METHOD AND MEANS FOR FEEDING FIBERS
TO A KNITTING MACHINE

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1 Claim. (Cl. 66—9)

This invention relates to knitting machines and to a
method of knitting therein for forming "high pile" fab-
rics and, more particularly, to a method and means
by which the fibers to be incorporated as tufts to form
the pile are conveyed in at least a part of their travel
from a supply to the knitting instrumentalities by an air
conveyor system.

It is a general object of the invention to simplify the
system and means for feeding fibers to the instrumental-
ities of these machines by utilizing an air conveyor means
to transport the fibers from a supply directly to the needles
or from a supply of bulk fibers (not in sliver or roving form) to means to present them to the instrumentalities.

A further object is that of simplifying the process and
mechanism by blowing fibers directly into the instru-
mentalities at the knitting point, either as said fibers are
conveyed by the pneumatic means itself or as they may be
picked up by that means in a form to be easily disinte-
grated and blown into the instrumentalities.

A more specific object is that of conveying fibers in
bulk form by a pneumatic means to a card by which
they are then treated and presented to be taken by the
instrumentalities.

A further object is that of working with a very loosely
formed sliver and transporting that sliver and at the
same time disintegrating it by a pneumatic means by
which the fibers are blown into the instrumentalities.

A further object is that of devising means for feeding
fibers in the form of a very loosely organized strand to
the instrumentalities along with a base yarn and of dis-
teintegrating the strand at the knitting point so as to cause
the instrumentalities to draw tufts of the fibers for the
purpose described.

Other objects will become apparent from the following
disclosure.

In knitting machines of the type adapted to incorporate
staple fibers in a base fabric during the knitting process
so that these fibers will appear at the face thereof and
may be finished to constitute a high pile material, it has
been considered necessary to prepare these fibers into a
sliver or similar strip of material and to feed these into
a card by some mechanical means. The slivers are pref-
erably drawn from a can and are treated to parallelize
and otherwise prepare and present a uniformly disposed
layer of fibers from which the instrumentalities, preferably
needles, may take and draw tufts. This system func-
tions well, but involves considerable cost in that there is
considerable expense involved in preparing the sliver and,
of course, a machine provided with cards is relatively
expensive.

According to the invention which may take several
different forms, all related, an air conveyor system is
provided which is adapted to pick up and present fibers
either to a card or to the needles themselves. This pneu-
matic system may, if no cards are used, act upon bulk
fibers and blow them into the hooks of needles at or
adjacent the knitting point or may act upon a very loosely
organized sliver and convey it directly toward the knitting
point where it is broken up by the air stream and blown
into the needles.

Again a small, loosely organized strand of fibers may
be fed having more or less a plating relation with a base
yarn with an air stream acting to break up the fibers
prior to the formation stitches so that tufts of fibers may
be drawn to extend from a face of the fabric.

The invention will be described in greater detail by
reference to a specific embodiment and modifications
thereof as illustrated in the accompanying figures of
drawing wherein:

FIG. 1 is a section taken through part of a knitting
machine to which the invention has been applied and
showing one card and means to supply fibers thereto.

FIG. 2 is a plan view of the supply and pneumatic
feeding means of FIG. 1.

FIG. 3 is a similar sectional view of a knitting machine
showing a modified form of the invention in which no
cards are utilized.

FIG. 4 is a plan view of the air conveyor system of
FIG. 5.

FIG. 5 is a section similar to that of FIG. 3, but
showing a modification for handling bulk fibers.

FIG. 6 is a section taken at line 6—6, FIG. 5.

FIG. 7 is a plan view showing in a somewhat sche-
matic way, a further modification for dealing with fibers
in strand form fed directly to the needles.

FIG. 8 is an elevational view of the mechanism of
FIG. 7.

FIG. 9 is a detail view showing plating relation of a
yarn and fiber strand and the behavior of the fibers as
the strand is disintegrated.

Now referring to FIG. 1, a knitting machine such as
that manufactured by Wildman Jacquard Co. of Norris-
town, Pennsylvania has a needle cylinder 10, a sinker
head 11 in which needles 12 and sinkers 13 are opera-

tively carried. These needles and sinkers, broadly de-

ote as knitting instrumentalities, are caused to pass
through the customary knitting waves by cam means of
usual type.

On a circular base 14 and suitable extensions, there are
mounted any convenient plurality of card units, gen-

erally indicated by numeral 15, and including, among
other parts, a base 16, a central shaft and bearing mem-
ber 17 about which a card cylinder 18 is rotated.

