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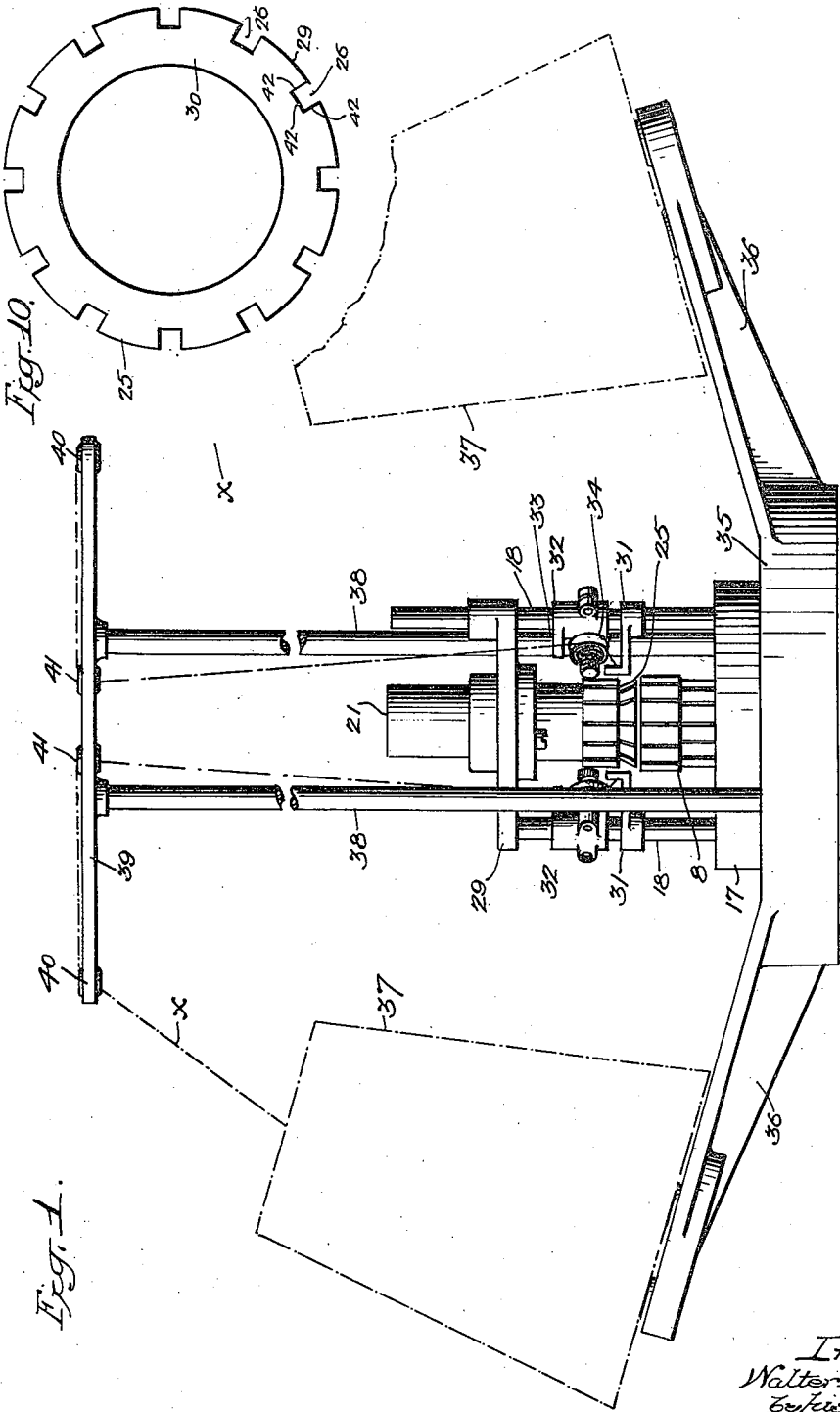
W. LARKIN

