Aug. 31, 1965 G. D. DEDMON 3,203,378

APPARATUS FOR AND METHOD OF FEEDING YARNS AT VARYING RATES

Filed June 13, 1960 3 Sheets-Sheet 1

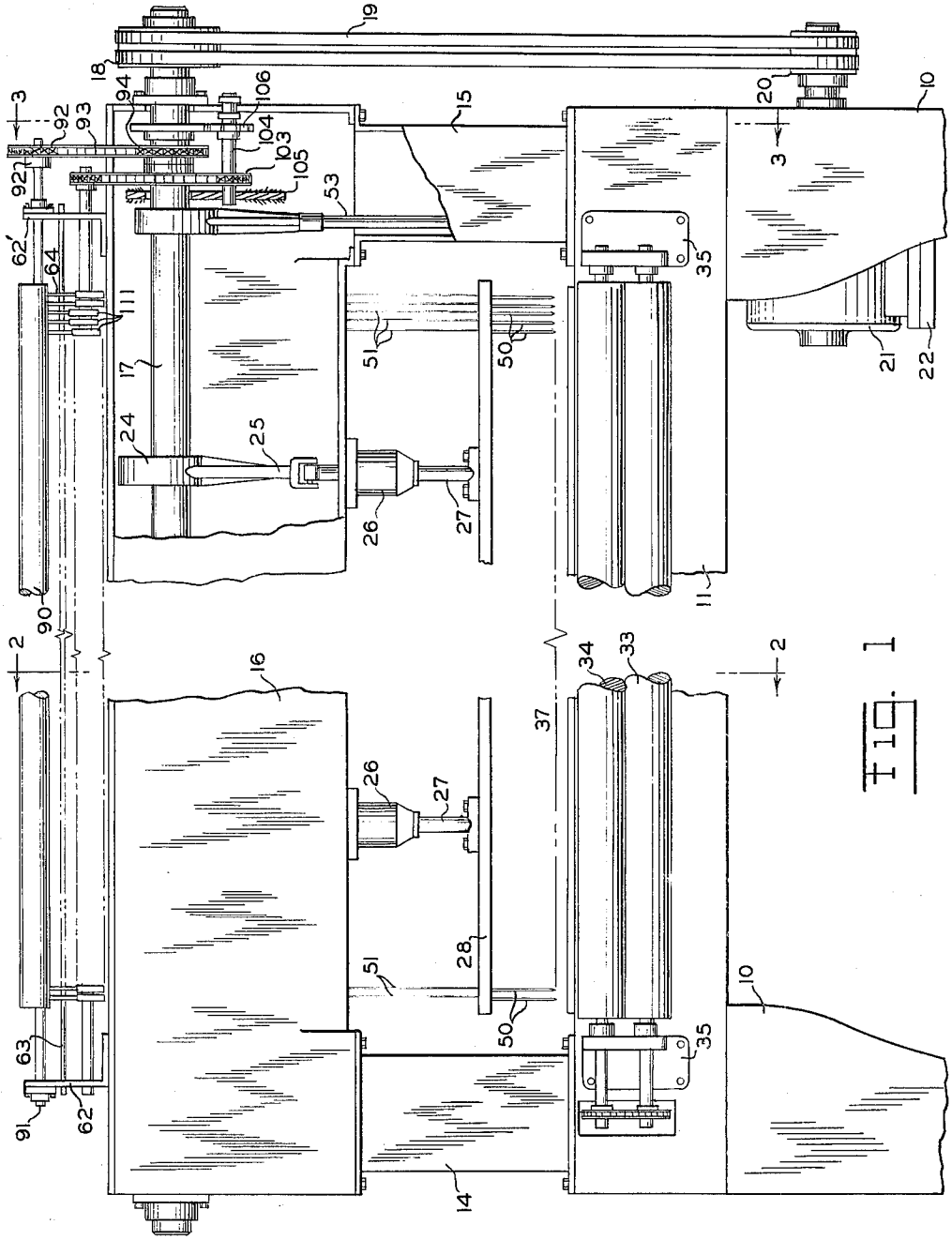


FIG. 1

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APPARATUS FOR AND METHOD OF FEEDING YARNS AT VARYING RATES

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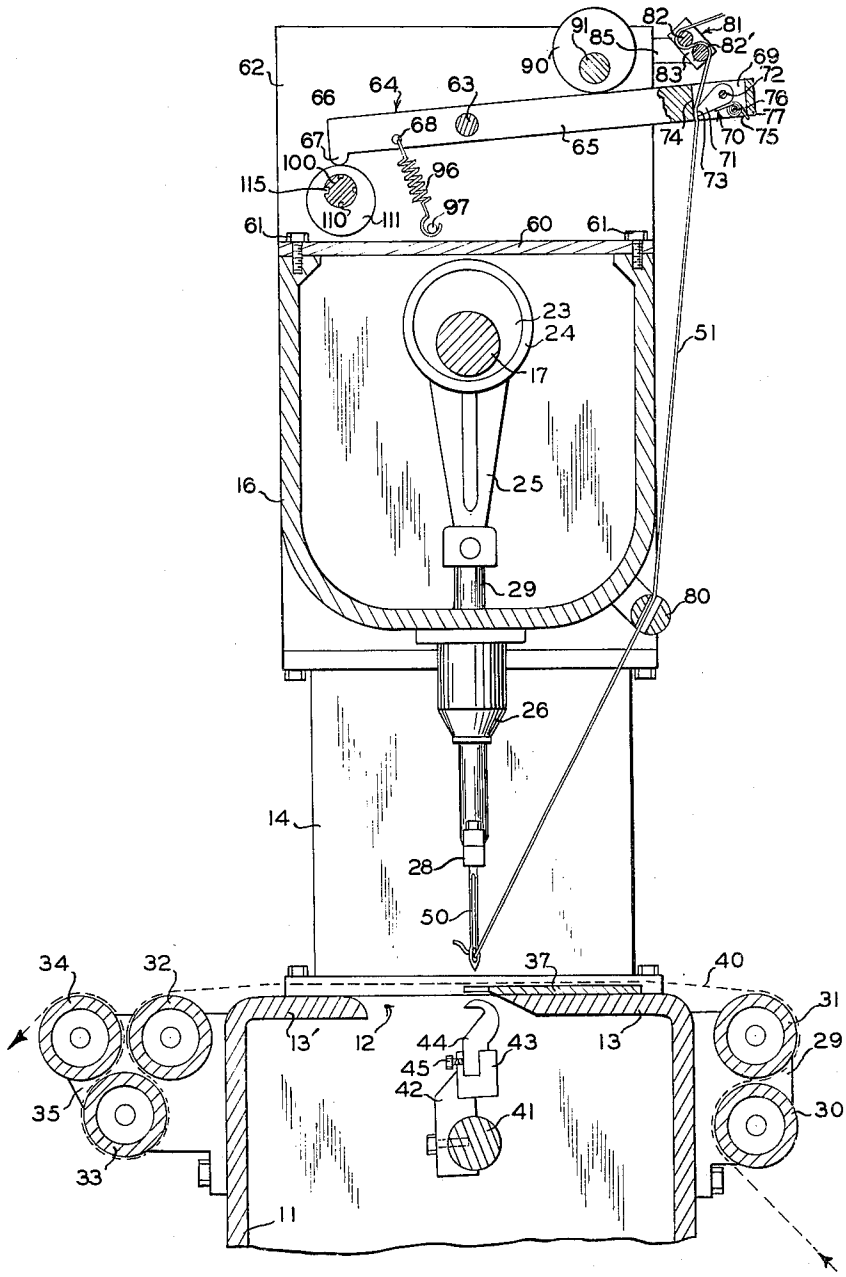


FIG. 2

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Aug. 31, 1965 G. D. DEDMON 3,203,378

APPARATUS FOR AND METHOD OF FEEDING YARNS AT VARYING RATES

Filed June 13, 1960 3 Sheets-Sheet 3

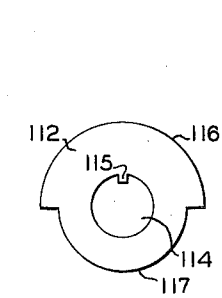


Fig. 4

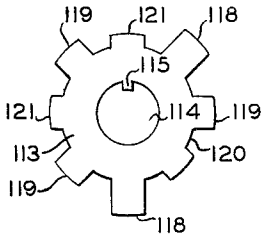


Fig. 5

Fig. 3

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United States Patent Office 3,203,378 Patented Aug. 31, 1965

3,203,378

APPARATUS FOR AND METHOD OF FEEDING YARNS AT VARYING RATES

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Filed June 13, 1960, Ser. No. 35,507
13 Claims. (Cl. 112—79)

This invention relates to apparatus for and method of feeding yarns at varying rates and is more particularly concerned with a pattern attachment particularly suited for a multi-needle tufting machine so as to feed yarns at varying rates to the needles to produce a predetermined pattern of multi-height loops in a base fabric.

In the past many and various devices have been devised for producing a predetermined design in a loop pile base fabric by varying the heights of the various loops. The best known of such devices include the developments of John H. Boyles and Joe H. Nix; however, there have been quite a number of other machines which accomplish substantially the same purposes developed. These machines take the forms of intermeshing slats, arrest solenoids and cam controlled mechanisms which laterally deviate the yarns as they are fed to the needles.

Certain of the prior art devices are extremely expensive to manufacture or will sew only the high or low loops. Certain of the devices, while sewing multi-height loops, require substantially a complete change in pattern attire in the pattern attachment in order to change the pattern produced. Certain of the devices require that the machine be rethreaded whenever a break occurs in the yarn or whenever the yarn is exhausted on the creel. Certain of the devices are limited in the patterns which may be produced therefrom, requiring a repeat pattern transversely of the machine or that one control mechanism control a multiplicity of yarns simultaneously so that each yarn so controlled will produce an identical pattern longitudinally of the fabric. Certain of the devices impart a ripple transversely of the fabric when the control mechanisms are shifted. Certain of the devices are not well adapted to standard tufting machines. Certain of the devices require that each needle sew a fixed ratio of long and short loops. Certain of the devices do not produce uniform length loops when such uniform length loops are dictated by the pattern attachment. Certain of the devices require accurate settings which are apt to get out of adjustment and thereby vary from the prescribed pattern in the event that the adjustments are not accurately made. Certain of the attachments require accurate alignment of the yarn as well as accurate and precise spacing between interrelated parts.

