May 7, 1957 E. T. C. BRINTON 2,791,261

MANUFACTURE OF TUFTED FABRICS

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Fig. 1.

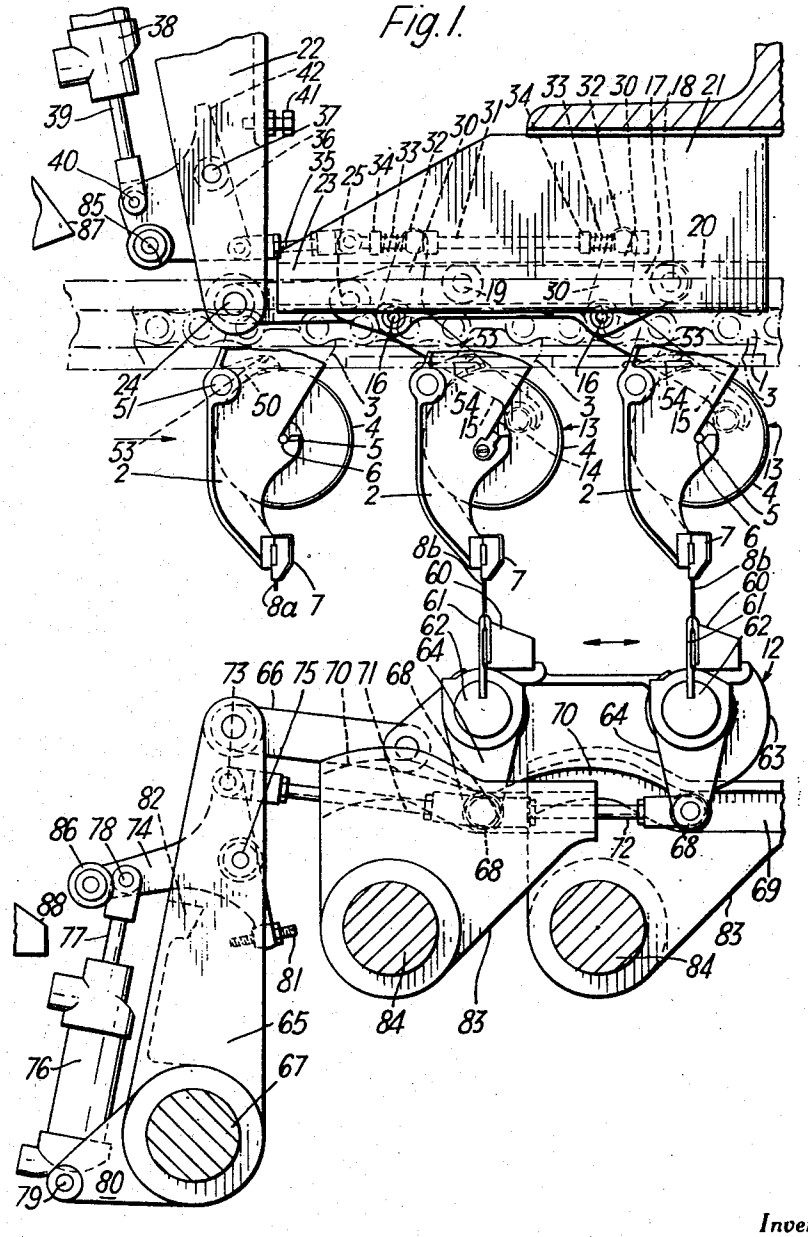

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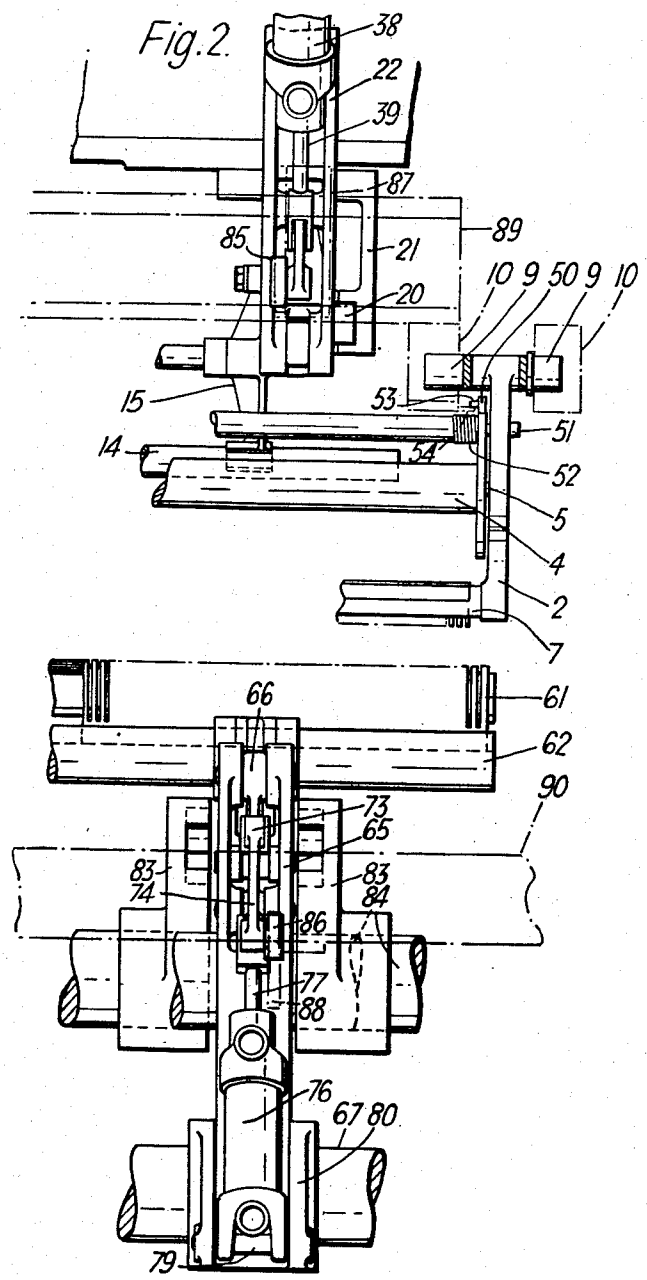
Fig. 2.



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MANUFACTURE OF TUFTED FABRICS

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8 Claims. (Cl. 154—1.1)

This invention relates to the manufacture of carpets and similar fabrics having a tufted surface. The commonest method for the production of such fabrics is by means of a spool loom, and as described in the specifications of U. S. Patent Nos. 2,711,777 and 2,747,647, the principal of the spool chain may also be employed in similar machines in which tufts are secured to an adhesive-covered backing instead of being woven in.

Whether the tufts are woven in or merely secured to the backing, each spool has to be passed through a sequence of movements during which a row of tufts is anchored in the backing, a further length of yarn is withdrawn to constitute the next row of tufts, and the anchored row is then cut off. The spool must be braked while the further length of yarn is being pulled out in order to control the length of yarn withdrawn, and the brake is in fact required to act during the whole of the passage of the spool around the chain so as to avoid accidental withdrawal of yarn. For this purpose each spool is normally fitted with its own individual brake acting on the flange of the spool.

The tension in the yarn, and hence the length of yarn pulled out, will depend on the effect of the brake which tends to vary as the spool unwinds. Since the brake acts on the flange of the spool it will exert a fairly constant braking torque, but as the spool is unwound the radius at which the yarn is drawn off decreases so that the relative effect of the brake on the tension of the yarn increases correspondingly.

