March 30, 1943. E. ST. PIERRE 2,315,166

METHOD AND MACHINE FOR KNITTING

Filed April 2, 1942 2 Sheets-Sheet 1

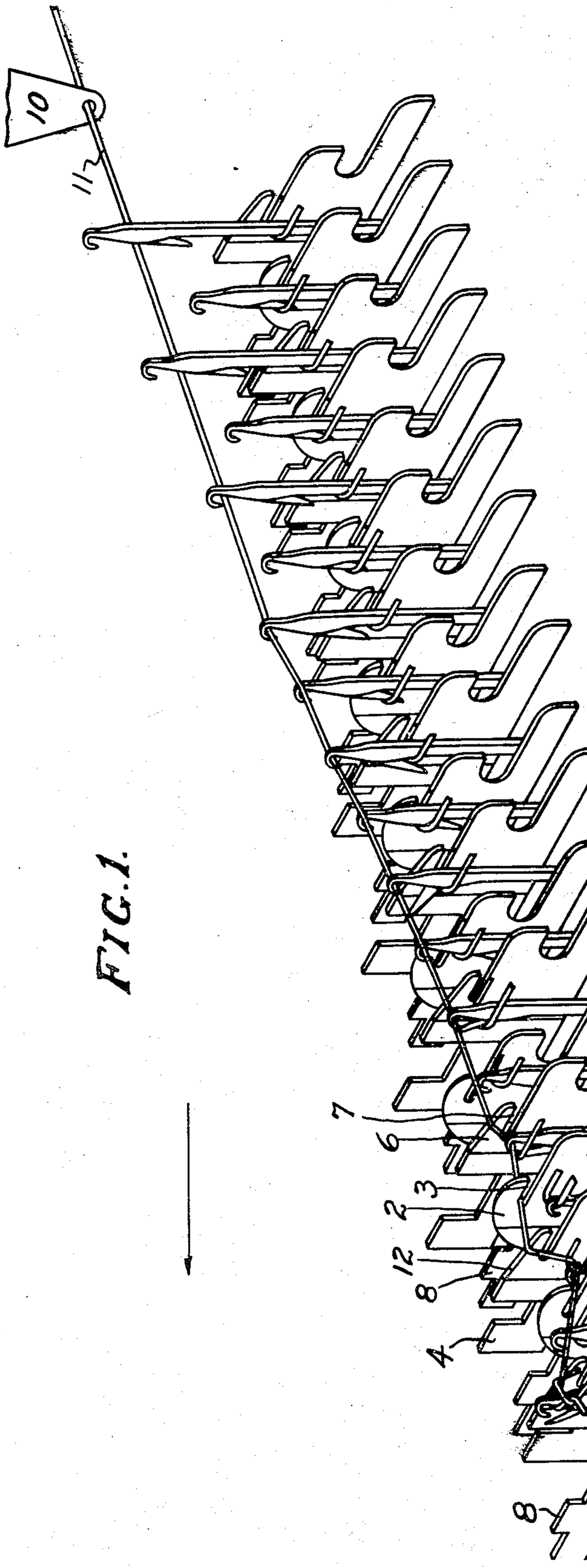

FIG. 1.

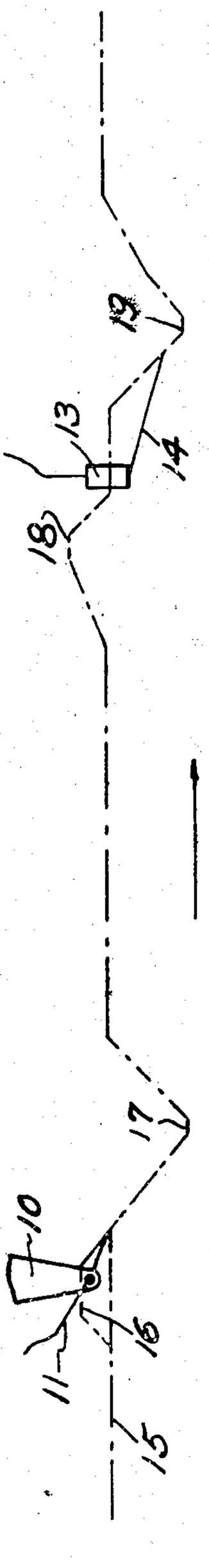

FIG. 2.