2,032,993

KNITTING MACHINE

Filed Aug. 2, 1933

3 Sheets-Sheet 1



Inventor:
Walter Larkin
By/His Attorneys.
Houson & Houson

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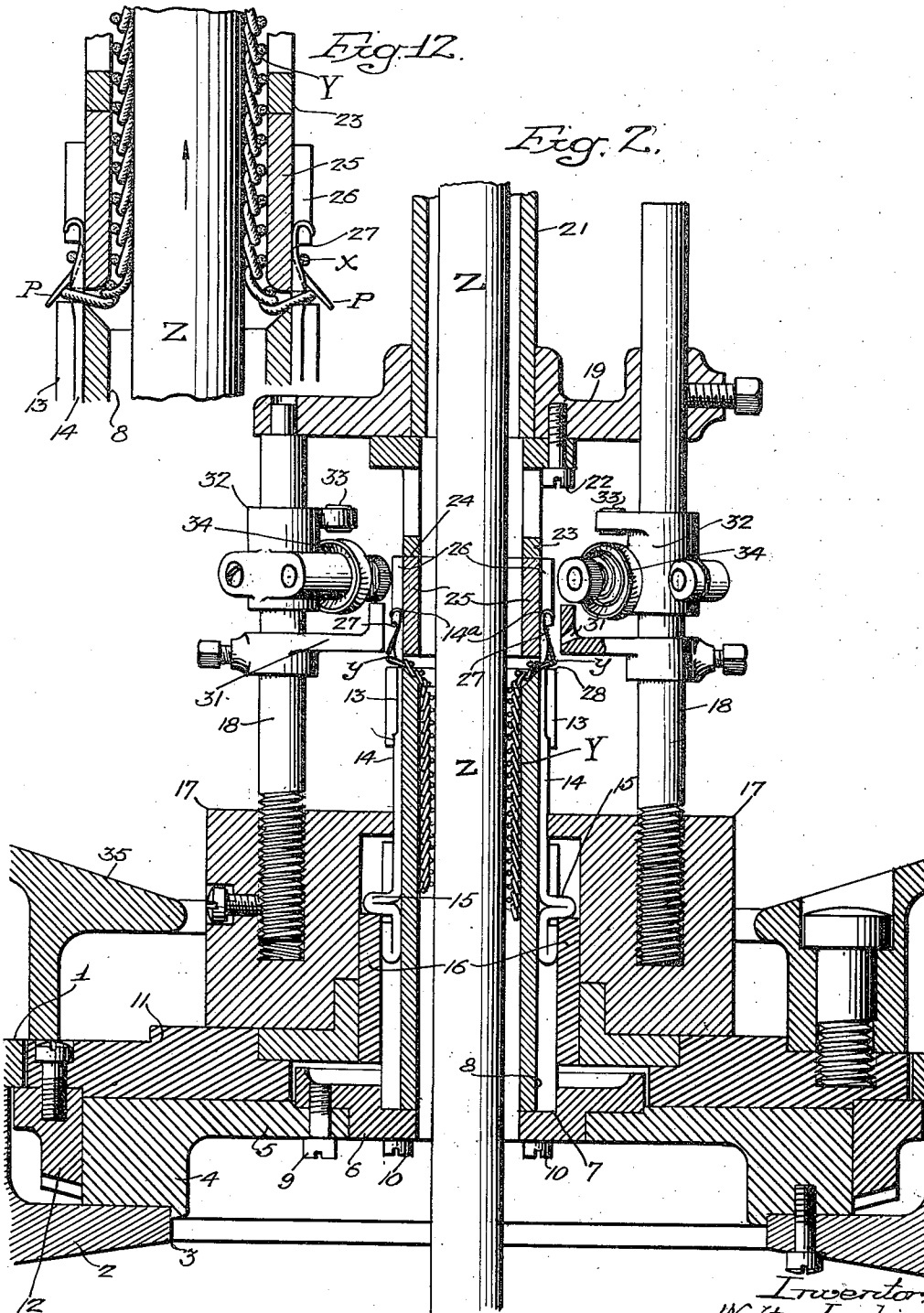
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3 Sheets-Sheet 2



