March 30, 1943. W. L. SMITH, JR. 2,315,138

METHOD OF KNITTING

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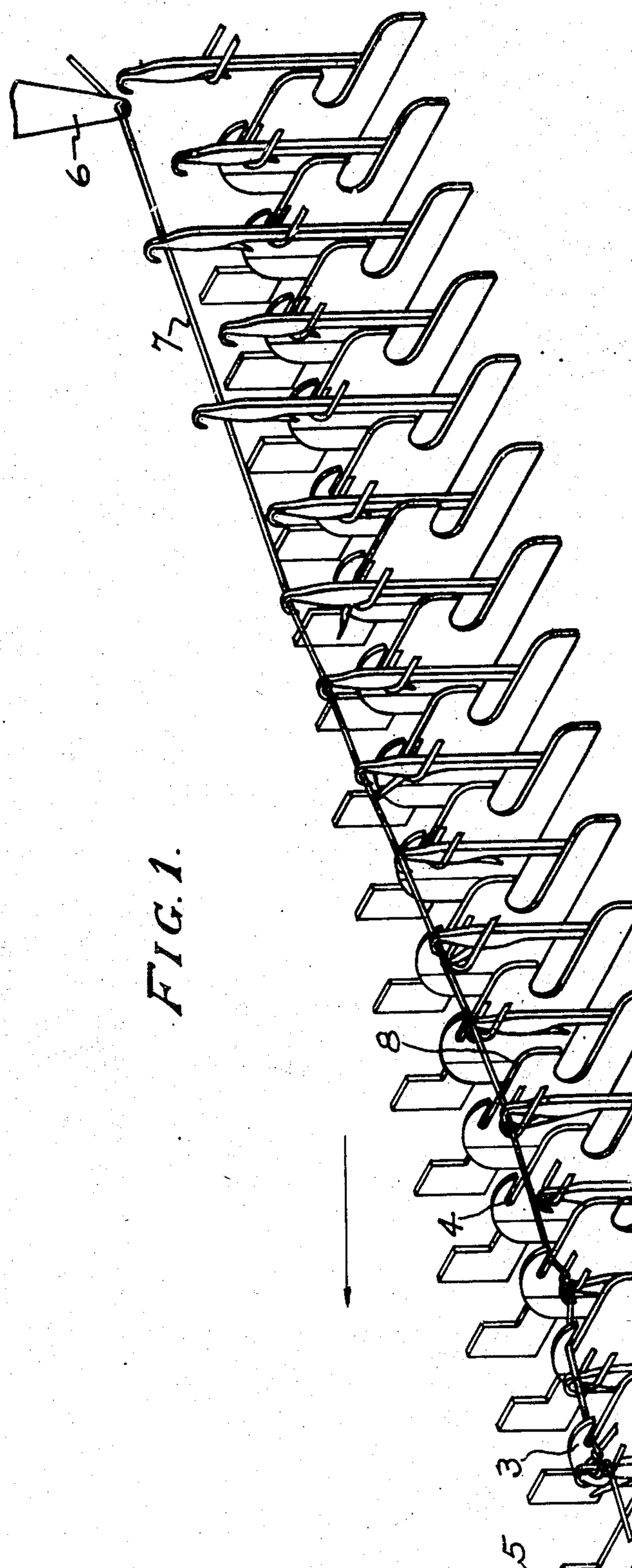


FIG. 1.

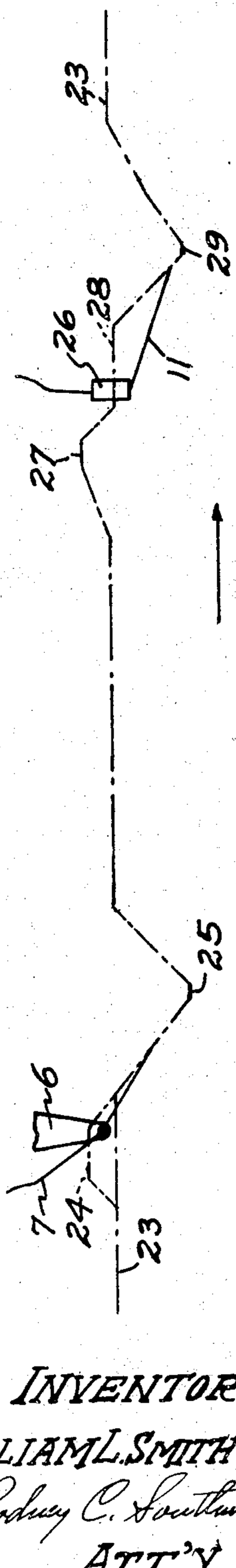


FIG. 2.

