

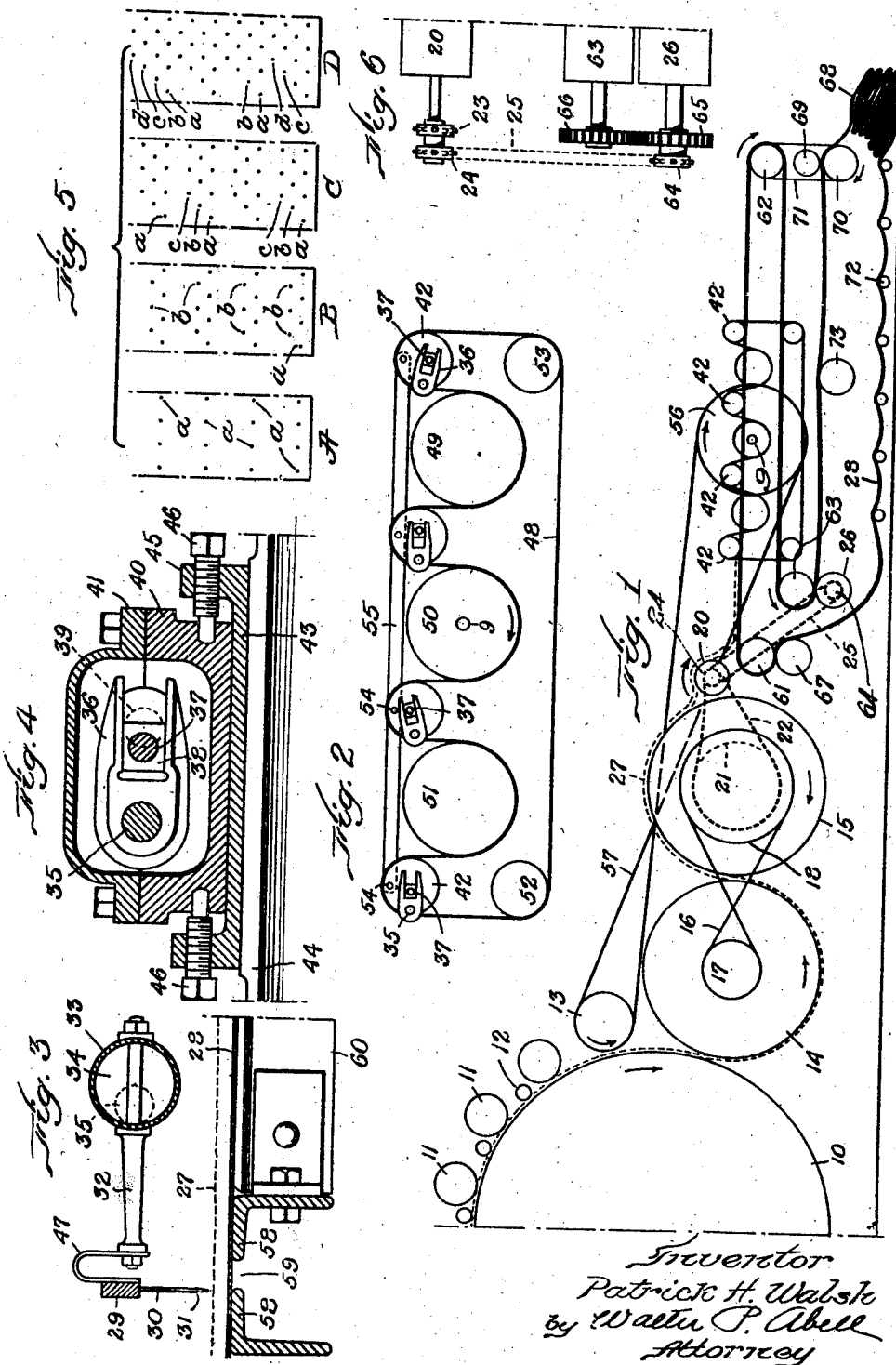
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METHOD OF AND APPARATUS FOR MAKING COMPOSITE FABRIC

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METHOD OF AND APPARATUS FOR MAKING COMPOSITE FABRIC.