At the outer part of this unit there is rotatably carried
in suitable frame brackets, one of which is indicated at
19, a licker-in cylinder 20 for depositing fibers on the

card teeth. In machines of this type as now employed
commercially, a sliver formed from the proper fibers
is fed into these cards by fluted or other feed rolls and
is deposited on the card cylinder 18 by the licker-in
cylinder 20. The cylinder 20 and other parts operable
therewith are positively driven at correct speeds and in
the proper directions so that fibers once introduced to the
licker-in will be carried onto the card cylinder, the sur-
face speed of which is greater than that of the licker-in.

As the card cylinder rotate, one or more sets of
worker cylinders may act upon the fibers to take them
from the card clothing, parallelize them and in other
ways add to the uniformity of the batt of material and
return it to the card. Here two such sets 21 and 22
of worker rolls perform this function and, of course, more
or fewer may be utilized.

A doffer cylinder 23 takes the fibers from the card
and, as the needles 12 rise in a knitting wave to take a
body yarn in known manner, their hooks also enter the
teeth of the doffer and take a tuft of fibers to be drawn
along with the next loop of the body yarn drawn by
that needle.

These cylinders, rolls and all members are driven by
gears, chains or other means all, in turn, preferably de-

erating motive power from some part of the knitting ma-

chine so as to function in synchronism therewith. Such
drive means and the details of these cards are now well
known and need no further description here. An example is to be found in French Patent 527,671 of 1921.

According to the invention, fibers F in bulk form are supplied by an air conveyer system to the licker-in, being blown into that converging space between that member and the card cylinder. These fibers may come from any source at which they are properly prepared and mixed and descends in a chute 24 at the lower end of which the flow or quantity of fibers emitted under the influence of a passing air stream is governed by a damper 25 or other valuaring control. This damper is hinged at 26 and its position may be varied and set by any convenient means such as a bead-chain 27 capable of being set at different levels in a confining notch in the side of the chute.

Air under pressure moves rapidly along a conduit 28 which flares at 29 as it passes beneath the chute 24 and which also dips downwardly below the exit portion of the chute and damper after which it narrows vertically to terminate in an upwardly directed nozzle 30 which discharges into the converging space between the licker-in and the card cylinder. This nozzle is of width slightly less than the width of these parts so that it feeds material over substantially their entire working surface. Air pressure of any convenient sort is connected up to the conduit 28 and the flow of air past the chute draws off an amount of fiber and carries it onto the card. The damper 25 is set to regulate the quantity of fiber that is permitted to pass and thereby, the amount that will be delivered. After being introduced into the card these fibers are subjected to practically the same treatment described in the French patent, above noted, and are taken by the needles at the doffer roll and incorporated in the fabric in a known way.

Referring to FIGS. 3 and 4, a knitting machine having a simple construction to that of FIG. 1 has its parts similarly numbered with the numerals primed. It has been found that for knitting some fabrics the carding of the fibers need not be done and instead of introducing the fibers to the needles from a doffer roll, they are carried into the needles by the air stream which is utilized to convey them. A sliver S drawn from a can 31 is passed through fluted or other rolls 32 and 33 mounted in bearings in end frames 34 fixed to the circular base 14 ′, for example. The roll 32 is driven through gearing meshing with a gear 35 fixed to its shaft end while the roll 33 is spring pressed toward it so as to nip the sliver between these rolls.

Drive to roll 32 is taken from a shaft 36 which is a rotating part of the basic machine itself by bevel gears 37 and 38 the latter of which is fast to a shaft 39 borne in a sleeve 40 and having a pulley 41 fixed at its lower end. A second shaft rotatable in suitable bearings has a pulley 42 fixed to one end and a worm 43 adjacent its other end meshing with a worm wheel 44. The latter carried on a stud shaft has a spur gear (not shown) fixed for rotation with it and meshing with gear 35. Thus rolls 32 and 33 are slowly rotated at an appropriate speed to draw and feed the sliver upwardly into a stream of air moving rapidly enough to convey it onto the machine knitting point.

A conduit 36 ′ connected to a source of air under suitable pressure narrows vertically but widens at a point where the sliver is admitted at an aperture 37 ′ and the increases in height after which it converges to a nozzle end 38 ′. Preferably, the action of the rolls 32 and 33 and also the effect of the air current should be such as to break the sliver apart to an extent such that it will, when emitted from the nozzle, be disintegrated to such an extent that the needles may easily tear away tufts to fill their hooks. The air stream will force those tufts about the hooks and to the inside of the cylinder so that the pile will appear at the inside of the fabric.