Briefly, the present invention attempts to overcome the disadvantages enumerated above and yet provide an inexpensive, versatile pattern attachment wherein the prescribed pattern may be changed readily and quickly. The mechanism of the present invention includes as an attachment for a standard loop pile tufting machine, a plurality of rocker arms which are individually rocked back and forth at varying amplitudes, dictated by the prescribed pattern to be produced on the base fabric. Yarns are fed by the rocker arms according to their varying amplitudes to the respective needles and hence will rob the preceding loops sewn by the needles, according to the prescribed pattern. The feed mechanisms of the various rocker arms are unidirectional feed members which do not permit the creel to backdraw the yarns while at the same time providing sufficient tension to the yarns that the needles on their downstroke, rob the preceding loops in preference to drawing yarn from the creel.

Accordingly, it is an object of the present invention

to provide a pattern attachment for producing a multiplicity of loop heights in a pile fabric as the tufts are produced by the multi-needle tufting machine in the base fabric.

Another object of the present invention is to provide in a multi-needle tufting machine, a pattern attachment which will feed the yarns under close control and, although it is simple in construction, the mechanism can be used to determine the height of every pile element in an area of the fabric carrying a repeat pattern.

Another object of the present invention is to provide a novel method and mechanism for feeding yarns at varying rates in accordance with a prescribed pattern.

Another object of the present invention is to provide a mechanism which will control the links of successive small feed increments of a large number of yarns being fed and a mechanism which is particularly suitable for use in the production of pile fabrics having different pile heights.

Another object of the present invention is to provide an attachment for a multi-needle tufting machine which will produce rapidly and at low cost a loop pile tufted fabric wherein a multiplicity of yarn heights are produced.

Another object of the present invention is to provide an attachment for feeding yarns which is inexpensive to manufacture, durable in structure and efficient in operation.

Other and further objects, features and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings wherein like characters of reference designate corresponding parts throughout the several views and wherein:

FIG. 1 is a front view, partially broken away, of a multi-needle tufting machine with a pattern attachment produced according to the present invention.

FIG. 2 is a cross sectional view taken along line 2—2 in FIG. 1.

FIG. 3 is a cross sectional view taken along line 3—3 in FIG. 1.

FIG. 4 is a side elevational view of a detail showing one of the cams employed in the machine illustrated in FIG. 1.

FIG. 5 is a view similar to FIG. 4, showing another form of a cam utilized in the machine illustrated in FIG. 1.

Referring now in detail to the embodiment chosen for the purpose of illustrating the present invention, it being understood that the drawings depict but one of the embodiments of the present invention and that it is not intended that the invention, in its broader aspects, be limited to the exact details herein depicted, the present invention is illustrated as being used in conjunction with a sewing machine, since all of the advantages of the new feed mechanism are realized in its use therewith.

In the drawings, numeral 10 denotes the legs of a multi-needle tufting machine supporting a transverse cross bed 11 which is hollow having a transverse upper opening 12 between its inwardly turned opposed upper flanges 13, 13'. Mounted at opposite ends of the cross bed 11 are upstanding stanchions or end frames 14 and 15 which support a cross head member 16 within which extends the horizontal overhead drive shaft 17 appropriately supported by bearings. The shaft 17 extends outwardly of the end of the cross head member 16 and is provided with a pulley 18 around which are continuous V-belts 19. The V-belts 19 are, in turn, driven by pulley 20 connected to the shaft of a motor 21. The motor 21 is supported on a bracket 22 extending from one of the legs 10.

Along the shaft 17 there are provided a plurality of eccentrically mounted circular cams, such as cam 23 in FIG. 2. Each cam is concentric with respect to the other similar cams and receives a connecting rod bearing, such as bearing 24, from which extends the connecting rod 25. The cross head member 16 is provided with a plurality of spaced, downwardly extending journal members 26 which receive for slidable movement needle bar supporting rods 27. The upper end of the supporting rods 27 are pivotally joined to the ends of the connecting rods 25 while the lower ends of the supporting rods 27 support a transverse needle bar 28 above the upper opening 12.

Upon rotation of motor 22, the belts 19 will rotate through pulley 18, the drive shaft 17 and thereby reciprocate through cams 23 the connecting rods 25. The reciprocation of connecting rods 25 will reciprocate the supporting rods 27 which reciprocate in a vertical path the needle bar 28.

Mounted on one side of the cross bed 11 and being supported by appropriate brackets 29 are the two infeed rolls 30 and 31. The outfeed rolls 32, 33 and 34 extend from the opposite side of the cross bed 11 and are supported between brackets 35. The rolls 30, 31, 32, 33 and 34 are driven in conventional manner, the infeed rolls 30 and 31 being driven at slightly less peripheral speed than the outfeed rolls 32, 33 and 34 so as to maintain the base fabric 40 in tension across the cross bed 11 and over the conventional bed plate 37, the bed plate 37 being located on flange 13 and extending over a portion of the opening 12.

Below the bed plate 37 is the loop pile looper shaft 41 with its spaced radially extending struts, such as strut 42, which support the looper receiving blocks, such as block 43. The conventional loop pile loopers, such as looper 44, are retained by the blocks, such as block 43, the looper 44 being fixed in place by a set screw 45.

A plurality of transversely aligned needles 50 corresponding to the number of loopers 44 are carried by the needle bar 28 so as to insert loops of yarns 51 through the base fabric 40, the loops being engaged by the loopers, such as looper 44, and temporarily held as the needles 50 are withdrawn.

