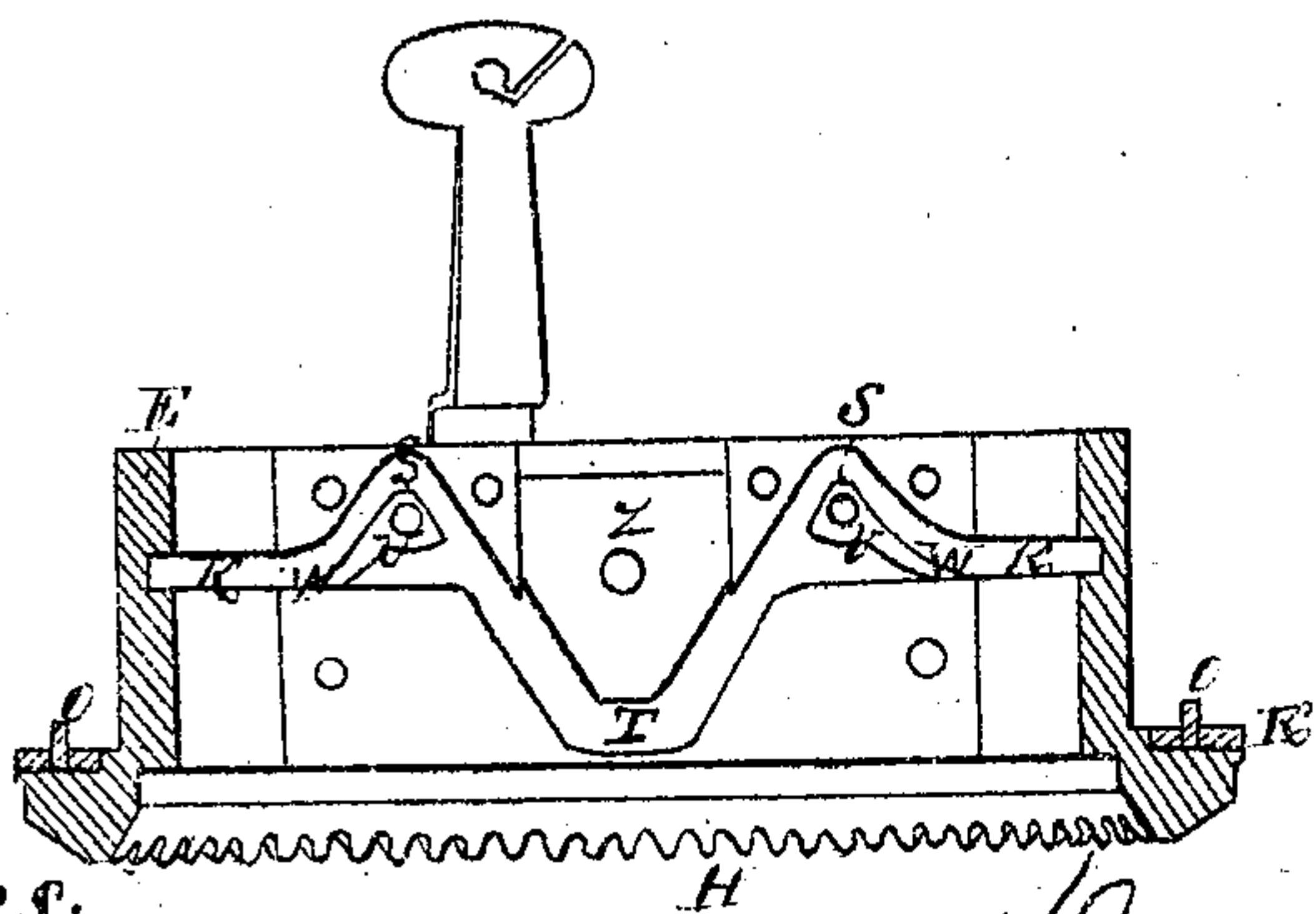
