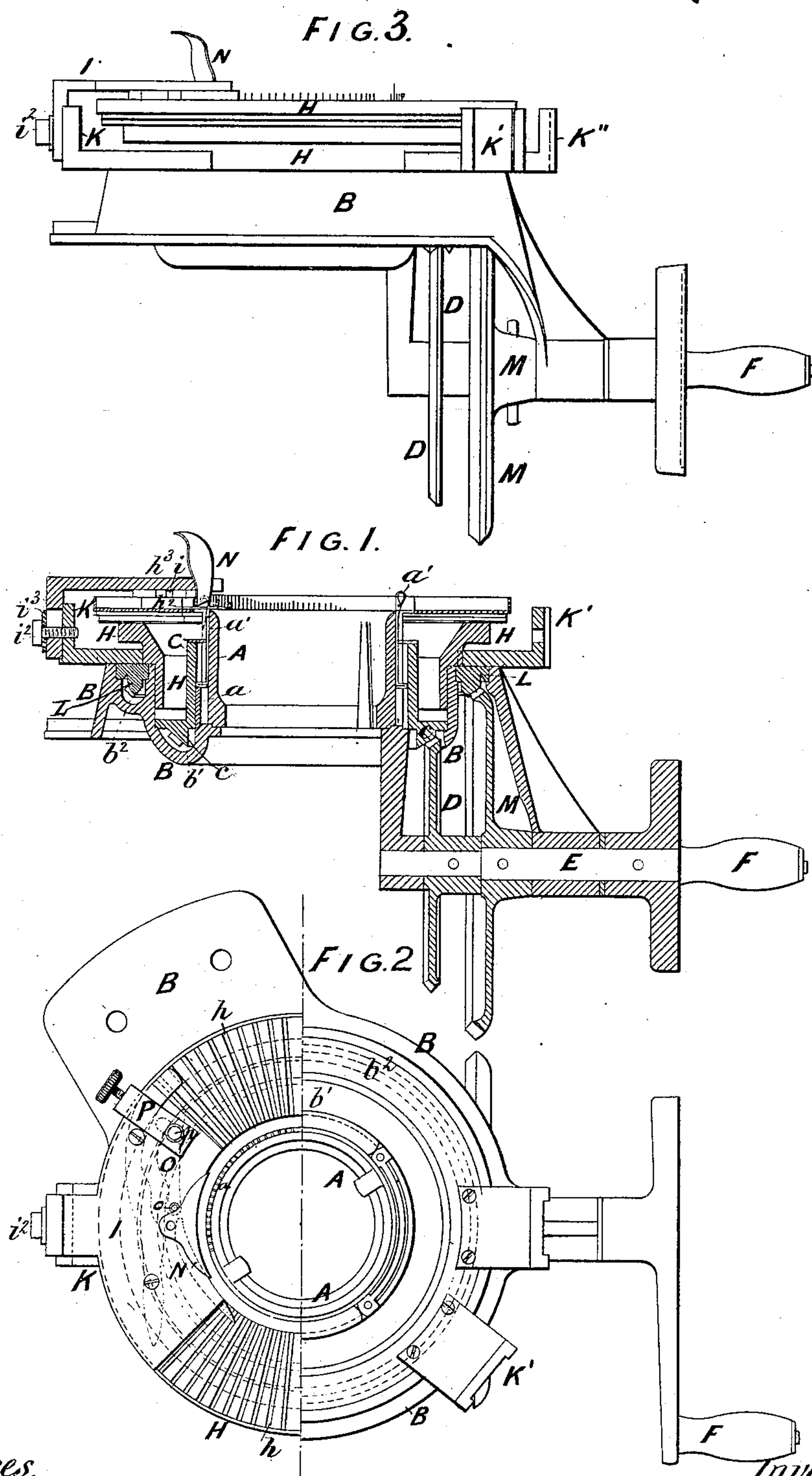


J. W. WATTS.

CIRCULAR KNITTING MACHINE.

No. 366,747.

Patented July 19, 1887.



Witnesses.

W. A. Jones,
A. H. Cragin

Inventor.

John W. Watts.
Jess W. Cragin. Secy.

(No Model.)

4 Sheets—Sheet 2.

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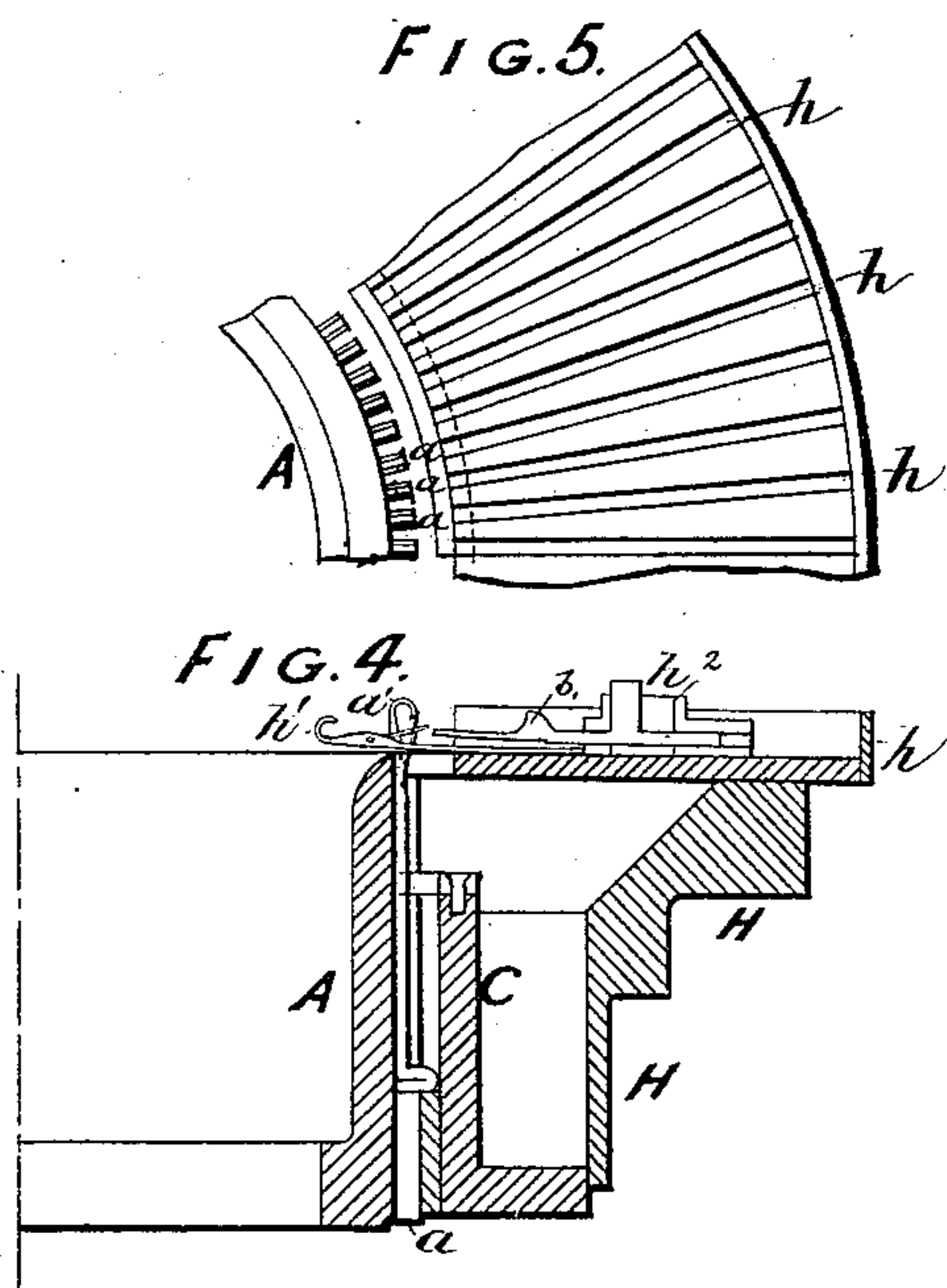


FIG. 18.