It will be understood by those skilled in the art that a suitable pitman 53, in FIG. 3, is adapted to rock the loop pile looper shaft 41 back and forth, the pitman 53 being connected to shaft 41 through a lever 54. Pitman 53 is connected to the main drive shaft 17 through an eccentric cam (not shown) in the usual way.

The mechanism heretofore described is conventional in most multi-needle tufting machines and hence those skilled in the art will understand the purposes and construction of the various components.

Yarn feeding attachment

In the modern multi-needle tufting machine there is provided an essentially flat access plate 60 along the upper surface of the cross head member 16, the access plate 60 being retained by bolts, such as bolt 61. According to the present invention, a pair of spaced upstanding brackets 62, 62' are mounted on plate 60 above the stanchions 14 and 15. Mounted centrally between the brackets 62, 62' is the rocker arm supporting shaft 63 on which are carried a plurality of rocker arms corresponding to the number of needles 50, the rocker arms being denoted generally by numeral 64. The shaft 63 acts as a fulcrum about which each rocker arm 64 is rotatable through a limited arc. As seen in FIG. 2, each rocker arm has a forward arm portion 65 on one side of the shaft 63 and a rear arm portion 66 on the diametrical opposite side of the shaft 63. In the preferred embodiment of the present invention, the rocker arm 64 is preferably a flat thin straight metal member having a sensing finger 67 extending from the lower end of the arm portion 66 and a spring receiving aperture 68 between the finger 67 and the

shaft 63. At the other end or arm portion 65, there is a vertical aperture 69 within which is the unidirectional yarn feed member denoted generally by numeral 70.

The function of the unidirectional feed member 70 is to feed the yarn 51 downwardly as the rocker arm 64 is pivoted in a clockwise direction, as seen in FIG. 2, and to slide upwardly along the yarn as the rocker arm 64 is pivoted in a counterclockwise direction, as seen in FIG. 2. To accomplish this purpose, I have provided a yarn arrest finger 71 which is pivotally mounted by one end to a horizontally extending pin 72 mounted centrally of aperture 69. From the pin 72 the finger 71 tapers inwardly and downwardly to a blunt point 73, the distance from pin 72 to point 73 being greater than the distance from pin 72 to the inner wall 74 defining the aperture 69. The inner wall 74 is generally about normal to the axis of rocker arm 64 and serves as an abutment against which the yarn 51 is yieldably or resiliently urged by the finger 71. For urging the finger 71 in a clockwise direction as seen in FIG. 2, whereby the finger urges the yarn 51 against the wall 74, a pigtail spring 75 is wound around a pin 76 carried within aperture 69 below the finger 71. The ends of the spring 75 project outwardly therefrom and respectively engage the lower surface of finger 71 and the lower corner of the outer wall 77 defining the aperture 69. Thus it is seen that the finger 71 is at all times urged toward the wall 74 and upon rotation of the finger in a counterclockwise direction as viewed in FIG. 2, the space between the wall 74 and the point 73 will be increased to apply a minimum clamping force to the yarn 51, while if the finger is rotated in the opposite direction, the space is decreased to apply a maximum clamping force to the yarn 51. Since the spring 75 urges the finger 71 in a clockwise direction, the finger 71 will clamp the yarn 51 against the wall 74 and upon the application of tension on the yarn 51 above the finger 71, the finger will be urged in a clockwise direction tending to bind the clamped increment of yarn and clamp it more firmly or with a minimum clamping force against the wall 74. On the other hand, if the yarn is pulled downwardly below finger 71, the finger will tend to be rotated in a counter-clockwise direction against the force of spring 75 and thereby the space between the wall 74 and the point 73 will be increased to apply a minimum clamping force to the clamped increment of yarn 51 and permit the yarn 51 to thus be drawn downwardly.

From FIG. 2 it will be observed that the rocker arm 64 is of such dimensions that the feed member 70 is located in a vertical plane outwardly adjacent the cross head member 16 and such that when the yarn 51 is fed through the yarn feed member 70 it projects in a generally downwardly direction, being guided through a yarn guide bar 80 mounted at the lower outer corner of the cross head member 16. Thence the yarn 51 is fed to the needle 50.

Extending across all of the yarn feed members, such as member 70, is a yarn tensioning device denoted generally by numeral 81. The function of the yarn tensioning device 81 is to impart sufficient arresting force to the yarns 51 that they will not be drawn by the needles 50 except as prescribed by the pattern attachment. In other words, the yarn tensioning device 81 imparts sufficient frictional arresting force to the yarns 51 that the force necessary to draw the yarns 51 downwardly through the unidirectional feed member 70 exceeds the force required to backdraw a preceding loop sewn in the base fabric 40 and hence upon the downstroke of a needle 50 the yarn from a preceding loop will be robbed in preference to the pulling of the yarn through the unidirectional feed member 70.

Preferably the yarn tensioning device 81 which yieldably arrests the feed of the yarns 51 at all times includes a pair of spaced parallel bars 82, 82' which are joined together at their ends by supporting plates 83, 83'. Outwardly of the bars 82, 82' and midway therebetween each of the end plates 83, 83' is provided pivot pins, such as pin 84, journaled by brackets 85, 85', respectively. Thus,

upon rotation of the yarn arresting device 81, the tension applied to all yarns 51 may be varied as desired.