Inventor:
Walter Larkin
By his Attorneys
Howson & Howson

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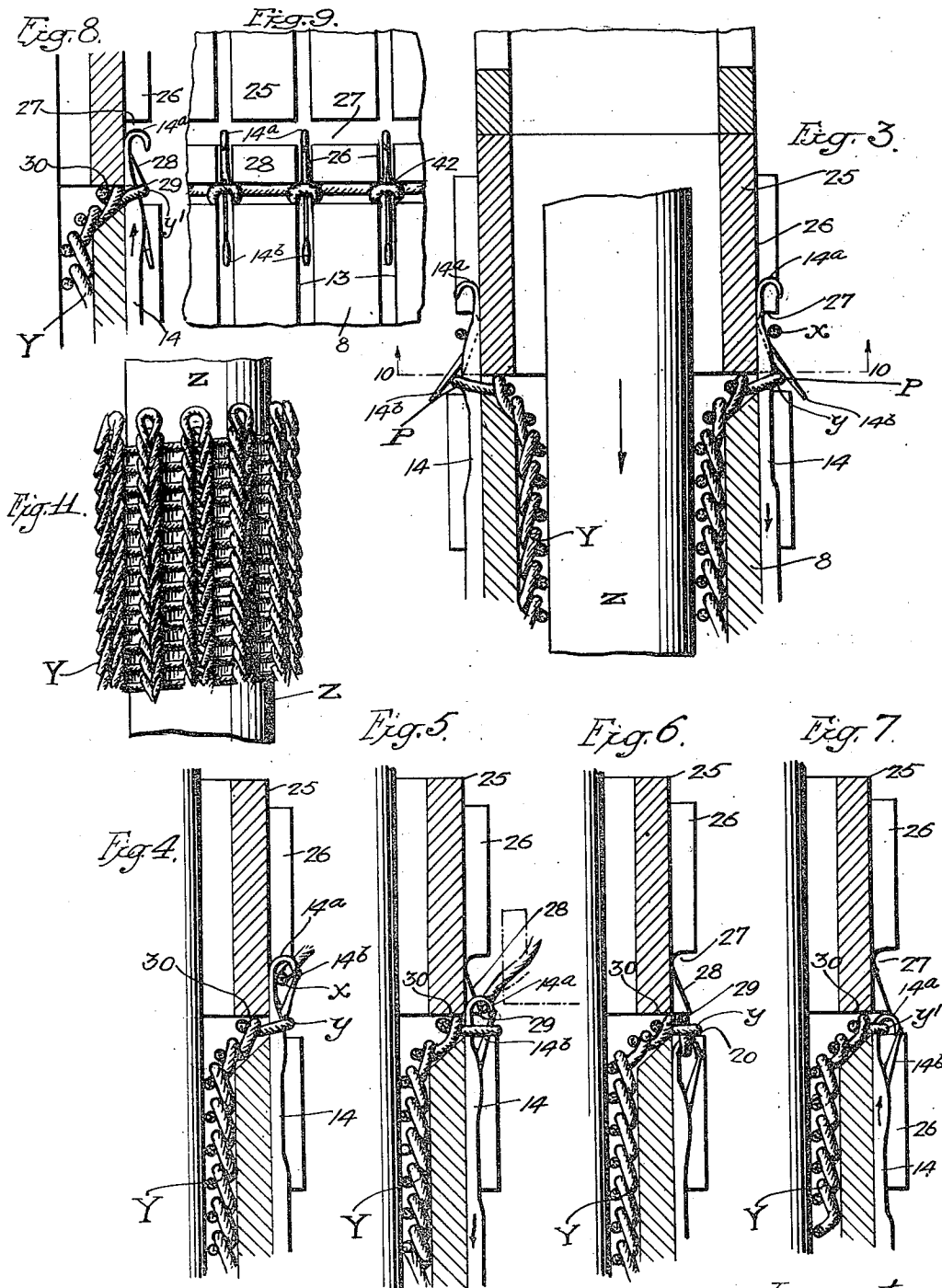
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Inventor:
 Walter Larkin
 by his Attorneys
 Hanson & Hanson

UNITED STATES PATENT OFFICE

2,032,993

KNITTING MACHINE

Walter Larkin, Norristown, Pa., assignor to Fidelity Machine Company, Wilmington, Del., a corporation of Delaware

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9 Claims. (Cl. 66—9)

This invention relates to a machine for knitting a seamless tube in the form of a reinforcing layer of fabric around a primary member, such, for example, as the inner rubber tube employed in the manufacture of rubber hose pipe according to the disclosure of the copending application of Sidney B. Blaisdell, Serial No. 593,594, filed May 23, 1931.

The machine made in accordance with the principles of the present invention is also adaptable to the knitting of a layer of fabric around an electric cable, in providing insulation thereon, or around a hollow primary member of a conduit adapted for receiving electric wires or cables.

