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R. LAING

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MACHINE FOR PRODUCING PILE FABRICS

Filed Oct. 21, 1949

3 Sheets-Sheet 1

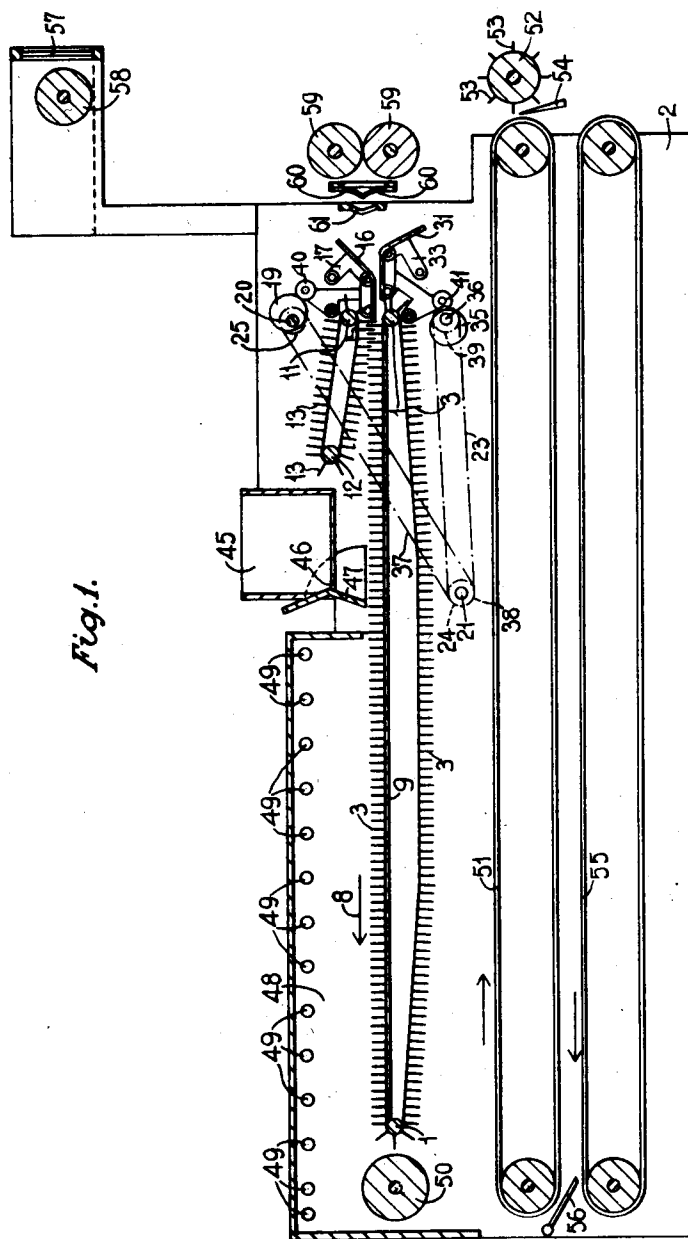


Fig. 1.

Inventor

Robert Laing.

By

Ferdinand Broder Boshardt
Attorney

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Fig. 2.

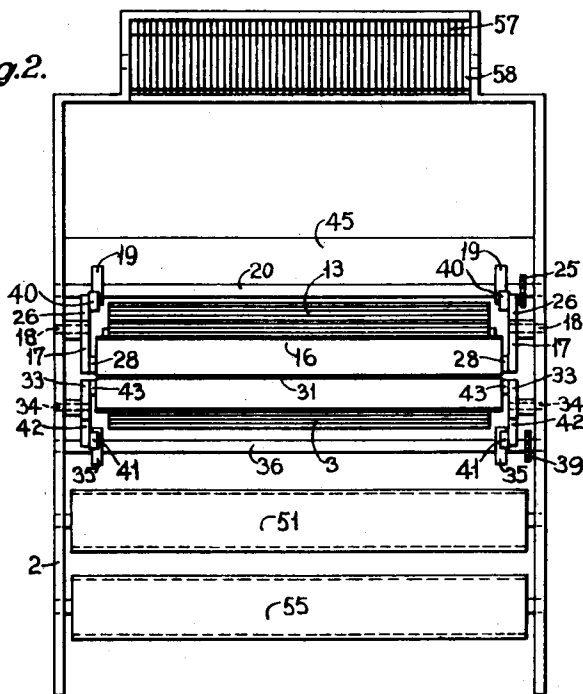
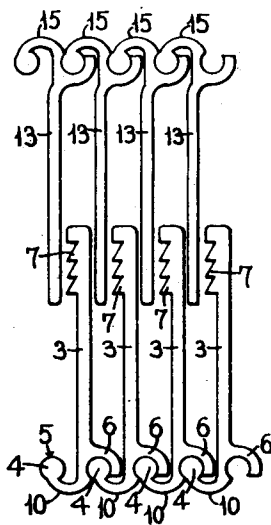


Fig. 3.