For rocking each rocker arm 64 in unison downwardly as the needles 50 are moved downwardly and thereby overcome the arresting force imparted to the yarns 51 by the yarn tensioning device 81, a long eccentrically mounted cam roller 90 extends over all of the outer arm portions, such as portion 65, the cam roller 90 being mounted eccentrically on a shaft 91 journaled by brackets 62, 62'.

As best seen in FIG. 3, the shaft 91 is provided with a sprocket 92 outwardly of bracket 62'. A continuous chain 93 extends around the sprocket 92 and also around a sprocket 94 on main drive shaft 17. By such an arrangement, the shaft 91 is driven at identically the same speed as the shaft 17 and therefore, the cam roller 90 will be driven in synchronization with the reciprocation of the needles 50. Thus, all of the rocker arms, such as rocker arm 64, will be urged downwardly, e.g., in a clockwise direction as the needles 50 penetrate the base fabric 40.

For urging each of the rocker arms 64 in a counterclockwise direction each rocker arm 64 is provided with a spring, such as spring 96, one end of which loops through the aperture 68 and the other end of which is suitably anchored below the rocker arm 64 such as on a shaft 97 extending between brackets 62, 62'.

Extending below all of the fingers, such as finger 67, is a cam shaft 100 journaled by brackets 62, 62'. An intermittent drive mechanism for rotating intermittently the shaft 100 from shaft 17 is best seen in FIG. 3. In more detail, shaft 100 outwardly of shaft 62' is provided with a sprocket 101 around which is a continuous chain 102. The chain 102 is driven by a sprocket 103 on a short shaft 104 journaled by a bulkhead 105 and the end of cross head member 16 as illustrated best in FIG. 1, the bulkhead 105 extending transversely within the cross head member 16. On the shaft 104 is a segment gear 106 having widely spaced recesses 107 along the periphery thereof. A single tooth gear 108 on shaft 17 meshes with the gear 106, its single tooth projecting into one of the recesses 107 upon each revolution of shaft 17. The construction and arrangement of gears 106 and 108 is such that the shaft 100 is rotated only during that portion of the cycle when the needles are projecting through the fabric and when the cam 90 is urging the rocker arms 64 downwardly in a clockwise direction.

As will be observed in FIG. 2, the shaft 100 is provided with a plurality of radially spaced longitudinally extending keyways 110. A plurality of cams, such as cams 111, 112 and 113, are adapted to be removably retained by the shaft 100, each cam being provided with a central opening 114 and an inwardly protruding detent 115 which is received in one of the keyways 110 on shaft 100. Each of the cams 111, 112 and 113 is provided with peripheral areas which are at varying distances from the center of the cam. For example, in FIG. 4 cam 112 is provided with a high peripheral area 116 and a low peripheral area 117. In FIG. 5, cam 113 is provided with a high peripheral area 118, intermediate peripheral area, such as area 119, and low peripheral area, such as area 120. For each rocker arm there is a cam provided on shaft 100; it will be understood, however, that any configuration cam may be employed and that the cams 111, 112 and 113 are by way of illustration of the type cams which may be employed. The cams, such as cams 111, are arranged respectively beneath the fingers, such as finger 67 of the rocker arm 64. Thereby as the rocker arm 64 is urged by spring 96 in a counterclockwise direction, it will strike the upper surface of its cams 111 to thereby limit the upward or counterclockwise movement of the rocker arm 64. The distance from the center of shaft 100 to the upper surface of the cam 111 determines the amplitude of stroke of the rocker arm 64 and therefore determines the amount of yarn fed to the needle 50 upon each cycle of the machine. If there is a relatively short distance from the center of shaft 100 to the upper surface of the cam, such as cam 111, the arm, as at 65, will approach very close to the cam roller 90 in the position shown in FIG. 2 and hence the yarn feed member 70 will be raised to a greater extent than it would be raised if the distance from the center of shaft 100 to the upper surface of the cam, such as cam 111, were greater. Thus, if a cam, such as shown in FIG. 5, is employed and the area 118 is upright on the shaft 100, the amount of rotation in a counterclockwise direction of the associated rocker arm 64 would be very limited. Thus, the yarn feed member 70 would be raised to a lesser extent than if an area, such as area 121, were upright.

Operation

From the foregoing description, the operation of the present invention should be apparent. The various yarns 51 are fed from a suitable creel to the tensioning device 81 by passing around bar 82 and over bar 82'. Thence, the yarns 51 are fed through the respective feed members 70 on the respective rocker arms 64 and down through the respective apertures in guide bar 80. Thereafter, the yarns are fed to the respective needles 50. The base fabric 40 is passed as shown in broken lines in FIG. 2 around feed roll 30 and thence around feed roll 31 and across the base plate 37 and the cross bed 11 to the rolls 32, 33 and 34, respectively.

During the process of setting up the machine, a plurality of cams, such as cams 111, 112 and 113, are successively placed on the shaft 100 and are spaced apart by suitable spacers (not shown) so that the various cams are beneath the respective rocker arms 64. These cams on shaft 100 define a prescribed pattern of high, intermediate and low loops to be sewn.