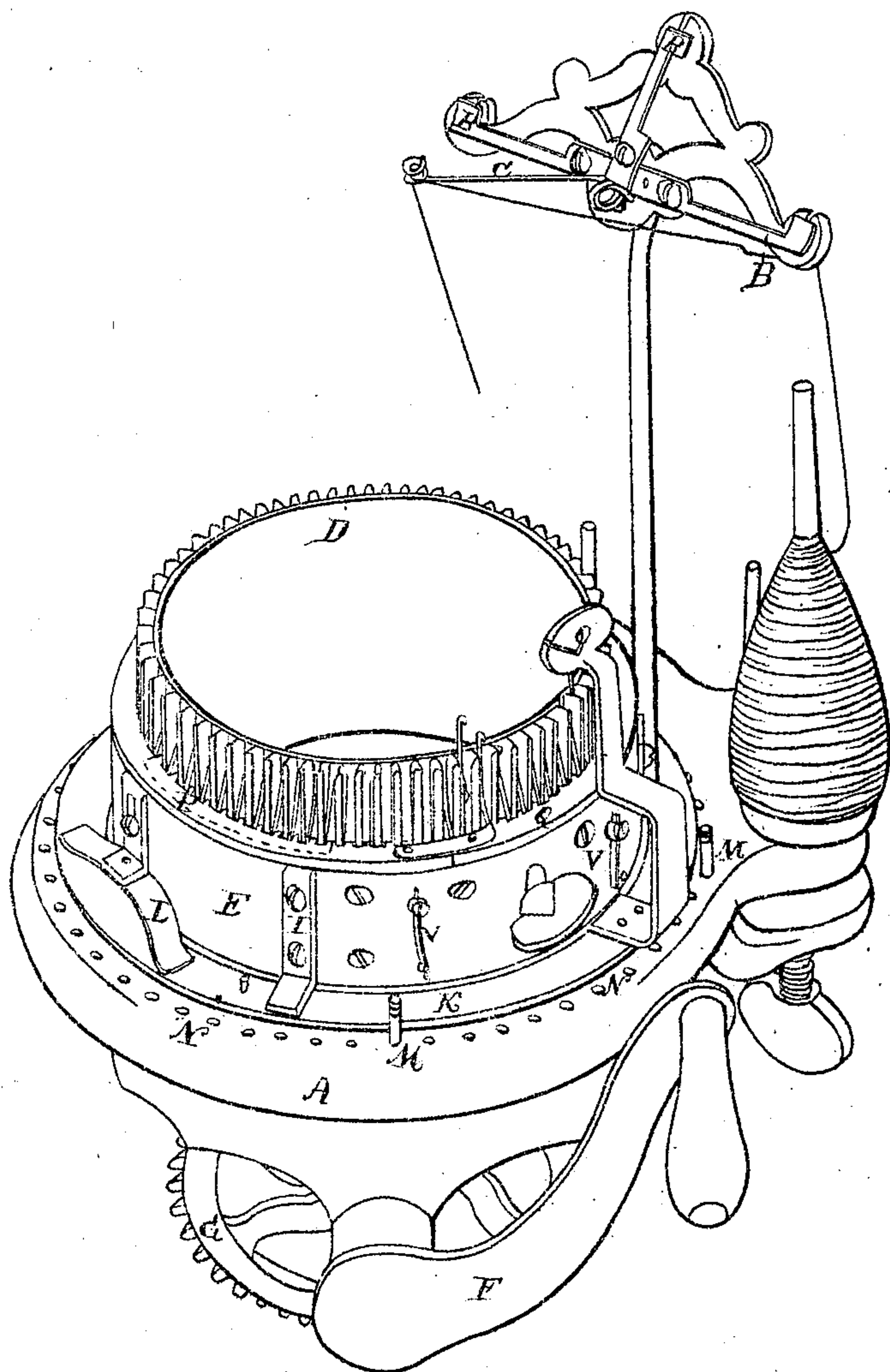