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FIG. 3.

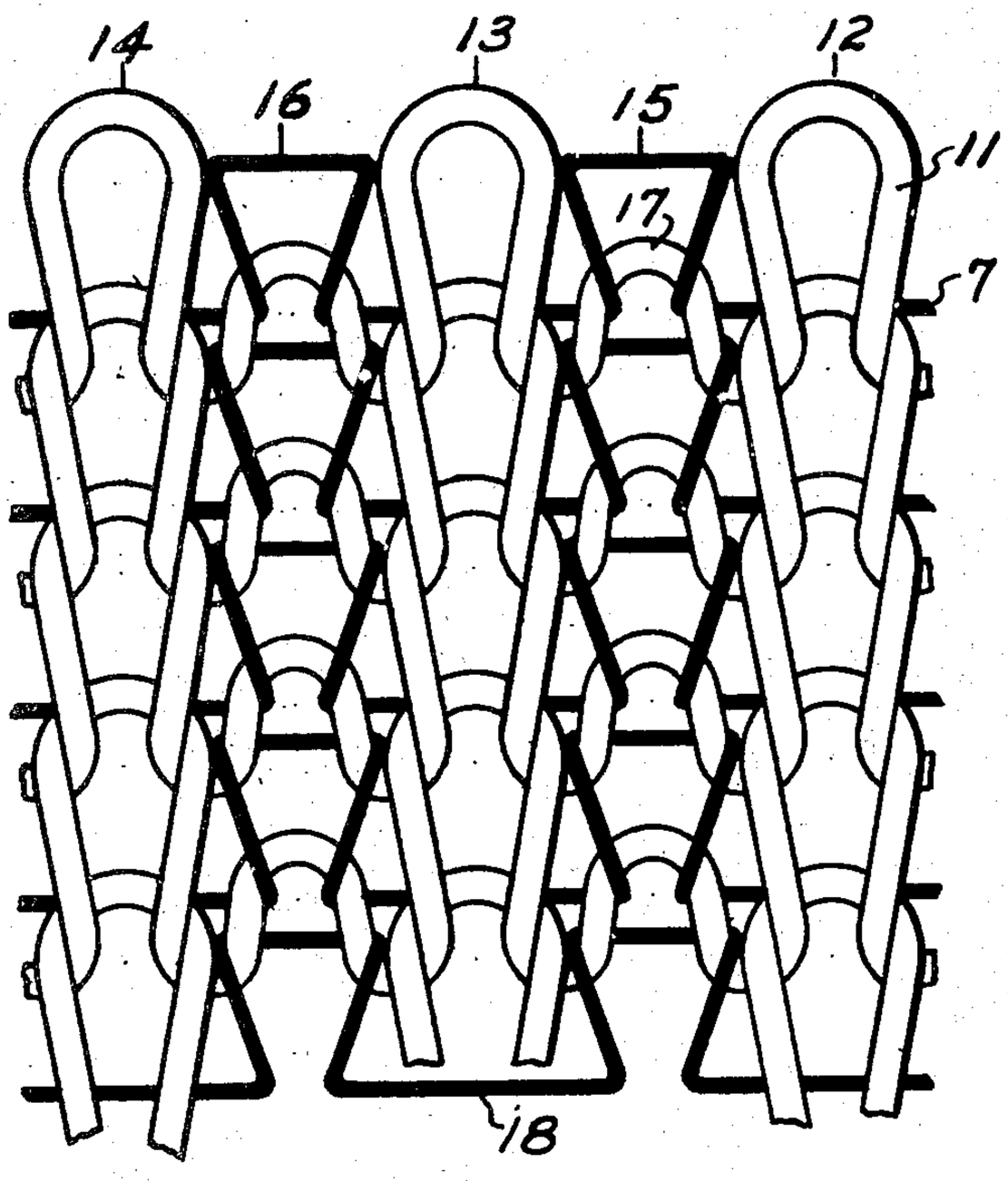



FIG. 4.

