

Sept. 15, 1936.

A. F. VERBEEK

2,054,686

ATTACHMENT FOR FLAT KNITTING MACHINES

Filed March 3, 1936

2 Sheets-Sheet 1

FIG. 1

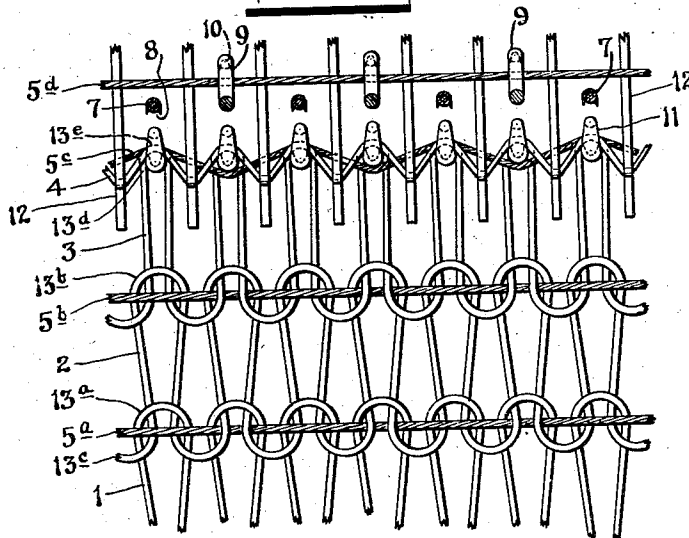


FIG. 2

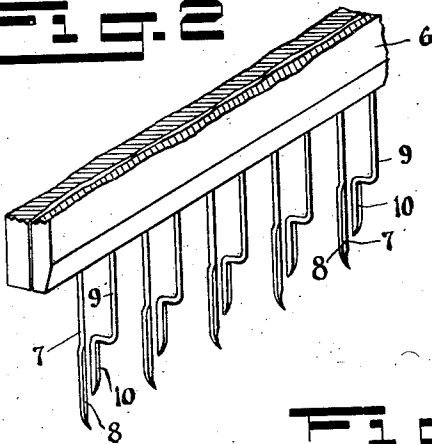


FIG. 3

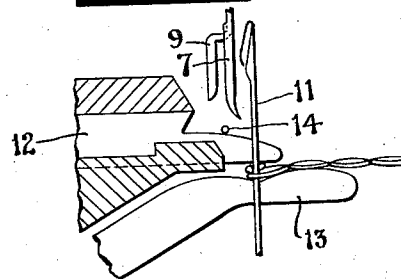
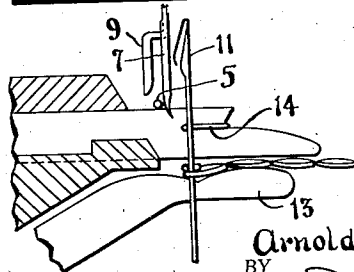


FIG. 4



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Fig. 5

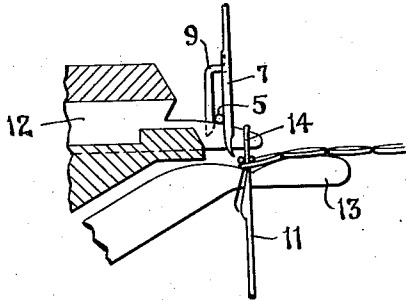


Fig. 6

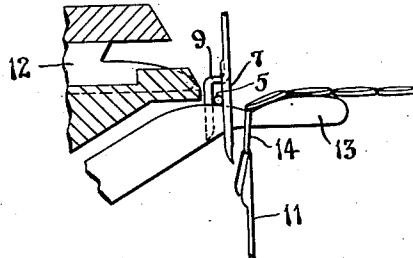


Fig. 7

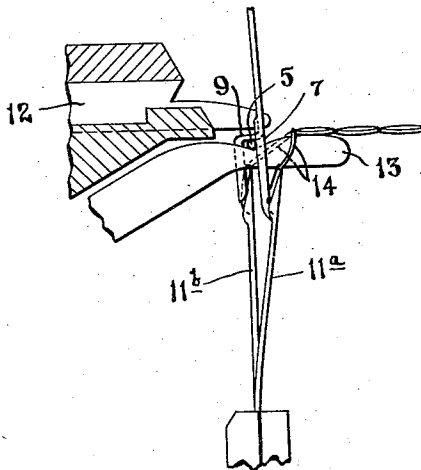
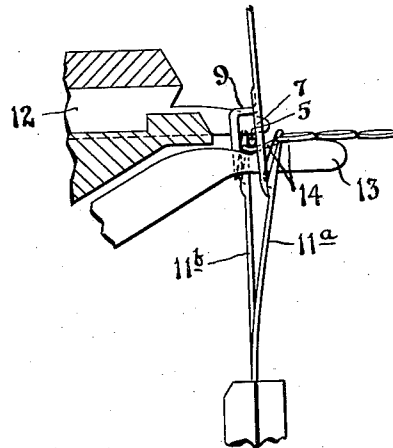