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March 30, 1943. E. ST. PIERRE 2,315,166

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Filed April 2, 1942 2 Sheets-Sheet 2

FIG. 3.

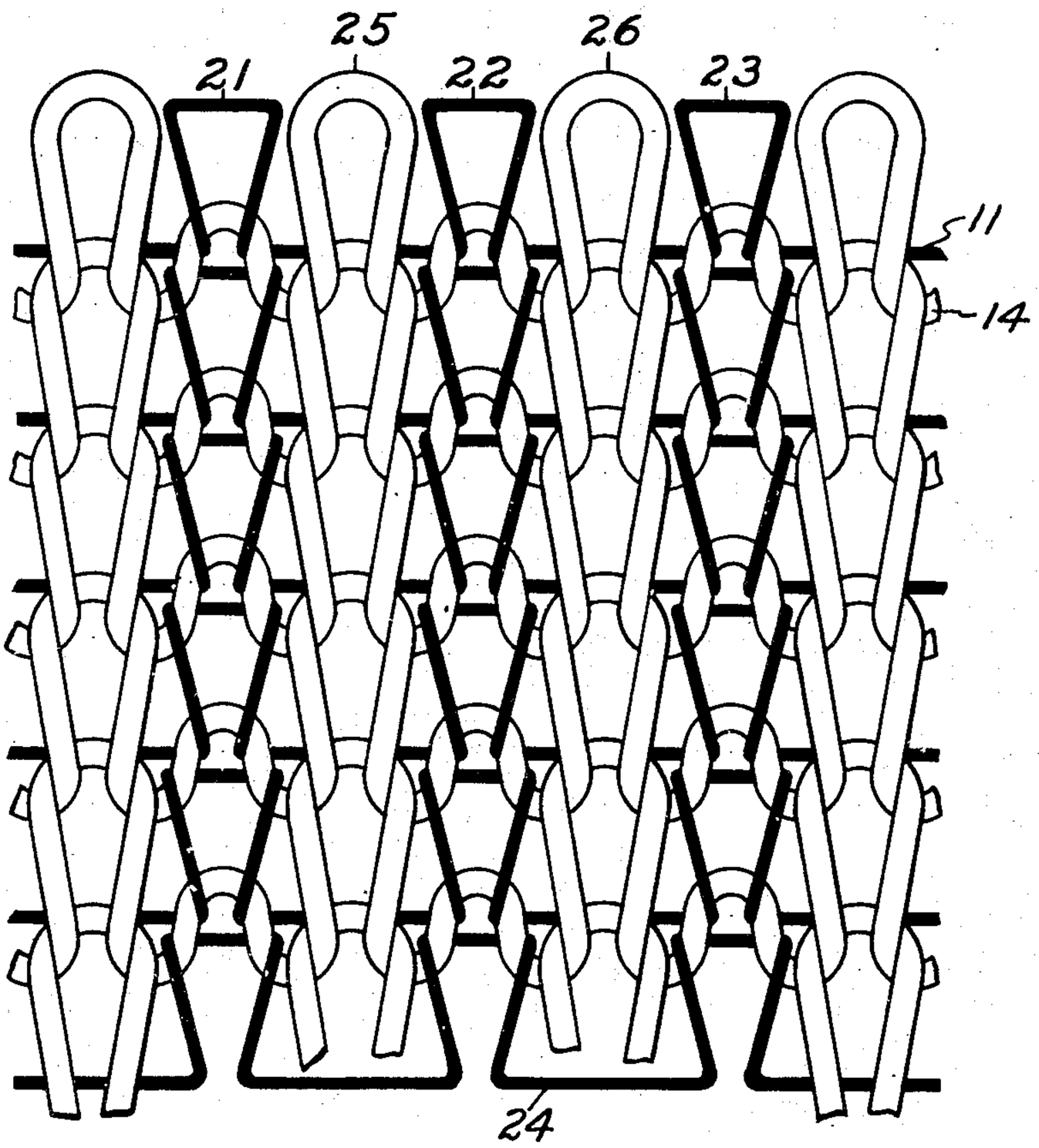


FIG. 4.

