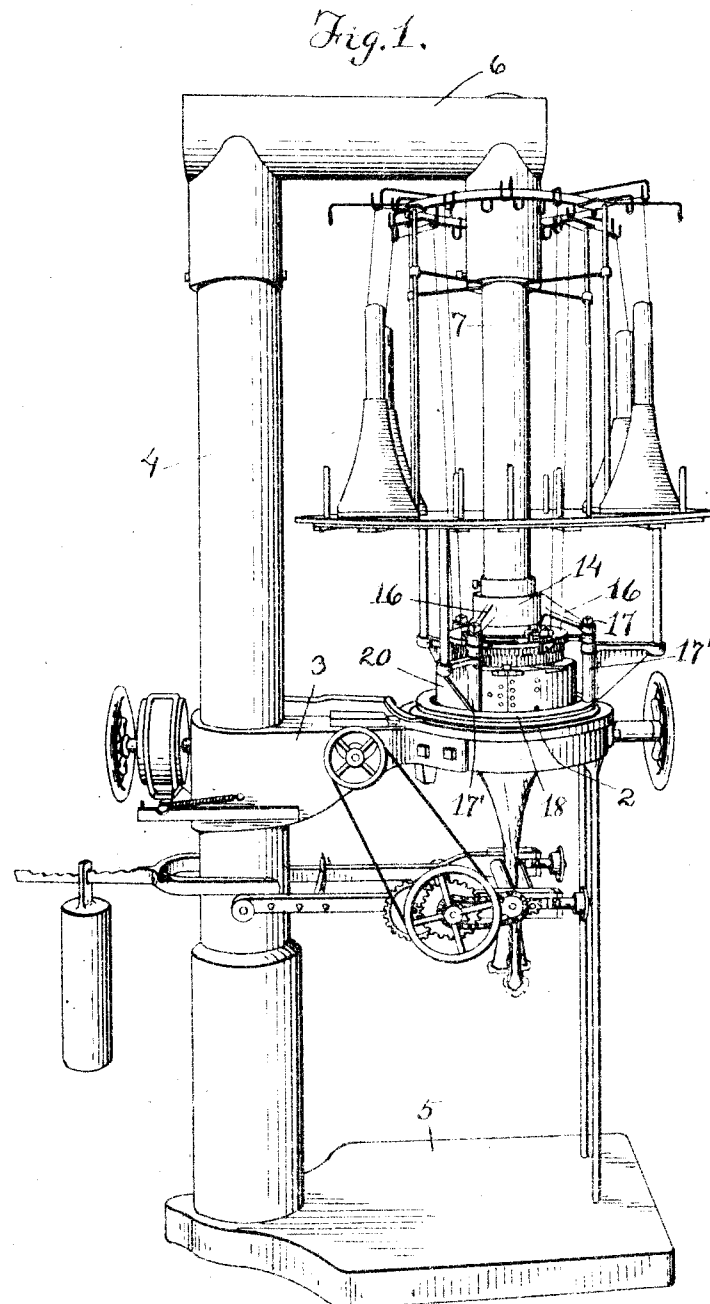


1,062,557.

B. T. STEBER.
KNITTING MACHINE.
APPLICATION FILED NOV. 29, 1910.

Patented May 20, 1913.

6 SHEETS—SHEET 1.



Witnesses
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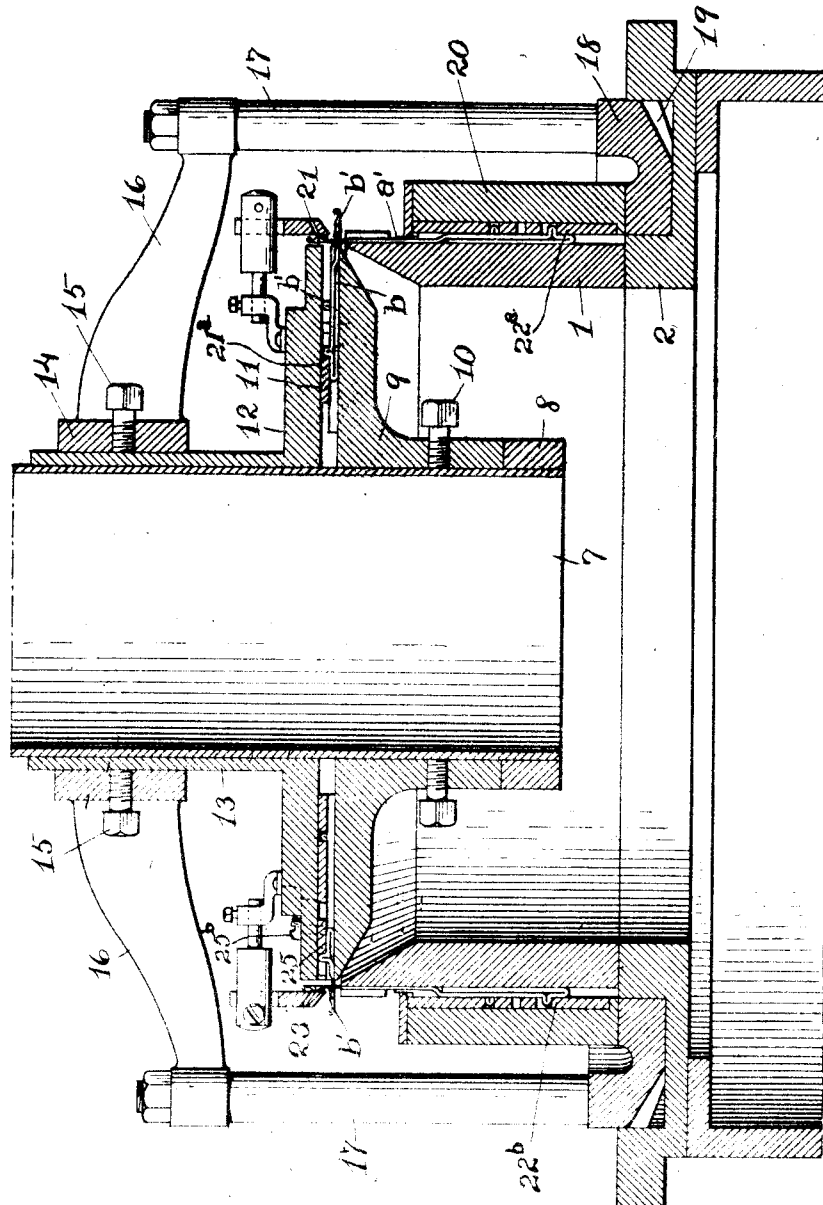
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1,062,557.

