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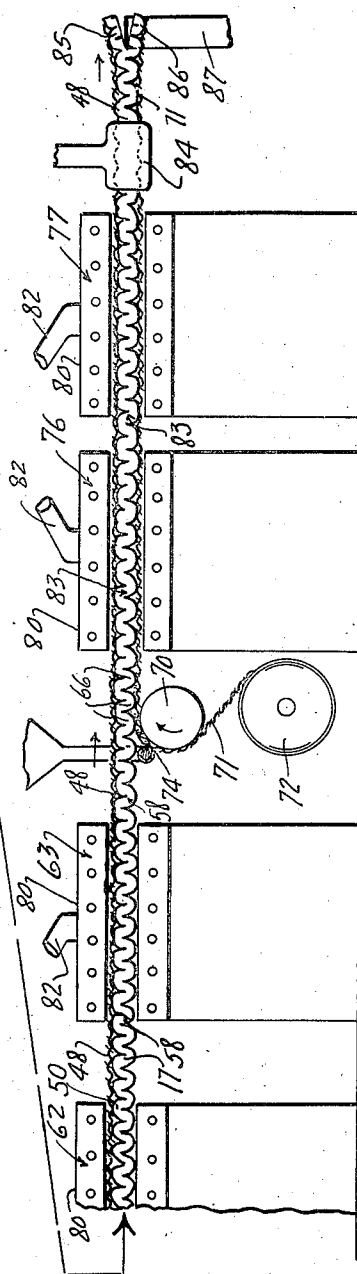
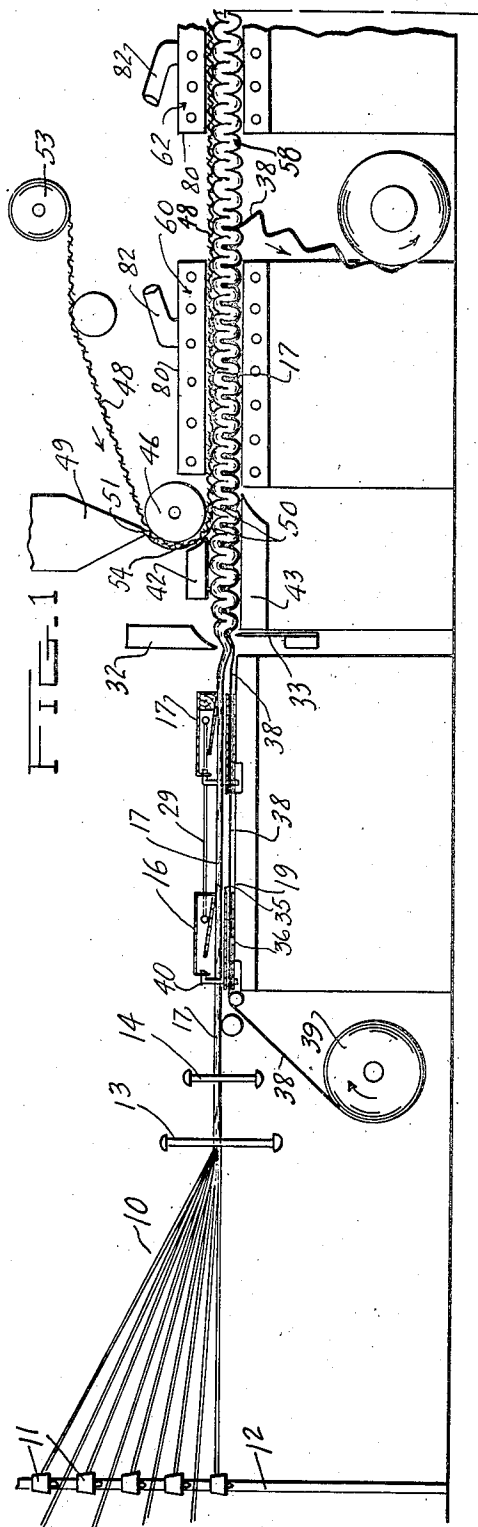
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2,248,135