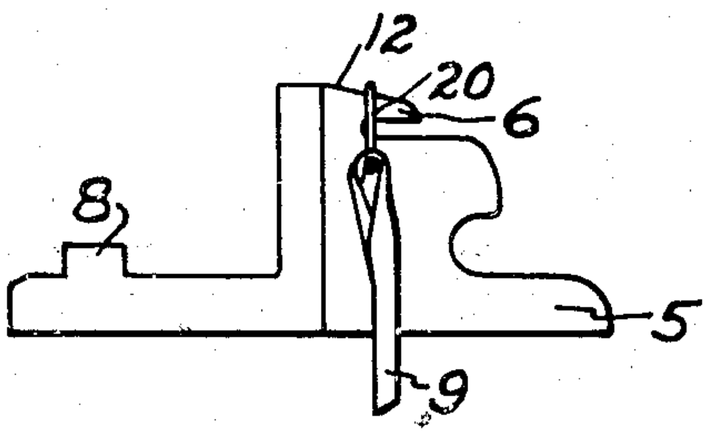


FIG. 5.

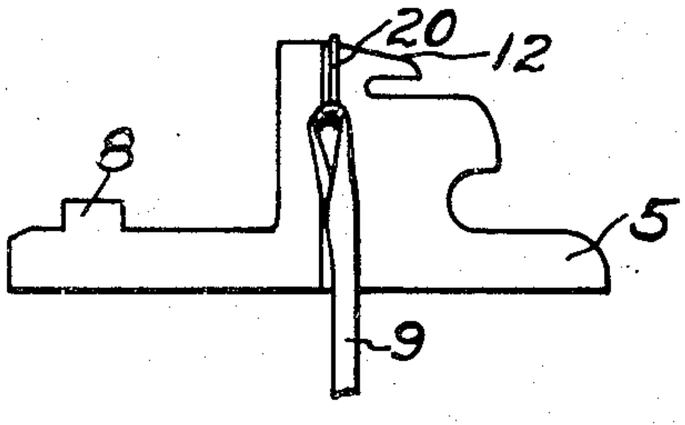


FIG. 6.

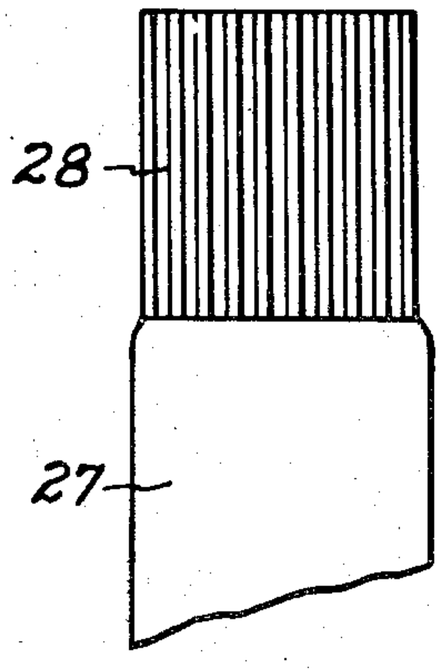
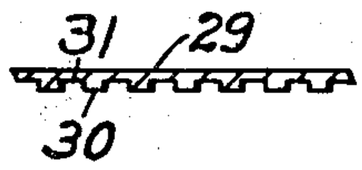


FIG. 7.