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This invention relates to the art of making composite textile fabric consisting of a base and a covering of fleece. In its broader aspects the subject-matter of this application is identical with that presented in my copending application filed November 7, 1921, Serial No. 513,311, and the present application is filed as a continuation of the former said application in so far as the subject-matter is common to both. However, the present application includes certain features that were not disclosed in said former application, as to which I do not claim the priority of my former filing date.

According to the disclosure in the former said application and in the present application the composite fabric comprises a base fabric and a covering of relatively loose textile fibers and is fabricated by thrusting some of the fibers of the covering through the base fabric so that they project from both surfaces of the latter and bind any fibers that have not been thrust through the base. The base fabric may be a woven fabric, though this is not an essential characteristic, since a base fabricated, for example, by felting would be usable for some purposes. The chief requirement as to the base fabric is that it should be susceptible of penetration to permit the fibers of the fleece covering to be thrust through it.

It has heretofore been common to manufacture composite fabric of the character described by machines known as "needle looms" in which a gang or group of barbed needles is reciprocated to cause the barbs of the needles to pass through the covering of fleece and the base fabric, the barbs being so pitched or inclined as to catch some of the fibers of the fleece during the penetrating stroke and carry them through the base fabric but to release the fibers so that they will remain interlaced through the meshes or fibers of the base fabric when the needles are withdrawn.

The web of fleece produced by a carding machine is commonly used to form the covering of composite fabric of the type under consideration, but according to former practice the production of the web of fleece and the operation of needling the fleece to the base fabric have been not only separate and distinct operations but have had no relation to each other either in point of time, rate

of production, or otherwise. The thickness of the web of fleece as produced by known methods and apparatus has not been sufficient for the thicker composite fabrics, and it has therefore been the practice to fold the web as delivered by the carding machine back and forth upon itself to build up a plurality of superposed layers before presenting the fleece and the base fabric to the needling mechanism. This lapping or folding of the web of fleece has commonly been effected by an apparatus known as a Blamire lapper which operates adjacent to the delivery end of a carding machine. The lapper comprises two travelling aprons one of which receives the web of fleece from the carding machine and is reciprocated to fold the fleece back and forth upon itself in zig-zagged lapped formation so that a plurality of layers will furnish the desired thickness of fleece, while the other apron conveys the folded or lapped fleece to one side where it is wound upon a roll until a considerable quantity has been accumulated thereon. The lapped fleece is then parted, the full roll is carried away and an empty roll is substituted in its place to wind another length of lapped fleece. The rolls of fleece, each a separate unit, are taken successively to a needle loom where the fleece, still in lapped formation, is unwound from the roll and laid upon the base fabric preparatory to being fed with the latter through the needling mechanism.

From the above description of a known method it will be understood that the carding machine and the needle loom perform their functions independently of each other and that the rate of production of one has no control over the rate of production of the other; that the web of fleece produced by the carding machine must be folded and lapped to provide the desired thickness and must be parted from time to time so that it can be handled incidentally to removing it from the lapper and presenting it to the needle loom; that the intermediate operations between the carding operation and the needling operation require not only costly and bulky apparatus but require also labor to perform the operations of parting the fleece as it is taken up and wound from the lapper, to carry the filled rolls of fleece away from the lapper and to place them in the desired

relation to the needle loom; and that the fleece as passed through the needle loom is necessarily thicker in some places than in others in consequence of having been folded back and forth upon itself in zigzag courses by the lapper.

In view of the above described known method of making composite fabric one object of the present invention is to provide an improved method of and apparatus for making such composite fabric continuously and at a rate of speed coordinated with, and governed by, the rate of delivery of the web of fleece from a carding machine, that is, an improved method by which a web of fleece as delivered by a carding machine will pass unbroken from the latter to and through a needle loom to be incorporated into a composite fabric while the web remains integral with that being delivered by the carding machine; another object is to provide an improved method by which all intermediate operations and the apparatus and labor incidental thereto may be eliminated; still another object is to provide an improved method by which the desired thickness of the covering of fleece in the composite fabric may be obtained without folding or lapping the fleece or otherwise subjecting it to any treatment that would militate against uniformity of thickness.

In addition to the foregoing an object of the invention is to provide improved apparatus to increase the rate of production of composite fabric and to improve its quality with respect both to uniformity and durability.