Inventor

Robert Laing

By

Ferdinand Broster Bonhardt
Attorney

Jan. 22, 1952

R. LAING

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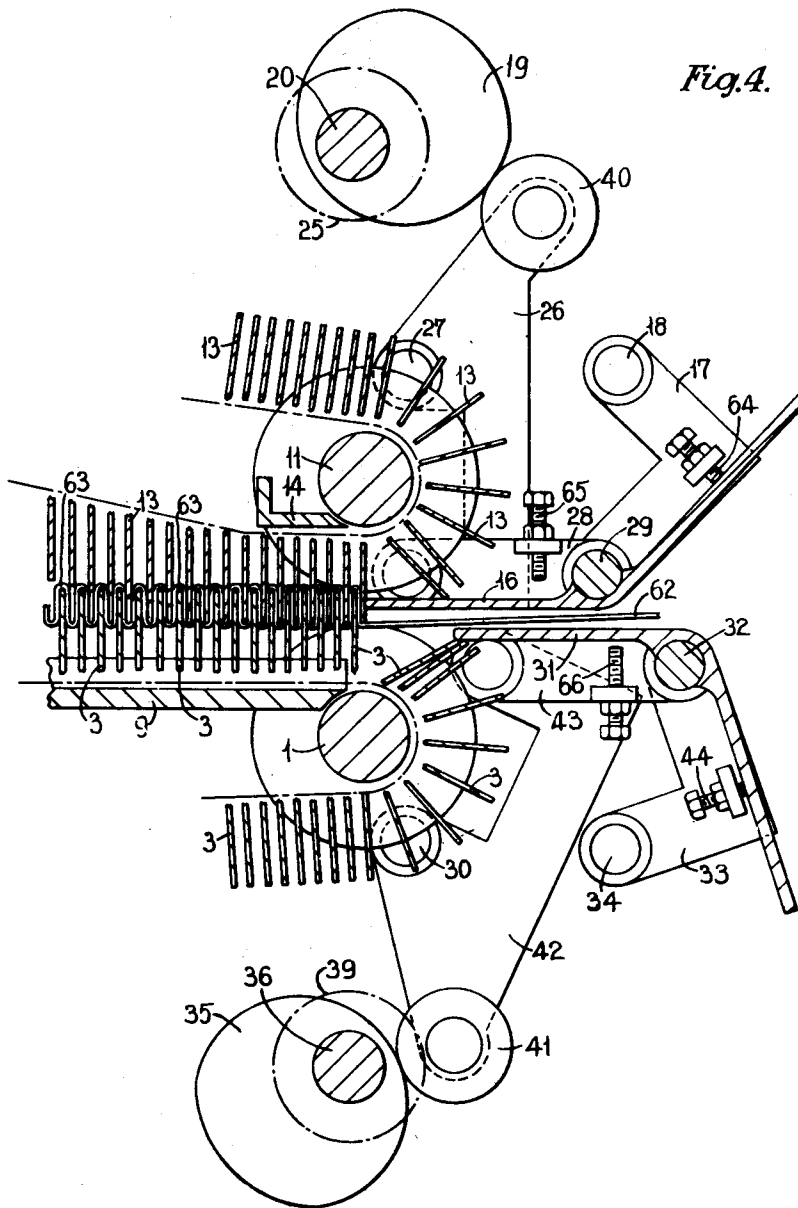


Fig. 4.

Inventor
Robert Laing.
By
Ferdinand Broster Bonshardt.
Attorney

UNITED STATES PATENT OFFICE

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MACHINE FOR PRODUCING PILE FABRICS

Robert Laing, Bury, England, assignor to Paerse-Laing Limited, Manchester, England, a British company

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6 Claims. (Cl. 154-1.1)

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This invention relates to machines for producing pile fabrics having pile loops adherent to and/or penetrating sheet material composed of plastics, rubber or other substance capable of being converted from a fluid or plastic condition into a non-fluid and non-plastic state by curing, vulcanisation or other treatment.