Since there will naturally be some fibers released which do not get caught in or remain in needle hooks, a suction system is provided at the interior of the needle cylinder. This is a part of machines of this type as previously constructed and air is drawn through an annular space at the outer edge of an inverted cone-shaped intake 45 the central area of which is blocked off by a disk 46. Now referring to FIGS. 5 and 6, a modification somewhat similar in that the fibers are conveyed by air directly to the needles is shown. However, this form of the device is adapted to function upon bulk fibers so that not only is it unnecessary to provide a card, but it is also not necessary to prepare the fibers into a sliver or otherwise treat them beyond blending as may be advisable.

Here the basic knitting machine is shown with corresponding parts designated by similar numerals heretofore employed, but having double primes added. A chute 47 ′ communicating with a supply of fibers leads into a duct 48 ′ via an inclined conduit 49. Air introduced through tube 50 which flares into a nozzle 51 picks up and carries the fibers along blowing them into the hooks of passing needles. They are then drawn by the needles as tufts which extend from the base fabric in a known manner.

If desired a damper or other restricting means may be used and may be made adjustable so as to regulate the amount of material to be incorporated as pile. Any excess which escapes is taken care of by a suction means acting through a hood 45 ′ as shown.

As an alternative method and mechanism to carry out that method, fibers may be formed into a very loosely organized strand, similar to a roving, and either spooled or deposited in a can 52, FIG. 7, from which it may be drawn by any convenient means and fed directly to needles 53, FIGS. 8 and 9 also, being so disposed in its approach to a knitting point that it may feed in a sort of plaiting relation to a base yarn Y introduced in the usual way through a guide 54. Here a strand or roving R is drawn from the supply by feed rolls 55 and 56 which may be fluted or covered in any acceptable manner to afford desired feeding characteristics. These rolls are mounted in end brackets 57 and 58, the roll 55 being fast on a shaft 59 to the end of which is attached a sprocket or pulley 60. This may be driven by a chain or belt 61 in turn getting its driving impulse from any convenient rotatable member on the machine.

These fibers in the strand are easily torn apart and for that purpose an air jet is applied just before the needles start downwardly in their stitch drawing wave and may be continued so as to apply during stitch drawing if desired, although that is not entirely necessary. For that purpose, a nozzle 62 connected to a source of air under pressure is directed toward the needles and has its end angled upwardly so that the air stream will separate the fibers, extend them inwardly of the needle circle and will thus form the tufts in the needles as they draw their stitches. Here a single air nozzle of considerable width is illustrated but a number of air jets may be utilized more effectively in some instances. In this form of the invention no card is required, but, of course, it is necessary to prepare the fibers into a loosely associated strand which can be fed to the needles and broken up after it is taken by them. In knitting with independent needles the base yarn may receive through the needle hooks and past the sinks and then roving action goes on but a roving strong enough to feed to the needles will not be strong enough to withstand the same treatment and so long as there is enough strength for it to be taken and held by the needles, the fact the stitch drawing action breaks it serves a useful purpose in that it is not then necessary for the air jet to do all the work in disintegrating the fibers.

When in this specification and claims the term "disintegrate" is used, it is to be understood to refer to a situation in which the fibers are pulled apart and separated to form tufts. No means for creating a source of air under pressure is shown since such are so commonly found in textile mills and widely varying means may be
used for the purpose. It may be an individual unit at each machine or a system common to a number of machines.

The disclosure here has been limited to description of a single feed, but it is to be understood that most all such machines have a plurality of feeds and that, of course, each feed is virtually a duplication of that described.

In any one of the suction hoods at the interior of the cylinder all stray or free fibers are drawn in to be discharged to a suitable collector or, alternatively, they may be returned or recirculated to the fiber supply to pass to the needles again.

In this specification and claims the card and worker units are referred to as a parallelizing means since it may take any one of several forms some of which might not fall strictly within the category of a card.

While one embodiment and modifications of the invention have been disclosed, it is to be understood that the inventive concept may be carried out in a number of ways. This invention is, therefore, not to be limited to the precise details described, but is intended to embrace all variations and modifications thereof falling within the spirit of the invention and the scope of the claims.

I claim:

In a knitting machine of the type described having knitting instrumentalties and means to cause said instrumentalities to draw stitches of a yarn to form a fabric, and means cooperating therewith for feeding fibers to said instrumentalities to be drawn along with said stitches of yarn which includes a carding unit having a licker-in cylinder, fiber parallelizing means and a doffer roll from which fibers are to be taken in hooks of needles, an air conduit and nozzle means for conveying and feeding loose, bulk fibers adjacent said licker-in cylinder, and means for feeding regulated quantities of said bulk fibers to said air conduit.

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