In addition, since there is a large number of spools in the chain, each with its own brake, it is impossible to obtain complete uniformity from spool to spool. Thus the length of yarn withdrawn will vary by a small percentage from spool to spool. The consequent variation in the length of the tufts produced, although undesirable, is not of great importance, but the effect on the yarn left on the spool is cumulative and a spool fitted with a weak brake may be exhausted considerably before one with a stronger brake. As soon as one spool is exhausted, the whole set of spools has to be rewound, and any yarn still remaining on the other spools is wasted. This wastage may amount to up to about 6 to 8 percent of the total quantity of yarn used and materially increases the cost of the carpet or other fabric.

According to the present invention, a brake or a small number of brakes each extending along the length of a spool is applied directly to the yarn on successive spools or groups of spools during the time when fresh lengths of yarn are being pulled out. Since each brake acts on the yarns themselves, its radius of action decreases as the spool is unwound and its effect on the tension of the yarn remains constant. Moreover since in the simplest case where only a single brake is used, this same brake acts on each spool, the tension in the yarns will be the same from spool to spool and equal lengths of yarn will be pulled out, thus greatly reducing the wastage referred to. If instead of using a single brake, a small number such as two or three is used which are applied to successive groups of two or three spools, the same effect will be obtained because whereas it is impossible to maintain uniformity over a large number of brakes, a small number such as two or three may be adjusted with precision so that each produces the same braking effect.