FIG. 19

FIG. 20.

Witnesses.

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John W. Watts.
per W. A. Cragin.

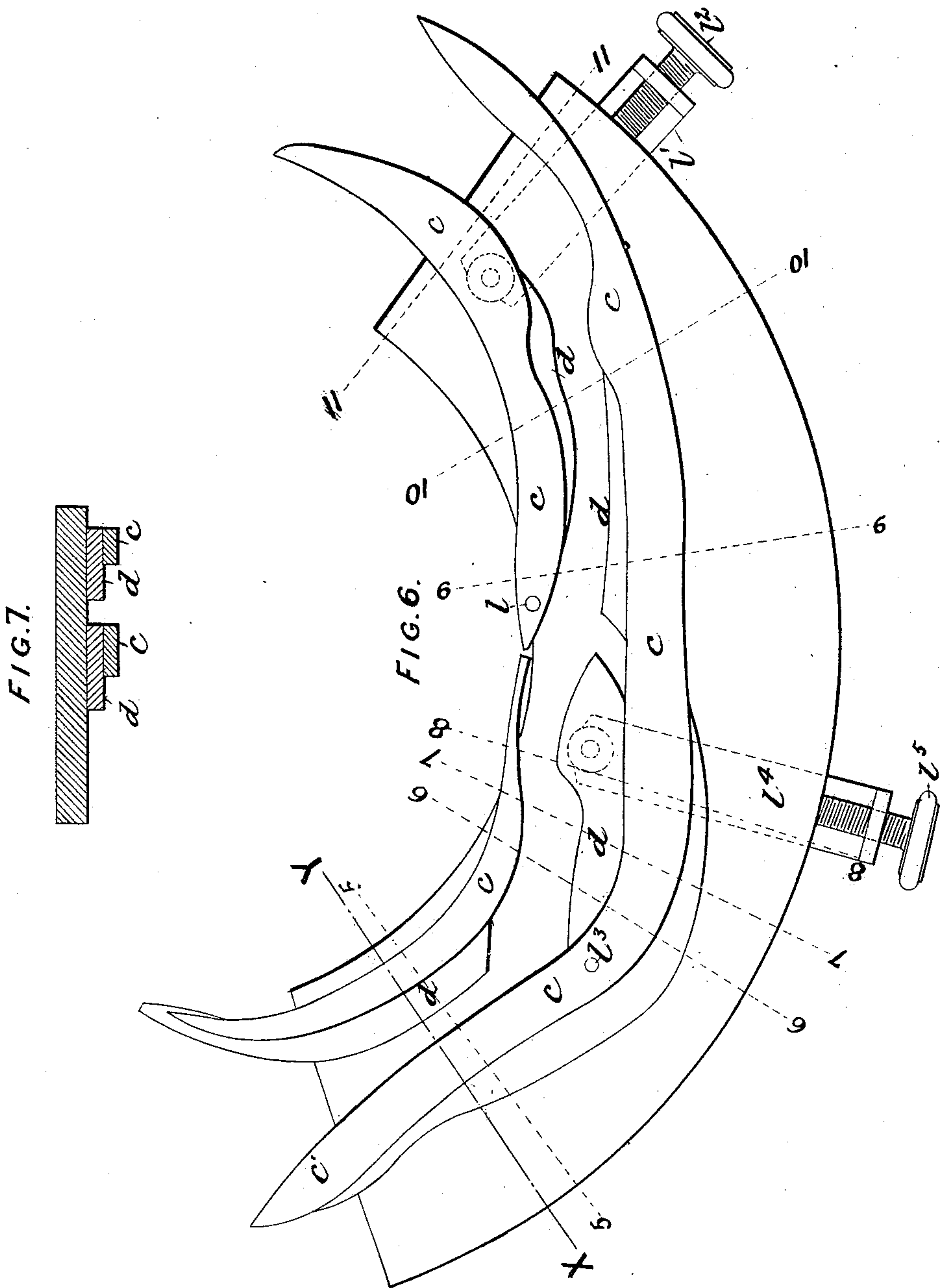
(No Model.)

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Witnesses.

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Inventor.

John W. Watts.
A. H. Cragin, Atty.

(No Model.)

4 Sheets—Sheet 4.

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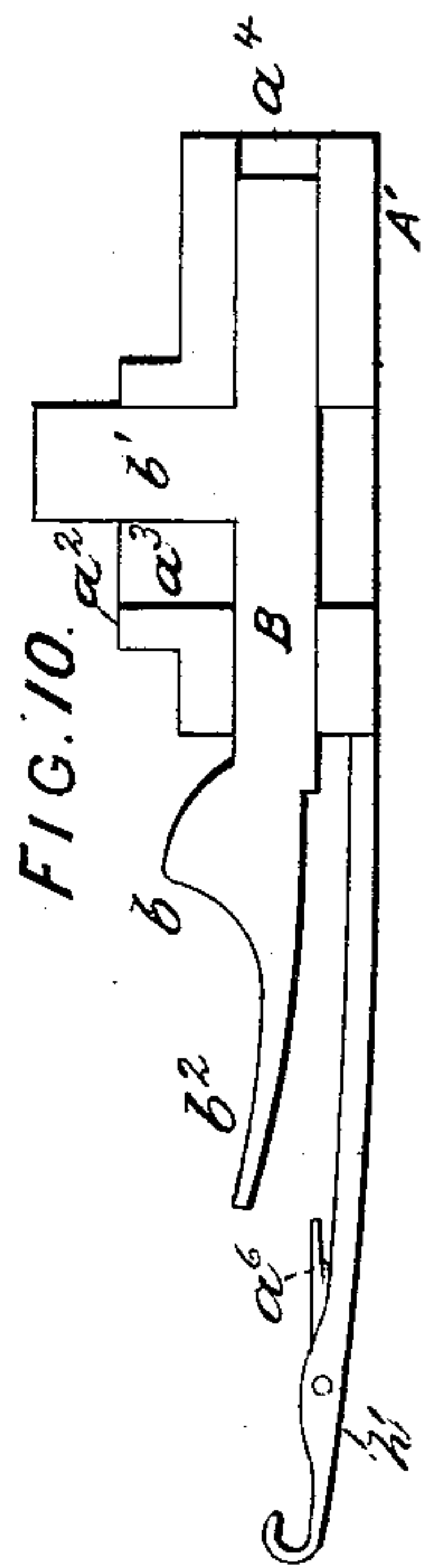


FIG. 14.

