R. W. SCOTT & A. E. PAGE.

CIRCULAR SPRING NEEDLE KNITTING MACHINE.

APPLICATION FILED AUG. 14, 1912.

1,167,024. Patented Jan. 4, 1916.

2 SHEETS—SHEET 1.

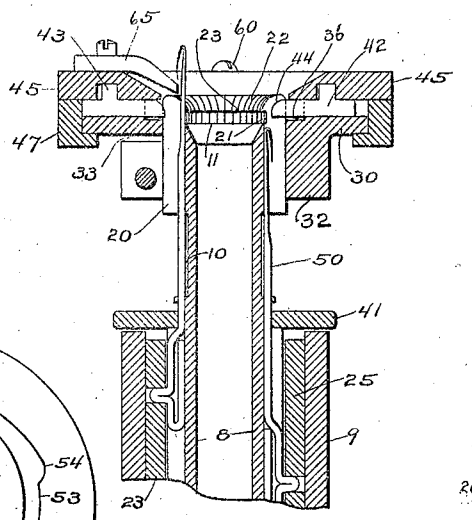

Fig 1

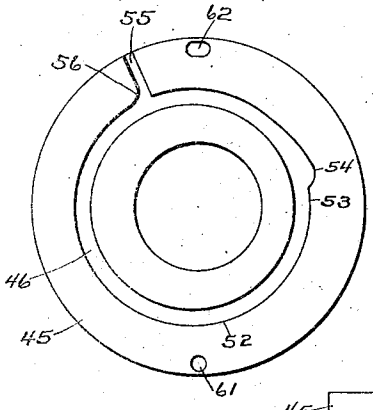

Fig 3

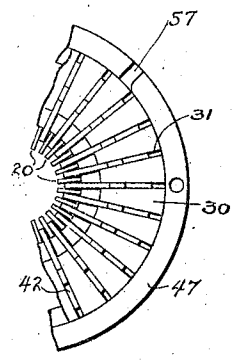

Fig 4

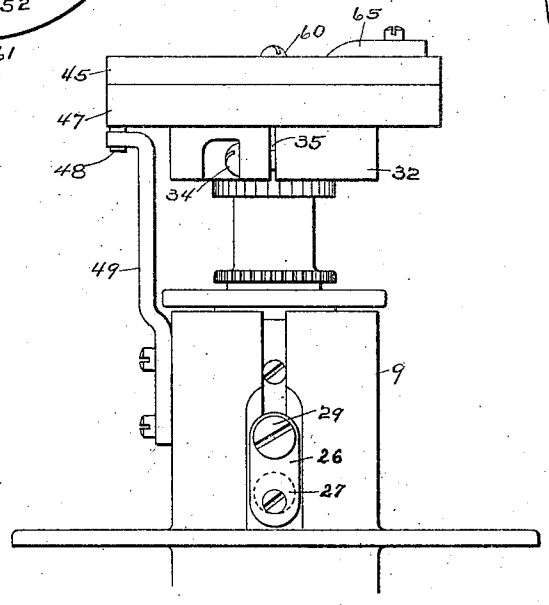

Fig 2

Witnesses
Walter Larkin
Mary J. Griffin

Inventor
Robert W. Scott
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by

ATTY.

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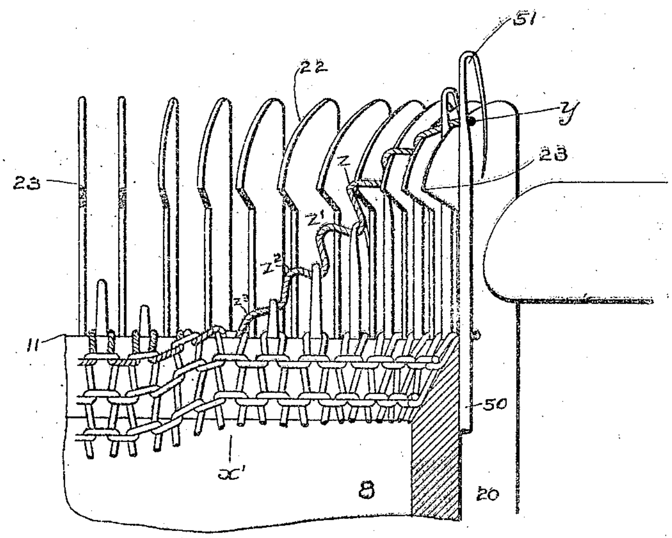