The principal object of the present invention is to provide a knitting machine by which the fabric tube will be knitted tightly around and in close embracing contact with the primary member. More specifically, the present invention involves the provision of a novel form of web holder, by which a course of stitches hanging on the knitting needles will be held in a substantially fixed position as the needles are operated longitudinally through the stitches to interknit new stitches therewith in the formation of a succeeding course, thereby permitting the knitting thread to be placed under relatively high tension to cause the successively knit courses of stitches to embrace the primary member tightly.

The construction of the knitting machine and particularly that of the novel web holder and the operation thereof will be fully disclosed hereinafter, reference being had to the accompanying drawings, of which:

Fig. 1 is a side elevation of a knitting machine including the web holder of the present invention;

Fig. 2 is an enlarged sectional elevation of the central portion of the knitting machine shown in Fig. 1;

Fig. 3 is a fragmentary sectional elevation drawn to a still larger scale and illustrating in detail the relation between the needle cylinder, the needles and the web holder;

Figs. 4 to 8 inclusive are partial views similar to Fig. 3 and illustrating various steps in the knitting operation;

Fig. 9 is a side elevation of the elements in the positions illustrated in Fig. 8;

Fig. 10 is an inverted plan of the web holder at the plane designated as 10—10, Fig. 3;

Fig. 11 is a side elevation of a portion of a primary member with a short section of the knitted tube thereon; and

Fig. 12 is a view similar to Fig. 3 but illustrating the movement of the primary member and knitted tube in a direction opposite to that shown in Fig. 3.

The knitting machine proper may be of any conventional type and for the purpose of illustration Fig. 2 of the drawings illustrates the machine as comprising a main bed plate 1, to which is suitably secured a hollow annular member 2. The annular member 2 comprises a horizontally extending inturned flange 3 upon the upper side of which is secured a cylinder-supporting ring 4. The cylinder-supporting ring 4 is provided with an inturned flange 5 which supports a supplementary ring 6. The supplementary ring 6 is counterbored at 7 for the reception and support of the needle cylinder 8. The supplementary ring 6 is secured to the ring 4 by means of screws 9 and the cylinder 8 is secured to the ring 6 by means of screws 10.

Rotatably mounted on the ring 4 is a cylinder cam plate 11 to which is secured a driving ring gear 12. The ring gear 12 snugly embraces and rotates about the periphery of the ring 4.

The needle cylinder 8 is provided with needle grooves 13, 13 which in the present instance are spaced laterally a distance approximately twice that of the ordinary spacing of the needle grooves of a cylinder of a particular gage.

Slidably mounted in each of the grooves 13 is a needle 14 provided with the usual form of butt adapted to be engaged by usual knitting cams 16. In the present instance, the machine illustrated is equipped with two feeds and consequently the knitting cams 16 are doubled accordingly. The cams 16, 16 are carried by the usual form of cam ring 17 which is secured in any suitable manner to the cylinder cam plate 11 for relative rotation with respect to the fixed needle cylinder 8, said cam plate and cam ring being rotated by the ring gear 12 which is driven in any suitable manner from the main drive shaft (not shown) of the machine.

At substantially diametrically opposed points in the cam ring 17 are secured vertically extending posts 18, 18. Carried by the posts 18, 18 is a bridge member 19 which extends across the axis of the cylinder 8 at a substantial elevation above the upper end 20 of said cylinder. Carried by and projecting above the bridge member 19 is a guide tube 21. Secured to the underside of the bridge member 19 by screws 22 in axial alignment with the tube 21 and the cylinder 8 is a cylindrical stop element 23.

Freely mounted in axial alignment with the

stop member 23 and the cylinder 8 intermediate the lower edge 24 of the said stop member and the upper work supporting end edge 20 of the cylinder 8 is a web holder 25. The web holder 25 is in the form of a short cylinder in the outer peripheral surface of which is formed a series of vertical grooves 26, 26. The grooves 26, 26 are equal in number to and are substantially aligned with the needle grooves 13 of the needle cylinder 8.

The outer surface of the web holder 25 is provided with a circumferentially extending thread-receiving groove 27, from the lower side of the base of which to the outer peripheral edge 29 of the lower surface 30 of the said cylindrical web holder 25 the outer peripheral surface of the web-holding cylinder 25 is inclined, as at 28.