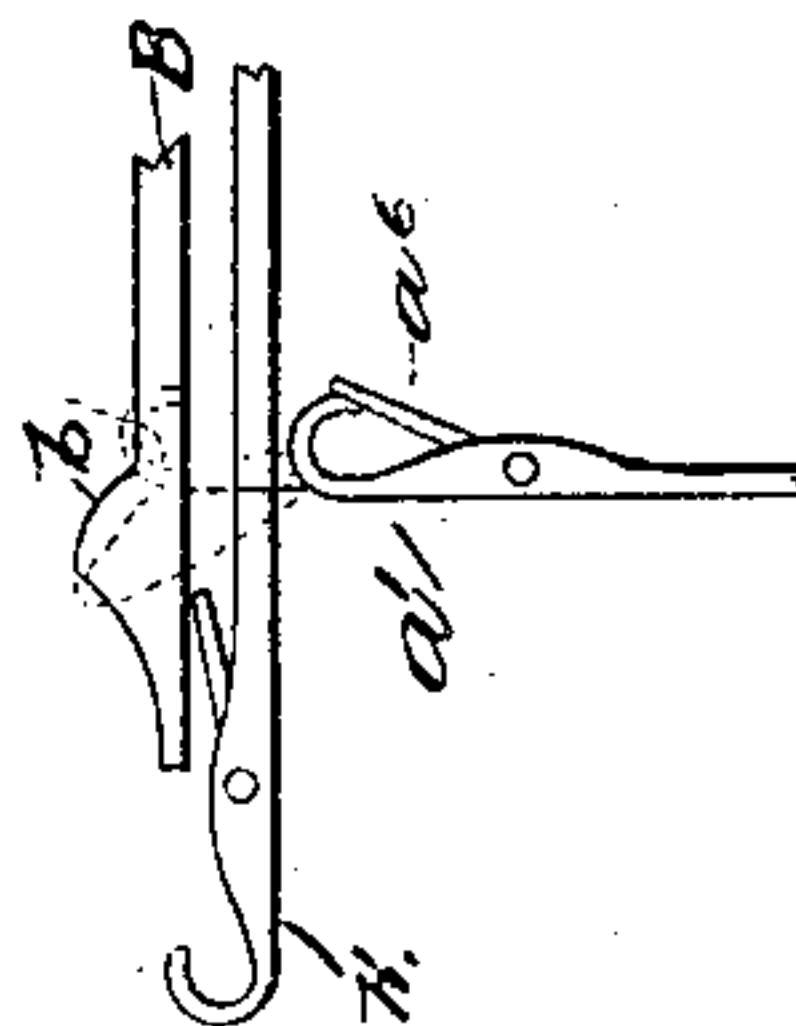


FIG. 13.

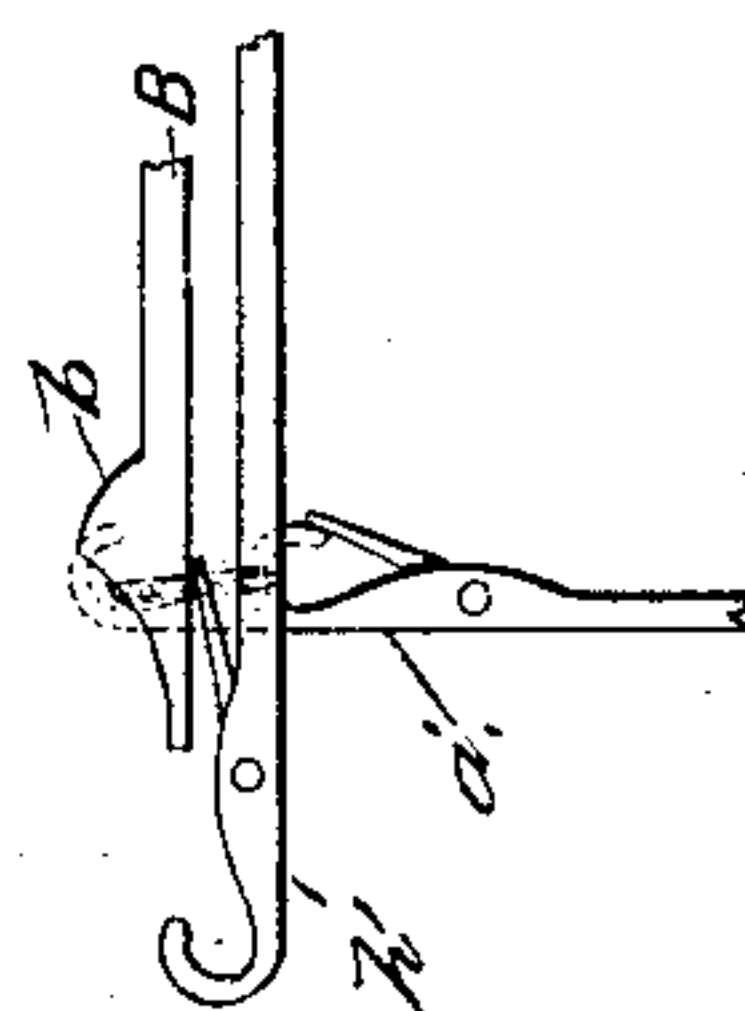


FIG. 17.