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5 SHEETS—SHEET 2

Fig. 2.



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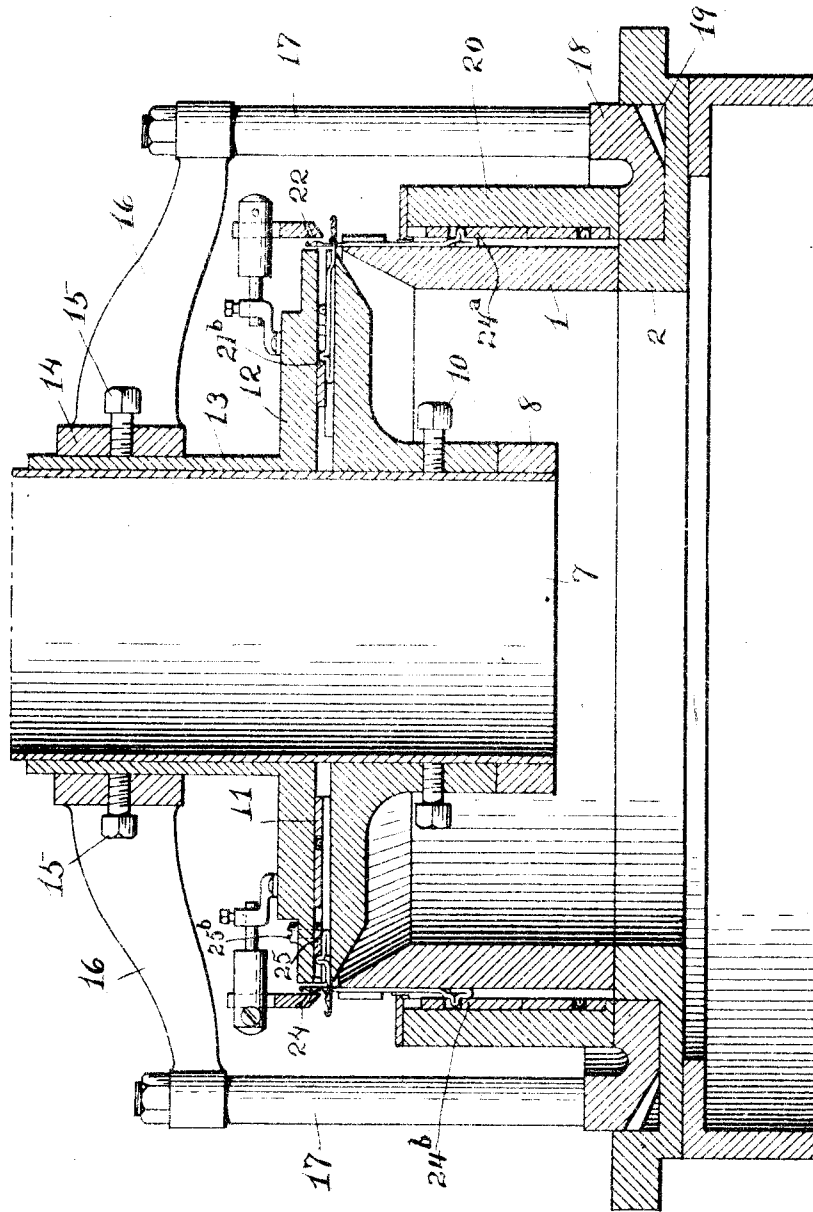
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5 SHEETS—SHEET 3.

Fig. 3.