Secured to each of the posts 18 and approximately in line with the circumferential groove 27 of the web holder 25 is a thread guide 31. Secured to each post 18, above the thread guide 31, is bracket 32 in which is mounted a thread guide 33. Secured to each bracket 32 and disposed intermediate the thread guides 31 and 33 carried by each post 18 is a thread-tensioning device 34, of conventional form.

Secured to the cylinder cam plate 11 and surrounding the cam ring 17 is an annular hub member 35 which is provided with diametrically opposed radially extending arms 36, 36, each of which is adapted to support and carry a thread cone 37.

Secured in the hub ring 35 and extending vertically therefrom is a pair of diametrically opposed rods 38, 38 supporting at their upper end a cross bar 39 in which is mounted a pair of outer thread guides 40, 40 and a pair of inner thread guides 41, 41. The threads x , x pass from the cones 37, 37 respectively, each to an outer thread guide 40, thence to and through an inner thread guide 41 from which it passes to a thread guide 33 carried by one of the posts 18. From the thread guide 33 the thread passes through the tensioning device 34 to the thread guide 31 from which the thread passes to a group of needles under control of one of the sets of knitting cams 16.

As the cam ring 17 revolves about the needle cylinder 8 the thread guides 31, 31 feed the threads x , x respectively to the needles 14, 14 at opposite sides of the needle cylinder, the knitting cams 16, 16 at the same time effecting longitudinal movement of the needles 14 through the course of stitches y , then hanging on the needles 14.

As shown in Fig. 2, the hooks 14a, 14a of the needles 14, 14 have been projected into diametrically opposite slots 26 in the cylindrical web holder 25 to elevations above the upper side of the circumferential groove 27 in said web holder, wherein the stitches y , y hanging on the needles have cleared the latches of the needles 14, 14 respectively.

As the needles 14 begin to descend, as illustrated in Fig. 3, the stitches y , y resting on the upper surface 20 of the needle cylinder 8 get behind the latches 14b, 14b of the needles while the threads x , x are laid in the groove 27 between the latches 14b, 14b and the hook 14a, 14a of the needles. As each needle descends further, as illustrated in Fig. 4, the latch 14b is closed around the thread x , holding the thread within the hook to be drawn through the stitch y . As the needle descends further, as illustrated in Fig. 5, the thread x under high tension applied by the ten-

sioning device 34 slides down the inclined surface 28 of the web holder 25 and is moved forward in the hook 14a of the needle toward the front thereof.

As the needle descends still further, and due to the tensioning on the thread x , as the inner surface of the hook 14a approaches the lower surface 30 of the web holder 25 the thread x is snapped around the peripheral edge 29 of the said lower surface 30 to a position below the lower surface 30 of the web holder and inwardly from the peripheral edge 29 thereof.

As the needle descends further, as shown in Fig. 6, the hook of the needle moves to a position below the upper surface 20 of the needle cylinder 8 while the stitch y of the previous course is supported by the upper surface 20 of the needle cylinder, whereby the needle 14 draws the thread x in a loop through the said stitch y .

The needle 14 then reverses its direction of movement, as shown in Fig. 7, after the stitch y has been cast over the hook of the needle, whereby the newly formed stitch y^1 is left resting on the upper surface 20 of the needle cylinder 8.

As the needle continues to rise, as shown in Figs. 8 and 9, the tendency of the newly formed stitch y^1 is to rise with the needle, such upward movement of the newly formed stitch is prevented by the said newly formed stitch engaging the under surface 30 of the web holder 25, which holds the newly formed stitch in this substantially fixed position while the needle rises to its full extent through said stitch, from the position shown in Fig. 8 to the position shown in Fig. 2 ready for a new supply of the thread x to form a stitch in the next succeeding course.

Due to the fact that the vertical grooves 26 in the web holder 25 are of a width just sufficient to receive the cheek and latch of the needle, the newly formed stitches are prevented from rising in the slots 26 with the needles 14 by the edges 42, 42 immediately adjacent the needle grooves 26 formed by and at the intersection of the vertical grooves 26 with the horizontal under surface 30 of the web holder 25.

By the use of the web holder as described in connection with the needle cylinder 8, it is possible to make the stitches of each course extremely short whereby a greater number of courses per inch longitudinally of the tube may be formed to provide the necessary circumferential binding around the primary element z to give the finished hose pipe the desired radial strength.