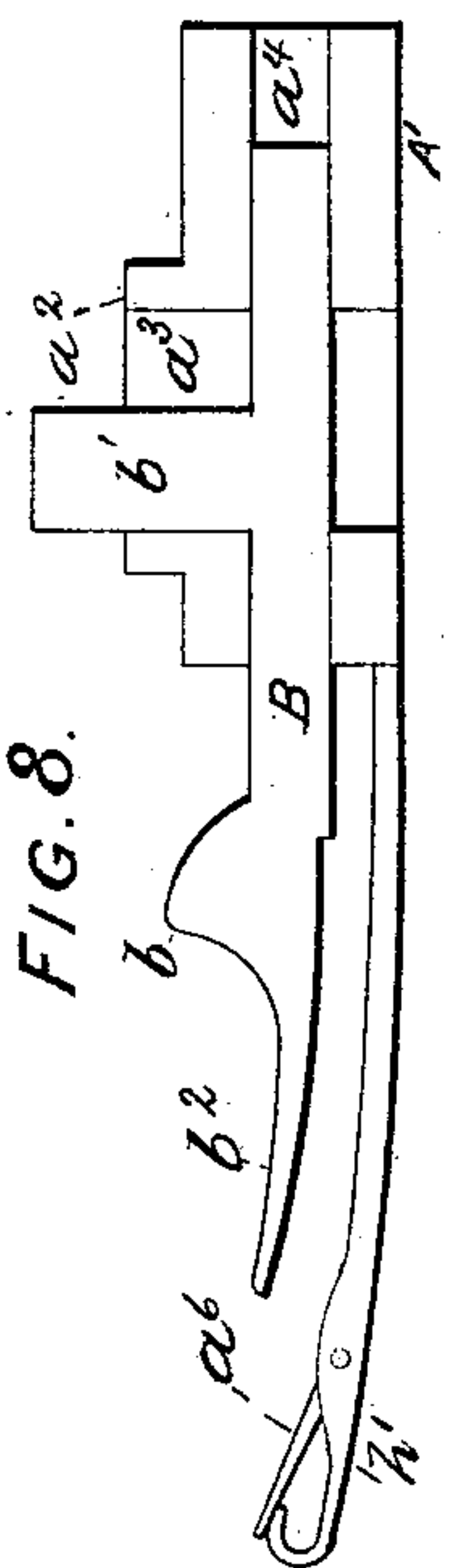
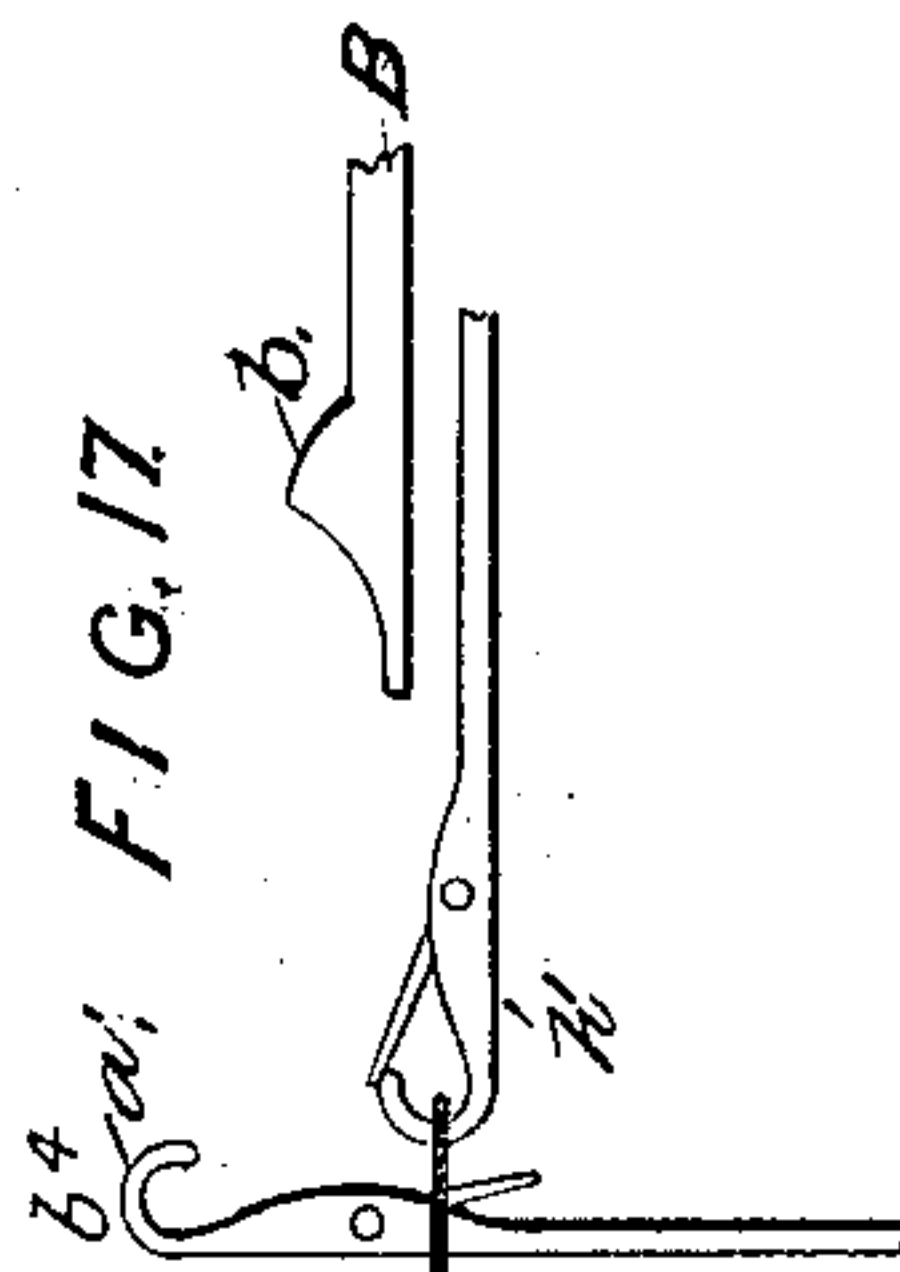


FIG. 9.

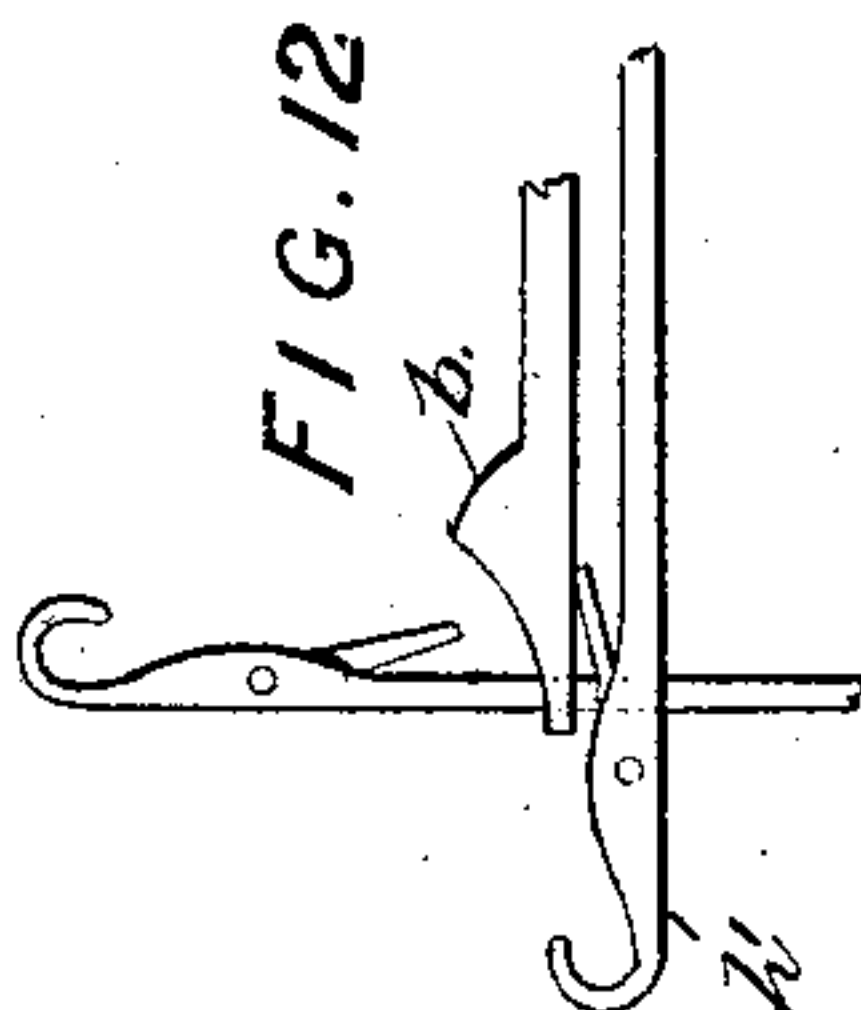
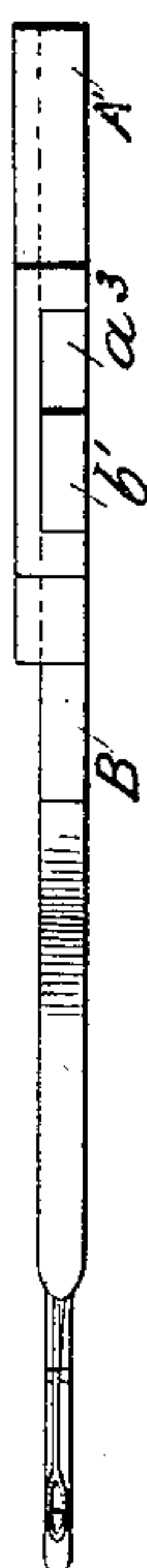


FIG. 11.