A novel feature relating to the method consists in conveying a web of fleece as delivered by a carding machine at a rate of speed governed by its rate of delivery by the carding machine, simultaneously feeding a base fabric at the same rate of speed and in co-operative relation to said web of fleece, and uniting the web of fleece and the base fabric by mechanism the operating speed of which is coordinated with and governed by that of the carding machine, so that the production of the web of fleece and the fabrication of the composite fabric will be effected as component parts of a single uninterrupted procedure.

Another novel feature relating to the method consists in condensing the fibers and increasing the thickness of the web of fleece after it has been doffed, by uniformly crowding the fibers longitudinally and progressively, in which respect the procedure is the direct antithesis of a so-called drawing operation. In its broader aspect this feature of the invention is not limited to the production of a composite fabric, since the condensed and thickened web of fleece is susceptible of being bought and sold as an article of commerce in that condition to be used

for any purpose desired. This feature of the invention, in its broad aspect, forms the subject-matter of my copending application Serial No. 16,948, filed March 20, 1925, as a division of this application. Nevertheless, in so far as the production of a composite fabric is concerned this feature of the invention may be utilized to compact the fibers and increase the thickness of the web of fleece between the point where it is doffed and the point where the web of fleece is attached to a base fabric.

Another novel feature of the invention consists in utilizing a base fabric to convey a continuously growing web of fleece from the delivery end of a carding machine to a needling mechanism by which they are to be united.

Still another novel feature consists in feeding an endless band of base fabric through an endless circuit two or more times, accumulating thereon two or more layers of fleece, one to each circuit, and needling each layer of fleece thereto before the next succeeding layer is superposed thereon.

A novel feature relating to the mechanical aspect of the invention consists in a unitary organization comprising mechanism for carding and delivering a web of fleece, a mechanism arranged to attach the fleece to a base fabric, mechanism for causing the first two said mechanisms to operate at predetermined coordinated speeds, and means for conveying the web of fleece, as delivered by the carding mechanism, at a rate of travel coordinated with its rate of delivery, from the carding mechanism to the mechanism by which it is to be attached to the base fabric.

Another novel feature relating to the mechanical aspect of the invention consists in mechanism arranged to feed a base fabric past a point adjacent to the delivery end of a carding machine and thence to a fleece-attaching mechanism so that the base fabric may be utilized as a conveyor to complete the mechanical organization.

Other features of the invention are hereinafter described and claimed and are shown by the accompanying drawings.

Referring to the drawings,

Figure 1 represents a side elevation of the cylinders at the delivery end of a carding machine and certain selected elements of a needle loom arranged to operate on the fleece as it is delivered by the carding machine, with means arranged to convey the fleece from the carding machine to the needle loom in an unbroken sheet.

Fig. 2 is a side elevation on a larger scale including those elements of the needle loom that are represented in Fig. 1 and including additional elements to illustrate one form of driving mechanism.

Fig. 3 is a longitudinal vertical section through one of the needling units.

Fig. 4 is a longitudinal vertical section through a suitable form of mechanism for operating one of the needling units.

Fig. 5 is a diagram including four fragments or areas of composite fabric as produced according to this invention, said fragments illustrating the preferred method of needling the fabric by successive stages.

Fig. 6 represents an elevation of certain rolls and means for operating them.

The drawings are made more with a view to disclosing the principles of the invention than structural detail since the latter is susceptible of many modifications and, if illustrated, would obscure the showing. For this reason those structural elements that are represented in the drawings are purposely shown, for the most part, conventionally, and while proportions are maintained the relative arrangement of the various elements is shown as nearly as it is feasible to do so within the rules governing drawings for this purpose.

A carding machine, which for brevity will hereinafter be termed a card, of any suitable construction or arrangement may be used according to the quality, quantity, and other conditions consistent with the ultimate result desired, but I prefer, for certain purposes, to supplement the usual equipment of the card with an additional cylinder similar in operation to the usual doffer. This feature will be hereinafter explained at greater length, but with the exception of this supplemental cylinder the card represented in Fig. 1 embodies a well-known construction and arrangement and operates in well-known manner. For this reason it will be sufficient, for present purposes, to refer only briefly to the well-known elements and operation of the card.