Since the common brake or brakes is or are only applied while fresh lengths of yarn are being pulled out, each spool still requires to be held against accidental withdrawal of the yarn during its travel round the remainder of the circuit. For this purpose each spool is preferably fitted with an individual brake which is released when the common brake or brakes is or are applied. It will be understood that the strengths of these individual brakes are of no importance since they exert no control over the yarns during pull-out.

As already explained, in the normal way the yarns are pulled out immediately after a row of tufts has been anchored in position, the anchoring of the tufts serving to hold the yarns while the spool is withdrawn to effect the pull-out. It is difficult to apply an independent brake at this point, partly because of the complicated motion of the spool, and partly because of the lack of space. Preferably, therefore, the pull-out of the yarns occurs at a point other than that at which the tufts are embodied in the fabric, being brought about by means of a gripper mechanism operating in synchronism with the brake or brakes. This may be achieved, for example, while the chain is travelling in a straight line, the gripper mechanism simultaneously travelling with each spool and moving away from it so as to pull out the yarn.

In such a construction the brake or brakes may be mounted on a reciprocating carriage so as to advance with a spool or group of spools and then to return ready for operation with the next spool or group of spools. Each brake may comprise a rod mounted at each end on one arm of a bellcrank lever, the other end of which is rocked under pneumatic pressure to apply and to release the brake. Similarly the gripper mechanism may be mounted on the other side of the spools from the brake mechanism on a reciprocating carriage co-operating with a stationary cam track shaped so as to give the grippers the necessary motion to advance to grip the ends of the yarn and then to withdraw. The opening and closing of the grippers may then conveniently also be controlled by pneumatic pressure.

An example of mechanism in accordance with the invention will now be described in more detail by way of example as applied to a form of machine as described in U. S. Patent No. 2,747,647. In the accompanying drawings Figure 1 is an elevation and Figure 2 is an end view of the mechanism.

The mechanism shown is designed to effect the pullout of the yarns at a point other than that at which the tufts are embodied in the fabric so that the motion at that point is correspondingly simplified. The pull-out operation is accordingly carried out at a point where the chain shown in dotted lines at 1 is travelling in a straight line. The chain 1 bears a series of carriers 2, the upper portion of each of which is broken away at 3 for clarity. Each carrier 2 carries a spool 4, the spindle 5 of which is held in a seating 6 in the carrier 2. Each carrier is provided with a pair of rollers 9 running in tracks in members 10 (not shown in Figure 1). These serve to steady the carriers and hence the spools in their movement at this point. Each spool is wound with the required number of lengths of yarn in the usual way, the ends of which are led off the spool through a gate member 7.

The left-hand spool of the three shown in Figure 1 has only a short length 8*a* of yarns projecting from the gate 7. This length of yarn remains projecting when

the yarn has been sheared after the preceding row of tufts has been secured in position. In order to constitute the next row of tufts, a further length of yarn must be pulled out as shown at 8*b* on the other two spools. For this purpose a gripper mechanism indicated generally at 12 is provided and while the yarns are being pulled out, the spools are controlled by a pair of common brakes 13. Each brake extends along the whole length of the spools and comprises a rod 14 mounted at each end on one arm 15 of a bellcrank lever pivoted at 16 to a link 17. The link 17 is provided with a pair of rollers 18 and 19 running in a track 20 in a casting 21 secured to the body of the machine. The link 17 thus constitutes a reciprocating carriage for the two brakes 13 and is caused to reciprocate by means of an arm 22 pivoted to a link 23 at 24. The link 23 in its turn is pivoted to the link 17 at 25.

The arm 22 is rocked in synchronism with the operation of the machine in such a way that the two brakes 13 travel to the right in register with a pair of spools and then return into register with the succeeding pair, after which they move to the right again.

Each of the bellcrank levers has its second arm 30 controlled by means of a connecting rod 31. This rod passes through a bush 32 on each arm 30, while springs 33 exert pressure between the bushes 32 and stops 34 on the rod 31. At its lefthand end, the rod 31 is connected via a pivoted link 35 to a plate 36 pivoted at 37 to the arm 22. The plate 36 is rocked by means of a pneumatic cylinder 38 of which the connecting rod 39 is pivoted to the plate 36 at 40. An adjustable stop 41 bearing against a nose-portion 42 on the top of the plate 36 limits the motion of the plate in a clockwise direction. The pneumatic cylinder 38 moves with the arm 22 as a self-contained unit so that any movements of the connecting rod 39 are translated into rocking movements of the two bellcrank levers and result in the application and freeing of the two brakes 13. By appropriate adjustment of the springs 33, the pressure applied to the two bellcrank levers can be equalised with considerable accuracy so that an equal braking effect is obtained on the two spools even if there are small variations in their relative diameters.

