel the plunger structure may include a base 920 as seen in Fig. 11 from which extend a plurality of individual plunger elements 921 adapted to fit snugly or loosely into the channels 914. The front end of the plunger elements may be full size or may be reduced as shown at 922 to produce a nested effect. It may be mentioned that each type of plunger may have a similar reduced front portion with or without the pegs 50, and with the thicker rear portion of a size to cut off the straggling fibers or to allow a thin layer of them to remain.

In Fig. 10 is shown a multi-channel unit for forming a plurality of sheets at once. This unit has three channels 101 which are shown of rectangular cross section though they could have any cross section or one or each could have a different cross section. The plunger would of course have three correspondingly shaped plunger elements. The three sheets formed in this way could be kept separate or simply sewn together by unit B or pressed together as by rollers and, if desired, sewn subsequently. Also some plastic or loose material could be injected between them, as by an extrusion nozzle, or a liquid could be sprayed between them.

A primary characteristic of the endless conveyors 41 which operate to feed to the fibers the different types of compacting arrangements is the automatic accommodation of the feed to the demands of the compacting chamber. With such a feed, no jamming of the apparatus is possible.

Of course, the plastic sheets may be of any desired thickness in order to obtain a product having different uses such as tiles, pavement slabs, linoleum sheeting and the like. By providing the plastic sheets of unlike color, novel ornamental effects can be produced by the alternation of the colors, making up the completed laminated product.

I claim:

1. The method of compacting compressible material and simultaneously applying said material upon a flexible backing web which comprises feeding the flexible backing web to a loading station, depositing between spaced-apart endless conveyor belts disposed to form a receiving hopper for feeding successive charges of the material onto said loading station and reciprocatingly compacting the successive charges of the compressible material at the loading station to obtain a coherent mass of said material supported by said flexible backing web.

2. The method of compacting compressible fibrous material and simultaneously applying said material upon a flexible backing web which com-

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prises feeding the flexible backing web to a loading station, depositing between spaced-apart endless conveyor belts disposed to form a receiving hopper for feeding successive charges of fibrous material onto said loading station, reciprocatingly compacting the successive charges of the compressible material at the loading station to obtain a coherent mass of said material supported by said flexible backing web, and stitching said fibrous material onto said backing web.

3. The method of compacting compressible elongate fibrous material and simultaneously applying said material upon a flexible backing web which comprises feeding the flexible backing web to a loading station, feeding the fibrous material without maceration and depositing between spaced-apart endless conveyor belts disposed to form a receiving hopper for feeding successive charges of fibrous material onto said loading station, reciprocatingly compacting the successive charges of aligned fibrous material to obtain a coherent mass of material supported by said flexible backing web, stitching said fibrous material onto said backing web and applying adhesive to said composite product of fibrous material and flexible backing web therefor.

4. The method of compacting elongate fibrous material and simultaneously applying said material upon a flexible backing which comprises feeding the flexible backing to a loading station, depositing successive charges of fibrous elongate material thereon without maceration and in a substantially aligned state, compacting the successive charges of fibrous material to obtain a coherent mass of material supported by said flexible backing, and cupping each charge of material and nesting it with respect to the previous charge while maintaining the general alignment of the fibrous material.

5. Sheet forming apparatus comprising a loading station, spaced-apart endless conveyor belts disposed to form a receiving hopper for feeding successive charges of material to said loading station, means for feeding a flexible backing to said loading station on to which said charges of material are deposited, and reciprocating plunger means for uniting the successive charges of material to obtain a coherent mass of material supported by said flexible backing.

6. Sheet forming apparatus comprising a loading station, spaced-apart endless conveyor belts disposed to form a receiving hopper for feeding

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successive charges of fibrous material to said loading station, means for feeding a flexible base to said loading station on to which said charges of material are deposited, reciprocating plunger means for compacting the successive charges of material to obtain a coherent mass of material supported by said flexible backing, and means for stitching said laminated product at a plurality of displaced points.

7. Apparatus for forming products of definite shape from a suitable elongate fibrous raw material, including a compacting unit having a channel and a reciprocating plunger for forcing said material into and through said channel in its substantially original alignment, the front end of said plunger being of reduced cross section to cup and nest successive charges of the material in a direction transverse to said alignment and means for feeding a flexible backing into said channel for supporting the compacted fibrous material.

8. Sheet forming apparatus including a compacting unit for compacting elongate fibrous material into a sheet, and including a channel having the cross section of the desired sheet and a reciprocating plunger for forcing the material into and through said channel and compacting it therein, endless conveying means for feeding said fibrous material to said channel in its substantially elongate alignment, means for feeding a flexible support for said fibrous material into said channel, and a stitching machine receiving the sheet from said compacting unit and forming a plurality of parallel lines of stitches therein extending longitudinally of the sheet and substantially transversely to the elongate fibrous material, the front end of said plunger being of reduced cross section to cup and nest successive charges of the material.

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