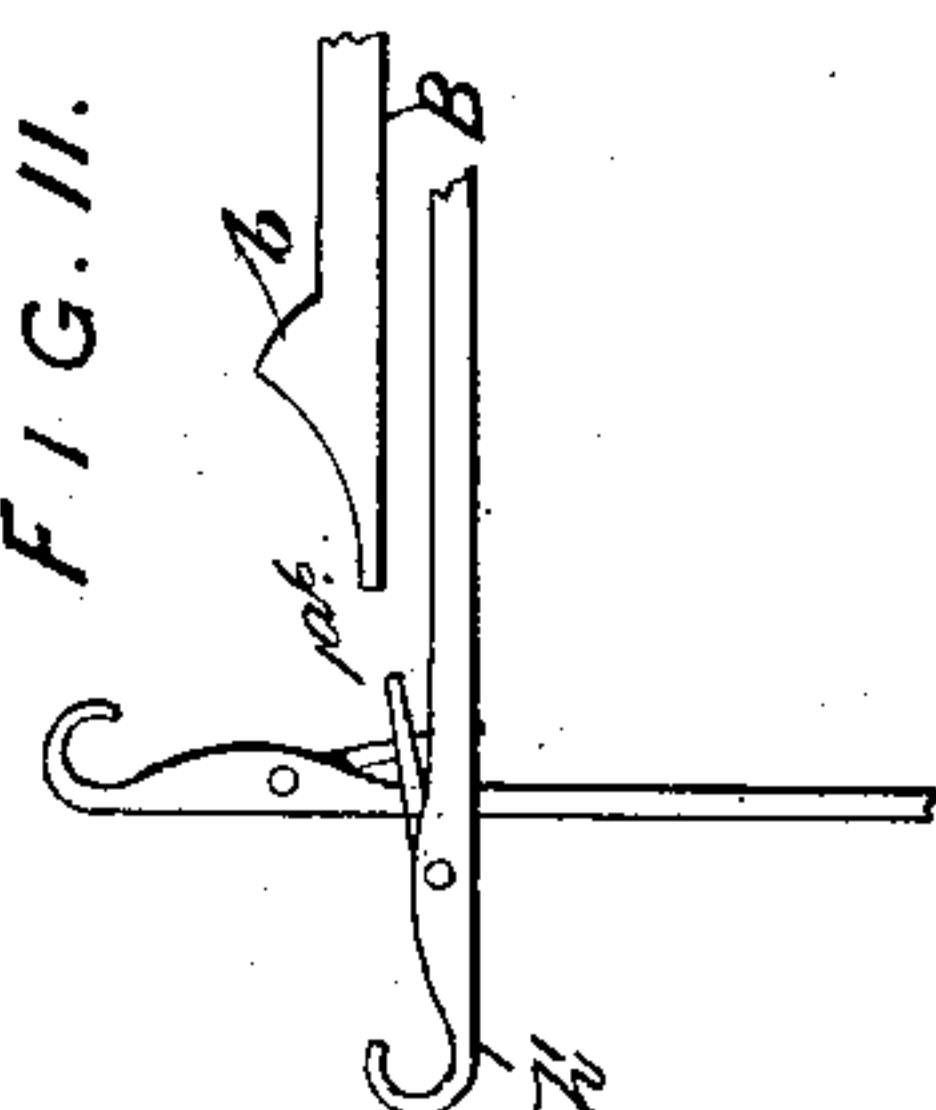


FIG. 16.