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UNITED STATES PATENT OFFICE

2,315,166

METHOD AND MACHINE FOR KNITTING

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Application April 2, 1942, Serial No. 437,403

10 Claims. (Cl. 66—41)

This application concerns a method of knitting accordion or mock rib type fabrics. More specifically, the method involves a manipulation of sinkers or web holders in a manner to elongate floats of the mock rib yarn thereby providing greater possibilities of elongation of the fabric during finishing and yet retaining the same lateral stretch.

In the figures of the drawings:

Fig. 1 is an isometric view illustrating the method of drawing stitches of the mock rib yarn and the special control effected by sinkers;

Fig. 2 is a diagrammatic illustration showing the needle hook pathways and the feeding of yarns;

Fig. 3 is a conventional illustration of one type of mock rib fabric in which the stitches are shown greatly enlarged and the fabric more open than it actually appears;

Fig. 4 is a detail of a sinker and part of a needle according to the invention and illustrating drawing a stitch over the sinker nib;

Fig. 5 is a view similar to Fig. 4 but after the sinker has been moved inwardly;

Fig. 6 is a conventional illustration of part of a stocking with a mock rib top applied thereto; and

Fig. 7 is a conventional section taken through fabric of the type illustrated in Fig. 3 or in the top, Fig. 6.

In knitting mock rib fabrics such as so-called accordion type fabrics two yarns are generally employed which are preferably knitted at two different knitting stations. Knitting of this type of fabric generally involves feeding one of the yarns continuously and to all needles at one of the feeds while the other yarn, frequently referred to as a mock rib or accordion yarn, to alternate or other space needles at another feeding station. The so-called accordion yarn is generally much finer than the first mentioned or main yarn and is usually drawn into tighter stitches whereby it will draw spaced wales laterally together thereby projecting intermediate wales outwardly to the face of the fabric, that effecting the ribbed appearance. One method and a mechanism involving drawing stitches over sinker nibs is disclosed in application Serial 430,042 filed February 9, 1942.

In that application the drawing of the accordion yarn has been effected by projecting alternate sinkers inwardly so that the said yarn is drawn over nibs of those sinkers. The intermediate sinkers are controlled in the usual way for holding the web down on the needles, and, of course, both groups of sinkers function at the casting off point moving inwardly as is the usual practice in casting off previously drawn loops. According to the method of the above mentioned application, the sinkers over the nibs of which the accordion yarn is drawn are horizontally disposed and for any predetermined draw of needles, a definite sized stitch is measured and formed and the length of float between said stitches is determined by the amount of yarn drawn over the nib of said sinker and extending from one alternate needle to the next. By that method and for any definite draw of needles at the auxiliary or accordion side of the machine, the proportionate quantity of yarn in stitches and in floats is invariably fixed.

By the present system needles and sinkers are similarly controlled but instead of drawing the accordion or mock rib yarn over nibs of alternate sinkers which nibs are horizontally disposed and by means of which the only manner of varying the amount of yarn in a stitch and float is by varying the draw of needles, stitches are drawn over sinker nibs having their upper surfaces inclined to the horizontal. Stitches are primarily measured over the forward part of sinker nibs, or at least, over a portion thereof which is at a relatively low elevation. Then sinkers are pushed inwardly, that added step being effected simultaneously with a slight raising of needles. According to one simple and preferred embodiment of the invention, sinkers are thus pushed inwardly by the usual casting off cam and at that time needles are slightly raised thereby relieving stitches. The inward movement of the sinkers slides the yarn upwardly along the inclined edges above sinker nibs and that action in combination with the relieving of stitches draws some of the yarn from stitches into the floats. This sinker action may be varied, one variation which may be effected being that of drawing at a lower or higher point along the inclined nib relative to the final point at which the yarn will be positioned after said sinkers have been moved inwardly to their greatest extent. Another way in which the action of the sinkers may be varied is to increase or decrease the angle which the upper surface of the sinker nib makes with respect to the horizontal. By this sinker control it is possible to vary the relative quantity of yarn in floats as compared to the amount of yarn in stitches, and for any particular machine, more yarn can be gotten into the float compared to the amount in a stitch than by methods heretofore known or practiced.