The main cylinder 10 carries the fibers past the usual workers 11, strippers 12 and fancy 13 to the usual doffer 14. Heretofore, in the production of a web of fleece to be used or sold to the trade as such, it has been the practice to strip the fleece from the doffer 14 and deliver it to a mechanism designed to fold the web back and forth upon itself in layers to obtain the desired thickness. A well-known machine for this purpose is called a Blamire lapper. My present invention dispenses with a lapper and provides other means for increasing the thickness of the fleece. This is accomplished by supplementing the doffer 14 with a cylinder 15, preferably clothed with longer teeth than those required for the doffer 14. Furthermore, the cylinder 15 is driven at a slower speed, meaning peripheral speed, than the doffer 14 and is rotated in the opposite direction. The effect of the cylinder 15 is to retard the travel of the fleece so that

the fibers will accumulate in its clothing to a greater thickness than that carried by the doffer. It is because of the increased thickness that it is desirable to clothe the cylinder 15 with longer teeth than those carried by the doffer. As shown in Fig. 1 the cylinder 15 is driven by a crossed belt 16 running over a relatively small driving pulley 17 on the doffer and over a relatively large driven pulley 18 on the cylinder. Since the purpose and effect of the cylinder 15 are to condense the fibers longitudinally, and since the prior art does not, to my knowledge, disclose any equivalent, I shall, for convenience, refer to it as a condensing cylinder.

The web of fleece, having passed from the doffer 14 to the condensing cylinder and having been condensed and increased in thickness at the point of transfer, passes over the top of the condensing cylinder to the point of delivery where it is stripped by any suitable means such, for example, as a wipe roll 20. The periphery of the wipe roll would preferably be provided with some sheet material that would not permit the fleece to slip. For example, the surface covering might be made of corduroy, plush, or other material to which the web of fleece would cling sufficiently to avoid slipping. The wipe roll would preferably be driven at the same peripheral speed as the condensing cylinder. For this purpose the condensing cylinder carries a sprocket wheel 21, represented by dotted lines, to drive a chain 22. This chain drives a sprocket wheel 23 fastened to the wipe roll 20. As shown by Fig. 6, the sprocket wheel 23 and a sprocket wheel 24 are integral, the latter being used to drive a chain 25 by which rotation is transmitted to a feed roll 26. The purpose of this feed roll will be described at a later point.

In accordance with one novel feature of the invention the web of fleece, indicated at 27 in Figs. 1 and 3, is fed directly from its point of delivery by the card to a needling mechanism by which it is attached to a base fabric 28 to form the composite fabric, and it will be apparent that the web progresses continuously from the card to and through the needling mechanism without being lapped or parted.

In needle looms heretofore used for needling a covering of fleece to a base fabric the needles have been spaced in accordance with the distance between jabs in the completed fabric, and have been operated in synchronism. Consequently, for the purpose of giving a concrete example, if the fleece was to be attached at points 1/8 inch apart a fabric sixty inches wide required 480 needles all of which were caused to penetrate the fleece and the base fabric simultaneously. While the resistance to penetration of a single needle is not very great, although ob-

viously it would vary according to the characteristics of the base fabric and also to some extent according to the thickness of the web of fleece, the simultaneous operation of a large number of needles causes a considerable resistance to penetration. This aggregate resistance depresses the fabric into the needling slot and militates against a uniform rate of travel of the fabric.

- 10 In view of the former practice as above explained, and in accordance with another feature of this invention, I divide the total number of needles into groups and arrange the groups in tandem relation so that only a relatively small proportion of the total number of needles will penetrate the fabric at any one line crosswise of the fabric. Furthermore, instead of operating all the needles in unison as it has been the practice heretofore, I prefer to operate the aforesaid groups of needles successively so that the resistance to penetration and the demand for power will be further distributed.

- For convenience of description I shall refer to the groups of needles as needling units. Fig. 3 represents one of the needling units, while Fig. 4 represents a form of mechanism suitable for operating one of the units. These units and their respective operating mechanisms are represented in Figs. 1 and 2 as arranged in tandem relation so that the needling units may operate successively as the base fabric and the web of fleece pass them one after another. As shown by Fig. 3, each needling unit comprises a needle bar 29 by which a series of needles 30 is carried. The bar 29 extends crosswise of the fabric, and since the total number of needles for making the fabric is divided into four groups or units the distance between the needles in each unit is four times as great as the distance between needle jabs in the completed fabric. Consequently, if it is desired to needle the fabric at distances 1/8 inch apart the needles of each unit may be 1/2 inch apart. Each needle is provided with barbs 31 near its penetrating end, the barbs being pitched or inclined to carry the fibers through the base fabric and to release the fibers as the needles are retracted. Each needle bar is carried by a plurality of fingers 32 which, in turn, are carried by a rocker 33. According to the illustrated construction the rocker 33 is made of tubing which affords the necessary strength and rigidity with comparatively little weight, since light weight is desirable to permit high speed of oscillation. The ends of the tube 33 are affixed to eccentric heads 34 formed on trunnions 35. These trunnions are mounted in suitable bearings supported by the framework at opposite sides of the needling mechanism. The trunnion 35 at one end of the tube is affixed to or formed as an integral part of a fork 36. The fork is oscillated at