METHOD FOR THE PRODUCTION OF FILE FABRICS

Filed April 25, 1938

3 Sheets-Sheet 1



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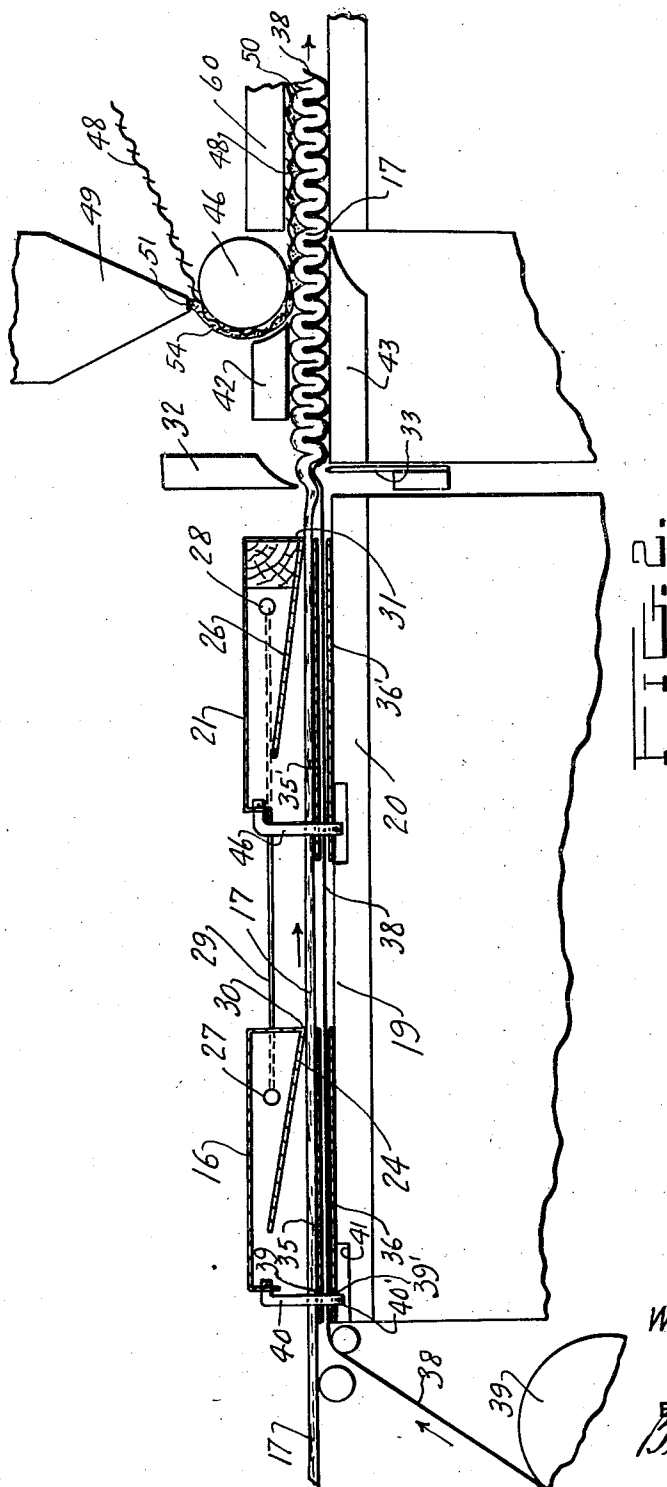
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METHOD FOR THE PRODUCTION OF PILE FABRICS