Now referring to Fig. 1, several needles and sinkers are shown at the auxiliary stitch drawing point or as they are taking the so-called mock rib or accordion yarn to measure and draw the same at that side of the machine. The method is herein described as applied in circular, independent needle type knitting machines such as Banner or other hosiery frames. The method is not limited to this type of machine but may be applied in any of the well-known systems of knitting and the present, more or less specific disclosure is not to be taken in a limiting sense. The needles and sinkers have been illustrated as though they were functioning in a straight line or plane, but, of course, in circular type machines, the progressive stitch drawing movements would be carried out in the arc of a circle. There are two types of sinkers, one having so-called plain nibs and the other having nibs with inclined stitch drawing edges. The first sinkers 1 have nibs 2, throats 3 and long butts 4, the latter being for the purpose of engaging certain cams and moving sinkers as dictated by said cams. The other sinkers 5 have inclined nibs 6, throats 7 and short butts 8. By means of the different lengthed butts the two types of sinkers are differently controlled. For an example of such control reference is made to co-pending application #422,622, filed December 12, 1941. As shown in Fig. 1, the sinkers 5 follow needles which take the accordion yarn, however, they may precede those needles and for some purposes that is preferable. The alternate form is not illustrated as it merely involves reversing the position of sinkers 1 and 5. That will readily be understood by those skilled in the art.

Needles 9 are of the usual latch type and function under the control of needle cams in a manner well-known in the art. Jacks (not shown) may be employed for selecting or dividing needles at the so-called auxiliary side of the machine, or other well-known selecting systems may be employed for those needles which are to take the mock rib or accordion yarn.

A yarn feeding finger 10 which is located just preceding the so-called auxiliary feed has threaded therethrough a yarn 11, this being the mock rib or accordion yarn which is fed under a suitable tension for producing a satisfactory ribbed appearance in the resulting fabric. Alternate needles are elevated higher than intermediate needles for the purpose of engaging the yarn 11 in their hooks while the said yarn is not engaged in the hooks of the intermediate needles. As the alternate needles are drawn downwardly by a convenient stitch cam (not shown), the said yarn 11 is drawn over the upper, inclined edges 12 above the nibs 6 of so-called alternate sinkers. This yarn will be drawn fairly close to the forward end or nose of these sinkers and for that purpose, the said sinkers are so controlled as to be positioned inwardly a little farther than intermediate sinkers but not nearly as far in radially as the casting off point, when the said yarn 11 contacts the surface 12.

Sinkers 1 are first moved outwardly so that the yarn will be drawn at the lower edge of the throat and forward of the nib so far as these intermediate sinkers are concerned; these sinkers then move inwardly to a position where the nibs engage the yarn and hold the fabric down thereafter moving inwardly to their greatest extent at the casting off point. The alternate sinkers 5 are not drawn outwardly since the cam does not effect short butts 8. By special control the position of these sinkers may be varied thereby to determine the point adjacent their noses at which the yarn 11 will be measured. At the casting off cam the sinkers 5 are pushed inwardly thereby sliding the yarn 11 upwardly along sinker nibs to a higher elevation on the surfaces 12. Simultaneously needles are relieved by raising them slightly and this combined needle and sinker action brings about a reapportioning of the amount of yarn in the stitches and in the floats. Each stitch gives up a certain quantity of yarn it possesses and that yarn is transferred to the adjacent float.

In Fig. 2 the yarn 11 is shown feeding through finger 10 at a so-called auxiliary feed marked A. At a main feed M a yarn lever 13 feeds a yarn 14. This yarn is the so-called main yarn which feeds to all needles and is continuously knitted at that side of the machine. Needle hooks move along in a pathway 15 which is at an elevation insufficient in height for the yarn 11 to be taken by them. Needles which are divided or selected to be raised to an additional height 16 do take the yarn 11. All needles are drawn down to the point 17 at which stitches of this yarn are drawn by alternate or other spaced needles. At the main side M, all needles are raised to a clearing height 18 and thereafter pass through the usual stitch cam at that side of the machine being drawn down to level 19 for forming their stitches.