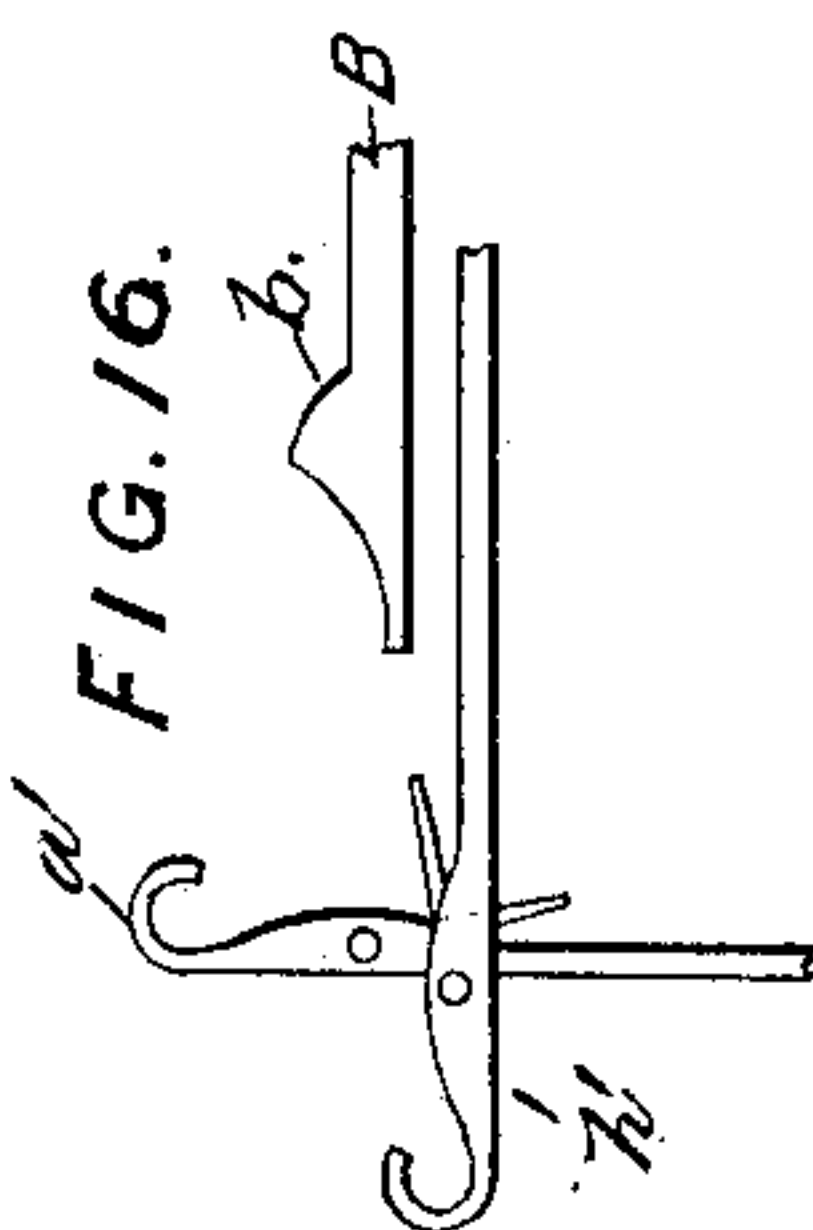
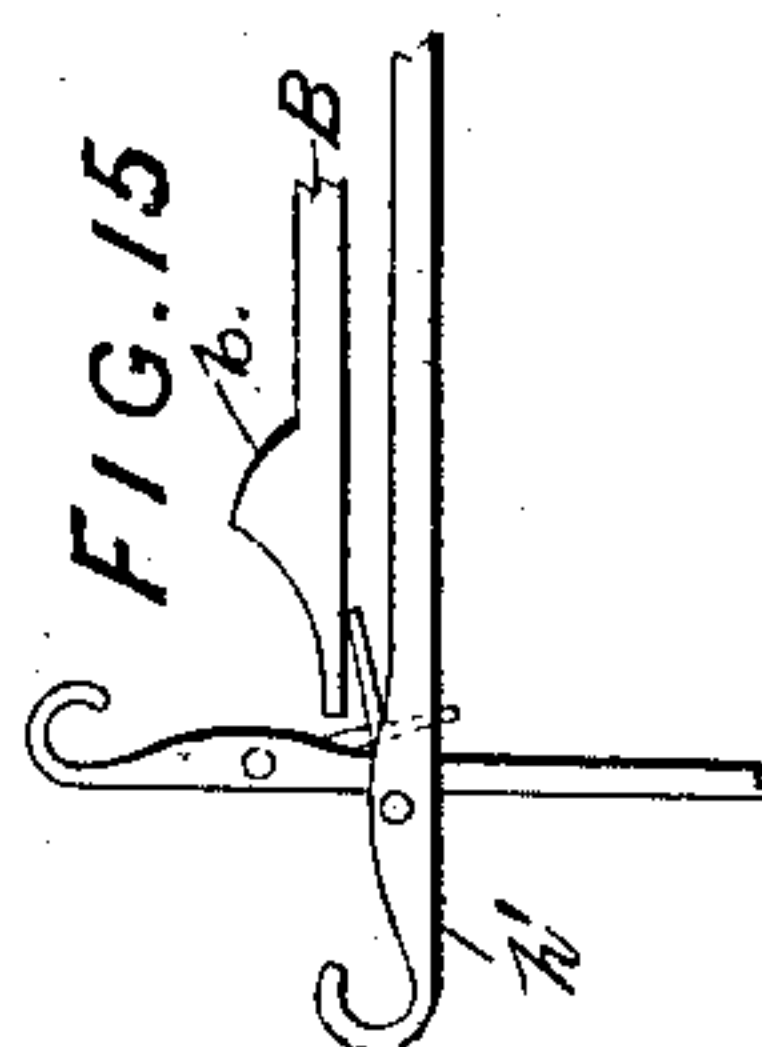


FIG. 15.



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Inventor:
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per Wm. A. Cragin, Atty.

UNITED STATES PATENT OFFICE.

JOHN WILLIAM WATTS, OF COUNTERTHORPE, ENGLAND.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 366,747, dated July 19, 1887.

Application filed July 14, 1885. Serial No. 171,603. (No model.) Patented in England January 21, 1884, No. 1,836.

To all whom it may concern:

Be it known that I, JOHN WILLIAM WATTS, of Counterthorpe, England, have invented a new and useful Improvement in Knitting-Machines, (for which I have obtained patent in Great Britain, No. 1,836, dated the 21st of January, 1884,) of which the following is a specification.

My invention relates to circular-knitting machines; and, it consists in the construction and novel combinations and arrangement of parts, as will be hereinafter described, and particularly pointed out in the claims.

The object of my invention is to produce a circular-knitting machine which will make fashioned or shaped goods, such as stockings, pants, shirts, sleeves, &c.—that is to say, articles of varying diameters. This I accomplish by arranging outside, and nearly at the top of a vertical needle-cylinder, a flat ring or dial-plate having as many needle-grooves cut into its upper surface as there are needle-grooves in the vertical needle-cylinder. These grooves of the flat dial-plate radiate from the center thereof and are placed in alternation with the grooves of the vertical needle-cylinder, (one radial groove between any two contiguous vertical grooves,) whereby when fashioning-needles are pushed into each of the radial grooves toward the center of the cylinder such needles will be situated immediately over the vertical needle guide-posts, between the needles of the vertical cylinder. The needles of the dial-plate are operated in connection with auxiliary yarn or thread engaging instruments, hereinafter described, by means of cams. If I wish to vary the width of the fabric, I can arrange as many needles and auxiliary instruments in the circular needle-disk as are required, in addition to those in the cylinder, for producing the maximum size of the fabric. The number of needles and auxiliary instruments actually employed may be less than the total number of grooves, and is in proportion to the size of the fabric to be produced. If I only wish to make stockings on the machine, I only require a segment of the outer disk; but I prefer a whole circle, although I may only wish to use a portion of it—for instance, that which is required for twenty needles. In knitting a stocking, both vertical and fashioning needles and auxiliary instruments being in operation, I

work as much wide or cylindrical part of the fabric as may be desired, and then I commence the narrowing process by gradually withdrawing out of reach of the actuating-cams, and thereby setting out of action, the needles of the dial-plate and their coacting auxiliary instruments, first taking off their loops and hanging them upon the vertical needles.

The plan I adopt for the removal of the needles, &c., of the dial-plate in making fashioned or shaped stockings is as follows: Suppose there have been twenty needles of the dial-plate at work. I commence by removing needles numbered 1 and 2 on the left side and 19 and 20 on the right side and the connected auxiliary instruments. Next I work a certain number of revolutions; then remove Nos. 3 and 4 on the left side and Nos. 17 and 18 on the right side, and so on until all the needles and auxiliary instruments of the dial-plate are removed.

The above description is all that is necessary to explain the manner of removing the needles and auxiliary instruments. The terms “needles 1 and 2” and “needles 19 and 20,” &c., are merely meant to refer to the needles at the end of the series.

I next work sufficient for a pair of stocking-smalls—that is, the narrow part of the stocking between the calf and the heel. I then commence widening the stocking by again putting the needles of the dial-plate and their coacting auxiliary instruments into action. I commence by hanging onto a fashioning-needle a portion of the loop that has been produced upon the nearest vertical needle.

The order of putting the needles of the dial-plate into action is preferably as follows: First, the needles 9, 10, 11, and 12 of the dial-plate are put into action, and the machine is operated to produce a certain number of revolutions or courses. Then needles Nos. 7, 8, 13, and 14 are put into action, and so on, until the twenty are all in action. I have not illustrated the manner of widening or narrowing the fabric, as I deem the explanation that I have given all that is necessary. I then work as much of the wide part as may be necessary for a pair of stockings. Then I recommence the narrowing process, and so on, so as to produce a continuous series of stocking-legs. I then cut the series through at the middle of the wide parts,

and also at the middle of the narrow parts. Again, if I wish to make cylindrical fabric, but wider than can be produced upon the vertical needles only, I can do so by means of the
 5 needles of the dial-plate and their auxiliary instruments and cams. For instance, if the vertical needle-cylinder contains one hundred fashioning needles and auxiliary instruments,
 10 I can, by filling all the grooves in the dial-plate, increase the fabric to double the width which would be produced by the vertical needles only.