Fig. 8



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UNITED STATES PATENT OFFICE

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ATTACHMENT FOR FLAT KNITTING
MACHINES

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Application March 3, 1936, Serial No. 66,812
In Germany October 11, 1935

4 Claims. (Cl. 66—83)

This invention relates to a new and useful improvement in flat knitting machines and specifically to an attachment for weaving transverse weft threads, preferably of rubber or other similar elastic material, into knitted fabric.

An advantage of such fabric is that the elastic weft thread imparts a high degree of elasticity thereto. This is of particular value in the weft of a stocking, for example, to insure a snug fit and to counteract the stretching tendency of the garter. Also it is of equal value in any other knitted article which is subjected to stretching strains where snug fit is desired.

In my copending application No. 3,892 filed January 29, 1935, I describe a method of weaving into knitted fabric transverse elastic or other weft threads without altering the conventional loop formation or retarding or otherwise affecting the regular knitting cycle. I also describe in that application several mechanisms for inserting the weft threads. The mechanisms there shown are not entirely satisfactory in that the means for guiding the weft thread has not proven sufficiently positive under certain conditions. By this invention this difficulty has been overcome and a means provided whereby proper positioning of the weft thread with respect to the needles is assured under all conditions and whereby the weft thread is interlocked with the needle and sinker loops of adjacent courses and thus positively positioned instead of being merely interwoven with the legs of the loops of each course.

The mechanism selected for the purpose of illustrating the invention herein is shown in the accompanying drawings, of which

Figure 1 is an enlarged diagrammatic view of a piece of fabric containing the interwoven transverse weft threads;

Fig. 2 is a diagrammatic view in perspective of the weft point bar and weft points employed to guide the weft threads during the knitting operation; and

Figs. 3 to 8 inclusive are diagrammatic illustrations of several of the steps of the knitting operation showing the cooperative functioning of the weft points and needles.

For the purposes of this specification it will be assumed that the fabric is of the conventional simple interlooped formation and that the weft thread is elastic and incorporated in successive courses, but it will be understood that the invention is not limited to this exact construction.

The character of the fabric is shown diagrammatically in Figure 1. It consists of the usual courses 1 and 2 of interlinked loops of whatever

yarn the fabric is composed and also of a weft thread 5 woven over the top portions of the needle loops of one course and through the sinker loops of the next course.

A somewhat similar construction can be secured by utilizing the narrowing mechanism and the picot bar to temporarily remove alternate loops from the needles and laying the weft thread between them and the other loops, but this method involves a loss of knitting time for each course equivalent to that required for a narrowing operation and, in consequence, reduces the capacity of the machine. Also the weft threads are not interlocked with the loops in the same manner as by this invention and a less uniform and satisfactory fabric results.

By this invention the regular loop laying and loop developing process is not disturbed. Instead the weft thread is inserted by independent steps carried out concurrently with the development of the regular fabric loops during the regular knitting cycle.

To obtain this fabric structure I employ the weft bar 6 illustrated in Fig. 2 equipped with a series of relatively straight weft points 7, each provided with a groove 8 adapted to receive the beard of a knitting needle. In short, each of these weft points closely resembles an ordinary picot or narrowing point. Alternating with these points 7 in weft bar 6 is a series of offset weft points 9 each of which is provided with a similar beard receiving groove 10. The relative positions of these two series of weft points are clearly shown in Figs. 7 and 8 from which it will also be noted that points 9 are shorter than points 7.

For producing the fabric of Fig. 1 as many weft points as there are needles are required, each point being positioned directly behind the needle in the alternate arrangement described above.

The manner in which these points operate, illustrated in Figs. 3 to 8, is as follows. In Fig. 3 the needles 11, sinkers 12 and knocking over bits 13 are shown in their usual positions during and immediately after the laying of the regular fabric yarn 14 upon the noses of the sinkers. The weft points 7 and 9 are positioned behind the needles and above the sinker noses, the tips of weft points 7 being below and the tips of weft points 9 somewhat above the upper edges of the sinkers and dividers. Therefore they will not interfere with the laying of the regular yarn.