Next, the motor 21 is energized which rotates the main drive shaft 17. Thus, the needle bar 28 begins its reciprocation whereby the needles 50 simultaneously insert loops of yarn through the base fabric 40 to form successive transverse rows of loops in which the loops formed by a single yarn are longitudinally aligned along the base fabric. This is accomplished because the rolls 31, 32, 33 and 34 gradually move the base fabric beneath the needles as the needles are reciprocated. Upon each downstroke of the needles, as the needles approach their bottom dead center position, the loopers, such as looper 44, move between the respective needles 50 and the yarns 51 to engage and hold temporarily the loops as they are being formed and as the needles 50 are withdrawn from the base fabric. Simultaneously therewith the shaft 17 rotates through chain 93, the shaft 91 which, in turn, rotates the cam roller 90 so as to move simultaneously all of the rocker arms 64 downwardly or in a clockwise direction, each such rocker arm being moved downwardly to a predetermined position.

On the upstroke of needles 50, the cam roller 90 is being rotated upwardly so as to permit the springs, such as spring 96, to return the various rocker arms 64 to their original position. On this upstroke, however, certain of, or all of the fingers, such as finger 67, engage the upper surfaces of their respective cams 111 which limit, respectively, the amount of counterclockwise rotation or upstroke of the various rocker arms 64. Those rocker arms 64 whose associated fingers 67 engage relatively high areas on the cams 111 will be prevented from rotating through as large an arc in a counterclockwise direction as the other rocker arms 64 which through fingers engage lower portions on their respective cams 111; and hence as the cam roller 90 approaches its upmost position, certain of the rocker arms 64 will be held at various distances spaced from the surface of the cam roller 90. On the subsequent downstroke of the cam roller 90, it will be seen that roller 90 first engages those rocker arms 64 whose fingers, such as finger 67, engage relatively low areas on the cams 111 and will carry them downwardly

in a clockwise direction before engaging other rocker arms 64 whose fingers have engaged intermediate height areas on their cams 111 and will finally engage those rocker arms 64 whose fingers, such as finger 67, engage relatively high areas on their cams 111. Thus, the amplitude of stroke of the various rocker arms 64 is dictated by their respective cams 111. With a relatively short amplitude of stroke for a particular rocker arm 64, its feed member 70 will urge its yarn 51 downwardly only a relatively short distance and an amount of yarn 51 will be fed to the needle, less than the requirement of the needle and hence, as the needle moves downwardly, it will rob the yarn necessary to form a predetermined height of loop from the preceding loop formed, it being understood that the tensioning device 81 is so adjusted that in cooperation with the finger 72 it will prevent the yarn from being drawn from the creel during the downstroke of the needle except insofar as the feed member 70 dictates.

During the time that the cam roller 90 is urging all rocker arms 64 in a clockwise direction or downwardly, all of the fingers, such as finger 67, are lifted from the cams 111. Thus, during the period that the needles 50 are penetrating the base fabric 40, and being withdrawn therefrom, all fingers 67 are withdrawn from the cams 111 and hence the cams will not effect the stroke of the various rocker arms during this portion of the cycle of the machine. During such portion, however, the cams are all simultaneously rotated through a slight arc so that upon the subsequent portion of the cycle of the machine, the various cams may prescribe the pattern to be sewn upon a subsequent downstroke of the needles 50. When the shaft 100 completes one revolution, the pattern prescribed by the cams 111 will repeat itself. If it is desired to elongate the pattern, a gear 106 with more recesses 107 is substituted for the gear 106 which the machine was using. On the other hand, if it is desired to condense the pattern longitudinally of the fabric, a gear 106 having fewer recesses 107 should be installed on the machine. Also, it will be understood by those skilled in the art that more than one cog may be employed on the gear 108 to more rapidly rotate the shaft 100.

The theory upon which the present invention operates is that the yarns 51 are fed from a supply, such as a creel (not shown), along a predetermined path defined by yarn tensioning device 81 and the yarn guide bar 80. The needles 50 when operating and the tensioning device 81 stretch the yarns 51 between these two points most of the time. Between the yarn tensioning device 81 and the yarn guide bar 80 are the yarn feed members 70 which are reciprocated in synchronization and in the same direction with the needles 50, the rocker arms 64 and cam roller 90 forming a driving means for the yarn feed members 70. The fingers 71 are inclined downwardly and inwardly so as to exert a maximum holding force or clamping force on the yarns 51 when the yarn feed members 70 are moved downwardly toward the needles and exert a minimum clamping or holding force on the yarns when the yarn feed members 70 are moved upwardly or away from the needles. The holding force of the yarn tensioning device 81 is greater than the tension applied by the creel in tending to backdraw the yarns 51 and less than the maximum holding force. Hence the yarns 51 will move downwardly upon each downward stroke of a feed member 70 by an amount proportional to the amplitude of that feed member 70. The holding force exerted on the yarns 51 by a needle 50 and the fabric 40 is less than the minimum holding force of the feed member 70 plus the holding force of the yarn tensioning device 81 and is greater than the minimum holding force of the yarn feed member 70. Hence there is sufficient tension on all yarns 51 to backdraw from the preceding loop, in the event no yarns are positively fed to the needles. Further, even with the yarn feed member 70 operating, no yarn is drawn through the yarn feed member 70 except upon upward movement of the yarn feed member 70. When insufficient yarn is fed to the needle 50, it will rob the preceding loop on its downstroke in preference to pulling yarn from the creel.