A machine for producing pile fabrics in accordance with the said invention has a mechanism for bending continuous filaments into a succession of connected loops, a device for feeding a fluid or plastic substance on to the looped filaments to form a sheet thereon whilst the filaments are retained in a looped state by the said mechanism and apparatus for heating the substance to cure or vulcanise it wholly or partly whilst the filaments are retained in the looped state.

Where a cut pile is desired, the machine may also have a cutting mechanism to cut the loops not adherent to or penetrating the sheet.

The mechanism for bending the filaments into connected loops may have a series of blades swingably connected together laterally and mounted in belt-like manner on rollers of small diameter and a second series of similar blades mounted in belt-like manner on rollers of small diameter, the blades of the second series entering and leaving spaces between the blades of the first series as the two series travel on their rollers, whereby filaments are bent by the blades into connected loops.

The second series may be above the first series and the first series extend beyond the second series to support and retain the filaments in loop form during the feeding and partial or complete curing or vulcanisation of the fluid or plastic substance.

Blade pushers are preferably provided which by their action on the blades assist the correct performance of the folding action of the blades and avoid straining of the blades and their connecting devices.

The device for feeding a fluid or plastic substance to the looped filaments may consist of a hopper disposed above the looped filaments and having a preferably adjustable slit in its underside through which a fluid or plastic substance can pass on to the looped filaments.

An adjustable doctor may be provided behind the feeding device to spread the fluid or plastic substance and control the thickness of the sheet composed thereof.

The apparatus for heating the substance may consist of a chamber into which the substance is

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carried after it has been deposited on the looped filaments and an electric heater or heaters disposed in the chamber.

The cutting mechanism may be disposed on the machine so as to cut the looped filaments after the substance has been cured or vulcanised.

In the accompanying drawings which illustrate more or less diagrammatically various embodiments of the invention—

Figure 1 is a side view in section of a machine for producing pile fabrics having loops adherent to sheet material.

Figure 2 is a front view thereof with parts of the machine omitted.

Figure 3 is a detached side view of a detail drawn to a larger scale than Figures 1 and 2.

Figure 4 is a fragmentary side view in section of a detail and is drawn to a scale larger than Figures 1 and 2 but smaller than Figure 3.

Referring to the drawings, in the construction shown therein, a pair of equal rollers 1 of small diameter are rotatably mounted on a machine frame 2 to extend cross-wise of the frame 2. On the rollers 1 there are mounted in endless belt-like manner a series of strip or ribbon-like parallel blades 3 which extend cross-wise of the frame 2 and each of which is hinged at its inner edge to the next blade to form an endless belt-like structure. The construction of the blades 3 and their hinges is shown in Figure 3. The hinges are composed of lateral projections 4 extending along the blades 3 and having cylindrical surfaces 5 and engaging longitudinal holes in lateral projections 6 provided on the blades 3, the cylindrical surface of each blade 3 engaging the hole in the lateral projection 6 of the adjacent blade 3 so that the blades can pivot about the centres of the cylindrical surfaces but are attached to one another.

The blades 3 have longitudinal teeth 7 provided on the rear sides at their outer edges.

One or both rollers 1 are driven and the upper part of the belt-like structure travels rearwards away from the front of the machine as indicated by an arrow 8 in Figure 1. A table 9 is provided between the rollers 1 to prevent sagging of the upper side of the belt-like structure by supporting the curved inner ends 10, Figure 3, of the blades. The blades 3 during their travel between the rollers 1 project substantially vertically upwards with their opposed faces substantially parallel, but whilst travelling round the rollers 1 they assume radially projecting positions. Due to the small diameters of the rollers 2 adjacent blades diverge substantially from their inner

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edges outwards whilst travelling round the rollers 1.

The frame 2 carries a second pair of rollers 11 and 12 respectively similar to the rollers 1 of the first pair, the roller 11 being disposed vertically above the front roller 1 of the first pair and the roller 12 being disposed at a higher elevation than the roller 11 and at a considerably less distance from the front of the machine frame 2 than is the rear roller 1 of the first pair. A second endless belt-like structure similar to that hereinbefore described, but much shorter in length and having blades 13 without teeth, is mounted in belt-like manner on the pair of rollers 11 and 12 in a somewhat slack state, and a short supporting plate 14, Figure 4, is arranged immediately behind the roller 11 to guide the structure parallel with the table 9 for a short distance behind the roller 11 by acting on the curved inner ends 15 of the blades 13. The second belt-like structure is driven by the first endless belt-like structure due to the blades 13 engaging between blades 3 at the upper side of the first endless belt-like structure.