After the sinkers have moved forward, as shown in Fig. 4, to kink the regular yarn 14 around the needles in the usual manner the weft thread 5 is laid upon the upper edges of the

sinkers also as shown in Fig. 4 immediately behind weft point 7 which prevent it from reaching the needles. The weft thread carrier may, of course, follow closely the regular yarn carrier so that no delay in the regular knitting cycle is occasioned by the laying of the weft thread.

Thereafter the needles descend and are pressed in the usual manner. Meanwhile the weft points move downwardly enough to cause the shorter offset weft points 9 to project slightly below the upper edges of the sinkers so that weft thread 5 is effectively held between the two sets of weft points against displacement by subsequent sinker action. The tips of straight weft points 7 are maintained above the tops of the needles so that they will not interfere with the press.

As the needles continue to descend they are followed by the weft points as illustrated in Fig. 5 which shows the regular yarn loops 14 about to slip from the noses of the partly retracted sinkers and the weft thread 5 as having fallen onto the sinker noses still under the guidance of the weft points which have descended so that their tips now project below the upper surface of the noses.

Thereafter the needles complete their downward travel still followed by the weft points until the latter project below the tops of the knocking over bits 13 whereupon the weft thread falls from the sinkers upon the knocking over bits between the two sets of weft points as the result of the complete retraction of the sinkers in the usual manner as shown in Fig. 6.

Shortly after the needles have started to move upward the weft points bar 6 is swung forward so that straight weft points 7 will engage with the corresponding alternate needles designated as 11^a in Fig. 7 and spring them forward sufficiently to permit weft points 9 to envelope the other needles 11^b without springing them. This action of the weft points will carry weft thread 5 into a position behind the tops of needles 11^a and in front of the tops of needles 11^b as shown in Fig. 7. At this time the knees 9^a of offset weft points 9 prevent the weft thread from rising from the knocking over bits also as shown in Fig. 7.

During the ensuing upward motion of the needles they are maintained as just described by the weft points which move upward with them until the tops of the needles project above the knocking over bits sufficiently to insure that the weft thread will be retained between them, as shown in Fig. 8, whereupon the weft points are swung back to permit the needles to regain their normal alignment and in time to permit the needle beards to open and the newly formed needle loops of regular yarn to pass onto the shanks of the needles. The weft thread 5 is now retained only by the needles. It lies behind needles 11^a and in front of needles 11^b.

During the remainder of the upward movement of the needles the weft points also move upward until they reach the initial position as shown in Fig. 3. As yet the weft thread 5 has not been woven into the fabric but is still interwoven through the needles and rests immediately above the newly formed fabric loops upon the knocking over bits.

In the next knitting cycle the operations described above are repeated, the weft thread being laid and manipulated in the same way. However, in this cycle when the newly formed loops are pulled through the loops formed during the preceding knitting cycle the weft thread which was laid during the preceding cycle as described

will be interlinked with the needle loops of the preceding course and the sinker loops of the new course. As shown in Fig. 1 the weft thread will lie above the needle loops referred to and pass through each corresponding sinker loop so that it is securely locked in position. The advantages of this particular arrangement in addition to those already mentioned is that the weft thread is exposed upon the back of the fabric only and is effectively concealed from the front by the regular fabric loops. Also, because of its intimate association with the interlinked sinker and needle loops, it acts as an effective means for stopping runs. The operation of the weft points described above may, obviously, be varied somewhat, the essential requirements being that they should adequately position and guide the weft thread and manipulate the needles at the proper time without otherwise interfering with the conventional needle operation.

From the above it will be evident that during each knitting cycle a weft thread is woven into the fabric and another weft thread is laid and positioned to be woven in during the next knitting cycle. As shown in Fig. 1 the weft thread 5^a, laid during the formation of course 1, was woven into the fabric when the needle loops 13^b of course 2 were pulled through the needle loops 13^a of course 1 so that it passes above each needle loop 13^a of course 1 and through each sinker loop 13^c of course 2.

Weft thread 5^b has been similarly interwoven into courses 2 and 3 by the completion of course 3. During the formation of the loops of course 3, a weft thread 5^c was laid and positioned alternately behind and in front of successive needles.