Filed April 25, 1938

3 Sheets-Sheet 2



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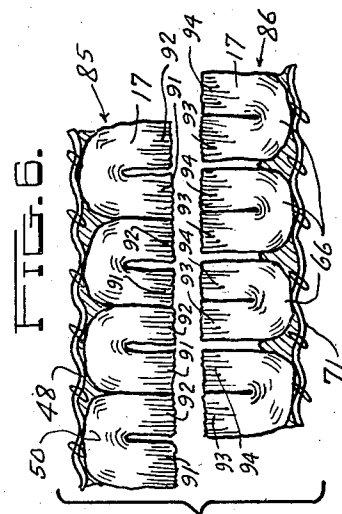
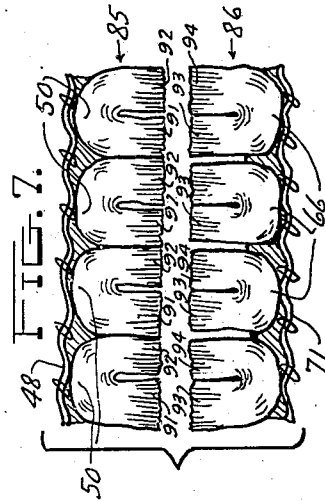
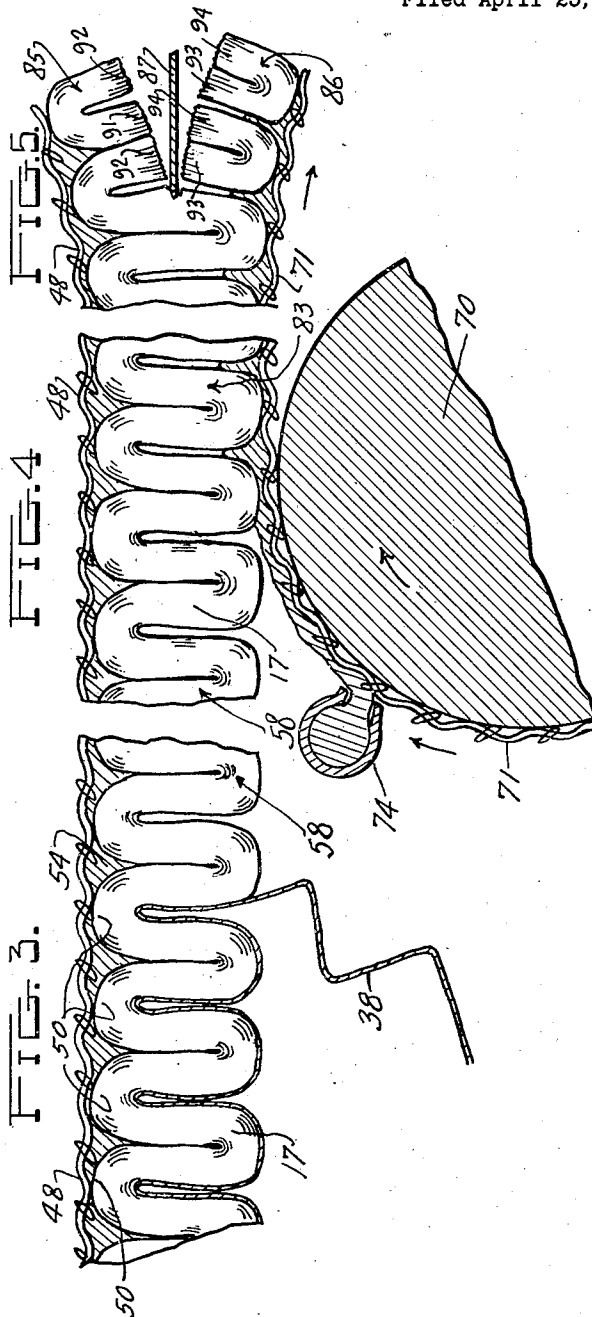
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METHOD FOR THE PRODUCTION OF FILE FABRICS

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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METHOD FOR THE PRODUCTION OF PILE FABRICS

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Application April 25, 1938, Serial No. 203,991

2 Claims. (Cl. 154—2)

This invention relates to a method for the production of a pile fabric and is more particularly directed to the fabrication of pile or tufted fabrics which have a plurality of threads, fibers or other pile forming material arranged to form the pile portion of the fabric, secured to a suitable backing material.

An important object of this invention is the provision of supporting and spacing means for certain portions of a suitable pile forming material during a plaiting operation in association with means for applying a backing material thereto whereby the material retains its pleated formation.

A particular object of the present invention is the provision of novel means for temporarily supporting plaits of the pile forming portion of fabric during the application of suitable backing material thereto.

A further object of the invention is an arrangement whereby a pliable sheet or creasable material is fed and guided to the material to be plaited and whereby both are concurrently and contiguously plaited and the creasable material removed therefrom.

A further object of the invention is the operation of simultaneously plaiting a relatively stiff yet plaitable material such as paper, sized cloth, woven fabric or the like constituting a supporting web with the plaiting of the pile forming material of the fabric for the purpose of properly spacing the plaits and maintaining the plaited material in even rigid rows during the cementing of a relatively inexpensive backing such as burlap or the like to the pile forming material immediately after the plaiting operation whereby sufficient pressure may be employed to effect a strong permanent anchorage between the two main portions of the completed fabric.

A further object of the invention is the operation of simultaneously plaiting a relatively stiff material as paper or the like as a supporting web with the plaiting of the pile forming material for the purpose of spacing the plaits and maintaining the plaited material in even rigid rows during the application of backing material immediately after the plaiting of the material whereby sufficient pressure is applied to effect a strong permanent anchorage.