In front of the two endless belt-like structures, there is a cross-bar 16 secured at its ends to the rotatable pivots 29 on arms 17 pivotally mounted at 18 in the machine frame 2 to move backwards and forwards and is driven forwards by cams 19 mounted on a shaft 20 journaled in the frame 2 and driven from a driving shaft 21 through an endless driving chain 37 running on a sprocket wheel 24 on the shaft 21 and a sprocket wheel 25 on the shaft 20. The cams 19 move the bar 16 by acting through rollers 40 provided on levers 26 pivoted at 27 and connected to the arms 17 by pivotal links 28. The links 28 are provided with adjustable stops 64 which limit the degree to which the bar 16 is permitted to rock downwards by being mounted on the rotatable pivots 29. A spring (not shown) is provided to yieldingly press the bar 16 against the stops 30. The cross bar 16, each time it is moved backwards by the cams 19 pushes a blade 13 rearwards thereby facilitating engagement of the blades 13 with the blades 3 and assisting in the driving of the two endless belt-like structures. Adjustable stops 65 are provided on the links 28 to limit the degree to which the bar 16 can rock upwards.

A cross bar 31 is attached at its ends to rotatable pivots 32 provided on arms 33 pivotally mounted at 34 to the frame 2 and actuated by cams 35 provided on a shaft 36 journaled in the frame 2. The shaft 36 is driven at the same speed as the shaft 20 by means of a driving chain 23 running on a sprocket wheel 38 on the driving shaft 21 and a sprocket wheel 39. The cams 35 move the bar 31 by means of rollers 41 provided on levers 42 pivoted at 30 to the frame 2 and connected by pivotal links 43 to the arms 33. Adjustable stops 44 are provided on the arms 33 to limit the degree to which the bar 31 can rock upwards, a spring being provided to yieldingly press the bar 31 against the stops 44. Adjustable stops 66 are provided on the links to limit the degree to which the bar 31 can rock downwards.

Behind the second endless belt-like structure, but above the rear portion of the first endless belt-like structure, a hopper 45 is mounted on the machine frame 2 and has a slot 46 extending cross-wise relative to the frame. The slot 46 may be adjustable. Above the rear portion of the first endless belt-like structure, there is a

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doctor plate 47 mounted on the machine frame 2 and extending cross-wise of the frame, but extending downwards somewhat obliquely to the blades 3. The doctor plate 47 is adjustable downwards towards and upwards away from the blades 3. Behind the doctor plate 47, an open bottomed heating chamber 48 is provided on the frame 2. The first endless belt-like structure extends into the chamber 48 and electric heating elements 49 are provided in the chamber 48 at a higher elevation than the first endless belt-like structure. Behind the rear end of the first endless belt-like structure there is a raising roller 50 the top of which is at a higher elevation than the upper side of the first endless belt-like structure. Beneath the said roller and structure there is a driven endless conveyor belt 51 associated with a rotary cutter 52 with helical cutters 53 co-operating with a stationary knife 54. A driven endless conveyor belt 55 is provided beneath the belt 51 and is driven in reverse direction to the belt 51. A row of cooling air jets 56 to direct air downwards towards the belt 55 is provided.

In front of the machine frame and at a suitable distance therefrom a creel (not shown) is provided with bobbins or cheeses of the filaments, such as wool, silk, cotton or rayon yarn, or threads such as are commonly employed to form the pile of carpet or chenille fabrics, and the filaments are threaded through a comb 57 to form a sheet of unconnected, parallel filaments extending from the comb 57 over a guide roller 58, between a pair of driven nip rollers 59, between friction brushes 60 and through a comb 61 to the blades 3 and 13. In operation, the blades 3 and 13 of the two endless belt-like structures come into engagement at the front roller 1 and the roller 11, and each filament of the sheet is pushed rearwards by each succeeding blade 3 or 13 against the preceding blade 13 or 3 and bending the filament into a sinuous or zig-zag like form so as to produce hairpin-like loops whose bends rest on the outer edges of the blades 3 and whose ends are continuous with or connected to the ends of the adjacent loops of the same filaments. In Figure 4 one of the filaments is indicated and marked 62 and bends of the hairpin-like loops are marked 63.