In addition to the two common brakes 13, each spool 4 is provided with an individual brake 50 pivoted at 51 and bearing against the flange of the spool under the control of a spring 52, the brakes being situated at alternate ends of successive spools. During the greater part of the circuit of the chain, each spool is prevented from rotating by means of the brake 50, but it will be understood that the strength of the spring 52 may well vary slightly from spool to spool so that no uniformity of braking effect is obtained. Consequently it is necessary to release each brake 50 during the time when the common brakes 13 are applied and when the fresh lengths of yarn 8*b* are being pulled out. For this purpose each brake 50 is formed with a small lug 53 which co-operates with one of two plates 54 arranged at opposite ends of the spools. The ends of these plates engage the lugs 53 on two successive spools and simultaneously lift the brakes 50 from the flanges of both spools against the effect of the springs 52. The operation is so synchronised that the brakes 13 are applied just before the brakes 50 are released, while the brakes 50 are applied again just before the brakes 13 are released so that at no time are the spools free of control.

During the time when the brakes 13 are applied, the gripper mechanism 12 comes into action to withdraw the further length of yarn 8*b*. The mechanism comprises two sets of grippers, each extending across the whole length of the spools and comprising a fixed jaw 60 and a moving jaw 61 mounted on an axle 62. The axles 62 turn in bearings in a plate 63 and have their angular positions controlled by arms 64 so as to open and close the two sets of grippers. The plate 63 is caused to reciprocate by means of an arm 65 connected to it by means of a pivoted link 66. The arm 65 is pivoted to the frame of the machine at 67 and is rocked by the same mechanism as rocks the arm 22 so that the plate 63 reciprocates in synchronism with the link 17 carrying the brakes 13.

The lower end of each arm 64 is fitted with a roller 68 running in a track 69 having two identical halves so that each of the two rollers has the same motion. The track 69 is formed with two upwardly curved portions 70 so that as the rollers 68 reach these portions, the arms 64, together with the gripper mechanism as a whole, are raised upwardly. The two halves of the track 69 are formed in plates 83 mounted on fulcrum shafts 84. By means of slight rocking adjustment of these shafts, the rise and fall of the gripper mechanism and hence the tuft length can be varied over a small range. When the grippers are closed as shown jn Figure 1, the rollers 68 move with the plate 63 as it reciprocates. An additional movement, however, can be superimposed by means of a connecting rod 71 which is pivotally connected to the lefthand arm 64 and a further extension 72 connected to the righthand arm 64. The connecting rod 71 is pivoted at 73 to a plate 74 in its turn pivoted to the arm 65 at 75. The plate 74 is rocked by means of a pneumatic cylinder 76, of which the connecting rod 77 is pivoted to the plate 74 at 78. The cylinder 76 in its turn is pivoted at 79 to an extension 80 on the shaft 67 so that the cylinder rocks with the arm 65.

Thus when air pressure is applied to the cylinder 76, the plate 74 is rocked in a clockwise direction giving the lower ends of the arms 64 an additional movement to the right in relation to the plate 63, thereby rocking the axles 62 in a counter-clockwise direction, and thereby opening the grippers. Movement of the plate 74 in a clockwise direction is limited by engagement between an adjustable screw 81 and a fixed stop 82 on the arm 65.

In the position shown in Figure 1, the grippers are closed to grip the lengths of yarn 8*b*, having just completed the pull-out operation. The rollers 68 are in their lowermost positions but as soon as air pressure is reversed in the cylinder 76 they are moved to the right to open the grippers, and although the rollers 68 remain at the same level, the effect of the rocking is to bring about a slight lowering of the plate 63 and the gripper mechanism as a whole so that as soon as the mechanism starts to return towards the left, the righthand gripper just clears the lengths of yarn which have been released by the lefthand gripper. As the movement to the left continues, the rollers 68 ride up the portions 70 and the gripper mechanism rises to bring it into engagement with the short lengths of yarn 8*a* projecting from the next pair of spools. When the gripper mechanism reaches the lefthand limit of its travel, the rollers 68 lie just to the right of the uppermost point of the portion 70 owing to the fact that they have previously been displaced in relation to the plate 63 in order to open the grippers. In this position the fixed jaws 60 of the grippers are instantaneously in register with the lower ends of the lengths of yarn 8*a* which are to be pulled out. At this point the gripper mechanism starts to move to the right and simultaneously air pressure is reversed in the cylinder 76 to close the grippers. This moves the rollers 68 to the left bringing them to the tops of the portions 70 and raising the plate 63 as a whole. In this way the grippers simultaneously rise and close to grip the lengths of yarn 8*a*.