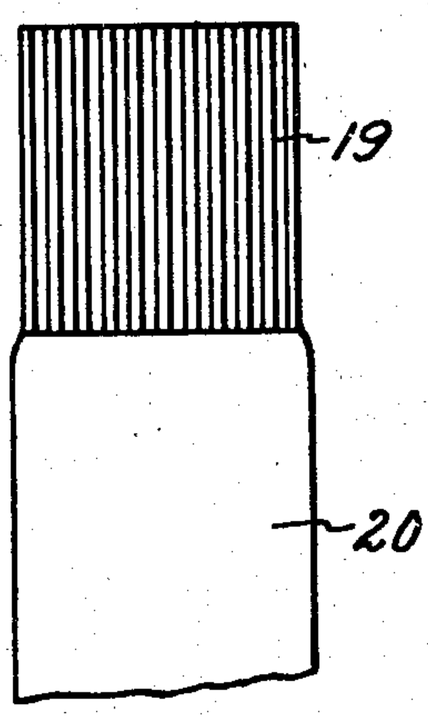



FIG. 5.

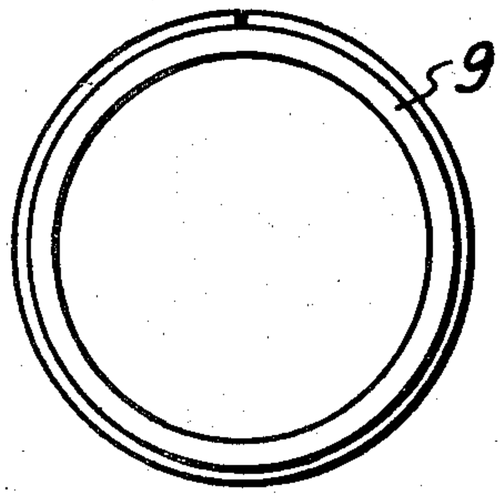



FIG. 6.

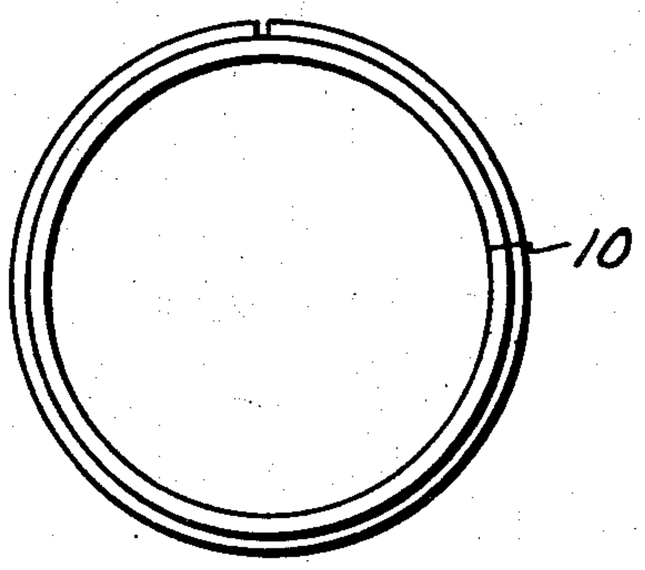
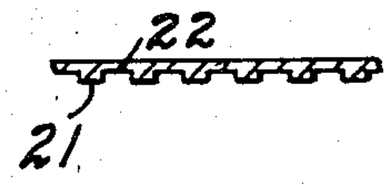



FIG. 7.

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# UNITED STATES PATENT OFFICE

2,315,138

## METHOD OF KNITTING

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Application February 7, 1942, Serial No. 429,851

3 Claims. (Cl. 66—41)

This application has for its subject matter an invention in knitted fabrics and the method of knitting wherein mock rib fabric of accordion type is produced having a pronounced ribbed appearance and in which the elasticity and extent to which the fabric may be stretched are comparable to these characteristics as exemplified in so-called, true rib fabric.

In the figures of drawings:

Fig. 1 is an isometric view of a group of needles and sinkers taking and drawing the accordion yarn;

Fig. 2 is a diagrammatic illustration of the pathways followed by needle hooks at so-called main and accordion yarn feeds;

Fig. 3 is a conventional illustration of a small section of fabric, greatly enlarged, showing more or less the theoretical stitch structure;

Fig. 4 is a conventional showing of a stocking having a top in accordance with the invention;

Figs. 5 and 6 are plan views of needle cylinders and wherein the relative size of cylinder appears;

Fig. 7 is a section showing ribbed construction of the fabric;