Witnesses
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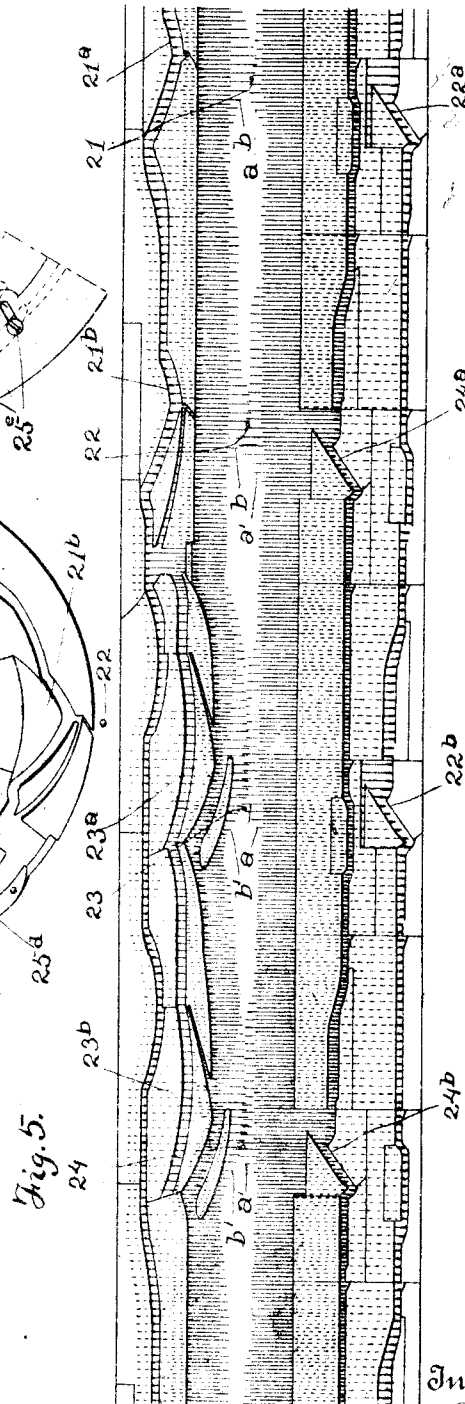
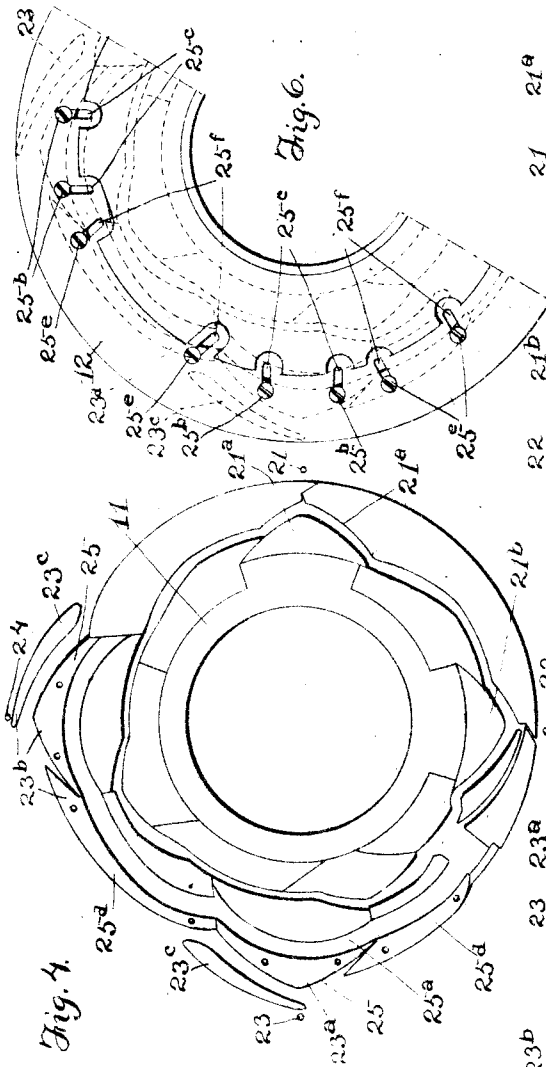
B. T. STEBER.
KNITTING MACHINE.

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Patented May 20, 1913.

5 SHEETS—SHEET 4

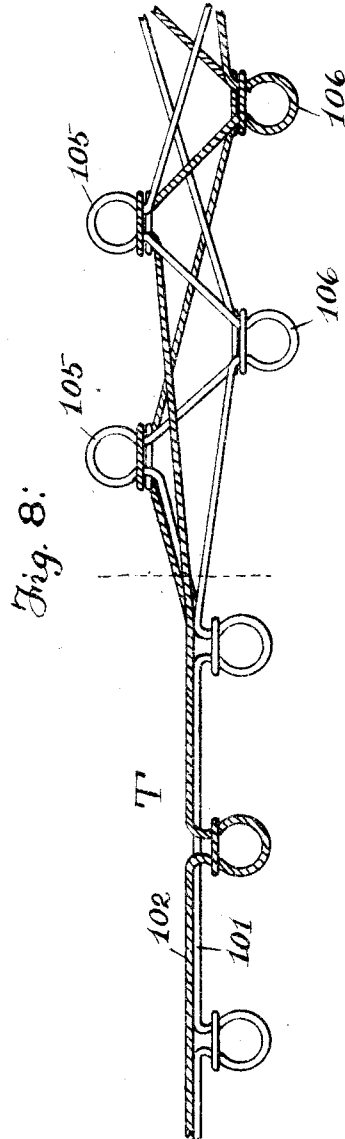
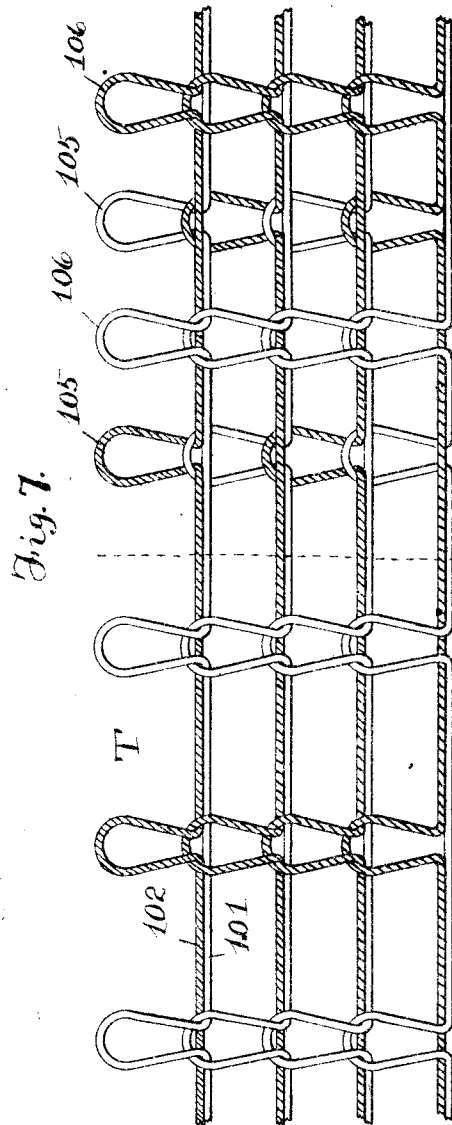
1,062,557.



1,062,557.

B. T. STEBER.
KNITTING MACHINE.
APPLICATION FILED NOV. 20, 1910.

Patented May 20, 1913.
5 SHEETS—SHEET 5



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UNITED STATES PATENT OFFICE.