*D. Brickford.*

*Knitting Machine.*

*Nº 92146*

*Patented Jul. 6, 1869.*



*Witnesses:*

*Wm A. Barnack  
Jas D. Patten*

*Inventor.*

*Dana Brickford  
by Crosby, Halsted & Gould  
his Attorneys*



# UNITED STATES PATENT OFFICE.

DANA BICKFORD, OF BOSTON, MASSACHUSETTS.

## IMPROVEMENT IN KNITTING-MACHINES.

Specification forming part of Letters Patent No. 92,146, dated July 6, 1869.

*To all whom it may concern:*

Be it known that I, DANA BICKFORD, of the city of Boston and State of Massachusetts, have invented certain Improvements in Knitting-Machines; and I do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

My improvements relate chiefly to rotary knitting-machines, and are designed to perfect and facilitate their operations, especially for knitting in opposite directions upon reversing the movements; and they consist in the employment, for the support of the yarn-delivering guide, of a shifting-ring, which, at certain periods, is operated by the cam-cylinder; in the use of changeable stops for determining the distance to which the yarn-guide shall be shifted; in the use of fixed stops on the cam-cylinder to check or limit the extent of its revolution to accord with the movements of the yarn-carrier; in the cutting away of a considerable portion of the inner surface of the cam ring or plate, or making a rabbet around its whole inner surface, for the purpose of allowing any of the needles to be promptly inserted or removed from the machine without the necessity of tediously putting them in or out at a single groove, as usual; in rounding the tops of the ribs or pillars which separate the needle-grooves, in order to prevent the cutting or breaking of the stitches or yarn, especially when knots or irregularities appear; and in a peculiar construction and application of automatic spring-switches in the cam-grooves, to compel the needles, at the commencement of each return movement of the cam-cylinder in either direction, to rise to their full height, to insure the rising of the latch above the loop on the needle, and the elevation of the hook, so that in its next descent it will seize the thread for the next loop or stitch.

In the drawings, Figure 1 represents a perspective view of my machine; Fig. 2, a cross-section of the cam-cylinder, giving a view of the cam-groove, self-acting switches, and adjustable central sliding piece.

A represents the frame of the machine,

which, when desired, is constructed as shown, so as to be capable of being attached by a clamp and thumb-screw to a table-top; or the clamping may be dispensed with, and the frame be secured in the center of a table, or supplied with legs reaching to the floor. Upon that portion projecting over the ledge of the table are attached spindles for the support of any desired number of bobbins, and also a corresponding number of slit-eyed thread-guides, each of which is furnished with an appropriate adjustable tension device, B, and a self-acting spring take-up for the slack yarn, and which is marked C. Rising within the central part of frame A is the needle-ring D, firmly secured thereto. Surrounding this ring is the cam-cylinder E, and which is driven, in a well-known manner, by means of the crank F, toothed pinion G, and rack H, on the cam-cylinder. To this cylinder are firmly secured two projections or stops, I, for a purpose hereinafter mentioned, and which also serve to keep in proper position the ring K. This ring, which carries the yarn-delivering guide, is not attached to the cam-cylinder, but lies loosely upon a flange thereon, and it is pressed down to its bed by an adjustable spring, L, which regulates to the proper degree its frictional contact with its bed. M M are removable stops or pegs, which fit into any of the circular series of holes N on the frame, and which holes correspond in number with the number of needles, and they are equidistant from each other. O O are pins fixed diametrically opposite each other upon the ring K, and which serve to arrest the motions of the cam-cylinder whenever either of the stops I shall come in contact with them, the pegs M M arresting the movement of the thread-carrier and its ring, which, until such arrest, are carried around by the cam-cylinder, the cylinder, however, after such arrest, continuing its further revolution until itself is arrested by the stop I I and pins O O, as before mentioned; the object of this travel of the cam-cylinder beyond the travel of the thread-guide being for the purpose of carrying the cams which actuate the needles far enough beyond the last needle of the series employed to cause said cams, upon their return movement, to actuate properly the same needle, which now