Fig 5

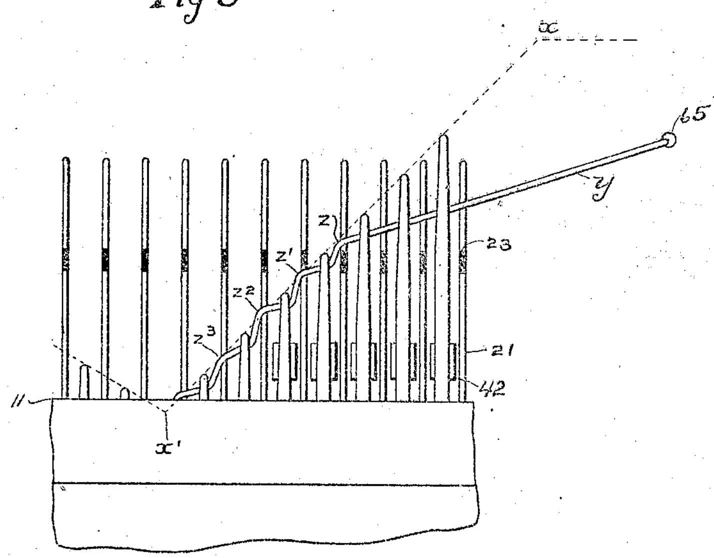

Fig 6

Witnesses
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UNITED STATES PATENT OFFICE.

ROBERT W. SCOTT AND ALBERT E. PAGE, OF BOSTON, MASSACHUSETTS, ASSIGNORS TO SCOTT & WILLIAMS, INCORPORATED, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF NEW JERSEY.

CIRCULAR SPRING-NEEDLE KNITTING-MACHINE.

1,167,024. Specification of Letters Patent. Patented Jan. 4, 1916.

Application filed August 14, 1912. Serial No. 715,042.

To all whom it may concern:

Be it known that we, ROBERT W. SCOTT and ALBERT E. PAGE, citizens of the United States, and residents of Boston, county of Suffolk, and State of Massachusetts, have invented a certain new and useful Improvement in Circular Spring-Needle Knitting-Machines, of which the following is a specification.

One object of our invention is to provide a simple, durable and efficient machine of the character indicated which shall be capable of knitting fine gage fabric at high speeds; for instance, speeds of the order of 1500 courses per minute.

A further object is to so construct the yarn-manipulating elements coöperating with the needles to make the fabric as to provide against undue strain upon and breakage of the yarn, as well as to provide the certain taking of the new yarn underneath the open beards of a needle about to receive yarn to form a new course of stitches.

A further object of our invention is to provide means for pressing the beards of the needles which shall place the least possible strain upon the delicate needle beard and which shall at the same time be efficient to prevent again taking an old loop into the needle hook while the machine is running at the speeds indicated.

Further features of our invention reside in the mechanical construction by which the purposes above outlined and other purposes are attained.

In the accompanying drawings, Figure 1 is a vertical central section of so much of the machine as is necessary to illustrate our present invention; Fig. 2 is an elevation of the cam cylinder and the top of the needle cylinder showing the presser-dial, its cam cap and the means for driving it; Fig. 3 is an under plan of the presser cap or cam; Fig. 4 is a fragmentary plan showing the presser dial and the drive ring for the presser cam cap; Fig. 5 is an exaggerated view in perspective of the interior face of the yarn-manipulating elements or sinkers, a presser and the top of the needle cylinder illustrating the behavior of the new yarn; Fig. 6 is a development on a plane of the matter shown in Fig. 5 to show the relation of the wave in the needles to the sinkers.

The machine we have chosen to illustrate our invention is of the type shown in the application of Robert W. Scott, Serial No. 714,535, filed August 12, 1912, which discloses a high speed spring needle circular machine of small diameter for knitting bands or tapes of fine gage web at high velocities. Said machine comprises a stationary needle cylinder 8 longitudinally grooved for the needles upon which is mounted for rotation a cam cylinder 9 upon the inner surface of which are a fixed advancing cam 23 and a vertically adjustable stitch cam 25. As disclosed in said application the stitch cam 25 may be delicately adjusted by means of the link 26 and eccentric stud 27 shown in Fig. 2 and be clamped in adjustment by the screw 29. The independently movable spring needles 50 may be of the usual form employed in independent needle machines, but it is essential that there shall be room at the heads of the hooks for the yarns to reeve through the apex of the hook. Needles of this type have long been known. As in the machine of the application above mentioned the needles are relatively free in their grooves, reliance being had upon a split ring 41, resting in a groove turned upon the needle cylinder, which ring is of an inner diameter providing a close running fit for the faces of the needle shanks to prevent the needles from being thrown out of their grooves centrifugally, or by the behavior of the needle as a lever under the forward stroke of the pressers. The needle cylinder is turned at 10, at a point midway between the verge of the cylinder and the deep grooving for the butts of the needles, to a surface of a smaller diameter than the bottoms of the grooves in the remainder of the cylinder, to provide a space across which the needles extend without touching, to prevent the flow toward the verge of the cylinder of the oil necessarily applied in the deep grooves, at the point at which the cams exert a lateral force upon