high speed, that is, from 500 to 600 strokes per minute, by a crank 37, although a block 38 carried by the crank engages the fork. The shaft 39 of the crank is mounted in bearings provided by a crank-case 40 having a detachable cap or cover 41, and one end of the crank-shaft projects beyond the crank-case and is provided with a pulley 42. The crank-case is mounted upon a bolster 43 affixed to a horizontal rail 44 of the framework and its ends are formed as ears 45 which are bored and tapped to receive bolts 46 for securing and adjusting the crank-case. The two bolts 46 are arranged in coaxial relation and their inner ends are turned to cylindric shape and fitted into sockets bored in the base of the crank-case. This mounting of the crank-case provides for adjusting it in lines parallel to the direction of travel of the fabric and also provides for slight rocking of the crank-case about the axis of the bolts to enable the crank-case to accommodate itself to the axis of the trunnions 35. Since the rocker 33 does not require operating mechanism at both ends one of its ends may be journaled in a bearing mounted in the same fashion as the crank-case 40 but not having any provision for duplication of the operating mechanism.

Since the base fabric 28 and the web of fleece are fed continuously in one direction at a predetermined speed while the needling units are operating I prefer to incorporate into the mounting of the needling units some provision for permitting the needles to partake of the travel of the fabric while the needles are in the fabric and thus to avoid temporarily arresting the fabric and stretching the holes made by the needles. Accordingly, as shown by Fig. 3, the needle bar 29 and its supporting fingers 32 are connected by springy strips 47 of thin sheet steel or any other suitable resilient material.

Fig. 2 illustrates a suitable arrangement of pulleys by which the several needling units may be operated at a uniform rate of speed by a single belt 48. This belt passes over the operating pulley 42 of one of the needling units, under an idle pulley 49, over the operating pulley 42 of the next needling unit, under a driving pulley 50, over the next operating pulley 42, under an idle pulley 51, and then over the last operating pulley 42 from which it passes under idle pulleys 52 and 53 back to the first operating pulley 42. The driving pulley 50 is affixed to one end of a shaft 9 which extends to the opposite side of the needling mechanism and is there provided with a similar pulley 56 which receives rotation from a crossed belt 57 driven by a pulley fastened to the fancy 13. As shown in this figure the four operating cranks 37 are at four different positions ninety degrees apart, and as long as this relation is maintained the needling units will

penetrate the fabric successively at uniform intervals and thus divide the total resistance to penetration into four equal parts. To insure the maintenance of the described angular relation of the four cranks without depending solely upon the frictional engagement of the belt with the four operating pulleys the latter may be provided with wrist pins 54 connected by a parallel rod 55 made in one continuous piece or in sections as preferred.

A development of the needling is represented graphically by Fig. 5, in which four sections or areas of the fabric are conventionally represented at A, B, C and D. It is to be assumed, in reading this figure, that the fabric travels from left to right, and that the dots *a* on section A represent the points at which the needles of the first unit have penetrated. The dots in each horizontal row represent the points at which an individual needle has made successive penetrations, while each vertical row represents the points at which all the needles of that unit have penetrated simultaneously.

Section B represents the result after any given portion of the fabric has passed the second needling locality but before it has reached the third. Here the points *a* of penetration are those of the first needling unit while those indicated at *b* are the points appertaining to the second needling unit. It is to be observed that the points *b* are out of line with the rows of points *a* with respect not only to the lines of travel but also with respect to transverse lines. This staggered relation of the points of penetration is obtained partly by setting the needles of the second unit out of line with those of the first unit and partly by relatively adjusting the units lengthwise of the direction of feed so that the transverse lines of penetration of the second unit will be midway between the transverse lines of penetration of the first unit.

