

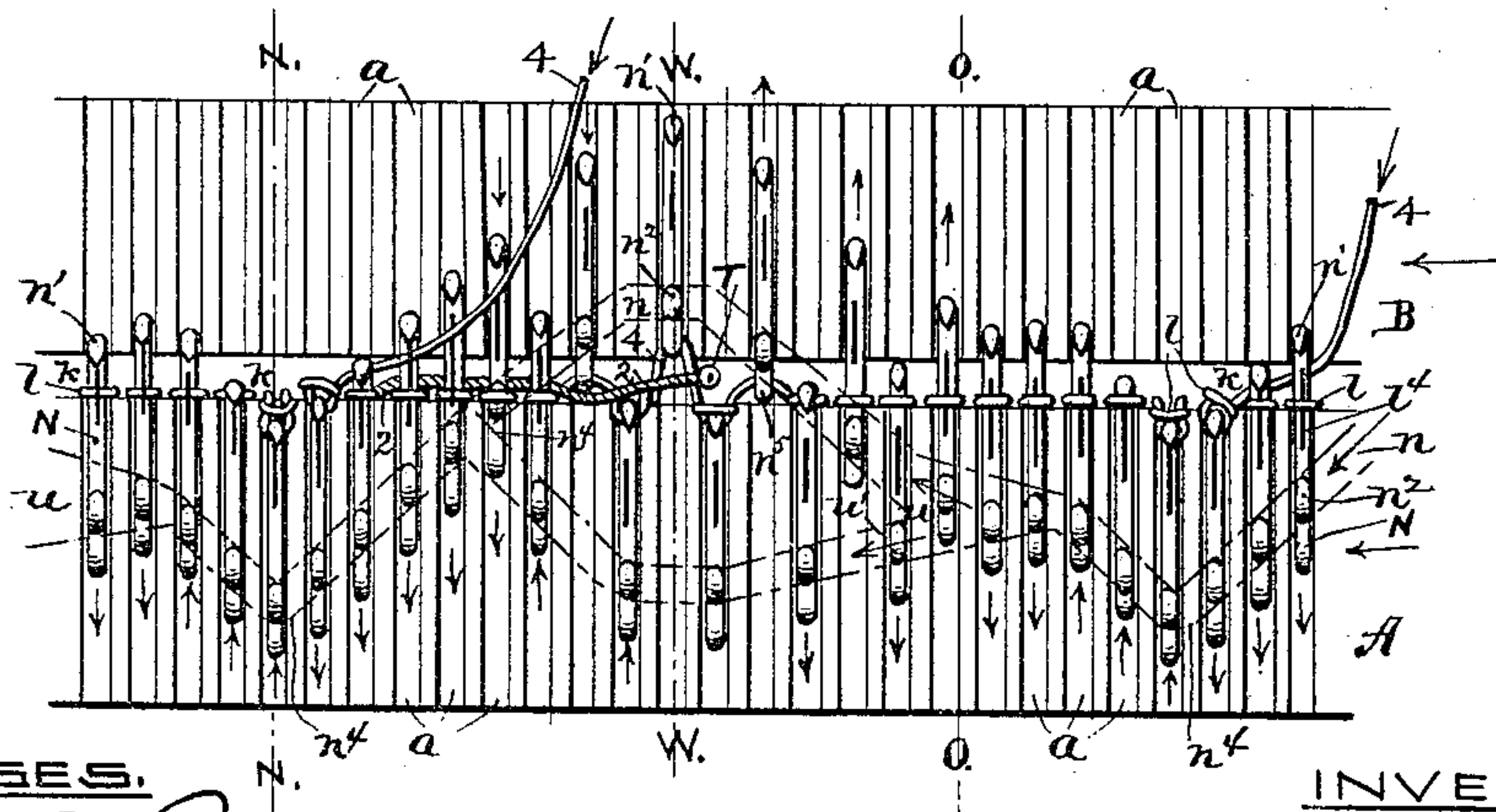