During movement to the right the rollers 68 fall and the corresponding downward movement of the gripper mechanism as a whole withdraws the lengths of yarn 8*a* until they reach the length 8*b* as seen in Figure 1. Once this position has been reached, the grippers open again as previously described and return ready for the next pair of spools.

The operation of the gripper mechanism is, of course, accurately synchronised with the operation of the brakes

and the sequence of steps may be summarised as follows. During the interval when the grippers are closing, the common brakes 13 are applied and shortly afterwards the individual brakes 50 are released, this release being completed just before the closing of the grippers is complete. During the next period of time, the grippers are withdrawing the lengths of yarn 8*b* and the common brakes 13 are in operation, while the individual brakes 50 are released. Immediately after the drawing operation is complete the individual brakes 50 are again applied and very shortly after this the common brakes 30 are released. Simultaneously with the raising of the brakes 13, the grippers start to open and the final stage is the return movement both of the brakes and of the grippers, the latter having to clear the pulled-out lengths of yarn as previously described.

In order to achieve this sequence of operations with accuracy, the mechanism must be very carefully adjusted and will require to be run very slowly for checking purposes. Since it is difficult to correlate the operation of the two pneumatic cylinders 38 and 76 with that of the other moving parts under conditions of slow operation, the plate 36 is provided with a roller 85 and the plate 74 is provided with a roller 86. These co-operate with restrictor cam surfaces 87 and 88 respectively secured to rails 89 and 90. These two surfaces are operative during the instants when the brakes are being applied and when the grippers are being closed and ensure that that pneumatically controlled operations are accurately synchronised with the remainder of the motion.

I claim:

1. A machine for the production of fabric having a tufted surface in which tufts of yarn from a plurality of spools each having a plurality of lengths of yarn wound thereon are attached to a backing, comprising a chain having mounting means for supporting said spools with the ends of said lengths of yarn projecting, a plurality of means supporting said chain in a closed circuit, means for driving said chain around said closed circuit, means for driving said backing in a path adjacent a run of said chain, means for giving each successive said mounting means the composite motion necessary for embodying said yarn ends in said backing, means for securing said yarn ends to said backing, means for severing said yarn ends, means for withdrawing fresh lengths of yarn from each successive spool, a first brake, mounting means for said first brake, said mounting means including means for applying said first brake to each successive spool simultaneously with the application of said means for withdrawing lengths of yarn from each spool and for releasing said first brake after the lengths of yarn are withdrawn from each spool.

2. A machine according to claim 1, in which each spool is fitted with a second brake which is released when the first brake is applied.

3. A machine according to claim 2, in which the pull-out of the yarns occurs at a point other than that at which the tufts are embodied in the fabric, being brought about by means of a gripper mechanism operating in synchronism with the first brake.

4. A machine according to claim 3, in which the first brake is mounted on a reciprocating carriage so as to advance with a spool or group of spools and then to return ready for operation with the next spool.

5. A machine according to claim 4, in which the brake comprises a rod mounted at each end on one arm of a bellcrank lever, the other end of which is rocked under pneumatic pressure to apply and release the first brake.

6. A machine according to claim 5, in which the gripper mechanism is mounted on the other side of the spools from the brake mechanism on a reciprocating carriage co-operating with a stationary cam-track shaped so as to give the grippers the necessary motion to advance to grip the ends of the yarn and then to withdraw.

7. A machine according to claim 6, in which the opening and closing of the grippers is controlled by pneumatic pressure.

8. A machine according to claim 7, in which a pair of first brakes are mounted on a reciprocating carriage above a straight run of the spool chain, while a pair of sets of grippers are mounted on a reciprocating carriage below the chain.

References Cited in the file of this patent

UNITED STATES PATENTS

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2,711,777	Brinton	June 28, 1955