The effort required to bend and convey each individual filament is not great, but due to the large number of filaments which may be present in the sheet of filaments, the total effort to bend all the filaments of the sheet may be considerable. To relieve the two endless belt-like structures of the strain to which they would be subjected in exerting the total effort, the plates 16 and 31 are forced rearwards alternately by the cams 19 and 35, so that each blade 13 is forced by the plate 16 against the preceding blade 3 and the filaments between them and the displacement of the two structures composed of the blades 3 and 13 is assisted or effected, and each blade 3 is forced by the plate 31 against the preceding blade 13 and the filaments between them and the further displacement of the two structures is assisted or effected. After each thrust of the plate 16, the plate 16 is withdrawn by a spring (not shown) before the next thrust of the plate 31 occurs. After each thrust of the plate 31, the plate 31 is withdrawn before the next thrust of the plate 16 occurs. During withdrawal, the plate 16 is free to swing upwards against spring pressure in order to reduce the period of obstruction of the momentarily next

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blade 3 obstructed by the said plate and enable it to sooner gain its correct, natural position ready for the thrust of the plate 31 thereon. During withdrawal, the plate 31 is free to swing downwards against spring pressure in order to reduce the period of obstruction of the next blade 13 obstructed by the said plate and enable it to sooner gain its correct, natural position ready for the thrust of the plate 16 thereon. The yielding and return motion of the plates 16 and 31, instead of being effected by the blades 3 and 13 and springs, may be effected by switch cam grooves acting on the plates through pieces engaging the grooves and swivellably mounted on the ends of the plates near the front thereof so as to positively turn the plates out of the way of the blades after each thrust and positively return them to the normal position before each thrust.

As the endless belt-like structures travel, the blades 13, after leaving the plate 14, gradually rise out of engagement with the blades 3 whilst leaving the looped filaments in position on and held in the looped condition by the blades 3. Continued travel of the first blade 3 brings the sheet of looped filaments beneath the hopper 45 from which a fluid plastic, such as polyvinyl chloride, or a rubber compound flows or is forced from above on to the upwardly facing outer edges of the blades 3 and the bends 63 of the inverted loops extending over the said upper edges. The plastic or rubber is pressed and spread over the said edges and bends and into intimate contact with the bends 63 by the doctor plate 47 which also spreads and doctors the plastic or rubber into a sheet of substantially uniform thickness. Further travel of the blades 3 carries the looped filaments and plastic or rubber sheet into the heating chamber 48 and under the direct action of heating elements 49 the heat of which cures or vulcanises the plastic or rubber sheet sufficiently to cause the bends of the loops to adhere thereto and give permanency and enough tensile strength to the sheet to enable it to remain unchanged and unbroken whilst continuing to be cured or vulcanised and at the same time continuing to be conveyed by the blades 3. The blades 3 supporting the thus produced uncut pile fabric arrive at the rear roller 1 and in passing round the same, release the looped filaments and leave them and the plastic or rubber sheet to return to the front roller 1 and thereafter again co-operate with the blades 13 to loop the filaments at new places. The fabric thereupon passes over the roller 50, which assists the withdrawal of the looped pile from between the blades 3 by raising the fabric, then descends on to the conveyor band 51 to lie thereon with its uncut pile uppermost and is carried to the rotary cutter which cuts the pile by removal of projecting ends of the loops, whereupon the fabric descends on to the conveyor band 55 and is carried thereby rearwards with its pile lowermost and cold air is blown on to it through the jets 56 to cool it. The fabric then is delivered from the machine at the rear thereof.

If an uncut pile fabric is desired, a rotary cutter and stationary blade is omitted. If desired, the cutting of the pile may be effected by a separate machine after the fabric has been delivered from the hereinbefore described machine.

The second endless belt-like structure may be adapted to be raised out of its operative position temporarily in order to facilitate the intro-

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duction of the ends of the filaments between the two structures in the preparations for production. A device for adjusting the depth of engagement of the blades of the second structure with those of the first structure may be provided to enable the length of the loops and therefore the pile to be changed at will.

Penetration of the plastic or rubber sheet by the bent portion of the loops, so that the bends are buried in the sheet or project through it can be effected by the provision of two hoppers with heating means arranged between them. Plastic or rubber of low viscosity is fed from the first hopper to form a film or sheet which is partly cured by heating means, whereupon plastic or rubber of higher viscosity is fed from the second hopper and cured or vulcanised in the hereinbefore described manner to become integral with the first sheet. Alternatively the blades of the first endless belt-like structure may be in two parts so that the outer edge, after formation and holding of the loops, can be lowered before the plastic or rubber is fed, so as to leave the bends of the loops projecting above the outer edges more or less unsupported by the said edges and thereby enable plastic or rubber to flow into the inner side of the bends so as to partly or wholly surround the bends.