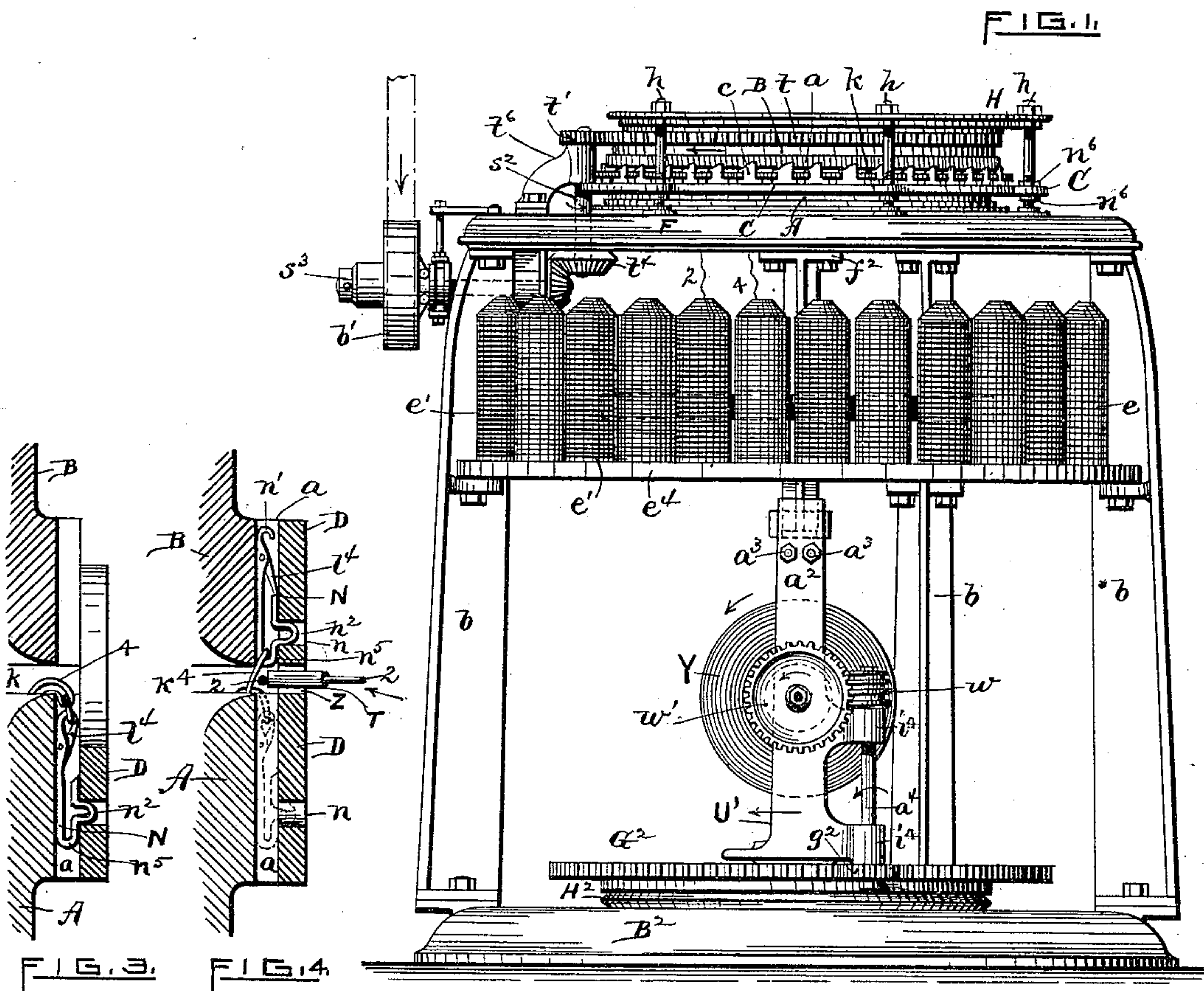
(No Model.)