The third needling unit is adjusted to make the transverse lines of penetration coincide with those of the first unit, but here again the third unit is adjusted transversely to place the individual points *c* of penetration midway between the points *a* of penetration. In like manner the fourth needling unit is adjusted so that the points *d* of penetration will coincide with the transverse lines of the points *b* but will be midway between the points *b*. Thus the points of penetration, considered collectively, are uniformly distributed and lie in diagonal lines as well as in lines crosswise of the fabric. Although the drawings do not show any means for keeping the fabric in a predetermined path it is to be understood that any suitable means may be provided for this purpose. For example, the rolls hereinafter described for supporting and feeding the fabric may

be provided with flanges to engage the longitudinal edges, or stationary edge gages may be provided for that purpose and fastened to the table or track along which the fabric moves while passing the needling localities.

As shown in Fig. 3, the fabric is supported under the needling unit by two transverse bars 58 spaced apart to provide a needling gap 59. This gap is wide enough to admit the needles and to provide clearance. As the fabric travels from the bars 58 of one needling unit to those of the next it is supported by a plurality of bars 60 extending lengthwise of the direction of feed and supported by the cross bars. The cross bars may be supported in turn by the longitudinally extending frame pieces 44.

If it be desired to draw the web of fleece incidentally to conveying it from the wipe roll 20 to the needling mechanism or to condense and thicken it the speed of conveyance would be faster or slower than the rate of delivery. In any case, it should be coordinated with and governed relatively to the rate of delivery, according to the result desired. The illustrated conveying mechanism is controlled to maintain a speed of travel substantially no faster or slower than the peripheral speed of the condensing cylinder. For convenience and simplicity I prefer to utilize the base fabric in the capacity of a conveyor to carry the fleece from the point where it leaves the wipe roll 20 to the first needling locality, since such utilization dispenses with the necessity for providing other means to accomplish that purpose. Accordingly, the assemblage shown by Fig. 1 includes a roll 61 arranged under and adjacent to the wipe roll to support the base fabric in position to receive the web of fleece as delivered by the wipe roll. The upper stretch of the fabric is supported at the other end by an idle roll 62 at a point far enough from the roll 61 to provide the necessary space for the entire series of needling units and as much farther as may be desirable or necessary to provide for any other conditions. Various forms and arrangements of feeding mechanism would be usable to feed the fabric at the same rate as the peripheral speed of the condensing cylinder, and the mechanism shown by Fig. 1 is merely one of many that would accomplish this purpose and at the same time provide for needling a piece of fabric greatly in excess of the longitudinal dimensions of the apparatus.

As shown, the feeding mechanism includes a feed roll 63 arranged to cooperate with the roll 26 hereinbefore referred to. The roll 63 may be covered with any suitable material for preventing the fabric from slipping and the two rolls 63 and 26 are preferably pressed one against the other

with sufficient pressure to insure a positive feed of the fabric. Since the roll 26 is driven positively by the condensing cylinder 15 through the agency of sprocket wheels and chains it is desirable to transmit such rotation positively to the roll 63, and for this purpose the sprocket wheel 64 which receives rotation from the chain 25 may be affixed to or formed on a toothed gear 65. A similar gear 66 affixed to the roll 63 completes the transmission.

It is desirable to maintain sufficient tension in the fabric passing the needling localities to take up all slack and eliminate wrinkles as well as to insure a rate of travel governed according to the peripheral speed of the condensing cylinder. For this reason it is desirable to arrange a pressure roll 67 to cooperate with the idle roll 61. The pressure of these rolls one against the other would preferably be capable of regulation and would preferably include springs, weights, or other pressure applying means having a yielding capacity to compensate for variations in the thickness of the material.

If it is desired to provide the base fabric with more than one layer of fleece the ends of the strip of base fabric will be joined by stitching or otherwise to make it into an endless band, as shown by Fig. 1. The slack material indicated at 68 is folded back and forth upon itself in a pile by delivery rolls 69 and 70, one of which is preferably held against the other with yielding pressure. Since no considerable power would be required to transfer the fabric from the feed rolls 26 and 63 to the point of delivery the roll 62 would be capable of furnishing enough power for that purpose. Accordingly roll 62 would preferably be covered with some suitable friction material by which the travel of the fabric would cause it to turn without slipping. By providing the rolls 62 and 70 with pulleys and a transmission belt 71 the means necessary to drive the delivery roll 70 is completed. If desired a series of small idle rolls 72 may be provided to support the stretch of fabric running from the pile 68 to the tension rolls 67, and 61, and one or more idle rolls 73 may be provided to support the stretch of fabric running from the feed rolls 26 and 63 to the delivery rolls 70 and 69.