the needles. This is to enable the machine to run without soiling the fabric, which is often used without any washing or finishing operation.

At the verge 11 of the needle cylinders we provide the instruments 20 which are fixed in grooves deeper than the needle grooves, and stand in between them. The instruments 20, as will be plain from Figs. 1, 5, and 6, are straight, thin, parallel-sided bars of metal having, in the faces turned toward the interior of the needle cylinder, notches 21. The upper ends of the said instruments are beveled at 22 preferably on a curved line sloping downwardly and inwardly. The beveled upper surface terminates on the inner side of the instruments 20 in the noses 23 which form the upper boundaries of the notches 21. When the instruments are in place the noses 23 project between the needles while the bottoms of the notches 21 form an annular groove in the inner surface of the cylinder defined by said instruments, the periphery of the annulus defined by said groove being usually of a slightly smaller diameter than the outer faces of the needles. At the bottom of said groove is the verge or upper edge of the needle cylinder. The vertical distance between the noses 23 and the verge 11 of the needle cylinder is comparatively large. We have shown it as amounting to four times the lateral spacing of the needles, to which, as it will presently appear, said vertical distance has a definite and necessary relation. While we have shown it as four times said spacing, it will be understood that the precise proportions can be greatly varied, and should be varied to suit varying conditions. The instruments 20 may be held in their slots, in their adjusted position by causing them to fit tightly in their grooves, or they may be brazed or soldered in place.

On the surface defined by the outer faces of the instruments 20 and at a height to bring its upper face slightly above the verge of the needle cylinder, we mount a presser-dial 30 having as many radial grooves 31 as there are needles in the machine. This dial is conveniently held upon the outer faces of the sinkers or instruments 20 by forming it with a depending integral collar 32, which is bored out to fit the outer surfaces of the instruments 20 and is separated for a part of its circumference from the dial proper by the horizontal slot 33 and is split at 35 to take the binding screw 34 by which it may be clamped for adjustment upon the outer surface of said instruments 20. In the radial grooves 31 of the dial 30, we provide independently movable pressers 42 having upwardly projecting butts 43 and cam shaped faces 44, which may be hardened and polished. The width of the pressers 42 is so calculated as to cause them to bottom and fit snugly in the diverging space between the heads of the instruments 20 between which the said pressers take at a point slightly inward of their necessary inward stroke. The dial 30 has an inner annular groove 36 deeper than the bottom of the slots 31, to provide a free space to prevent the creeping of oil along the pressers for the same purpose as the groove 10 with respect to the needles. Running on the upper surface of the dial 30 is the presser cam 45 which is provided with an eccentric groove 46 to actuate the butts 43. The cam ring is retained in place and actuated by an internally flanged ring 47 running snugly upon the periphery of the dial 30. The ring 47 is provided with a depending pin 48 which takes into a radial slot at the upper end of an arm 49 mounted on the cam cylinder 9, which is the driven element in this machine. The groove 46, for cheapness and accuracy of construction may be a true circle, eccentric from the center of figure of the cam 45 by a sufficient amount to provide the necessary movement for the pressers. We have so designed our machine that this necessary movement is less than the width of the instruments 20, so that the pressers 42 are never wholly withdrawn from the space defined by two adjacent sinkers or instruments 20. We may thus provide a very loose running fit for the pressers 42 in their grooves 31. To further secure ease of running the width of the groove 46 in the cam 45 may be relatively great with respect to the width of the butt 43 running in said groove. The outward limit of motion of the pressers 42 may thus be determined by the inner diameter of the ring 47, the length of the presser being such as to cause it to contact with the ring before its working face leaves the space between the sinkers 20.