In the accompanying drawings, Figure 1 is vertical section, Fig. 2 a plan, and Fig. 3 an elevation, of a circular-knitting machine embodying my invention, while the remaining
 15 seventeen figures represent details.

The left half of Fig. 2 shows the guide-ring for the needles of the dial-plate and the cam-plate for operating the needles, as well as the
 20 yarn-guide, while the right half shows the machine after the removal of the said ring and of the parts attached to it.

A is the vertical needle-cylinder, which is stationary and provided on its circumference
 25 with grooves a , for guiding the vertical needles a' .

The needle-cylinder A rests on an annular casting, B, having two concentric grooves, b' and b'' , the inner one of which, b' , serves to
 30 support and guide the cam cylinder or ring C, which has on its under side a toothed ring, c , gearing into the bevel-wheel D, as shown in Fig. 1, adapted to impart to the cam-cylinder C a rotary motion, and thereby to the vertical
 35 needles a' the necessary up-and-down motion, as in ordinary circular-knitting machines. The tooth-wheel D is mounted on the driving-shaft E, provided with a handle, F.

H is the guide ring or disk, provided on its
 40 upper side with radial grooves h , as shown in Figs. 2 and 5, for guiding the horizontal or fashioning needles h' . (See Fig. 4.) The lower part of the stationary ring H projects into the groove b' of the casting B, and is thereby held
 45 concentrically to the vertical needle-cylinder A.

The to-and-fro motion of the fashioning needles is produced by a cam or raceway secured to or formed on the under side of a cam-plate,
 50 I, adapted to move around the axis of the machine with the same angular speed as the cam-cylinder of the vertical needle. Fig. 6 shows a bottom view, and Fig. 7 a cross-section, of such a cam-plate.

For guiding the fashioning-needles h' in the radial grooves h of the guide-ring H, the rear part of each needle has the shape of an upright plate, A' , fitting into one of the radial grooves
 55 of the guide-ring H, and for guiding the needles in the cam or raceway of the cam-plate the said rear part of each needle has a pin or lug, a^2 , projecting upward, so as to fit into the raceway of the cam-plate I when the latter approaches the needle. This part of the ma-
 60 chine will be described in detail farther on.

The rotary motion of the cam-plate I is produced by a bracket, K, to which the out-

side of the cam-plate is secured by means of screws i^2 , passing through adjusting-slots i^3 , which bracket is fixed to the top of a ring, L, 70 resting on the casting B and fitting into the annular groove b'' of the same. The under side of this ring is provided with teeth gearing into a bevel-wheel, M, mounted on the driving-shaft E. The upper part of the groove b'' 75 serves to guide the ring L concentrically to the vertical needle-cylinder. The yarn-guide N is fixed to the top of the cam-plate I, as shown in Fig. 1. The curved block O, (shown in Fig. 2 by dotted lines,) which forms (an in- 80 ner) part of the raceway for the horizontal or fashioning needles, is pivoted at o for the purpose of making the corresponding end of the said raceway narrower or wider.

The combination and arrangement of the 85 guide-ring H and of the fashioning-needles h' with regard to the vertical knitting-needles a' , and the vertical knitting-cylinder A is more clearly shown by the detail Figs. 4 and 5, of which Fig. 4 is a vertical section 90 of one-half of the ring and needle-cylinder, showing the needles, while Fig. 5 is a partial plan with the needles omitted.

To better regulate the length of loops made by the fashioning-needles h' , I use, in combina- 95 tion with every fashioning-needle, an auxiliary instrument, B, adapted to slide over the latches in the fashioning-needles, as illustrated by the accompanying drawings, of which Figs. 8 and 10 are side elevations, and Fig. 9 is a 100 plan showing the auxiliary instrument on a large scale, while Figs. 11 to 17 show the relative positions of the vertical needles, fashioning-needles, and auxiliary instrument B at various consecutive stages of the knitting pro- 105 cess. The upper surface of this auxiliary instrument B may be straight and the thread only laid across it; but I preferably form a shoulder or upward projection, b , near the free or front end, as shown in Figs. 8 and 10, 110 (that end which moves over the latch of the fashioning-needle,) for the purpose of drawing more loop than would be practicable without such shoulders or projection. This auxiliary instrument B has also a projecting butt or lug, 115 b' , adapted to come in contact with suitable cams, as shown in Fig. 6, which cause the said auxiliary instrument to move forward or backward, as required. This auxiliary instrument is made to slide off and over the needle-latch— 120 for instance, by having its rear end shaped as above described—so that it can be actuated by cams of the shape shown, or of other various shapes; but I preferably guide the rear end of the auxiliary instrument B in a suitable re- 125 cess, a^4 , formed on the side of the needle-jack, as shown in Figs. 8 and 10, the grooves in the ring or dial plate being cut deep enough to allow the needle-jack to lie in the groove, so that the side of the groove prevents the rear 130 end of the auxiliary instrument from getting out of the recess formed in the side of the needle-jack.

The needles a' h' and cams work as follows:

When the fashioning or ribbing needle h' is pushed forward, the loop upon it causes the latch a^6 to open, and while the said latch is open (see Fig. 11) the auxiliary instrument B is made to slide over it. Consequently, when the fashioning-needle h' is pushed forward by the cams sufficiently (the auxiliary instrument advances forward likewise) to throw off the loop from the latch a^6 onto the stem of the needle h' , the latch is prevented from closing by the end b^2 of the auxiliary instrument B lying over it. The thin front part, b^2 , of the auxiliary instrument now lies ready for the vertical needles a' to draw their loops across it. Just as the preceding frame-needle a' has drawn its full loop, the auxiliary instrument pushing the thread forward causes more thread to be drawn from the bobbin than would otherwise have been had the auxiliary instrument remained stationary until the following frame-needle had drawn its full loop. When the succeeding frame-needle has drawn its full loop, or later still, if preferable, both the auxiliary instrument and the ribbing or fashioning needle h' are made to recede simultaneously until the newly-formed loop is transferred from the end of the auxiliary instrument to the fashioning or ribbing needle. The auxiliary instrument is then withdrawn from over the latch of the fashioning or ribbing needle, which allows the latch a^6 liberty to close, which it does on the needle being drawn farther back, causing the old loop to slide over the end of the needle, while the new loop is secured inside the hook.

The requisite motion of the auxiliary instrument is automatically produced during the working of the machine by a peculiar shape of cam or cam-plate, which causes the to-and-fro motion of the fashioning-needles. In the accompanying drawings, Figs. 6 and 7 show such a cam-plate, Fig. 6 being a bottom view, and Fig. 7 a cross-section along line X Y of Fig. 6. The upward projection or butt a^2 of the fashioning-needle works in the main raceway formed by the guides c , Fig. 6, while the lug or butt b' , formed on the auxiliary instrument, projects beyond the lug a^2 into the auxiliary raceway formed by the shallow guides d .