In Figs. 2 to 8 inclusive, the primary element Z is shown as moving downwardly through the guide tube 21, the stop element 23, web holder 25 and the cylinder 8, the knitted tube Y moving downwardly through the cylinder 8 with the primary member Z after having been knit in the space between the upper edge 20 of the needle cylinder and the lower surface 30 of the web holder 25. This, however, is not essential and the primary element Z and finished tube Y knitted therearound may move upwardly from the knitting plane $P-P$ through the web holder 25, the stop member 23 and the guide tube 21, as clearly illustrated in Fig. 12, which presents the reverse face of the fabric to the element Z from that presented when the two move downwardly as noted above. In either case, the newly formed stitch is held in a substantially fixed position between the upper surface 20 of the needle cylinder 8 and the lower surface 30 of the web holder, whereby close tight knitting of the tube Y around the primary member Z is effected.

The web holder 25 preferably is not rigidly secured to the stop member 23 but may rise and fall as occasion requires so as to keep the lower surface 30 thereof at all times in intimate contact with the course of stitches hanging on the needles 14, however, the stop member 23 limits the amount of movement of the web holder 25 in a direction away from the needle cylinder 8. The web holder is maintained in axial alignment with the needle cylinder 8 by reason of the fact that two diametrically opposite needles are at all times, projected into the needle grooves 26 of the web holder, thus relative rotation or lateral displacement between the web holder 25 and needle cylinder 8 is effectively prevented.

In cases where a single feed is employed the web holder 25 may then be secured to the lower end of the stop element 23 or be formed as an integral part thereof as desired.

I claim:

1. The combination of a needle cylinder adapted to support knitted work at one of its ends, needles parallel to the axis of the cylinder and supported by and operable longitudinally of said cylinder, and a web holder comprising relatively fixed work-engaging surfaces intermediate and immediately adjacent the opposite sides respectively of said needles and extending from the front to the back faces thereof in a plane closely adjacent and substantially parallel to the work-supporting end of the cylinder for engaging and holding those parts of knitted stitches on and lying at said opposite sides of said needles from movement with and by the needles during said longitudinal movement thereof.

2. The combination of a hollow needle cylinder adapted to support knitted work at one of its ends, an annular web holder axially aligned with said cylinder, said web holder and said cylinder having longitudinally aligned needle-receiving grooves formed in the peripheral surfaces thereof respectively, needles in said grooves in parallel relation to the aligned axes of the cylinder and work holder respectively, and work-engaging surfaces on said cylinder end and said web holder immediately adjacent the opposite sides of each of said needles and extending from the back to the front faces thereof in closely adjacent parallel planes for holding the side portions of the knitted stitches hanging on the needles from movement with and by the respective needles during movement of said needles longitudinally of the aligned cylinder and web holder.

3. The combination of a hollow needle cylinder adapted to support knitted work at one of its ends, an annular web holder axially aligned with said cylinder, said web holder and said cylinder having longitudinally aligned needle-receiving grooves formed in the peripheral surfaces thereof respectively, work-engaging surfaces on said web holder immediately adjacent the needle grooves of the web holder in a plane adjacent and substantially parallel to the work-supporting end of the cylinder, and needles operable longitudinally of and in said grooves whereby thread-engaging ends of said needles are projected into the needle grooves of the web holder to positions beyond the said work-engaging surfaces thereof, said web holder having a circumferential groove intersecting said needle grooves and spaced from said work-engaging surfaces for feeding thread to said needles.

4. The combination of a hollow needle cylinder adapted to support knitted work at one of its ends, an annular web holder axially aligned with

said cylinder, said web holder and said cylinder having longitudinally aligned needle-receiving grooves formed in the peripheral surfaces thereof respectively, work-engaging surfaces on said web holder immediately adjacent the needle grooves of the web holder in a plane adjacent and substantially parallel to the work-supporting end of the cylinder, and needles operable longitudinally of and in said grooves whereby thread-engaging ends of said needles are projected into the needle grooves of the web holder to positions beyond the said work-engaging surfaces thereof, said web holder having a circumferential groove intersecting said needle grooves and spaced from said work-engaging surfaces with the peripheral surface of said web holder intermediate said circumferential groove and said work-engaging surfaces inclined from substantially the base of said grooves to the peripheral edge of the web holder at the plane of said work-engaging surfaces, for feeding thread to said needles.