becomes the first in course. It must, therefore, have, through the medium of the stops, just the proper amount of additional traverse, and this will vary with the number of needles employed, and may be regulated by altering, as need be, the positions of pins or pegs M. P P designate the spaces or rabbets cut away from the inner side of the cam-cylinder, and extending part of the way down, reaching to the cam-groove, and which allow of the removal and insertion of many needles at once, when the clasp or ring Q is removed. I prefer, however, to make this rabbit continuous all the way around the cylinder, and rely upon the weight of the knitted fabric and the usual weight which is attached thereon to keep the needles down upon the lower edge of the cam-surface; and by this construction, in connection with the removable pegs, I dispense with the necessity of removing the pegs, in order to revolve the cylinder far enough to bring the single groove usually employed opposite the needle to be removed, and also the necessity of replacing the pegs, with the risk of not replacing them in the same holes from which they were taken. The top of the needle-cylinder, as heretofore made, is ground smooth horizontally, so as to be at sharp right or other angles with its vertical sides; and when the needle-grooves have been made therein, it leaves the tops of the piers or ribs which separate the grooves with sharply-defined edges, which not only have a tendency to cut the yarn as the yarn is suddenly pulled over them upon the descent of the needles within the grooves, but also when knots or irregularities occur in the yarn. To prevent this entirely I round off the top of each rib, and this is also productive of another result, namely: It enlarges the top opening of the groove to ease the entrance of the yarn or knots without enlarging the groove itself, or interfering with the action of the needles. Upon the inner side of the cam-cylinder is a groove, R, annular, as usual, for most of its length, but having its needle-actuating parts made as shown, with two elevating and one depressing curvature, the former marked S S, and the latter marked T. Within each of the elevated portions S of the groove is a spring-switch, U, which acts automatically as follows: Its pivot projects through the cylinder, and receives in a slit in its outer end a spring, V, supported as shown at one end. The force of this spring keeps the switches or latches in the positions shown at W, and which is their normal position. Any form or arrangement of spring may be used, or the mere weight of the switch, if made heavy enough, will answer the same purpose, so long as the switch, after being lifted, will of itself resume its place. When the cylinder is revolved in either direction, the butts of the needles, as they ride along the straight part of the groove and come to the sharp edge of the switch, ride up and over the switch to the highest part of the groove; thence they descend to the lowest part, and,

again ascending, are so guided as to ride under the spring-switch on the opposite side, the spring or weight, as the case may be, instantly restoring the switch to its normal position. Z is a sliding adjustable piece, which, being raised or lowered, varies the descent of the needles, and so permits the knitting of tight or loose work.

The operation of the machine is as follows, when it is desired to knit less than a tube, and to revolve the machine partially alternately in opposite directions: As many needles as are not wanted are first taken from the ring, but these must be as many as would reach to both sides of the needle-operating cams, in order to clear them. This number, as shown in the drawing, is twelve, and if the needles were smaller and the cylinder of the same size, this number would be greater, and vice versa. The pins M M are next adjusted the proper distance apart to limit the movements of the thread-carrier, and the crank being turned, it will be found that the cam-cylinder will revolve no farther than has been previously determined, the yarn-guide being first stopped by M M, and the cylinder next stopped by pins O O. The crank is now reversed, and precisely the same operation takes place, the yarn-carrier being always carried to the proper distance to deliver its yarn to the first needle of the series, and the cam-cylinder being always carried the proper distance to operate the first needle of the series in the beginning of the next course of stitches. When all the needles are in my machine, it knits tubular work continuously, whether revolved in one direction or the other, and without any change in any of the devices.

I claim—

1. The combination, with a revolving cam, grooved substantially as described, of a thread-carrier so held by friction on the cam plate or ring as to be carried by it, and yet permit the latter to continue its motions after the carrier is at rest, substantially as set forth.

2. In combination with above last-named devices, adjustable pins and a series of holes in the frame of the machine, substantially as and for the purpose set forth.

3. Stops or their equivalents, and projections on the cylinder, for determining the extent of traverse in either direction of the cam-cylinder of a rotary knitting-machine.

4. A needle ring or plate, the tops of whose walls or ridges between the needle-grooves are rounded off, substantially as and for the purposes set forth.

5. The continuously-grooved cylinder, having spacious rabbets, P, two similar needle-elevating cams, and two automatic spring-switches, substantially as and for the purpose set forth.

DANA BICKFORD.

Witnesses:

JOHN J. HALSTED,  
WM. A. BARNACLO.