3 Sheets—Sheet 1.

L. E. SALISBURY.
CIRCULAR KNITTING MACHINE.

No. 379,819.

Patented Mar. 20, 1888.



WITNESSES.

Charles Harrigan
Joseph A. C. Sanford

FIG. 2.

INVENTOR.

Levi E. Salisbury

Remington Henthorn

Attys.

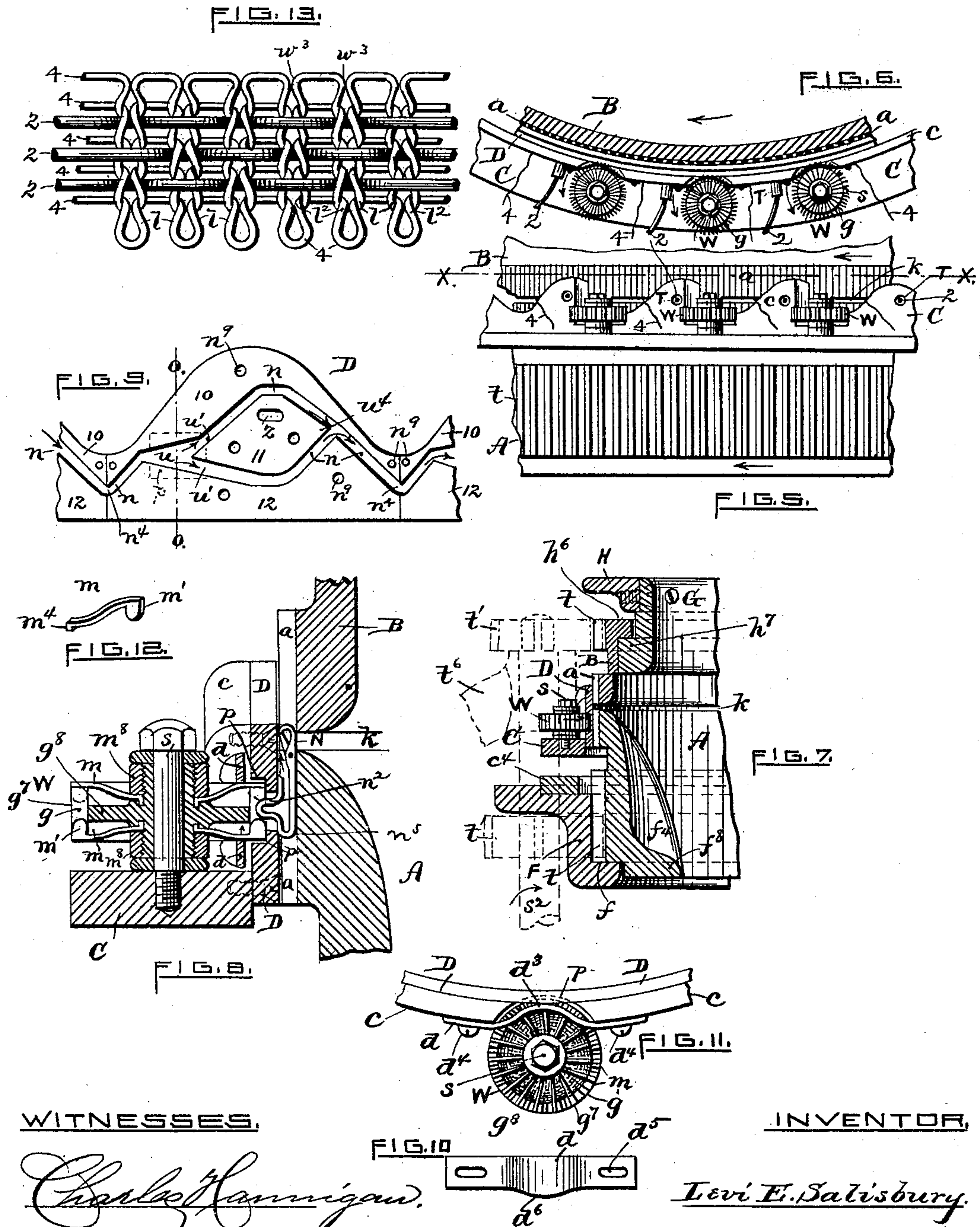
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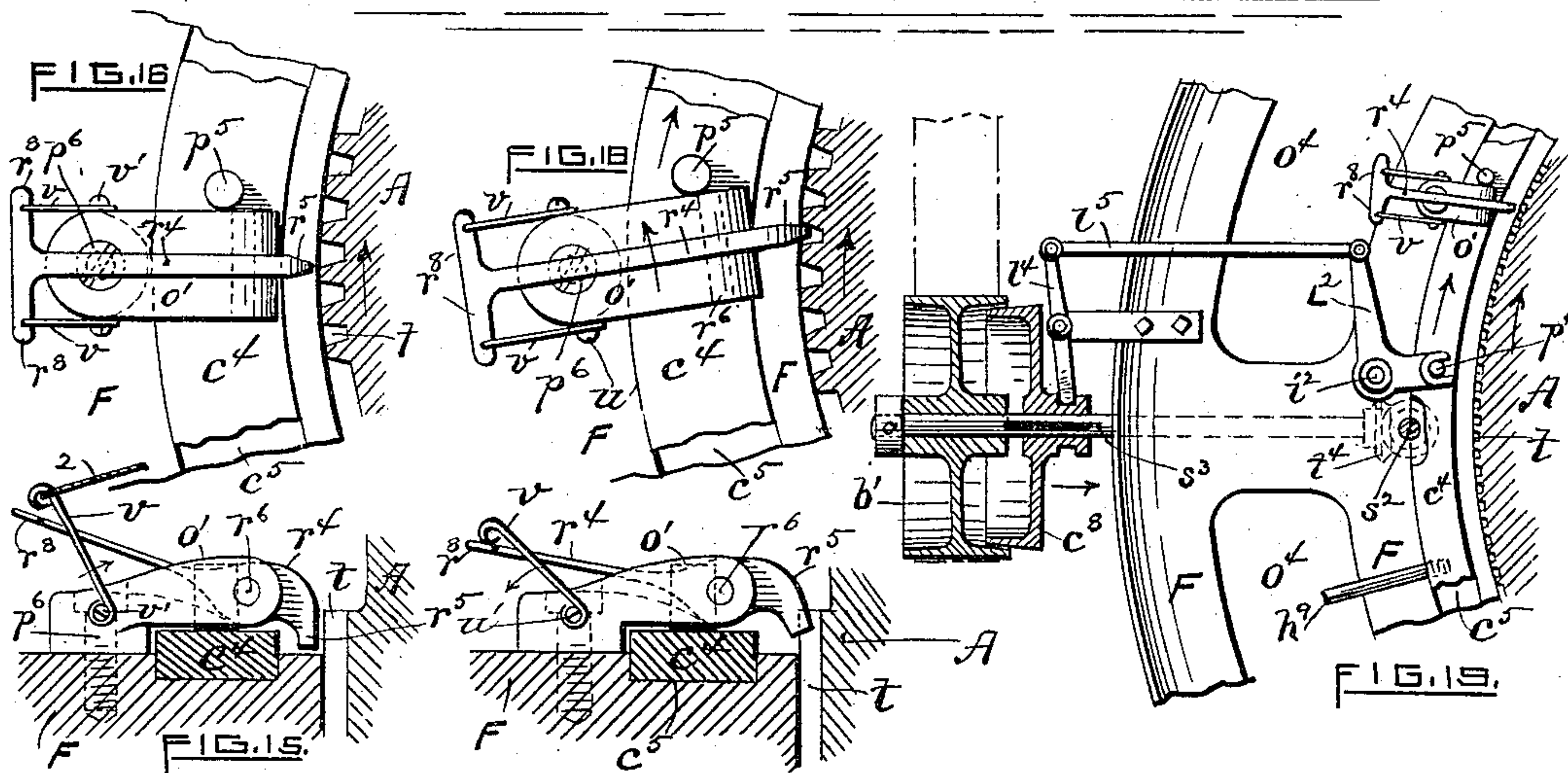
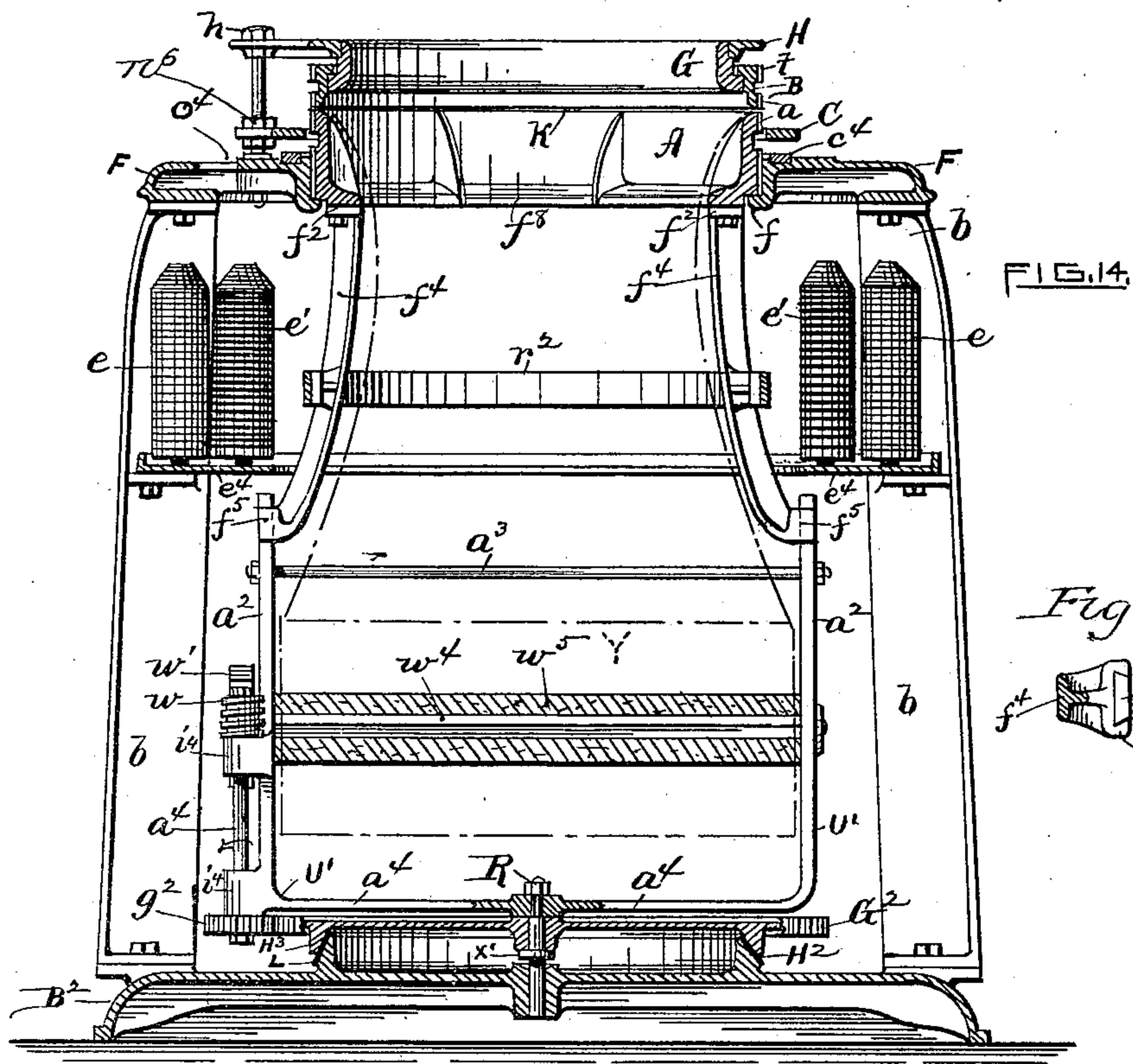
Remington & Wentworth