With this or any equivalent arrangement of feed rolls, tension rolls and idle rolls, an endless band of base fabric 28 may be caused to traverse an endless circuit any desired number of times, and for each circuit it will receive a layer of fleece of uniform thickness, since the fleece is delivered to it without being lapped or folded or otherwise thickened in one place more than in another. Furthermore, when the second layer of fleece is superposed upon the first

layer which has already been needled to the base those fibers of the second layer that are carried through the base by the needles will necessarily be carried also through the first layer of fleece and will therefore bind the first layer more securely to the base. In like manner, if a third layer of fleece is needled to the base some of its fibers will necessarily be passed through the second and first layers of fleece and still further strengthen the bonds previously made by needling. However, if the card is provided with a condensing cylinder 15 it would seldom be necessary to provide the base fabric with more than one layer of fleece unless it is desired to produce a very thick and heavy composite fabric. The condensing cylinder not only accomplishes the purpose for which the so-called Blamire lapper has heretofore been used but it produces a relatively thick fleece without folding or lapping and without requiring parting of the fleece between its production by the card and its attachment to the base fabric by the needling mechanism.

The illustrated feed mechanism is also usable without any alteration to produce composite fabric having but one layer of fleece. The mode of operation for producing such fabric would not need to include joining the two ends of a piece of base fabric to form an endless band as hereinbefore explained but each new piece of base fabric would be joined to the trailing end of the preceding piece. The pieces of composite fabric would then be disjoined as the successive junction points pass out from the delivery rolls 70, and 69.

I claim:—

1. That improvement in methods of making composite fabric, which consists in feeding an endless base through an endless circuit repeatedly, and simultaneously supplying a web of fleece to one face of said base and needling said fleece to the base until a plurality of layers of fleece have been accumulated upon and needled to the base.

2. That improvement in methods of making composite fabric which consists in needling a layer of fleece to a base, superposing another layer of fleece upon that already needled to the base, and needling the superposed layer to the base so that the needled fibers of the superposed layer will extend through the first layer.

3. That improvement in methods of making composite fabric which consists in laying a web of fleece upon a base so as to provide integral layers superposed one upon another, and needling each layer to the base before needling the next layer thereto.

4. An apparatus for uniting a base fabric and a web of fleece to produce a composite fabric, comprising mechanism for feeding the base fabric and the web one on the other,

and needling mechanism including a series of needling units each having an operating pulley, driving means including a driving pulley and a belt, said belt being arranged 5 to run on each of said operating pulleys, and means other than said belt for controlling the operating speed of said units so that one cannot work faster than another.

5. An apparatus for uniting a base fabric 10 and a web of fleece to produce a composite fabric, comprising mechanism for feeding the base fabric and the web one on the other, and needling mechanism including a series 15 of needling units each having an operating pulley, driving means including a driving pulley and a belt, said belt being arranged to run on each of said operating pulleys, wrist-pins carried by said operating pulleys 20 respectively, and a parallel rod connecting said wrist-pins to equalize the operating speeds of said units.

6. An apparatus for uniting a base fabric and a web of fleece to produce a composite fabric, comprising mechanism for feeding 25 the base fabric and the web one on the other, said mechanism including an idle roll ar-

ranged to be driven by the fabric, needling mechanism and take-up mechanism arranged to be operated by said idle roll to take up the fabric on the delivery side of said feed- 30 ing mechanism.

7. An apparatus for uniting a base fabric and a web of fleece to produce a composite fabric, comprising mechanism for feeding 35 the base fabric and the web one on the other, and needling mechanism the needles of which are arranged to partake of the travel of the work while they extend into or through the latter.

8. An apparatus for uniting a base fabric 40 and a web of fleece to produce a composite fabric, comprising mechanism for feeding the base fabric and the web one on the other, and needling mechanism the needles of which 45 are carried by resilient means arranged to let the needles partake of the travel of the work while they extend into or through the latter.

In testimony whereof I have signed my name to this specification.

PATRICK H. WALSH.