BERNARD T. STEBER, OF UTICA, NEW YORK, ASSIGNOR TO THE STEBER MACHINE COMPANY, OF UTICA, NEW YORK, A CORPORATION OF NEW YORK.

KNITTING-MACHINE.

1,062,557.

Specification of Letters Patent.

Patented May 20, 1913.

Application filed November 29, 1910. Serial No. 594,803.

To all whom it may concern:

Be it known that I, BERNARD T. STEBER, a citizen of the United States, residing at Utica, in the county of Oneida and State of New York, have invented certain new and useful Improvements in Knitting-Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in knitting machines of the type adapted to produce ribbed fabric, and the object in view is the production of such a machine having knitting instrumentalities adapted for knitting a fabric comprised of two plain, flat webs as a base knitted together for forming a ribbed fabric, the distinct or individual characteristics of the webs being obliterated in the formation of the ribs, and the fabric as a whole presenting a single entity, the webs of which are not independent.

With this and further objects in view as will be in part hereinafter stated and in part will become obvious, the invention comprises certain novel constructions, combinations and arrangements of parts as will be herein specified and claimed.

In the accompanying drawings, Figure 1 is a perspective view of a knitting machine embodying the features of the present invention. Figs. 2 and 3 are vertical, central sections therethrough, one being taken at right angles to the other, and parts being broken away. Fig. 4 is a top plan view of the dial cams with the dial cap removed. Fig. 5 is a diagrammatic view illustrating the cylinder and dial needles and cams developed as an extension or on a flat plane. Fig. 6 is a fragmentary top plan of the dial cap, indicating a method of adjustment of certain dial cams. Fig. 7 is a view in elevation of a section of fabric produced by the machine and projected from a section of fabric such as constitutes the base or two-web fabric from which the ribbed fabric is formed, the two sections of fabric affording a comparative illustration. Fig. 8 is a horizontal edge view of the same.

For the purpose of illustrating a concrete example of an embodiment of the invention, a knitting machine is shown in the accompanying drawings which is particularly well adapted to produce the form of fabric illus-

trated at the right of Figs. 7 and 8. However, it is obvious that the invention is not limited to this particular example, but comprehends all mechanical equivalents and substitutes.

For a definite and detail understanding of the embodiment of the invention illustrated, reference will be had to the accompanying drawings in which—

1 indicates the needle cylinder mounted upon and fixed to the bed plate 2 sustained by bracket 3 carried by standard 4. Standard 4 may be supported on any suitable base 5 and extends above the bracket 3 and is provided with a cross piece 6, and a pendent rigidly connected supporting member 7. Fixed to the lower end of the member 7 is a collar 8, and surrounding the member 7 immediately above collar 8 and resting thereon is the dial 9, which may be clamped and thus rigidly connected to the member 7, as by set screws 10, 10. Above the dial is the dial cam ring 11 fixed to and carried by the dial cap 12, which cap is in turn carried by a sleeve 13 revolubly surrounding the supporting member 7, the sleeve 13 being in turn surrounded by and connected to a collar 14, set screws 15, 15, clamping the collar and sleeve together. The collar 14 is connected by radial arms 16 to vertical posts 17, which in turn have their lower ends fixed to the operating ring 18 rotatively mounted in the bed plate 2 and provided with the operating gear 19 adapted to be driven in the usual manner by a beveled gear not illustrated. The cylinder cam ring 20 surrounds the cylinder 1 and is mounted upon and fixed to ring 18 for being driven thereby. The cylinder is grooved vertically for the reception and guidance of cylinder needles, which needles are divided into two sets *a* and *a'*, the needles of one set alternating with the needles of the other throughout the cylinder. The dial is grooved radially for the reception and guidance of dial needles, which are divided similarly into sets *b* and *b'*, the needles of one set alternating throughout the dial with the needles of the other set. The needles of the respective sets both in the cylinder and dial may be distinguished by any of the well known means of separating needles into sets, but for clearness and facility of illustration, I have selected long and short needles as representative of the two sets in each needle bed, and in this connec-

tion it will be observed that the needle beds while illustrated as cylinder and dial may assume other forms.

Dial cap 13 carries four yarn feeds 21, 22, 23 and 24, the mounting of each on the cap being preferably adjustable as illustrated. Obviously, any multiple of the feeds illustrated may be utilized, but for clearness of disclosure only four have been shown, and on straight machines but two feeds would be required where the taking of the yarn occurs only once with each movement of the parts in one direction.

The needles of the cylinder and dial are each divided into two sets, as for instance, long and short needles, the long needles in each needle carrier being actuated by certain cams and the short needles by other cams. Obviously, this method of dividing the needles into sets may be modified as preferred, but for facility of description and illustration the set of long cylinder needles will be referred to as set *a*; the set of long dial needles as set *b*; the set of short cylinder needles as set *a'*, and the set of short dial needles as set *b'*. These needles may, of course, be arranged numerically in whatever clusters or groups the particular operator may select, but for facility of illustration, and as a preferred embodiment, the long needles in each needle bed have been indicated as disposed in successive alternation with the needles of the short set, and for the production of the fabric hereinafter described the same number of needles is utilized in each set as in any other set. Another important feature of the arrangement of the needles resides in the fact, which will be obvious from a study of Fig. 5 of the drawing, that any one long needle of the dial operates in the space between a long and short needle of the cylinder, being arranged, for instance, to operate at the left of the long cylinder needle and consequently at the right of the short cylinder needle, and each short dial needle is similarly arranged to operate in the space between each two of the cylinder needles, as for instance, at the left of a particular long cylinder needle and at the right of the adjacent short cylinder needle.