In Figs. 4 and 5, one of the sinkers 5 is shown with a cooperating needle 9. In Fig. 4 the said sinker is shown at that position it occupies when the yarn is drawn into a stitch 20 over the inclined surface 12 of the nib 6. As before stated, the position of the sinker at this time may be varied so that the later reapportioning action of the sinker may be regulated to transfer more or less of the yarn from a stitch to a float as desired. In Fig. 5 this sinker has been moved inwardly as at the casting off point and the stitch 20 is back at about the highest part of the inclined surface 12. The needle 9 will have been raised thereby allowing the transfer of a portion of the yarn in the stitch to the float.

In Fig. 3 one simple form of accordion fabric is illustrated in which the appearance of a 1 x 1 rib is effected. In this fabric yarn 11 is drawn into stitches at alternate wales 21, 22 and 23 and floats as at 24 at the intermediate wales 25 and 26. Yarn 14 which is the main yarn is drawn into stitches at all wales but in the wales 25 and 26 that is the only yarn knitted. In the so-called alternate wales 21, 22 and 23 the stitches of yarn 11 and 14 are interknitted in alternation. While stitches of yarn 14 originally drawn at the main side would tend to be drawn the same size, they are actually of different size in the finished fabric since loops in intermediate wales cast off at the main side and those in alternate wales cast off as the accordion yarn is drawn at the auxiliary side. The general appearance of the fabric is very much like that of the illustration, Fig. 3, but of course, this figure shows stitches much enlarged and the fabric exceedingly open.

The effect of the sinker action herein described is to get more of the yarn 11 into the floats 24 so that they will tend to be slack as they lie at the back of the fabric or as they float behind the intermediate wales. Of course, that is at the expense of the amount of yarn in the loops of that yarn in wales 21, 22, 23, etc. In finishing, the wales 21, 22, 23, etc. can be extended longitudinally only at the expense of drawing yarn from floats 24 or drawing some of the yarn 14 through some intermediate wale

stitches. The result in actual practice is that as such fabric is finished it does finish down narrower proportionately than if not knitted by the method herein described. That is a decided advantage because these mock rib fabrics when knitted as stocking tops always tend to be wider in proportion to the width of the stocking leg than would be a true rib top for the same article of hosiery.

The advantage just above described is obtained without detracting from the lateral extensibility the fabric has since the floats **24** were slackened and apparently the narrowing down is effected by elongating the fabric at the expense of some of the yarn in wales **25**, **26**, etc. Thus extensibility is retained, that being something which heretofore has not been forthcoming if the fabric were originally narrowed down merely by drawing tighter stitches.

In Fig. 6 a stocking **27** has a top **28** knitted in accordance with the invention. The ribbed appearance is diagrammatically shown and the drawing in or narrowing up of the top in proportion to the width of the stocking leg is approximated.

In Fig. 7 a conventional section of fabric **27** shows the ribs **30** which are the intermediate wales while the alternate wales such as **21**, **22** and **23** are drawn to the back of the fabric and form depressions **31** which simulate the rib wales.

The fabric described and the method have been specifically applied to the knitting of a 1 x 1 type rib but other ribbed effects are obtainable by varying the spacing of the needles which knit the accordion yarn. One specific form of sinker has been illustrated and the invention is herein effected by sinkers, but it is to be understood that the sinkers may take other forms or that the method may be practiced by other instrumentalities, for example, special instrumentalities alongside the sinkers or web holders and working in the same slots. The invention is to be limited only by the scope of the appended claims.

I claim:

1. In a method of knitting an accordion fabric wherein at one feeding station a yarn is knitted by all needles and at a second feeding station another yarn is knitted by spaced needles only, floating over intermediate needles, the step of elongating the floats of the second mentioned yarn by robbing material from the stitches thereof.