Attys.

3 Sheets—Sheet 3.

No. 379,819.

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WITNESSES.

FIG. 17.

INVENTOR

Charles Harrigan.

Levi F. Salisbury.

Joseph A. C. Sanford by Remington & Hawthorn

Atys.

UNITED STATES PATENT OFFICE.

LEVI E. SALISBURY, OF PROVIDENCE, RHODE ISLAND.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 379,819, dated March 20, 1888.

Application filed February 26, 1887. Serial No. 228,923. (No model.)

To all whom it may concern:

Be it known that I, LEVI E. SALISBURY, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Circular-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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in circular-knitting machines adapted more especially for knitting plush or carded face fabrics; and it consists, essentially, in the combination of mounted upper and lower needle-carrying cylinders revolving in unison, needles mounted therein adapted to retain the loops of the fabric while said needles are in the upper cylinder, and means for separating the column of needles and guiding them from a common path into diverging paths leading to the upper and lower cylinders, respectively, from whence said paths converge and again unite in a common track.

The invention further consists in the general combination and arrangement of the parts or elements, all as will be more fully hereinafter set forth and claimed.

The object of the invention is to provide a machine upon which may be knitted not only a plain fabric or base, as usual, but at the same time a plushing thread or threads may be interknitted into the base over the front and back of the "wales," so as to make a knitted fabric having its two surfaces alike, or, in other words, a fabric in which the plush-threads show the same on each side thereof, and nearly or quite conceal the base-threads.

The fabric itself, as improved, forms the subject of another application for Letters Patent filed by me in the United States Patent Office under date of December 14, 1886, Serial No. 221,519.