As clearly seen in Figs. 4 and 5, the dial needles are actuated by cams timed relative to the action of the cams of the cylinder as well as to the disposition of the respective yarn feeds, there being a cam 21^a and a cam 21^b for successive actuation of the needles of set *b*, the remainder of the cam path for needles *b* being disposed for preventing operation and for holding the said needles in a retracted condition, while cams 23^a and 23^b are disposed for actuating the needles of the set *b'* successively, and the cam path of the needles *b'* is shaped to leave the needles *b'* inactive and retracted during the

remainder of the rotation of the dial cap from the cam 23^b to the cam 23^a. Of course, each cam 21^a, 21^b, 23^a and 23^b is made up of the pair of cam surfaces necessary for effecting a knitting operation, that is a needle pushing out or projecting cam surface, and a needle retracting or stitching cam surface, both surfaces for facility being herein referred to as a cam.

In order to facilitate rendering certain of the dial needles inactive at times, as for instance, the set *b'*, the projecting cam surfaces of cams 23^a and 23^b are made adjustable by having the material of the cam ring 11 cut away at the back or inside of such surfaces, as indicated at 25^a leaving adjustable portions 25, of the cam ring outside of such cut-away portion. Each portion 25 is connected to the dial cap 12, as clearly seen in Fig. 6, by a pair of adjustable set screws or bolts 25^b, 25^c, extending through slots 25^e, 25^f, in the dial cap 12, whereby, by loosening screws 25^b, portions 25 may be adjusted inwardly sufficiently to cause the short dial needles to remain inactive and to take no yarn whatever. The cams 23^a and 23^b as illustrated each has an auxiliary or approach cam portion 25^a leading up to the respective portion 25, and to insure against any undesired movement of the short needles, each of such auxiliary portions 25^a is rendered adjustable by retaining set screws or bolts 25^c, 25^e, extending through slots 25^f, 25^f in the dial cap, each set screw 25^c having its lower end threaded into the respective portion 25^a and its upper end provided with the usual head engaging the upper surface of the dial cap in the same manner as screws 25^b. When adjusting the cams for throwing the short dial needles out of operative condition, the screws 25^b are loosened, portions 25 moved inwardly, the screws 25^b moving in the slots 25^e, and, when the portions 25 have been moved sufficiently inwardly, the screws 25^b are tightened so that their heads engage the upper surface of the dial cap, and the threaded lower ends draw the portions 25 tightly in position. The portions 25^a are then similarly adjusted inwardly, the adjustment of the portions 25 occurring prior to the adjustment of the portions 25^a owing to the lapping of the latter over the former. To reestablish the operative condition of the short dial needles, the cam portions 25^a are first readjusted to their outer position, and then cam portions 25 are correspondingly readjusted. Obviously the short dial needles have been selected merely for purposes of illustration, and the same effective adjustment of the actuating cams of the other set of dial needles may be provided instead.

By reference to Fig. 5, it will be seen that below cams 21^a the cylinder is provided with a cam 22^a for actuating the set of needles *a*.

or long cylinder needles. Beneath cam 21^b a cylinder cam 24^a is provided for actuating the short cylinder needles or set *a'*, while beneath cam 23 of the dial a cam 22^b is provided for the cylinder for actuating the long cylinder needles or set *a*, and beneath cam 24 of the dial a cylinder cam 24^b is provided for actuating the short cylinder needles or set *a'*. Thus in operation cams 22^a and 21^b cooperate to actuate the needles of the sets *a* and *b* at yarn feed 21, while cams 24^a and 21^b cooperate to actuate the sets of needles *a'* and *b'* at feed 22. Then cams 22^b and 23^a cause the cooperation of needles *a* and *b'* at feed 23, followed by the action of cams 24^b and 23^b causing the cooperation of needles *a'* and *b'* at feed 24. Thus the operations of the machine are naturally divided into two distinct units, one represented by the successive operations of the short dial needles, or one set of dial needles, first with respect to the long cylinder needles, or one set of cylinder needles, and then with respect to the short cylinder needles, or the other set of cylinder needles. The other unit of operation consists of the actuation of the other set of dial needles relative to the cylinder needles, as for instance, the short dial needles acting first with respect to the long cylinder needles and then with respect to the short cylinder needles. Either one of these two complete units may be eliminated by the removal or rendering inactive of a respective set of dial cams, as for instance, the throwing out of action of the cams 23^a and 23^b, whereupon the other unit of operation may continue and will produce another form of fabric, not herein illustrated, but embodying a product of one species of the genus of the present invention. To again knit the more complex fabric, such as seen in Figs. 7 and 8, it is only necessary to move the portions 25 and 25^a to the position for rendering cams 23^a and 23^b active.

In operation, for clearness of illustration, it should be understood that the two sets of cylinder needles when knitting alone at all four yarn feeds and without the presence of the dial at all, alternate feeds being taken by one set only, and the other alternate feeds by the other set only, will produce a fabric comprised of two plain, flat webs, such as is illustrated at T, at the left of Figs. 7 and 8. It is, of course, understood that the function of a dial needle in an ordinary ribber is to knit wales of loops in the connecting yarn or sinker wales between the cylinder needle wales which thus produces a rib. When but one unit of operation is being carried out, as by the throwing out of operation of cams 23^a and 23^b, the active dial needles act first with respect to the web being made by one set of cylinder needles, and then with respect to the web being made by the other set of cylinder needles, so that the first loop on a given

dial needle will be drawn from the sinker wale connecting the needle wales of one of the basic webs, and the next loop on the same dial needle will be drawn from the next sinker wale of the other basic web, whereby the rib produced by a particular dial needle will be composed of successive alternate loops of yarn making up the two independent needle wales on the outer or cylinder face of the fabric.