Reels may be provided on the machine frame to carry a supply of tape and guide devices be provided for laying the tape along the edges of the plastic or rubber sheet before it is cured or vulcanised and pressure rollers may be provided for pressing the tape into intimate contact with the sheet so that it has become adhered thereto when the curing or vulcanisation of the sheet is complete.

A punching or piercing apparatus may be provided on the machine frame to punch or pierce holes through the plastic or rubber sheet between the lines of pile loops.

I claim:

1. A machine for producing pile fabrics comprising a series of blades swingably connected together laterally and mounted in an endless form on rollers, a second series of blades swingably connected together laterally and mounted in an endless form on rollers with the blades in mesh with blades of the first series at the front portion thereof, blade pushers provided in front of the two series for pushing the blades in the direction of their travel and thereby assisting them to perform the movement necessary to produce connected loops in filaments, means for applying a sheet of viscous substance to the filaments after having loops produced in them, and means for changing the viscous substance into a solid substance.

2. In a machine for producing pile fabrics, an endless belt, pivotally connected blades composing the endless belt and extending crosswise thereof, longitudinal teeth on the blades, spaced rollers on which the endless belt runs, and an oscillatory pusher intermittently pushing against the said blades and thereby making the endless belt travel stepwise on the said rollers.

3. In a machine for producing pile fabrics, two rollers, blades pivotally connected together and forming an endless belt mounted on the rollers for receiving, holding and conveying connected loops of pile material, a mechanism for pressing the pile material down between the blades at one of the rollers where the blades are spread open, and a pusher bar for exerting on each blade successively a displacing push in the

direction of the run of the belt for closing the blades together and thereby gripping the pile material between them, also for driving the belt stepwise.

4. A machine for producing pile fabrics comprising an endless conveyor belt, two spaced rollers on which the conveyor belt is mounted; the said belt being curved where it rides on the rollers and straight where it extends between the rollers, blades which form the conveyor belt and are pivotally connected together for changing their positions between divergent and substantially parallel positions as the belt travels; means for forcing parallel continuous lengths of yarn simultaneously between adjacent of the said blades whilst they are divergent and thereby producing bends in the said lengths; a pusher pushing each blade in turn close to the preceding blade for tightening the grip of the blades on the yarn, the said pusher also driving the belt stepwise over the rollers by exerting a propellant thrust successively on each blade along the whole of its length.

5. A machine for producing pile fabrics comprising an endless conveyor, a series of blades swingably connected together laterally and composing the endless conveyor; two rollers of small diameter on which the endless conveyor is mounted, an endless keeper, a second series of blades swingably connected together laterally and forming the endless keeper; rollers of small diameter on which the endless keeper is mounted for the blades of the endless keeper to enter and leave spaces between the blades of the endless conveyor, a pusher mechanism for driving the endless conveyor and the endless keeper by direct thrusts on the blades thereof and causing them to bend continuous filaments into and keep the said filaments in a succession of connected loops, means for feeding a viscous substance on to the top of the bent filaments at a place between the first named two rollers and forming a sheet of the said substance in contact with the bent

filaments where they extend between the said two rollers and heating means above the filaments for converting the viscous substance into a permanently solid substance whilst on top of the filaments and between the said rollers.

6. A machine for producing pile fabrics, comprising a freely rotatable front roller, a freely rotatable rear roller, loop forming, holding and conveying blades hinged together laterally and forming an endless belt and supported on and extending between the front and rear rollers in a similar manner to a driving belt, whereby at the front and rear parts of the endless belt the belt is curved and the natural relative positions of the blades are divergent whilst at the part between the rollers, the belt is straight and the natural positions of the blades are substantially parallel, a feed hopper above a straight part of the belt behind the front roller, a doctor blade in association with the feed hopper behind the said hopper, a device for bending and forcing continuous lengths of pile yarn between the blades from above, a cross bar in front of the belt for forcing each blade rearwards in succession and thereby forcing each blade in turn rearwards from a position in the curved part of the belt path into a position in the straight part of the said path, producing a tightened grip of adjacent blades in the said straight part on the pile yarn between them and pushing the belt round on the said rollers, levers on which the cross bar is mounted for driving the cross bar forwards and backwards, and rotary cams for actuating the said levers.

ROBERT LAING.

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