One object of the invention resides in the provision of the method in which a suitable pile forming material such as yarn, threads, fabric or a sheet of a plurality of unwoven fibers or filaments are anchored or fabricated into sheet formation on which are performed a continuous

series of steps to produce a tuft fabric thereby enhancing the rapidity of production.

Another object of the invention is to include in the method the guiding and feeding of spun or unspun yarn or the like from a source of supply in a manner which provides a uniform density of the fibers forming a sheet material.

A still further object of the invention contemplates the inclusion of synchronized feeding for providing a uniform flow of material from a source of supply to a forming apparatus.

Further objects and advantages are within the scope of this invention such as relate to the arrangement, operation and function of the related elements of the structure, to various details of construction and to combinations of parts, elements per se, and to economies of manufacture and numerous other features as will be apparent from a consideration of the specification and drawing of a form of the invention, which may be preferred, in which:

Figure 1 is a view illustrating diagrammatically the apparatus and sequence of steps of my invention in the formation of pile fabric;

Figure 2 is a view showing diagrammatically in detail certain steps of the process of my invention;

Figure 3 is an enlarged sectional view illustrating the formation imparted to the material after certain steps of the method of my invention has been carried out;

Figure 4 is an enlarged sectional view illustrating the formation imparted to the material at a subsequent step to the one shown in Figure 3;

Figure 5 is an enlarged view illustrating a step in the method of my invention wherein the material is cut to produce two similar pile fabrics;

Figure 6 is an enlarged sectional view of the material illustrating the pile fabrics produced after the cutting step shown in Figure 5 has been completed;

Figure 7 is an enlarged sectional view of the pile fabrics produced by the method of my invention arranged to show the relation of the loops with respect to the spacing of the upstanding pile fabric rows.

In general, the method of making pile fabric in accordance with my invention includes the step of continuously forming a plurality of threads, fibers, yarns, strands or the like into substantially flat sheet material. The sheet material following the method of the invention is directly conveyed to a position to be continuously plaited or folded contiguously with a supporting web preferably of paper or woven fabric having

the proper consistency, the purpose of which is to support and space the folds or plaits of the sheet material in even rigid rows, while a backing is applied and bonded or cemented to the folds constituting one side of the plaited material so that the upstanding rows have certain predetermined spacing. The plaited material, supporting web and backing with its cementitious bond is then passed between a series of heating units which serve to dry the bond and permanently secure the folds in proper spaced relation to the backing, and the supporting web is then removed from the plaited material. The plaited backed material without the supporting web is fed through additional heating units to evaporate any solvents and complete the fixing operation while the structure is fed to a position where a backing is applied and bonded or cemented to the folds forming the opposite side of the plaited material, the resulting structure is then subjected to suitable heating or a solvent removing operation whereby this backing material is permanently secured to the plaits. The plaited and backed structure is subjected to a solvent removing operation by the use of one or more suction members positioned at the side or open ends of the composite structure. The composite structure is then split longitudinally or substantially midway between the backings in order to produce two similarly formed pile fabrics.

It is to be understood that any suitable material forming the pile fabric of the invention may be used in connection with the process or that a loom may be incorporated therein and the sheet material woven thereby fed directly to the plaiting apparatus. It is also contemplated that a roll of prefabricated sheet material formed with suitable pile elements or fibers may be used in conjunction with the invention, the sheet material being fed directly to the plaiting apparatus.

It is contemplated that any suitable machinery may be used in connection with the invention but it has been found that by the incorporation of certain improvements therein the product may be produced in a greatly decreased length of time and containing a more uniform texture than pile fabrics of this nature heretofore produced.

Referring to the drawings and particularly Figure 1 which diagrammatically illustrates a cycle of operations including the various steps of my invention for continually producing a pile fabric or carpet, 10 illustrates a supply of yarn fed from a plurality of spools or bobbins 11 supported by the usual creel 12. The yarn 10 is drawn through a plurality of spreading members or reeds 13 and 14 through the use of a reciprocating mechanism inclusive of a pull bar 16 which cooperates with a table or support 19 to give to the yarns drawn through members 13 and 14 a flat formation suitable for plaiting.

As particularly shown in more detail in Figure 2, the flat sheet material 17 is conveyed along the stationary table 19 by the reciprocatory movement imparted to the pull bar 16 and the interconnected push bar 21. The pull bar 16 and push bar 21 are synchronously reciprocated by suitable mechanism incorporating a suitable source of power and are interconnected through means of link or connecting member 23 which is pivotally secured at one end to the pull bar 16 through the medium of stud 27 and at its other end to the push bar 21 through the medium of the stud 28 whereby reciprocatory motion of the pull bar 16 is transmitted through the member synchronously to the push bar 21.