In the accompanying three sheets of drawings, illustrating my improved knitting-machine, Figure 1 represents a side view, in elevation, of the machine as a whole. Fig. 2 is a front view, greatly enlarged, showing a por-

tion of the upper and lower needle-carrying cylinders, one section of the cam-grooves being indicated by broken lines, said figure also showing a base or knitting thread and the manner of introducing the plushing-thread. Fig. 3 is a partial vertical cross-section taken on line N N of Fig. 2, showing the relative positions of needles, cylinders, and cams. Fig. 4 is a similar view taken on line W W of Fig. 2, showing a needle deflected wholly into and carried by the upper cylinder while passing the point at which the plushing-thread is fed into the space formed by the separation of the two cylinders. Fig. 5, Sheet 2, is a partial side view of the two cylinders, showing the relative arrangement of the needle-shifting wheels. Fig. 6 is a horizontal sectional view, taken through the line *x x* of Fig. 5, of the upper needle-cylinder. Fig. 7 is a vertical sectional view taken through the two cylinders, frames, &c. Fig. 8 is a similar view enlarged, the line of section being through one of the needle-shifting wheels. Fig. 9 is a detached view of one section of the cam plate or ring viewed from the rear. Fig. 10 is a detached view of one of the cams adapted to vertically operate the spring-arms of the needle-shifting wheels. Fig. 11 is a plan view of a portion of the cam-ring, a needle-shifting wheel, and one of the cams for acting on the arms of the latter, showing said cam secured to the vertical rim of the cam-ring. Fig. 12 is a perspective view of one of the said spring-arms detached from the wheel. Fig. 13 is an enlarged front or face view showing a piece of my improved knitted fabric, the several threads being loosely woven to more clearly represent the manner of interknitting the plushing-threads with the wales thereof. Fig. 14, Sheet 3, is a reduced vertical sectional view taken through the center of the machine. Figs. 15 and 16 are enlarged sectional and plan views respectively, showing the yarn-guide and "shipper-ring" in their normal position. Figs. 17 and 18 are corresponding views of the same, showing the lower cylinder in the act of operating the shipper-ring. Fig. 19 is a reduced plan view in partial horizontal section, showing the clutch disconnected from the driving pulley by means of the combined circular movement of the cylinder and shipper-ring; and Fig. 20 is a horizontal sectional

view taken through the upper portion of one side of the web-carrier.

The following is a more detailed description of my improved knitting-machine, including the manner of its construction and operation.

B², again referring to the drawings, designates the base of the machine, to which are secured a series of legs or uprights, *b*, the latter in turn being secured to the under side of the top frame, F. The said frame is annular in form and provided with openings *o*⁴, Fig. 19, through which the yarn passes from the bobbins to the needles.

*e*⁴ indicates an annular plate or "creel" secured to the said legs *b*. On the plate *e*⁴ are mounted the yarn-holding bobbins *e* *e'*, on which are wound, respectively, the base and plishing threads 4 2.

f designates an inwardly-projecting flange formed on the lower inner edge of the frame F (see Figs. 7 and 14) for the purpose of supporting the revolving lower needle-carrying cylinder. An annular groove, *c*⁵, is formed in the top surface of the frame F, adjacent to the lower cylinder, in which is loosely fitted and adapted to move the shipper-ring *c*⁴, the latter having a pin, *p*⁴, engaging an arm of a bell-crank lever, L², pivoted to the frame F, Fig. 19. The other arm of said lever, by means of the connecting-rod *l*⁵, is adapted to operate the shipper-lever *l*⁴ of the splined clutch member *c*⁸, thereby connecting the latter to or disconnecting it from the loosely-mounted driven pulley *b'*, as common. Exterior of said ring *c*⁴ are circularly arranged a series of yarn-guides, which are pivoted to the top of the frame F by means of screws *p*⁶. (See Sheet 3 of drawings.) Each guide consists of the holder or base *o'*, adapted to receive a screw, *p*⁶, and having ears extending over the shipper-ring, which are drilled to receive a pin, *r*⁶. A lever, *r*⁴, is loosely mounted on said pin. The short arm *r*⁵ of the lever is counterweighted and adapted to engage the teeth *t* of the lower needle-carrying cylinder. The long arm of the lever *r*⁴ extends rearwardly over and past the pivot *p*⁶, the end thereof being flattened laterally to form the two wings *r*⁸, the proportion of the parts just described being such that in the normal position the arm *r*⁵ is disconnected from the teeth *t*. On each side of the holder *o'*, adjacent to the screw *p*⁶, is pivoted, at *v'*, a yarn-guide, *v*, its upper end being bent to receive the yarn. A series of pins or stops, *p*⁵, are secured to the ring *c*⁴, said stops being located so as to bear against the holders *o'*, all as clearly shown.