As stated above the needles 50, because the machine is an independent needle machine in which the stitch is drawn by the recession of the needle beneath the verge of the groove in which it works, are necessarily provided with hooks 51 sufficiently open to enable the yarn to run freely through, to prevent breakage during the loop drawing movement of the needle. We have found that this form of needle cannot be pressed without constant breakages, if the presser is permitted to run up the beard of the needle or in any other manner to act on the beard so as to cause pressure to be applied near the bend 51. With the devices above described the needles are gradually pressed by the downward movement of the needles and the inward movement of the working face 44 of the pressers 42, when they are in the quadrant of the

groove 46 extending from 52 to 53. The point 53 is the point at which the circle defined by the groove 46 approaches a circle central with the cam cap 45 most closely. It will be understood that the rotative adjustment of the cam 45 is such as to bring the point 53 into such a relation with the needles running down the downward slope of the cam 25 as to cause them to be pressed until the point of the needle beard is well beneath the line determined by the verge of the needle cylinder, at which time the needle presser is resting about at the middle of the needle beard. The needle will now descend under the influence of the cam 25 a sufficient distance to complete its stitch, and to prevent breakages, for the reasons above stated, it is desirable to release suddenly the presser 42 which has at this point completed its function, so as to avoid placing the bend 51 under any strain from the presser. This we accomplish by providing a relief space 54 in the presser cam groove 46. The pressers being loose in their grooves the sudden release from pressure at the point 53 will permit the presser 42 to move out sharply at this point, the released needle beard supplying sufficient energy for this purpose. The presser cam 45 is provided with a gate 55 having a beveled inner surface 56 through which the pressers may be entered and removed one at a time. The ring 47 has a similar gate 57 formed in it to register with gate 55.

It will be seen from the structures above described that slight movements of adjustment are sufficient for the cam ring 55, the play of the pressers being very short, in practice of the order of $\frac{1}{16}$ of an inch. We provide this adjustment by attaching the cam 45 to the ring 47 by screws 60 in diametrically opposite bores 61, 62 in the cam 45. These bores are on a diameter perpendicular to the line of maximum eccentricity of the groove 46. The bore 62 is slotted circumferentially so that its screw 60 may be loosened and the whole structure 45 swung on the other screw 60 as a pivot, for the slight adjustment necessary. The yarn is supplied to the needles through a yarn guide 65 having a delivery opening above the groove formed by the sloping faces 22 of the sinkers 20 and the cylinder defined by the front faces of the advanced needles 50. The lead or circumferential position of the yarn guide 65 with respect to the point x' Fig. 6, which is directly above the lowest point of the stitch cam 25, may be as much as 120° of the circle of needles. We employ this long lead to secure the wrapping about the faces of the shanks of the advanced needles of the new yarn y. Referring to Fig. 5 it will be seen that the friction of this yarn will cause it to be taken down by the shanks of the receding needles 50 until it firmly encounters the faces 22 of the sinkers 20. Up to this time the yarn lies in a free spiral path extending from the guide 65 to the first face 22 which it encounters. The downward and inward slope 22 is here of great assistance in holding the yarn firmly against the shanks of the needles to permit the sharp and delicate point of the needle beard to pass safely over it to take the new yarn into the needle hook. Further movement of the needles downward now lands the new yarn well up into the head of the needle and the noses 23 of the sinkers now become effective to draw off or sink the yarn between the pairs of needles to measure out enough of it to form a part of the ensuing stitch. It will be seen that the function of the sloped faces 22 and noses 23 is two-fold, to support the yarn to take it under the needle beard, and to draw off the yarn to aid in the formation of a stitch in addition to the effect of the underside of the noses 23 and the inner walls of notch 21 respectively as web-holders and aids to knocking over. Bearing in mind that the stitch length is determined by the degree of recession of the needles beneath the verge 11 of the needle cylinder, it will be seen that, as shown in Fig. 5, the needle at the position x' must necessarily draw some of its yarn from the run of yarn between the next pair of needles following it, which is the pair of needles to the right of x', Figs. 5 and 6. We find it undesirable to make the noses 23 of the pressers long enough to draw off sufficient yarn for the entire stitch, preferring to make said noses instead project inwardly sufficiently to provide enough yarn for a stitch of the maximum tightness to be knit by the machine and relying upon the adjustment of the cam 25 for an additional increment of length for the stitch. Otherwise the fact that the structures 20 are fixed structures would limit the machine to the production of fabrics with one length of stitch only, there being a definite relation between the size and condition of the yarn and the size of the loop to be knit from it.