The pull bar 16 supports a material contacting arm 24 having the extreme end 30 adapted to contact with the sheet of material 17, while the push bar 21 supports a material contacting arm 26 having the extremity 31 adapted to contact with the sheet material 17. It should be noted that reciprocatory movement imparted to the pull bar 16 will be transmitted to the push bar 21 and due to the particular arrangement of the material contacting members 24 and 26 their respective ends 30 and 31 will contact with the sheet material 17 and move it along the table 19 during the forward stroke. The pull bar 16 and the cooperating push bar 21 will function to draw the yarns through the reeds 13 and 14 and at the same time pushing the sheet material or flat layer of yarns 17 along the table 19 to the plaiting mechanism which may comprise any standard machine including the plaiting knives 32 and 33.

The relative position and interconnection of the pull bar 16 with the push bar 21 whereby their movement is in proper timed relation provides a mechanism wherein the pull bar draws sufficient yarn or suitable material through the reeds 13 and 14 and concurrently relieves any pulling strain on the sheet formation 17 by the action of the push bar providing an arrangement for the uniform flow of sheet material through the table 19 and their combined timed action insures the accurate and uniform delivery of the sheet material to the plaiting mechanism.

The supporting base or table 19 as particularly illustrated has one end located adjacent to the reeds 13 and 14 while the other end is adjacent to plaiting knives 32 and 33. The table 19 supports transversely extending sets of reciprocable spaced plates 35, 36 and 35' and 36' one above the other and between which the supporting web 38 supplied from a roller 39 is fed to the plaiting knives by the reciprocatory action imparted thereto through the pull bar 16 and push bar 21. The plates 35 and 36 are connected to the lateral side walls of the pull bar 16 by means of connecting rods 40 each pivotally secured at one end to a portion of the pull bar 16, the other end of which is received in aligned openings 39 and 39' located at one end of these plates. The extreme end portion 40' of the connecting rod 40 is free to reciprocate in a slot 41 provided in the table 19 which arrangement also serves to prevent lateral motion of the plates 35 and 36. The plates 35' and 36' are connected to the push bar 21 through connecting rods 46 by an arrangement similar to that of plates 35, 36. The connection of the plates and connecting rods 40 and 46 being such that binding of the related parts is prevented. The plates 35, 36 and 35', 36' serve to feed and guide the web 38 to a position directly below the sheet material 17 adjacent to the plaiting knives 32, 33 and also prevents contacting engagement between the sheet material 17 which is conveyed along the top surfaces of plates 35 and 35' and the supporting web 38 prior to the plaiting step, thus preventing any crawling or side motion being imparted to the yarn or bat of fibers forming the sheet material 17 by the web 38. The reciprocatory movement of pull bar 16 and push bar 21 as well as that of the plates 35, 36 and 35', 36', is in proper timed relation with the action and movement of the plaiting knives 32 and 33 so that all these members coact to withdraw the sheet material 17 and web 38 from the source of supply. The coaction of the reciprocable members with the plaiting knives be-

ing such that in their forward stroke they frictionally grip and feed the material and web to the plaiting knives at the beginning of their plaiting operation, while the backward stroke takes place before the knives separate thus avoiding the drawing back of either the sheet material 17 or the web 38.

The plaiting knives 32 and 33 operate in a well known manner to simultaneously hold the sheet material 17 and the web 38 so that rigid folds or plaits of sheet material and supporting webs are formed.

As particularly shown in Figure 1, the combined plaited structure formed of the sheet material 17 and the supporting web 38 after leaving the plaiting knives 32 and 33 is fed or passed through the guiding lips 42 and 43 by means of a suitable mechanism including a drawing roller driven by a suitable source of power. The guiding lips 42 and 43 serve to hold and direct the plaits before the same are in contact with the backing 48 which has an adhesive in the form of rubber cement 54 applied thereto from a hopper 49 by means of a spreading member 51. The idler roller 46 is in close proximity to the straight forward edge of lip 42 and serves to position the backing with its cementitious material in contact with the bights 50 of the plaited material 17. The idler roller 46 is adjustable with respect to the plaited material 17 in order that sufficient edgewise pressure may be exerted by the backing 48 to the plaited material 17 supported by web 38 to insure proper bonding of the rubber cement 54. The backing material 48 which may be burlap or other inexpensive strong material is withdrawn from a suitable source of supply or roll 53. The stiffening web 38 supports the plaited yarn material 17 to enable the same to withstand sufficient pressure applied by the idler roller 46 so that proper impregnation of the material 17 by the rubber cement 54 is obtained whereby the fibers of the plaited material is permanently anchored to the backing 48.