Mock rib fabrics have been made for several years, one particular form thereof being known as accordion fabrics, the general method of knitting such a fabric and the construction thereof being well-known, see United States Patent #1,377,459. As a mock rib fabric employed for a stocking top accordion stitch fabrics have been lacking in two particulars, one, the appearance of the rib has not been sufficiently outstanding, and two, the elasticity and extensibility of the fabric has been less than is commonly demanded in a top for a saleable stocking. According to the present invention ribbed appearance in an accordion fabric is realized which is very hard to distinguish from true rib fabric and which remains ribbed or corrugated when extended and worn. Extensibility has been increased so that when finished down to more or less normal dimensions for commercial tops, the actual stretch laterally is such that the stocking may be put on without effort and will fit any size leg which might be accommodated by the true rib top. Upon actually stretching and releasing the fabric, its elasticity allows it to return practically to its original dimensions.

In the method of knitting this accordion type fabric a larger needle cylinder is employed, that is, the needle cylinder is of appreciably greater diameter when considering the weight and type of fabric produced. In this larger cylinder a number of needles are employed corresponding to the usual number of needles for such weight and type of fabric, but the needles are of heavier gage and especially is that true of the wire which goes to make up the hook part of the needle. Sinkers operate along with these larger needles, said sinkers being relatively thin or of finer gage than the needles so that the fabric is knitted on a machine having a cylinder appreciably larger in diameter, with a number of needles substantially the same as that now employed for the weight and type of fabric knitted, heavier gaged needles and relatively fine gage or thin sinkers. In addition, needles are drawn down to a lesser extent in their stitch measuring and drawing movement than would be the conventional needles employed and manipulated in the way now accepted as standard.

Now referring to Fig. 1, needles 1 are of the usual latch type, but are of larger gage than would ordinarily be employed for knitting any particular fabric in question. As fully disclosed in applicant's co-pending application Serial #426,984, needles are used having a hook diameter of, for example, .022" rather than .016". In other words, 24 gage needles are used to knit fabric such as would normally be knitted by 48 gage needles. The hooks of these needles are preferably squeezed together as described in the application above identified so that the actual space inside the hook is approximately that of a 48 gage needle. Along with these larger needles, sinkers employed are preferably of about .007" thickness so that we have a hook diameter of .022" along with a sinker thickness of .007". This is merely given as one typical example of a successful combination. These dimensions may be varied to some extent and with the hook diameter of .022" slightly thinner or slightly thicker sinkers may be used. Also, slightly larger needles may be employed, for instance, needles having a hook diameter corresponding to that of 18 gage needles (.028"). To express the limits of the invention in this respect as a ratio, the needle hook diameter may bear a ratio to the sinker thickness of 2.8:1 to 4:1. Of course, the thickness of the sinker is taken at the stitch drawing edge and the hook wire diameter to which reference is made is the cross-sectional diameter of the hook wire at that part of the needle measuring or contacting the loop as it is being drawn.

In this Fig. 1 sinkers 2 have nibs 3, throats 4 and the usual sinker butts 5. The isometric view shows knitting in the direction of the arrow and

at the auxiliary side of the machine or at that feed known as the accordion feed. A yarn feeding finger 6 moved to and from feeding position by any convenient means feeds an accordion yarn 7 and there is provided a selection for needles which raise every other needle to take this accordion yarn while intermediate needles are not so raised. After the said yarn is taken in the hooks of every other or alternate needles, and upon drawing needles downwardly as by a stitch cam, the said yarn is passed behind intermediate needles. The accordion yarn is drawn over the sinker edges 8 which are merely the lower edges of the sinker throats and as the relative movement or progressive stitch drawing continues, a stitch may be measured and drawn by each alternate needle. Sinkers are pushed inwardly for casting off and shed the old loop from the needles thus completing the accordion stitches which are of course drawn on every other needle leaving a long float behind intermediate needles, these eventually appearing as floats at the back of the fabric. These floats are drawn over two intermediate sinkers.

In Figs. 5 and 6 needle cylinders are shown, that of Fig. 5 indicated by numeral 9 being the usual 3½'' needle cylinder upon which ordinary gages of men's hosiery are made. The cylinder 10, Fig. 6, is a 4'' cylinder which, according to the present invention, is to be used in the production of fabric according to this case. The relative size of cylinder to be used may be determined by increasing by 10% to 20% the size cylinder now established as standard.

The number of needles will still remain the same so that a corresponding increase of 10% to 20% in the distance between adjacent needles is realized. This increase in the distance between needles, along with the heavier gage needles and thin sinkers allows production of a fabric in which needle wales are comprised of loops substantially larger than loops in sinker wales.