We have found in practice that the proper position of the noses 23 with respect to the verge 11 is of the utmost importance in the operation of independent needle machines with fixed instruments to guide and manipulate the yarn. The condition of best operation is when the nose 23 shall have finished its sinking function at a needle so far in advance of the needle at which the new loop is being drawn through the old one as to release the yarn drawn off and now in the hooks of the intervening needles before the penetrating movement of the new loop with respect to the old loop takes places. This will be understood by reference to Fig. 5,

wherein the loop z is shown upon the point of the nose of the sinker and therefore at the moment of its maximum draft under the influence of said nose. There are at least two preceding loops crimped or crinkled between the surfaces 22 and the needle hooks, as a necessary result of the comparatively gradual slope of the needle cam, the position of the series of needle hooks corresponding to said slope. The yarn is restrained where it is crimped between the needles and the surface 22 from responding to any sudden draft upon it. But by providing a sufficient distance between the points 23 and the verge 11, which we have for purposes of illustration only shown as amounting to four times the space between adjacent needles, the loops in the relative position of those at z will be released in succession as shown at z', z^2, z^3, leaving at least three loops free to supply yarn for the sudden penetrating movement of the needle at the position x'. If necessary the needle x' can use up a great part of this yarn in forming its stitch without trapping the yarn by drawing it around any sharp bends, as would be the case if the stitch were formed while the yarn between pairs of needles adjacent to the stitch drawing needle were still upon the noses 23. In other words the yarn from the point z to the point x' has been drawn off between the needles and is loose and crinkled or bent so that it is possible to make it take a comparatively straight path between these points without increase of tension. The bottoms of the notches 22 being in practice on a line with a point between the inner face of the needle shank and the center line thereof, said yarn can assume a nearly straight path without encountering any obstacle to increase the tension upon it.

We have found in practice that the fixed sinkers or yarn positioners 20, when provided in accordance with our invention operate as well in connection with spring beard needles as the movable instruments heretofore thought to be essential to the performance of the sinking function, and that we are thereby enabled to produce spring needle fabric at the great speeds rendered possible by limiting the movable yarn-manipulating instruments to one set only, that is to say to the needles themselves.

What we claim is:

1. In a knitting machine, a needle-carrier and independently movable spring-beard needles therein, means to press the needle beards, a cam carrier, and needle cams thereon, in combination with yarn positioning and sinking instruments fixed with respect to the needle carrier standing between the needles and having downwardly and inwardly sloping faces and inwardly pointed noses projecting between the needles and separated from the verge of the needle carrier by a space greater than that between adjoining needles, and means to supply yarn against the shanks of projected needles.

2. In a knitting machine having independently movable spring-beard needles, needle and cam carriers and knitting cams, a yarn guide, and means to press the needle beards, fixed instruments mounted on the needle carrier having notches wider than the space between said instruments, terminating in noses standing between each pair of needles, and terminal faces sloping toward said noses for guiding and sinking the yarn under the beards and against the shanks of the needles.

3. In a knitting machine having independently movable spring-beard needles, needle and cam carriers and knitting cams, a yarn guide, and means to press the needle-beards, fixed instruments mounted on the needle carrier, said instruments having notches terminating in noses standing between the needles, and terminal faces sloping toward said noses for sinking and guiding the yarn against the shanks and under the beards of the needles, the said noses being separated from the verge of the needle carrier by a distance greater than the space between said instruments.

4. In a circular knitting machine having independently movable spring-beard needles, needle and cam cylinders and knitting cams, a yarn-guide, and means to press the needle-beards, fixed instruments mounted on the needle carrier, said instruments having internal notches wider than the space between adjacent instruments terminating in noses standing between the needles, and terminal faces sloping inwardly toward said noses for sinking and guiding the yarn against the shanks and under the beards of the needles.

5. In a knitting machine, in combination, a needle-carrier and needles, means to move the needles up and down, a yarn-guide, means to support the yarn against the shanks of the needles, independent beard-pressers, and means to advance said pressers at an angle to the direction of motion of the needles, during the descent of said needles, and means to release said pressers before the needle-beards have completely passed their working faces.

6. In a knitting machine, in combination, a needle-carrier and independently movable needles, a cam-carrier and a stitch-cam, a yarn guide, means to support the yarn against the shanks of the needles, independently movable beard-pressers, and means to advance said pressers at an angle to the direction of motion of the needles, during the passage of the stitch-cam, and means to re-

lease said presser before the needle beards have completely passed their working faces.