In the knitting of ordinary ribbed fabric, it is common to feed yarn to the cylinder needles and then when they rise to pull the ribbing wales by the dial needles from the sinker wales connecting the cylinder needle wales, but obviously a converse relation in the action of the needles may be provided, and the same mechanical action will occur. one set of needles producing the basic fabric and the other set drawing in the sinker wales to make the fabric ribbed instead of plain stitch. Of course, where a machine is actually making ribbed fabric there is no point in the fabric where the plain web is apparent, as each course is knit into a rib as it progresses, so that the reference to the two plain webs herein merely bears out a theory of operation which facilitates an understanding of the construction of the machine and its functions. If at any time all of the dial needles were thrown out of action, the cylinder needles would produce the two distinct interlooped, flat webs and as soon as the dial needles were placed in action again, the ribs would again appear, the two webs being interknit into a single ribbed web, and in the instance of the operation of but one set of dial needles, each needle of that set pulls a loop from a sinker wale of one web of the basic fabric at one side of one cylinder needle, and then pulls a loop from the next sinker wale of the other web of the basic fabric at the other side of the adjacent cylinder needle of the other set. For instance, where only the long dial needles are operating, one long dial needle will pull a loop at one side of one long cylinder needle, say to the right thereof, and will then pull its next loop at the other side, say to the left, of the adjacent short cylinder needle. The same is true where only the short dial needles operate. It will thus be noted that by reason of the relative positioning of the dial and cylinder needles, the thread constituting the stitches which are drawn in by the dial needles to form needle wales producing loops on the inner face of the fabric describes lines similar to the outline of an ordinary saw tooth, that is, having a long inclined strand or sinker wale extending one way, and a short strand or sinker wale disposed at an angle thereto, so that the saw tooth has the appearance of leaning in a direction away from the long strand or sinker wale, as clearly seen at the right of Fig. 8, the saw

tooth, being drawn in by a needle of one set of dial needles inclining in one direction when taken from a given set of cylinder needles and in an opposite direction when taken from the other set of cylinder needles, that is inclining in one direction in one course and in another direction in another course, whereby the long strands of one course are caused to cross the short strands of the preceding course. This is true regardless of whether all of the needles in the dial are operating or not. Any one dial needle will effect the same result so far as the production of the oppositely inclined saw tooth stitches is concerned by reason of its coöperation with at least one needle of each of the two sets of needles in the cylinder.

When the embodiment of the fabric seen at the right of Fig. 8 is to be produced, the cams 23^a and 23^b are thrown into action and all cylinder cams are restored to operative condition and yarn is supplied to feeds 23 and 24, whereupon the cylinder needles will produce the same form of basic fabric T made up of the two simple plain flat webs, the cylinder needles forming needle wales 106, as seen at the left of Figs. 7 and 8, and the dial needles will pull in loops from the sinker wales of such basic fabric, each dial needle pulling alternately from one web and then from the other for producing a wale 105, so that each dial needle wale is made up of first a loop of yarn from a sinker wale 102 of one of the basic webs and then a loop of yarn from a sinker wale 101 of the other basic web, whereby the fabric seen at the left of Figs. 7 and 8 is produced. Thus the knitting instrumentalities contemplated by the present improvement, and an embodiment of which is illustrated in the accompanying drawings, are designed to produce a single integral fabric having within its complete entity that which would have been two distinct flat webs formed for instance on the cylinder needles after a manner common in the art, but which distinct entity of such webs has been obliterated by the formation of a single inseparable fabric, each of the ribs of one face of which is made up of loops of yarn from a plurality of ribs on the other face.

When all dial needles are operating, one set of dial needles pulls from one basic web and then from the other, and then the second set of dial needles repeats this operation at different feeds. As there are in the two dial sets an equal number of needles to the total number of cylinder needles, there will be one dial needle wale produced for each cylinder needle wale, making a one-and-one ribbed fabric, the cylinder or outer face of which has alternate independent ribs, while each rib on the inner or dial face of the fabric is a composite of two yarns, one

from one cylinder needle wale and the other from another adjacent independent cylinder needle wale. Each dial needle wale will contain the same number of loops as any one cylinder needle wale and of the same length. If yarn of one color is delivered from feeds 21 and 22 and of another color from feeds 23 and 24, the cylinder face of the fabric will display alternate stripes of two colors, while the two colors will appear in each stripe or needle wale on the inner or dial face, one loop of each dial needle wale being of one color and the next loop in the same wale being of the other color; thus alternating throughout the length of the wale, and giving to the back or dial face of the fabric a motley appearance. If four differently colored yarns are employed, each wale on the cylinder face of the fabric will be formed of alternate loops of two colors, corresponding to the two respective feeds, and each wale on the dial face of the fabric will present first a loop of a color of one cylinder needle wale and then a loop of a color of an adjacent independent cylinder needle wale, and alternating thus throughout the length of the dial wale, and the next adjacent dial wale will present first a loop of the other color of the first cylinder needle wale and then a loop of the other color of the other or adjacent independent cylinder needle wale, the motley stripes on the dial face of the fabric thus differing in color effects from the motley stripes on the cylinder face of the fabric.

As there are only one-half as many dial needles in one set as there are cylinder needles in the two cylinder sets, the elimination of one dial needle set from action with the elimination of its corresponding feeds, would, in producing the simpler form of fabric, cause each dial needle to pull in two loops for each single loop pulled in by any one cylinder needle, one of the dial needle loops being pulled first from one feed and the next dial needle loop from the other feed, while each cylinder needle pulls in loops only from its own respective feed.