Now referring to Fig. 3, a small section of fabric is shown greatly enlarged. This illustration is partially of a theoretical nature and to some extent, shows the real appearance. The relative size of the loops adheres fairly closely to that of the actual fabric, but the fabric has been extended laterally so as to show up the sinker loops which otherwise would be considerably foreshortened and in some cases, after the fabric has been finished, would extend almost perpendicular to the face of the fabric. The accordion yarn 7 is preferably much smaller than the yarn 11 fed at the so-called main or regular feed of the machine. This contrast in size of yarns contributes to a more pronounced ribbed effect and also appears to render the fabric more elastic. The tension at the main side may be termed ordinary knitting tension; that at the auxiliary side is enough to force the accordion yarn properly to interlace between needles. The fabric finishes down narrower yet allows maximum extension.

At the respective main and auxiliary feeds the stitch lengths are governed according to the size or weight of yarn so that naturally the length of stitch drawn at the main side is appreciably longer than that at the auxiliary side at which the relatively fine accordion yarn is fed. While the stitch lengths at the two sides are varied according to the particular yarns fed, it is to be understood that in the system herein described, the actual distance to which a needle hook is drawn below the cooperating stitch drawing edge of a sinker or other instrumentalities is approximately 50% of what that distance would be by the now accepted conventional system of knitting in circular independent needle knitting machines.

The wales 12, 13 and 14 are comprised of stitches from yarn 11 only while the intermediate wales 15 and 16 are made up loops alternately drawn from the accordion yarn 7 and then from the so-called main yarn 11. The accordion yarn is drawn into rather tight and smaller stitches in the wales 15 and 16 and although all loops of the yarn 11 are drawn at the main side of the machine, there is a certain readjustment or robbing of yarn during the knitting so that the loops 17 of yarn 11 in these intermediate wales eventually appear smaller than adjacent loops of the same yarn in the wales 12, 13 and 14. By variation of tension in the yarn 7 and also by adjustment of stitch length, the relative prominence of the rib, the width of the fabric as it comes from the machine and the possibility of finishing down or narrowing the fabric are controlled. Since the needles are relatively more widely spaced and are of much heavier gage in comparison to the thickness of sinkers than is now the conventional practice, the needle wales will be comprised of loops which show up as of much greater size than the sinker loops.

The amount of each yarn 7 and 11 which is fed into the fabric is carefully balanced so as to allow an elongation of the fabric in finishing and yet, will provide sufficient possibilities of stretch laterally, both these characteristics being essential in a commercial stocking top. The stocking top must finish down smaller than the width of the stocking leg and yet for commercial purposes, must have a lateral stretch which will allow it to be put on without effort and worn without discomfort. Before and in the finishing operation, there is a redistribution of yarn in the stitches to some extent, but the general characteristics of large needle loops and smaller sinker loops are maintained.

The increased size of the needle cylinder (comprising increase in size of needle circle) combined with the larger needles functioning as they do with narrow sinkers brings about or allows the construction of a fabric in which the floats 18 of the accordion yarn 7 are of greater length than such floats would be if knitted according to the practice heretofore prevailing and of which United States Patent #1,377,459 is a fair example. This combination by which the fabric may be finished down to desired width and yet will still present possibilities of maximum lateral stretch is in part, at least, a function of the increased length of the floats 18 resulting from the use of the larger cylinder. The increased length of floats does not merely give a fabric in which possibilities of stretch are proportionally greater, but in combination with the other factors entering into the construction of the fabric and method of producing it, brings about a much finer ribbed appearance, markedly better elasticity and possibilities of finishing down to a practical width.

In Fig. 4 a top 19 according to the invention is shown on a conventional stocking having a leg 20 the rest of the stocking not being illustrated since it would, when finished, be similar in appearance to the usual circularly knit stocking or half hose.

In Fig. 7 a section cut through the fabric illustrates how the raised ribs 21 extend out at the face of the fabric while the back portion 22 is

more or less flat, the latter being characterized by intermediate wales 15—16 and the floats 18 behind the alternate wales 12, 13 and 14.

Now referring to Fig. 2 a needle hook pathway appears in which the path 23 is that at which needle hooks approach the auxiliary feeding fingers 6 through one of which accordion yarn 7 is threaded. At a point just in advance of the finger 6 any suitable needle dividing or selecting means will raise the alternate needles to the pathway 24 while the intermediate needles continue along at the lever 23. After taking the yarn 7 the alternate needles are moved downwardly in a stitch drawing wave as by the usual stitch drawing cam and reach a lowermost point 25 at which point stitches will have been drawn and the previously drawn loops cast from the needles. That particular phase of the knitting is clearly illustrated in Fig. 1. Intermediate needles do not take the yarn 7 but are drawn down by the stitch cam (not shown) to the same level at 25.