There is also shown in Fig. 1 a new course 4 of fabric loops in the stage of formation corresponding to that of Fig. 4. The sinkers and dividers have advanced, kinking the yarn around the needles and a weft thread 5^d has been laid upon the top edges of the sinkers between weft points 7 and 9. Thus at this stage of the knitting cycle each needle carries a completed fabric loop 13^d, a weft thread 5^c woven through the needles and a partly formed fabric loop 13^e which when it is pulled through fabric loop 13^d will incorporate weft thread 5^c into the fabric. Also, as stated above, weft thread 5^d has been laid upon the top of the sinkers below and alternately behind and in front of weft points 7 and 9. This weft thread 5^d will be positioned during the knitting cycle in progress and will be woven into the fabric during the following knitting cycle.

While for convenience several weft threads 5^a, 5^b, etc. have been mentioned in this discussion of Fig. 1 it will be understood that they may all represent a single continuous weft thread carried from course to course in the usual way.

Since no change in needle action from established practice is required to perform the knitting process described above the usual needle operating mechanisms may be utilized. These require no description. For imparting the required movements to the weft bar a separate mechanism is required. The weft bar operating mechanism disclosed in my copending application referred to above and in particular by Figs. 2, 3 and 14 thereof is suitable for operating the novel weft bar of this invention. Since it forms no part of this invention, however, it will not be again described herein. Its details may be learned from the copending application. It will be sufficient here to say that the position, mode of attachment and motion of the weft bar and weft points are very

similar to those of the standard picot bar, the dipping motions of the weft points as described above being imparted thereto by a suitably shaped cam which may be conveniently mounted upon the same shaft as the usual picot cam and arranged so as to operate the weft bar during the knitting cycle instead of between knitting cycles as in the case of the picot bar mechanism.

The additional forward swinging motion required for springing the needles may be produced by any suitable device such, for example, as that disclosed in connection with Fig. 14 of my co-pending application. It will now be obvious that all that is required is some suitable mechanism for dipping the weft points in proper relation to the needle movement and for swinging the weft points forward at the proper time to spring alternate needles and to guide the weft thread into position between the sprung and unsprung needles.

If desired this mechanism for swinging the weft bar forward to spring the needles may be omitted and in lieu thereof a slight modification made in the cam which controls the regular press of the needles so that it will cause the needles to swing back against the weft points at the proper time for springing them as above described. By either method alternate needles will be sprung and the weft thread properly laid.

What I claim is:

1. In a flat knitting machine provided with a bank of needles; a weft bar and means thereon adapted to be positioned on both sides of a weft thread laid behind the needles to guide said weft thread downward in a substantially vertical plane onto the knock-over bits concurrently with the descent of the needles and for then springing alternate needles forward and simultaneously moving the weft thread forward into a position in front of the unsprung and behind the sprung needles, and for then maintaining said needles and weft thread in these relative relations during the initial stage of the ascent of the needles.

2. In a flat knitting machine provided with a bank of needles, means adapted to be positioned on both sides of a weft thread laid behind the needles to guide said weft thread downward in a substantially vertical plane onto the knock-over bits concurrently with the descent of the needles and for then springing alternate needles forward and simultaneously moving the weft thread forward into a position in front of the unsprung and behind the sprung needles, and

for then maintaining said needles and weft thread in these relative relations during the initial stage of the ascent of the needles, said means comprising two series of weft points in alternate arrangement each provided with weft thread guide tips, the tips of one series of points being parallel to the tips of the other series and positioned behind them sufficiently to permit a weft thread to pass across the needle blank in a straight line between the tips of the two series of points.

3. In a flat knitting machine provided with a bank of needles, means adapted to be positioned on both sides of a weft thread laid behind the needles to guide said weft thread downward in a substantially vertical plane onto the knock-over bits concurrently with the descent of the needles and for then springing alternate needles forward and simultaneously moving the weft thread forward into a position in front of the unsprung and behind the sprung needles, and for then maintaining said needles and weft thread in these relative relations during the initial stage of the ascent of the needles, said means comprising two series of weft points in alternate arrangement, the shanks of all of the points lying in the same plane and the tips of the points of the two series lying in different but parallel planes, the tips of one series being connected to their shanks by portions at substantially a right angle thereto, said portions comprising means for confining the weft thread to the tip portions of the points.

4. In a flat knitting machine provided with a bank of needles, means adapted to be positioned on both sides of a weft thread laid behind the needles to guide said weft thread downward in a substantially vertical plane onto the knock-over bits concurrently with the descent of the needles and for then springing alternate needles forward and simultaneously moving the weft thread forward into a position in front of the unsprung and behind the sprung needles, and for then maintaining said needles and weft thread in these relative relations during the initial stage of the ascent of the needles, said means comprising two series of weft points in alternate arrangement, a weft thread guiding tip on each point, and means on alternate points to confine the weft thread to the tip portion of said points of the series.

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