The yarns 51 between the yarn guide bar 80 and the yarn tension device 81 are essentially parallel to each other and parallel to the path of travel of the needles 50, the paths of travel of the yarns 51 between the two places, namely, yarn guide bar 80 and yarn tensioning device 81, being essentially linear. The paths of travel of the yarn feed members 70, while being arcs, are also essentially linear, the maximum amplitude of travel of the yarn feed members 70 being equal to the length of yarn 51 required to produce a loop of maximum height. The frequency of oscillation of all yarn feed members 70 are essentially uniform or constant and synchronized with the reciprocation of the needles 50. This amplitude, however, is damped in varying amounts according to the pattern prescribed by the fingers 67 striking raised portions on discs or cams 115. Therefore, not only is the amplitude of reciprocation reduced for various yarn feed members 70 in accordance with the pattern, but the time in which the feed members 70 pull the yarns 51 and the distance the yarns 51 are pulled from the yarn tensioning device 81 are varied during successive cycles since the period of downward pull is the function of amplitude and frequency and the distance traveled by feed members 70 is the function of amplitude.

It will be obvious to those skilled in the art that many variations may be made in the embodiment here chosen for the purpose of illustrating the present invention without departing from the scope thereof as defined by the appended claims.

I claim:

1. In a feed mechanism of the class which feeds yarns at varying rates to a plurality of reciprocating needles as said needles are reciprocated comprising a plurality of grasping and advancing means for grasping increments of said yarns and advancing the gripped increments of said yarns toward said needles, means for reciprocating all of said means for advancing said yarns in synchronization with the reciprocation of said needles and means for damping the reciprocation of said means for advancing said yarns according to a prescribed pattern.

2. In a method of forming patterns with pile loops in a base fabric, comprising inserting a plurality of yarns through a base fabric to a uniform predetermined depth to form a first row of pile loops, pulling from a supply along a normal path during a yarn feeding period yarns for the successive formation of additional pile loops and repeating the loop forming operation; the steps of applying sufficient tension to said yarns supplied to the needles to rob yarns from all the next preceding loops, and positively pulling the yarns with sufficient force for overcoming during said yarn feeding period said tensions in varying amounts corresponding to the demands of a prescribed pattern whereby loops of varying heights are formed.

3. In a method of feeding varying amounts of yarn, applying a holding force to said yarn at spaced intervals along a path of travel of said yarn, grasping a first increment of said yarn between said spaced intervals, urging said increment a first predetermined distance in one direction along said path of travel of said yarn to thereby feed said yarn a predetermined length corresponding to the distance said yarn is urged in said one direction, releasing said first increment and grasping a second increment of yarn between said intervals, and urging said second increment a second predetermined distance different from said first predetermined distance to thereby feed said yarn a predetermined different length corresponding to said second predetermined distance.

4. In a method of feeding varying amounts of yarn, passing said yarn from a supply along a path, resisting

the movement of said yarn at one place along said path, holding said yarn beyond said one place and pulling said yarn along an essentially linear path by the held portion away from said one place, releasing said held portion, holding a subsequent portion of said yarn, repeating the pulling operation while varying the distance which the yarn is pulled according to a prescribed pattern.

5. A feed mechanism comprising a reciprocatable yarn feed member for feeding yarn engaged thereby upon reciprocation of said feed member adjacent the path of said yarn, said yarn feed member applying a maximum holding force to an increment of said yarn when said yarn feed member is moved in a forward direction along said path and a minimum holding force when said yarn feed member is moved in a rearward direction along said path, means for engaging said yarn in its path rearwardly of said yarn feed member for applying a holding force to said yarn less than said maximum holding force, and means for engaging said yarn in its path forwardly of said yarn feed member for applying a holding force to said yarn greater than said minimum holding force, and means for varying the amplitude of reciprocation of said yarn feed member.

6. In a tufting machine of the class having a plurality of reciprocating needles which pass yarns through a base fabric to form tufts therein, the yarns passing from a supply to said needles along a predetermined path, the combination therewith of drive means reciprocated in synchronization with said needles adjacent said predetermined path of said yarns and feed means carried by said drive means and engaging said yarns for clamping said yarns only when said drive means moves said feed means toward said needles to urge predetermined lengths of said yarns toward said needles and for sliding along said yarns when moved by said drive means away from said needles, and means for varying according to a predetermined pattern the distance along said predetermined path which said drive means moves said feed means.

7. In a tufting machine of the class having a plurality of needles and main drive shaft within said cross head member for reciprocating a plurality of needles for the insertion of yarns carried by said needles through a base fabric to form transverse rows of loops as said base fabric is moved beneath said needles and wherein looper means engage the loops and said yarns are passed in essentially parallel paths adjacent said cross head, the combination therewith of a plurality of rocker arms disposed on the top of said cross head member, a common pivot shaft carried by said cross head member and extending parallel to said main shaft, said rocker arms being pivotally mounted on said pivot shaft, said rocker arm projecting across said cross head member, unidirectional yarn feed members carried respectively by the ends of said rocker arms for engaging said yarns in said paths passing adjacent said cross head member, a yarn tension device above said yarn feed members over which said yarns pass, a yarn guide bar below said yarn feed members and through which said yarns are fed, means synchronized with the rotation of said main drive shaft for rocking said rocker arms back and forth at a uniform amplitude so as to reciprocate said yarn feed members upon each cycle by amounts sufficient to feed a full feed of yarn to said needles for the travel of the needles, a pattern member arranged below the other ends of said rocker arms, and means for indexing said pattern member in timed relationship to the movement of fabric beneath said needles, said pattern member having areas of different heights for engagement by said other ends of said rocker arms upon rocking of said rocker arms whereby the amplitude of rocking of said rocker arms is decreased in accordance with the variation in height of said areas to thereby proportionally decrease the feed of yarns by said feed members.