After passing this accordion yarn feed, the needles are raised until stitches hang on the latches and approach a so-called main feed at which, by one of several yarn fingers 26, are fed the regular or main yarn 11. Just prior to reaching this point all needles rise up a front stitch cam to a latch clearing level 27, then move downwardly to the elevation 28 as they pass beneath the top center cam and thereafter are drawn down in a stitch forming wave by the usual stitch cam and leave a lowermost point 29 after which they are again elevated to the level 23. The level 29 is, as explained before, lower than that at 25, depending upon how much longer the stitch at the main side is compared to that at the accordion feed. Of course, this is illustrative of one representative pathway by means of which the method may be practiced, but it is to be understood that variations are possible, for example, needles may be cleared at different points and, especially at the accordion feed, the intermediate needles may be maintained at a relatively low level so that the yarn 7 will be drawn into stitches and the sinkers pushed in so that their nibs engage the yarn and push it behind the intermediate needles before those intermediate needles rise, that is, befor interlacing is effected.

Any selvage may be employed at the start of knitting or the fabric may be turned and sewed. Preferably some sort of selvage is to be used and for that purpose one of the yarns may be fed to alternate needles at the start and cast off in the first full course of either yarn to be knitted. Most naturally this will be accomplished by feeding the yarn 7 to alternate needles and casting the same off in the first course knitted at the main side. This is a simple or elemental type of selvage and other more complicated edge structures may be knitted, for example, an initial starting course may be followed by spaced tuck work or the like.

The invention may be practiced with any of the usual textile yarns, for example, with mercerized cotton, silk, wool, rayon, nylon or other synthetic filaments. Preferably the accordion yarn is to be elastic in nature, and should take a permanent set when finished.

The invention has been described by reference to one specific embodiment of the same and it is to be understood that this is illustrative of the general principles to be applied and that certain changes and variations may be resorted to without going beyond the scope of the appended claims in which the invention is defined.

I claim:

1. A method of knitting an accordion stocking top in a circular, independent needle knitting machine having needles and sinkers which function in a needle cylinder and a sinker head respectively, said needle cylinder and sinker head each being of a diameter 10% to 20% greater than that now accepted as standard for any particular weight of fabric in question, including the steps of measuring and drawing loops of a so-called main yarn and an accordion yarn at spaced feeding stations, drawing large needle loops and small sinker loops by maintaining a ratio of from 2.8:1 to 4:1 between the diameter of needle hooks at the stitch engaging portion thereof and the thickness of sinkers at that part of the sinker over which loops are measured, thereby to permit the drawing of accordion yarn floats proportionately longer so as to impart to the fabric greater stretch and elasticity.

2. A method of knitting an accordion stocking top in a circular independent needle knitting machine having needles and sinkers spaced from 10% to 20% farther apart in a carrier than said needles and sinkers would normally be spaced for knitting any particular weight of fabric in question, including the steps of measuring and drawing loops of a so-called main yarn and an accordion yarn at separate feeding stations, drawing latch needle loops and small sinker loops by maintaining a ratio of from 2.8:1 to 4:1 between the diameter of wire in the needle hooks of the stitch engaging portion thereof and the thickness of sinkers at that part of the sinker over which loops are measured, and maintaining a distinction between the main and accordion yarn whereby the accordion yarn will be finer than the main yarn, drawing said accordion yarn into loops sufficiently long to allow considerable extension of the fabric as the same is elongated upon finishing, but drawing accordion yarn floats between the adjacent accordion stitches 10% to 20% longer according to the increased distance between needles.

3. In knitting an accordion fabric in a circular, independent needle knitting machine having needles and sinkers, that method which includes mounting said needles and sinkers in a needle cylinder and sinker head having a diameter 10% to 20% greater than that now accepted as standard for any particular weight of fabric in question, drawing large needle loops and small sinker loops by maintaining a ratio of from 2.8:1 to 4:1 between the diameter of needle hooks at the stitch engaging portion thereof and thickness of sinkers at that part of the sinker over which loops are measured, thereby drawing accordion yarn floats proportionately longer to increase stretch and elasticity in the fabric.

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