As particularly shown in Figure 1 the composite plaited structure formed by the sheet material 17 and web 38 with the cementitious backing 48 are then passed through heating or seasoning unit or oven 60 which vulcanizes or bonds the cementitious backing to the plaited material thus fixedly securing the plaits in proper spaced relation forming a plaited backed material 58. It should be noted that the heating unit 60 is in close proximity to the roller 46 whereby the heat applied to the plaited backed material produces a sufficiently strong bond between the cementitious backing material 48 and the plaited material 17 so that the web 38 can be withdrawn without affecting the formation of the plaited material 17. The immediate introduction of the composite structure with the cementitious backing within the heating unit 60 enhances the rapid fixation of the folds or plaits to the backing material and prevents any distortion or disruption of the folds. The web 38 which enables the composite plaited structure to withstand the desired pressure for the proper bonding of the backing to the plaited material 17 may be in the form of an endless belt or a take off roll may be provided to receive the web after it is removed from a plaited material 17. I have found that when a soft fibrous material such as yarn is used to produce the pile fabric, the presence of the supporting web during the plaiting and first backing operation is very necessary in order to insure that the plaited configuration imparted to the yarn will not be

destroyed when pressure is applied thereto during the fixation of the cementitious backing and thus preventing that the plaited material becomes an unusable mass.

The plaited backed material 58 is conveyed by a suitable source of power through spaced heating units 62 and 63 thereby removing any solvent from the adhesive 54 and completing the permanent fixation of the backing 48 to the bights 50. The material 58 is then suitably supported and passed to a position over a roller 70 which positions and lays a backing material 71 in contact with the bights 66. The backing material is fed from a source of supply or roller 72 and has an adhesive or cementitious material applied to one surface thereof as at 74 forming the composite structure 83. The composite structure 83 including the backing 74 is then conveyed through the spaced heating or drying units 76 and 77 wherein its fixation and vulcanization to the backed material 58 is completed. The heat supplied by units 60, 62, 63, 76 and 77 may be in the form of superheated steam contained within suitable pipes and fed from a source of supply (not shown). The pipes forming the heating unit 60, 62, 63, 76 and 77 are enclosed by suitable housings such as 80 and a conduit or duct such as 82 is connected with each housing. The ducts 82 are connected to a suitable air withdrawing means which may be in the form of a fan (not shown) of sufficient size to continuously withdraw the saturated air formed by subjecting the cementitious material or rubber cement applied to the backings to the heated areas formed by the heating units. In this manner the solvent contained in the cementitious material or rubber cement is immediately removed avoiding skin drying of the cement and insuring the proper bonding of the backings to the bights of the folds of the plaited materials. The spacing of the folds produced by the temporary use of the supporting web 38 aids materially in the removal of the solvent and the proper fixation of the fibers to the backings.

For the purpose of increasing the rate and speed at which the pile fabric is produced, one or more suction nozzles or members 84 positioned at the sides or open ends of the composite structure 83 may be used so as to insure that the drying of the cement and removal of any solvent remaining in the composite structure will be effectively accomplished. However, it should be noted that due to the predetermined spacing of the folds present in the backed plaited structure, the drying of the cementitious material or rubber cement while the same is passed through the heating units is secured in a comparatively short time. After this optional drying step is effected, the composite structure 83 is then conveyed to a cutting or splitting mechanism which is preferably in the form of a self-sharpening belt knife 87 which is so located as to sever the structure longitudinally between the backings 48 and 71 producing two similar pile fabrics 85 and 86 having upstanding rows of fibers permanently anchored to a backing material. The rows of fibers constituting the pile fabrics 85 and 86 are formed by the leg portions 91 and 92 as well as 93 and 94 of U-shaped loops which have the bight portions 50 and 66 cemented to the backing materials 48 and 71 respectively. The pile fabrics 85 and 86 after the cutting step may be then subjected to the usual finishing steps which may include brushing, shearing, burnishing and printing if desired.