8. In a tufting machine of the class having a plurality of needles and a main drive shaft within a cross head member for reciprocating said plurality of needles for the insertion of yarns carried by said needles through a base fabric to form transverse rows of loops as said base fabric is moved beneath said needles and wherein looper means engage the loops, the combination therewith of a plurality of rocker arms pivotally connected to said tufting machine, unidirectional yarn feed members constructed to feed yarns in only one direction and carried respectively by the ends of said rocker arms for engaging said yarns to feed the same toward said needles, means synchronized with the rotation of said main drive shaft for reciprocating said rocker arms a uniform amplitude such as to reciprocate said yarn feed members upon each cycle by amounts sufficient to feed yarns to said needles for a full feed for the travel of the needles, a pattern member arranged adjacent said rocker arms, and means for indexing said pattern member in timed relationship to the movement of fabric beneath said needles, said pattern member having areas of different heights for engagement by said rocker arms upon reciprocation thereof whereby the amplitude of reciprocation of said rocker arms is decreased in accordance with the variation in height of said areas to thereby proportionally decrease the feed of yarns by said feed members.

9. In a tufting machine of the class having a plurality of needles and a main drive shaft within a cross head member for reciprocating said plurality of needles for the insertion of yarns carried by said needles through a base fabric to form transverse rows of loops as said base fabric is moved beneath said needles and wherein looper means engage the loops, the combination therewith of a plurality of rocker arms, a common pivot shaft extending parallel to said main shaft, said rocker arms being pivotally mounted on said pivot shaft, unidirectional yarn feed members constructed to feed yarns in only one direction and carried respectively by the ends of said rocker arms for grasping increments of said yarns to feed the same by their grasped increments toward said needles, a yarn tension device adjacent said yarn feed members through which said yarns pass to said yarn feed members, means for actuating said rocker arms at a uniform amplitude so as to reciprocate said yarn feed members to feed yarns to said needles for a full feed of travel of said needles, a pattern member arranged adjacent said rocker arms, and means for actuating said pattern member in timed relationship to the movement of fabric beneath said needles, said pattern member varying the length of travel of said feed means to decrease the feed of yarns by said feed members according to the prescribed pattern of said pattern member.

10. In a tufting machine of the class having a plurality of needles and main drive shaft within said cross head member for reciprocating a plurality of needles for the insertion of yarns carried by said needles through a base fabric to form transverse rows of loops as said base fabic is moved beneath said needles and wherein looper means engage the loops, the combination therewith of a plurality of unidirectional yarn feed members having spring loaded fingers carried respectively adjacent said yarns for clamping said yarns when said feed members are moved toward said needles and for releasing said yarns when moved in another direction, a yarn tension device adjacent said yarn feed members over which said yarns pass, means synchronized with the rotation of said main drive shaft for actuating said yarn feed members to feed yarns to said needles, a pattern member controlling the actuation of said feed members, and means for actuating said pattern member in timed relationship to the movement of fabric beneath said needles.

11. In a tufting machine having a plurality of reciprocating needles for inserting yarns into a base fabric, means for releasably holding said yarns inserted into the base fabric by the needles to form loops, a plurality of feed means arranged respectively to grasp and advance successive increments of said yarn by its grasped incre-

ments toward said needles, control means connected to said feed means, drive means for actuating said control means to drive said feed means to feed prescribed lengths of yarn to their associated needles only in response to the degree of actuation of said control means, and pattern forming means associated with said control means to vary the degree of actuation of said control means thereby to control the amount of yarn fed by said feed means to their associated needles, whereby prescribed patterns of multi-height loops may be formed on said base fabric.

12. Apparatus for tufting comprising a plurality of reciprocating needles for inserting yarns into a base fabric and means for releasably holding said yarns inserted into the base fabric by the needles to form loops, comprising a plurality of feed means arranged respectively to grasp and advance successive increments of said yarn by its grasped increments toward said needles, a plurality of oscillatory drive means respectively connected to actuate said feed means, so that each of said feed means is operable to feed prescribed lengths of yarn to its associated needle only in response to the actuation by said drive means, pattern forming means engageable by said drive means to predeterminately regulate said drive means to vary the amplitude of oscillation of said drive means to control the amount of yarn fed by each feed means to its associated needle to form prescribed patterns on said base fabric.

13. Apparatus for tufting comprising a plurality of reciprocating needles for inserting yarn into a base fabric and means for releasably holding said yarn inserted into the base fabric by the needles to form loops, said yarn being passed to the needles along a predetermined path, comprising a plurality of feed means arranged to firmly grasp said yarn and feed said yarn only by the grasped portion along said predetermined path, and to disengage the grasped portion of said yarn after feeding the same a prescribed distance toward said needle and thereafter grasp another portion of said yarn to repeat the feeding process, and means for prescribing the distance between successive grasped portions of said yarn.

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