The butts of both the auxiliary instruments and the needles are conducted into the raceway by the open-mouthed end c' of the cams. The needles are next forced inwardly until the loops upon the needles have turned back the latches to the stems, the auxiliary instruments being forced to the back of the recess a^3 , in order to allow the latches to turn back. (See Fig. 11.) The auxiliary instrument is next moved forward and the vertical needle upward (while the fashioning-needle remains with the old loop lying across the latch) until the fore end of the auxiliary instrument lies over the end of the latch, as shown by Fig. 12. The upper cam, d , now pushes the butt of the auxiliary instrument forward (and as the butt was already in contact with the front of the recess a^3 in the needle-jack, it cannot go for-

ward without taking the needle with it) until it reaches the position shown by Fig. 13. During this time the vertical needle has moved downward into the position shown by the same figure. Here the thread is laid across the fore end of the auxiliary instrument just in front of its shoulder as soon as the preceding vertical needle has obtained its loop, the cam still pushing the auxiliary instrument inward toward the axis of the needle-cylinder until it has drawn sufficient thread from the bobbin to make the same-sized loop as those formed by the vertical needles. (See Fig. 14.) Meanwhile the vertical needle has reached its lowest position. (Shown by the same figure.) During the inward motion the old loop has slid off the latch of the fashioning-needle onto the stem. After the succeeding vertical needle has formed its loop, the fashioning-needles may begin to move outward, (later if desired, but not earlier.) The lower inner cam—that is to say, the inner edge of the main raceway—next strikes against the inner edge of the needle-butt a^2 , which causes the needle to recede from its extreme inward position (at this point the cams do not act upon the butts of the auxiliary instrument, and consequently the fore end of the latter is not withdrawn from over the latch) until the end of the latch arrives in front of the vertical needles, as shown by Fig. 15, by which time the new loop has passed from off the auxiliary instrument onto the latches. The vertical needle has again been lifted and now occupies the position shown in Fig. 15, in which it remains for about three-fourths of the course—that is to say, until the yarn-guide has nearly reached it. The upper inner cam of the raceway—that is to say, the inner edge of the auxiliary raceway—next operates upon the front of the butt b' of the auxiliary instrument, (while the outer edge of the main raceway prevents the needle-butt from receding until after the latch is liberated,) so as to push the auxiliary instrument outward until its fore end has been drawn from over the latches, as shown by Fig. 16. Next the fashioning needle and the auxiliary instrument are simultaneously drawn farther back until the old loop has closed the latch and has been finally knocked over the end of the hook, while the new loop is secured in the hook of the needle, as represented by Fig. 17.

If it is desired to fashion only a part of the circle of fabric, I only use a sector of the flat ring or dial plate, which has as many grooves cut in the upper surface as there are needles required to make the maximum width of fabric.

The cams or raceways may be made adjustable by converting a portion of the side of each raceway into a lever, which can be turned inward and outward, so as to alter the width of the raceway for the purpose of regulating the length of loops formed by the fashioning-needles, and also for knocking over the said loops.

In the accompanying drawings, Fig. 6, the cam-section for moving the fashioning-needles

for effecting the knocking over of the loops upon the fashioning-needles is pivoted at l and controlled by a shackle and screw, l' and l'' , while the cam for regulating the amount of thread drawn from the bobbin by the auxiliary instruments is pivoted at l^3 and controlled by a shackle and screw l^4 and l^5 , which serve for fixing them in the desired position. The consecutive positions of a fashioning-needle (represented by Figs. 11 to 17) with regard to the cam-plate are shown by the radii, 5 to 11.

As shown by the drawings, both ends of the cams or guides forming the raceway for the butts a^2 and b are bell-mouthed, so that the needle may be actuated by turning the machine either backward or forward, in order to make a good heel for the stockings.

In the diagram, Figs. 11 to 17, the amount of to-and-fro motion is somewhat exaggerated, as will be seen by comparing with it the width of the recess a^3 in Figs. 8 and 10, which figures are drawn to a scale twice as large as that of Figs. 6 and 7.

In machines where the needle-cylinder revolves and the vertical needle-cam is therefore stationary, the fashioning-ring must revolve at the same angular speed, and the horizontal needle-cam remains stationary. In this case the knitting begins when the horizontal needles reach the yarn-guide. The series of operations is analogous to that just described, and will not, therefore, require a detailed description.

The foregoing description shows how my fashioning or intermediate needles work in making plain fabric—that is, fabric with the loops turned all one way.

Practically my fashioning-needles work in the same manner whether they are used in the production of plain or ribbed fabric—that is, with a portion of the loops turned one way and another portion the other way—for on whatever pattern of fabric my fashioning or intermediate needles are used such fabric can be narrowed until all the intermediate needles are thrown out of action, as before described.

Figs. 18, 19, 20 represent three of the ribbed patterns of fabric that my intermediate needles can help to produce. The dots represent the vertical needles, the full lines my fashioning-needles, and the dotted lines the ribbing-needles. Fig. 18 represents a $\frac{3}{1}$ pattern which can, by removing the intermediate needles, be reduced to a 2 and 1 pattern. Fig. 19 is a $\frac{4}{1}$ pattern which can be reduced to a $\frac{3}{1}$ pattern. Fig. 20 is a $\frac{5}{2}$ which can be reduced to a 3 and 2 pattern.

I wish it to be understood that my invention

can be applied to any ordinary ribbed or plain latch-needle knitting-machine whether such machines are constructed for the fabric produced to ascend or descend, and is particularly adapted for making shaped stockings, shirts, sleeves, &c., by reducing or increasing the number of loops formed in a given circle, which result I obtain by decreasing or adding needles and auxiliary instruments, every needle so added being equal to an additional needle in the vertical needle-cylinder. If desired, I can double the width of the fabric produced on the vertical needles by adding as many fashioning-needles and auxiliary instruments as there are needles in the vertical cylinder, and still the fabric produced will be of the same gage and quality as if made on the vertical needles only.

What I claim is—

1. The combination, with the vertical needles and means, as described, for operating the same, of the fashioning-needles arranged outside of the vertical needles, the auxiliary instruments, and means, as described, for imparting motion to said fashioning-needles and auxiliary instruments, substantially as described.

2. The combination, with a vertical needle-cylinder having arranged therein vertical needles and mechanism for operating said needles, and a flat dial-plate surrounding said cylinder, provided with grooves, of the fashioning-needles and cams for operating the same, the auxiliary instruments, cams for operating said instruments, and the cam-carrying plate, substantially as shown and described.

3. The combination, with the frame-needles and fashioning-needles and mechanism, as described, for operating said frame-needles, of the auxiliary instruments and a cam-mechanism for operating said fashioning-needles and auxiliary instruments, as shown and described.

4. The combination, with the fashioning-needles having at their ends upward projections and the auxiliary instruments provided with similar projections, of the cam-plate having raceways for the projections of the needles and instruments, respectively, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

JOHN WILLIAM WATTS.

Witnesses:

A. E. MELHUSH,
T. A. RAE.