7. In a circular knitting machine, in combination, a needle cylinder and independently movable needles, a cam cylinder and a stitch cam, a yarn guide, and means to support the yarn against the shanks of the needles, independent radial movable beard-pressers, and a cam to independently advance said pressers inwardly during the passage of the stitch cam, said cam having a recess to permit the pressers to move outwardly before the stitch cam completes its function.

8. In a knitting machine, in combination independently movable spring beard needles, a carrier therefor, and fixed instruments for guiding and sinking the yarn at the verge of said carrier, needle cams, a presser dial, independently movable pressers in grooves in said dial, and a presser cam, the relation of the pressers and the remaining instruments being such as to cause the working faces of the pressers to advance and retract with respect to the needles within the space defined by two adjacent guiding and sinking instruments.

9. In a circular spring beard knitting machine, in combination with a needle cylinder and independently movable spring beard needles therein, a cam carrier and knitting cam, a dial, independently movable pressers therein and means for actuating said pressers comprising a cam cap, a circular eccentric groove in said cam cap and means for causing the relative rotation of the cam cap and the sinker dial cap.

10. In a circular spring beard knitting machine, in combination with a needle cylinder and independently movable spring beard needles therein, a cam carrier and knitting cam, a dial, independently movable pressers therein, and means for actuating said pressers comprising a cam cap, having a circular eccentric groove therein, said cam cap having a recess in the outer periphery of said groove to provide a relief space for the pressers.

11. In a circular knitting machine, a needle carrier, a dial relatively fixed with respect to said needle carrier, needles in said carrier, radial grooves in said dial, auxiliary instruments coöperating with the needles in said grooves, a cam cap, a drive ring having a bearing on the periphery of said dial, and means to secure the cam cap to the drive ring comprising a pivot and a diametrically opposite clamp screw in a slot in one of said parts.

12. In a presser device for independently movable spring beard needle circular knitting machines, a needle carrier, needles, a series of instruments at the verge of the carrier, defining radial grooves in which the needles work, pressers, a carrier for said pressers, a drive ring surrounding the periphery of the presser carrier, and a cam driven by said drive ring, said cam having therein a substantially circular eccentric groove for moving the inner end of the pressers in a radial path wholly within the grooves at the verge of the needle cylinder.

13. A circular knitting machine having a needle carrier and needles therein, yarn manipulating instruments fixed at the verge of said carrier, a dial for auxiliary instruments surrounding the outer faces of said fixed instruments, said dial having a depending flange split to permit expanding and contracting a central opening in said dial, and means to clamp said flange on the faces of said fixed instruments.

14. In a circular knitting machine, a needle carrier and needles therein, yarn-manipulating instruments fixed at the verge of said carrier, a dial fast upon the outer faces of said instruments, and auxiliary instruments independently movable in radial grooves upon the upper face of said dial, operating butts upon said instruments projecting above the face of the dial, a cam for operating said butts having therein a circular eccentric groove materially wider than said butts, and means for adjusting said cams comprising a pivot at one end of the diameter of the cam perpendicular to the greatest eccentricity of the groove, and clamping means at the other end of said diameter.

15. In a knitting machine, a needle carrier, independently movable spring-beard needles therein, means to operate said needles, a yarn-guide, instruments fixed upon the verge of the needle carrier and extending freely thereabove and between each pair of needles, said instruments having noses pointing toward the backs of the needles, notches between said noses and the verge of the needle cylinder, and terminal faces sloping from said noses in the direction of the head of the needles and the faces thereof, the distance separating said noses from the verge of the needle cylinder being sufficient to permit the free passage of the yarn into said notch at one needle before the next needle but one preceding it shall have passed beneath the verge of the needle cylinder.

16. In an independent needle knitting machine, a needle carrier and needles therein, a yarn guide, a cam carrier and cams, including a stitch cam having an active face of a certain slope, whereby the needles under the influence of the cam are withdrawn into their carrier upon an angle measured by said slope, in combination with instruments at the verge of the needle carrier for positioning the yarn in the hooks of the needles, said instruments being provided

with noses intersecting the series of needles in said carrier, the points of said noses standing in a plane intersecting the line of movement of the needles determined by said slope of the cam at a point in advance of the lowermost needle and separated therefrom by a distance measured by an intervening plurality of said needles.

In testimony whereof we have signed our names in the presence of the subscribing witnesses.

ROBERT W. SCOTT.
ALBERT E. PAGE.

Witnesses;
MARY F. GRIFFIN,
ROBERT C. CEULD.