As a further exposition of the operation of the machine when producing the one-and-one fabric illustrated at the right of Figs. 7 and 8, referring more particularly to Figs. 4 and 5 of the drawings, it will be assumed that feed 21 is working with white yarn, feed 22 with black yarn, feed 23 with red yarn and feed 24 with blue yarn. Starting with feed 21, the white yarn will be taken by the long cylinder needles and by the long dial needles, the two sets of needles pulling in opposite directions and forming a zigzag line of yarn between feeds 21 and 22. At feed 22 the black yarn is pulled in opposite directions by the short cylinder needles and by the long dial needles, the long dial needles thus inter-

looping the white yarn with the black yarn as soon as feed 22 reaches the point of the first taking of white yarn, whereat the long dial needles cast off the loops of white yarn and hold loops of black yarn. At feed 23, at the beginning of a knitting operation, the red yarn is taken by the other or new set of dial needles, that is the short dial needles, and is taken by the long cylinder needles, that is those needles carrying loops of white yarn from feed 21, the long cylinder needles casting off the white loops and interlooping therewith the red yarn of feed 23. Going now to the next feed, or feed 24, the same short dial needles will pull in loops from the blue yarn of feed 24 and cast off the loops of red yarn with which they have interlooped the blue, whereas the short cylinder needles take the blue yarn interlooping the same with the black yarn taken from feed 22 and casting the loops of black yarn. Of course, it is understood that in thus considering the operation, those sets of needles not referred to relative to a particular feed remain inactive and well pending the arrival of the next feed. Thus at no point in the operation of the machine is there formed a section of fabric however small in which one of the basic webs is independent of the other, but at every point as soon as an interlooping of yarns occurs sufficient to constitute a portion of fabric such interlooping destroys and eliminates the distinct entities of the basic webs and produces a resulting integral ribbed fabric having its existence as a ribbed fabric developed at the expense of the loss of the independence of such basic webs. After the taking of yarn from feed 24, the course or round of operation is complete, and the next round begins and repeats the one just specified.

I am aware that it has heretofore been proposed to provide instrumentalities for knitting two independent webs to form a fabric, in one instance one of the webs being ribbed and the other flat with the needle wales of the flat web appearing in the spaces between the ribs of the ribbed web, and in the other instance the fabric being constituted of two independent webs each ribbed, all of the ribs of each appearing in the spaces between the ribs of the other. Both of these fabrics, however, are essentially distinguished by the maintenance of the distinct independence of the basic webs which are not connected other than by the interlocking resultant from the disposition of certain sinker wales of one web relative to the needle wales of the other web, such that the webs may not be readily separated. Such fabrics, however, being distinguished by the independence of the basic webs are not to be confused with the fabrics which the present improved knitting machine is de-

signed to produce, the product of such improved knitting machine being essentially an integral structure in which the basic webs are absolutely dependent upon each other for the production and maintenance of the ribbed nature of the fabric, and such basic webs may not, therefore, by any possible mutilation of the fabric be separated from each other except by the destruction of the ribbed nature of the fabric. Thus it becomes apparent that the independent webbed fabrics and machines for producing the same represent one type of development, while the present improvements involve a diametrically opposite type.

It will be perfectly obvious to those familiar with the art that the invention comprehends knitting instrumentalities capable of interlooping the connecting yarns between needle wales of two plain stitch webs into a wale on the opposite face from such needle wales, whereby a single integral fabric structure is produced possessing the characteristic of ribs, not formerly possessed, and deprived of the characteristic of independence of the webs; and such instrumentalities may be developed in many embodiments susceptible of the production of widely varying fabrics, all clearly falling within the intent and spirit of the invention.

While throughout this description I have referred to the cylinder needles as being adapted to form the basic fabric of two flat webs, and the dial needles as drawing in the rib-making wales, it is obvious that the operation may be performed conversely; that is, the dial needles may be made to produce the basic fabric of two plain, flat webs and the ribs be formed therefrom by the cylinder needles.

Variations in the relative number of sets of needles in the two carriers may clearly be made within the spirit and scope of this invention, and to embody the invention as particularly pointed out in some of the appended claims does not require that two sets of needles be provided in each carrier.

For the purposes of identity and facility of application of the terms of the appended claims to the elements of the particular embodiment herein disclosed, the cylinder may be considered the first needle carrier and the dial the second needle carrier, but this is not to be taken in any sense as a restriction of the scope of the claims which are intended to apply to such constructions whether the same or a converse disposition of parts is employed.

The fabric produced by the invention herein set forth is disclosed and claimed in my United States Letters Patent No. 951,033, granted March 1, 1910.

What I claim is:—

1. In a knitting machine, two needle carriers, two sets of needles in one carrier, two

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sets of needles in the other carrier, four yarn feeds, cams for actuating one set of needles in one of the needle carriers arranged to successively operate the needles of such set to knit two successive yarns and to be idle with the remaining two yarns, similar cams for the other set of needles of the last-mentioned carrier for similarly operating such needles, and cams for the other needle carrier arranged to operate the needles of each set successively.

2. In a knitting machine, two needle carriers, a set of needles in one of said carriers, cams for actuating the needles of said set a multiplicity of times in succession adapted to allow the needles to remain inactive during a portion of the operation of the machine, a second set of needles in the same carrier, and cams for similarly actuating the second set of needles and allowing the same to remain inactive, the cams of the two sets being disposed to cause one set to be actuated while the other remains inactive, a plurality of needles in the other carrier, cams for actuating the latter sets successively, and yarn feeds for said needles.

3. In a knitting machine, the combination of two needle carriers, herein identified as first and second, two sets of needles in each carrier, yarn feeds for the needles, cams for actuating the needles of the first needle carrier for causing one set of such needles to take yarn from alternate feeds only and for causing the other set of the first carrier to operate, for taking yarn from other alternate feeds only, cams for actuating one set of needles of the second carrier for taking yarn from two successive feeds, and cams for actuating the other set of needles of the second carrier for causing the same to take yarn from two other successive feeds.

4. In a knitting machine, the combination of two needle carriers, herein identified as first and second, two sets of needles in each carrier, yarn feeds for the needles, cams for actuating the needles of the first needle carrier for causing one set of such needles to take yarn from alternate feeds only and for causing the other set of the first carrier to operate, for taking yarn from other alternate feeds only, cams for actuating one set of needles of the second carrier for taking yarn from two successive feeds, and cams for actuating the other set of needles of the second carrier for causing the same to take yarn from two other successive feeds, the needles of the second carrier being disposed for taking yarn first at one side of the space between active needles of the first carrier and then from the other side of the space between other active needles of the first carrier, there being an equal number of needles in each set in both carriers.