The configurations imparted to the material used in carrying out the different steps of the method of my invention hereinbefore described are particularly illustrated in detail in Figures 3 to 7 inclusive where it can be seen that the sheet material 17 due to the presence of the supporting web 38 when plaited takes the configuration of spaced folds as illustrated in Figure 3. The spacing of the folds is retained when the plaited sheet 17 is secured to the backing material 18, before the removal of the supporting web 38 so that its removal does not modify the distinct separation or a space therebetween. As particularly shown in Figure 4, this separation or space between the folds is also retained when the backing material 71 is applied to the other end of the plaited structure so as to enhance the drying and permanent backing fixing steps so that when the plaited backed material is cut longitudinally as particularly shown in Figure 5, two similar pile structures are produced.

The resultant pile fabrics 85 and 86 are shown in detail in Figure 6 where it can be seen that in the pile fabric 85 there is a distinct separation or space between the upstanding rows formed by the leg portions 91 and 92 of each loop while the outer surface of the leg portions of adjacent loops are in contact, thus the upstanding spaced rows are produced by the fibers of the leg portions of adjacent loops. However, it should be noted that the separation in the rows forming the pile fabric 86 is present between the leg portions of adjacent loops while the leg portions 93 and 94 of each of the loops are in close contact as is particularly shown in Figures 6 and 7. However, when the spacing between the rows of the pile fabrics 85 and 86 is in alignment as shown in Figure 6 the similarity of the same becomes readily apparent.

It should be noted that by the use of the supporting web not only the sheet material used for producing the pile rows is prevented from changing its formation during the application of the backing material, but that the supporting web also effects a substantial saving in the amount of plaited material required for producing a predetermined area of pile fabric. The supporting web with which the sheet material is plaited should be of a material having the proper consistency to serve as a stiffening structure, capable of being creased or plaited without cracking or breaking and at the same time able to retain temporarily the plaited formation. I have found that paper having such characteristics serves the purpose very effectively, but other types of sheet material for the stiffening web may be used, such as cloth or a woven fabric.

The invention also contemplates a step wherein the yarn or the material used for plaiting is slightly moistened or softened by steaming. This step can be accomplished by the use of a steaming unit or other suitable means wherein the yarns are softened and moistened prior to its passage through the reeds 13 and 14. I have

found that with certain types of yarns when the same are in a soft moist state they will more readily adhere to the cementing rubber compound than when in a dry state. The softening and moistening of the yarns 10 also decreases the period of time necessary for binding the backing material by means of the rubber cement to the plaited yarns, the moisture acts as a solvent for the rubber cement and when the yarns are in a soft state the impregnation of the yarns by the rubber cement is deeper, thus enhancing the bonding or anchoring of the fibers to each other and to the backing thereby producing a pile fabric having a very firm nap. It is also contemplated that the yarns may be impregnated with a solution of water and a percentage of rubber cementing compound simultaneous with the steaming and softening step.

It is to be understood that certain steps herein described may be omitted in order to produce a pile fabric having different formation and final appearance than the one herein described. Among others, it is contemplated to omit steps such as the application of a second backing and longitudinal cutting operation so as to produce a fabric consisting of a continuous series of plaits secured to a backing material. It is also contemplated that the application of the second backing be omitted, but the free loops may be cut and subjected to the usual finishing operation so as to produce a pile fabric having upstanding fibers of considerable length.

It is apparent that, within the scope of the invention, modifications and different arrangements may be made other than is herein disclosed, the present disclosure is illustrative merely, the invention comprehending all variations thereof.

What I claim is:

1. A method of making a pile fabric including arranging in juxtaposition a continuous sheet of pile forming material and a relatively stiff continuous web adapted to form a temporary support therefor; advancing said web and pile fabric to a position between reciprocating elements; simultaneously plaiting said material and web by said elements to form a mat consisting of a plurality of rows of plaits; applying a cement to a backing; applying the cement coated backing to the pile forming material side of said mat; compressing said backing material and mat; and removing the relatively stiff web from said mat.

2. The method of making a pile fabric including forming a plurality of strands into a sheet of pile forming material; feeding with said material to a position between the reciprocating knives of a plaiting mechanism, a relatively stiff continuous web of paper to form a support therefor; simultaneously plaiting said sheet and paper material to form a structure having spaced folds; cementing the folds of said sheet of pile forming material to a backing, and removing said stiff web of paper.

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