5. The combination of a hollow needle cylinder adapted to support knitted work at one of its ends, an annular web holder axially aligned with said cylinder, said web holder and said cylinder having longitudinally aligned needle-receiving grooves formed in the peripheral surfaces thereof respectively, work-engaging surfaces on said web holder immediately adjacent the needle grooves of the web holder in a plane adjacent and substantially parallel to the work-supporting end of the cylinder, needles operable longitudinally of and in said grooves whereby thread-engaging ends of said needles are projected into the needle grooves of the web holder to positions beyond the said work-engaging surfaces thereof, said web holder having a circumferential groove intersecting said needle grooves and spaced from said work-engaging surfaces with the peripheral surface of said web holder intermediate said circumferential groove and said work-engaging surfaces inclined from substantially the base of said grooves to the peripheral edge of the web holder at the plane of said work-engaging surfaces, and a relatively rotatable thread guide disposed adjacent said circumferential groove for feeding thread across said needles in said circumferential groove.

6. The combination of a hollow needle cylinder adapted to support knitted work at one of its ends, an annular web holder axially aligned with said cylinder, said web holder and said cylinder having longitudinally aligned needle-receiving grooves formed in the peripheral surfaces thereof respectively, work-engaging surfaces on said web holder immediately adjacent the needle grooves of the web holder in a plane adjacent and substantially parallel to the work-supporting end of the cylinder, needles operable longitudinally of and in said grooves whereby thread-engaging ends of said needles are projected into the needle grooves of the web holder to positions beyond the said work-engaging surfaces thereof, said web holder having a circumferential groove intersecting said needle grooves and spaced from said work-engaging surfaces with the peripheral surface of said web holder intermediate said circumferential groove and said work-engaging surfaces inclined from substantially the base of said grooves to the peripheral edge of the web holder at the plane of said work-engaging surfaces, a relatively rotatable thread guide disposed adjacent said circumferential groove for feeding thread across said needles in said circumferential groove, and tensioning means for applying

tension to the thread prior to its delivery to said thread guide.

7. The combination of a hollow needle cylinder adapted to support knitted work at one of its ends, an annular web holder axially aligned with said cylinder, said web holder and said cylinder having longitudinally aligned needle-receiving grooves formed in the peripheral surfaces thereof respectively, work-engaging surfaces on said web holder immediately adjacent the needle grooves of the web holder in a plane adjacent and substantially parallel to the work-supporting end of the cylinder, needles operable longitudinally of and in said grooves whereby thread-engaging ends of said needles are projected into the needle grooves of the web holder to positions beyond the said work-engaging surfaces thereof, said web holder having a circumferential groove intersecting said needle grooves and spaced from said work-engaging surfaces with the peripheral surface of said web holder intermediate said circumferential groove and said work-engaging surfaces inclined from substantially the base of said grooves to the peripheral edge of the web holder at the plane of said work-engaging surfaces, a relatively rotatable thread guide disposed adjacent said circumferential groove for feeding thread across said needles in said circumferential groove, tensioning means for applying tension to the thread prior to its delivery to said thread guide, and means for limiting axial movement of the web holder in a direction away from the cylinder as a result of crowding of work under tension between the

work engaging and supporting surfaces of the web holder and cylinder respectively.

8. The combination of a hollow needle cylinder adapted to support knitted work at one of its ends, an annular web holder axially aligned with said cylinder in free floating relation thereto, said cylinder and web holder having longitudinally aligned needle grooves in their peripheral surfaces respectively, needles operable in said grooves whereby axial alignment between the cylinder and web holder is maintained, and means for limiting axial movement of the web holder in a direction away from the cylinder.

9. The combination of a hollow needle cylinder adapted to support knitted work at one of its ends, an annular web holder axially aligned with said cylinder, said web holder and said cylinder having longitudinally aligned needle-receiving grooves formed in the peripheral surfaces thereof respectively, work-engaging surfaces on said web holder immediately adjacent the needle grooves of the web holder in a plane adjacent and substantially parallel to the work-supporting end of the cylinder, and needles operable longitudinally of and in said grooves whereby thread-engaging ends of said needles are projected into the needle grooves of the web holder to positions beyond the said work-engaging surfaces thereof, the peripheral surface of the web holder adjacent the work-engaging surfaces thereof being inclined from substantially the base of the needle grooves to the peripheral outer edges of said work-engaging surfaces for feeding thread to said needles.

WALTER LARKIN. 35