5. In a knitting machine, two needle carriers, herein identified as first and second, a

set of needles in the second carrier, two sets of needles in the first carrier, yarn feeds for the needles, a cam for actuating the needles of one set of the first carrier to take yarn from one yarn feed, a cam for actuating the needles of the other set of the first carrier to take yarn from another feed, and cams for actuating the needles of the set in the second carrier for taking first a yarn of one feed and a yarn of the other feed, the needles of the set in the second carrier being equal in number to one half the total number of needles in the first carrier.

6. In a knitting machine, two needle carriers, herein identified as first and second, a set of needles in the second carrier, two sets of needles in the first carrier, needles of each set in the first carrier alternating in one-and-one relation to the needles of the other set therein, yarn feeds for the needles, a cam for actuating the needles of one set of the first carrier to take from one yarn feed, a cam for actuating the needles of the other set of the first carrier to take yarn from another yarn feed, and cams for actuating the needles of the set in the second carrier for taking first a yarn of one feed and then a yarn of another feed, each needle of the set in the second carrier being positioned and adapted to operate at one side of a needle of one set of needles of the first carrier to take one yarn and then to operate at the other side of an adjacent needle of the other set of needles of the first carrier for taking another yarn.

7. In a knitting machine, two needle carriers, herein identified as first and second, two sets of needles in the first carrier, the needles of one set alternating in one-and-one relation with the needles of the other set, a set of needles in the second carrier equal in number to one half the total number of needles in the first carrier, yarn feeds for the needles and cams cooperating therewith for actuating the needles, means positioning the carriers relative to each other adapting each needle of the set of needles in the second carrier for drawing yarn first from between the needles of one set of the first carrier at one side of a particular needle of that set and for next drawing yarn from between the needles of the other set of the first carrier at the other side of the adjacent needle of such second set, the cams being adapted to thus actuate said needles.

8. In a knitting machine, a needle carrier, needles guided thereby, yarn feeds cooperating with the needles, cams for actuating said needles in sets for causing certain of the needles to knit yarn independent of yarn knit by the other needles, and a second needle carrier, needles guided thereby, and means for actuating the last-mentioned needles twice for each actuation of any one of the needles of the first-mentioned carrier

for causing the needles of the second carrier to successively take from the yarns of both sets of needles of the first carrier for interlooping said yarns alternately into needle
5 wales.

9. In a knitting machine, a needle carrier, needles guided thereby, yarn feeds cooperating with the needles, cams for actuating said needles in sets for causing certain of
10 the needles to knit independent yarn from that knit by the other set, and a second needle carrier, needles therein designed to pull said yarns in an opposite direction to the direction of pull of the needles of the first
15 needle carrier, and means for actuating the needles of the second carrier twice for each actuation of any one of the needles of the first mentioned carrier for causing the needles of the second carrier to successively
20 take the yarn of the feeds of the two sets of needles of the first mentioned carrier for interlooping said yarns into needle wales in alternation at the opposite face of the fabric from the face on which appears the
25 needle wales of the first needle carrier.

10. In a knitting machine, two sets of needles, feeds therefor, means for cooperatively actuating the needles and the feeds for causing the needles of one set to knit yarn
30 from one feed, and causing the needles of the other set to knit yarn from another feed, and a third set of needles, and means for actuating the third set of needles for causing the needles thereof to knit at said feeds
35 at each and every course, each needle of the third set being disposed to operate in the space between a needle of the first and a needle of the second set so as to pull yarn first from one side of a needle of one set
40 and then to pull yarn from the relatively other side of the adjacent needle of the other set.

11. In a knitting machine, two sets of needles, feeds therefor, means for cooperatively
45 actuating the needles and the feeds for causing the needles of one set to knit yarn from one feed, and causing the needles of the other set to knit yarn from another feed, and a third set of needles disposed for
50 pulling loops in a different direction from the needles of the first two sets for producing ribs, and means for actuating the third set of needles for causing the needles thereof to knit at said feeds.

12. In a knitting machine, a needle carrier, two sets of needles therein, yarn feeds therefor, means for actuating said needles in sets for causing the needles of the respective sets to knit only from independent yarns, a second needle carrier, needles
60 guided thereby, and means for actuating the needles of the last-mentioned carrier for drawing loops alternately from the independent yarns into the same needle wales at that face of the fabric opposite the face on which
65 appears the needle wales of the needles of the first-mentioned carrier, the relative numbers and operations of the several needles being such that the total number of loops drawn to one face of the fabric is the
70 same as that drawn to the other face thereof.

13. In a knitting machine, the combination of a cylinder, needles therefor, means for actuating said needles in alternating
75 sets, means for feeding a plurality of yarns to each set, a dial, needles therefor, and means for actuating the dial needles in sets corresponding to the cylinder needle sets for knitting successively and alternately
80 from the yarns fed to the cylinder needles, said actuating means imparting to each dial needle set a plurality of knitting operations in succession, while the other dial needle set remains inactive.
85

14. In a knitting machine, the combination of a cylinder, needles therefor, means for actuating said needles in alternating
sets, means for feeding a plurality of yarns independently to each set, a dial, needles
90 therefor, and means for actuating said dial needles in alternate sets for causing one set of the dial needles to knit first from yarn from one set of cylinder needles and then to knit from yarn from the other set of cylinder
95 needles successively, and causing the other set of dial needles to knit from another yarn from the first-mentioned set of cylinder needles and then to knit from another yarn from the other set of cylinder
100 needles successively.

In testimony whereof I affix my signature in presence of two witnesses.

BERNARD T. STEBER.

Witnesses:

OWEN F. LUKER,
EDGAR M. KITCHIN.