2. In a method of knitting an accordion type fabric wherein one yarn is knitted on all needles at one feeding station and a second or accordion yarn is drawn into knitted stitches at alternate needles and is floated behind intermediate needles, the step, after drawing said stitches, of elongating the floats of the accordion yarn by extending them while robbing material from adjacent needle loops.

3. A method of knitting in a circular, independent needle knitting machine which includes the steps of drawing stitches by each needle in one feeding station, knitting through said previously drawn stitches but drawing stitches of another yarn at a second feeding station and floating said second yarn behind intermediate needles and thereafter elongating said floats by transferring during the knitting process, some of the material of the knitted loops to the said floats.

4. A method of knitting in a circular, independent needle knitting machine having needles and sinkers which includes the steps of drawing knitted stitches at each needle at one feeding point and then drawing knitted stitches of a second yarn at a second knitting point but at non-adjacent needles only and floating said yarn behind intermediate needles, then moving sinkers in such a manner as to elongate said floats simultaneously with transferring material from the knitted stitches of the second mentioned yarn to the floats thereof.

5. A method of knitting in a circular, independent needle knitting machine which includes the steps of controlling needles and sinkers in such a manner as to draw stitches on each needle and over each sinker at one feeding station of said machine, then dividing needles and drawing stitches of another yarn at a second feeding station and floating said second yarn behind intermediate needles, thereafter projecting sinkers inwardly for transferring, during the knitting process, some of the material in stitches of this second mentioned yarn, to the intervening floats thereof.

6. A method of knitting accordion fabric in a circular, independent needle knitting machine having needles and sinkers, said sinkers having nibs upper surfaces of which are inclined downwardly toward the point of said nib, including the steps of knitting one yarn at each needle at one feeding station, then dividing needles and knitting a second or so-called accordion yarn at an auxiliary feeding station on alternate needles only and by drawing said yarn over some at least of said sinker nibs, thereafter during the knitting process, the steps of pushing said sinkers inwardly thereby to slide the said yarn drawn over sinker nibs upwardly of the inclined edge thereof to rob material from the stitches and elongate the floats.

7. A method of knitting accordion fabric in a circular, independent needle knitting machine having needles and sinkers said sinkers having nibs upper surfaces of which are inclined downwardly toward the point of said nib, including the steps of knitting one yarn at each needle at one feeding station, then dividing needles and knitting a second or so-called accordion yarn at an auxiliary feeding station on alternate needles only and by drawing said yarn over some at least of said sinker nibs, thereafter during the knitting process, the steps of pushing said sinkers inwardly thereby to slide the said yarn drawn over sinker nibs upwardly of the inclined edge thereof simultaneously with moving needles upwardly to relieve stitches to rob material from the stitches and elongate the floats.

8. A method of elongating floats of a yarn drawn on non-adjacent needles in a circular, independent needle knitting machine which includes the steps of drawing said yarn over sinker nibs and thereafter moving sinkers in such a manner as to cause the nibs of those sinkers to elongate the floats by robbing or transferring material from stitches.

9. A method of elongating floats of a yarn drawn into knitted stitches at non-adjacent needles in a circular, independent needle knitting machine including the steps of first drawing said yarn over inclined edges of a sinker and thereafter moving said sinkers in a direction so that said yarn will slide upwardly along inclined edges of sinkers simultaneously with relieving stitches by moving needles upwardly thereby to transfer material from the stitches to the said floats.

10. For a knitting machine the combination of

needles and sinkers, said sinkers having nibs, the upper edges of which are inclined downwardly toward the points thereof, two feeding stations and means at one of said feeding stations for dividing needles and so controlling sinkers that those sinkers having nibs with downwardly inclined edges remain inwardly so that divided needles will draw their yarn at a point closely adjacent the point of said nibs and means for pushing said sinkers inwardly simultaneously with relieving stitches by raising needles thereby to transfer material from said loops to floats.

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