The needle-carrying cylinders are constructed as follows:

A designates the horizontally-arranged lower cylinder, and B the corresponding upper one, each having the same number of needle-grooves *a* cut vertically therein around its periphery. The under side of the lower cylinder is adapted to rest upon the circular flange *f* of the base F. (See Fig. 7, &c.) The vertical face below the needle-grooves *a* is turned off true and cut

to produce cogs or teeth *t*. The base F is bored out to receive the cylinder. The upper ends of the teeth project above the base F for the purpose of engaging with the short end of the lever *r*⁴, before described. An opening is made through the wall of the base F, adjacent to the cylinder A, through which a small toothed wheel, *t'*, (see dotted lines, Fig. 7,) projects to intergear with the teeth *t* of said cylinder.

B, the upper needle-carrying cylinder or ring, is turned the same diameter as the lower one, and is provided on the lower portion of its vertical exterior face with a series of grooves *a*. A series of gear-teeth *t* is cut in the upper portion of the vertical face, adapted to engage with and be operated by a small spur-wheel, *t'*, having the same diameter as the lower wheel. Both the said gears *t* are secured to the vertically-mounted shaft *s*², which in turn is driven by the bevel-gears *t*⁴, one being secured to the lower end of the shaft and the other secured to the inner end of the horizontally-mounted shaft *s*³, which latter also carries the loosely-mounted driving-pulley *b'* and its clutch member *c*⁸. The two cylinders, when mounted, are separated about one-eighth of an inch, as at *k*, and have the grooves directly in line, both cylinders being driven in unison by the upper and lower wheels, *t*.

H indicates a stationary ring mounted at the top of the machine, to which is secured a ring, G, which in turn, by means of the circumferential flange *h*⁷ and the corresponding inwardly-projecting flange, *h*⁶, of the cylinder B, resting thereon, serves to support the latter and at the same time permits it to revolve freely.

h *h*, Fig. 1, designate studs secured to the top of the frame F, the upper end of said studs being adapted to receive and support the ring H, before described.

C indicates a "cam-ring," so called, having an L-shaped section, the base-flange thereof being enlarged at intervals to loosely receive the said studs *h*, and the latter being screw-threaded adjacent to the cam-ring and provided with upper and lower nuts, *n*⁶ *n*⁶, whereby the ring with its attachments, about to be described, may be vertically adjusted in a very expeditious and accurate manner. The rim *c* of the cam-ring C is cut away at intervals to permit the vertically-mounted needle-shunting wheels W to freely revolve therein. The said wheels W consist each of an elongated hub having a thin web or plate, *g*⁸, Fig. 8, extending from the center thereof and terminating in the comparatively-wide circumscribing-flange *g*⁷, which is grooved or cut through vertically, as at *g*, to receive a series of spring-arms, *m*, the latter having the inner ends, *m*⁴, bent to enter a groove formed in the hub of the wheel. The outer end of each arm *m* is provided with an attached or integrally-formed lug, *m*¹, adapted to freely move up and down in its groove *g*. Nuts *m*⁸ serve to retain the spring-arms in position. Stud *s*, tapped into the base-flange of

the cam-ring, form each a vertical support on which the wheels freely revolve.

The wheels may be of larger or smaller diameter, as desired, and provided with groove 5 g , corresponding to the coarseness of the needles used and the style of the fabric to be produced. Practically, if there be, say, twenty-four grooves cut in the wheel, there would be used the same number of spring-arms—twelve 10 on the upper alternating with twelve on the lower side of the wheel.

Cams d are adjustably secured to the rim c above and below each wheel, each cam being formed from a piece of thin metal, and bent, as 15 at d^3 . The under edge of the cam is formed with projections at d^6 sufficiently to produce the requisite vertical movement of the needles. Screws d^4 , passing through the elongated holes d^5 , serve to attach the cams to said cam-ring.

20 DD indicate the cams proper, the same being formed from sheet-steel about three-sixteenths of an inch thick. Each section of cam as drawn (see Fig. 9) is composed of three pieces, 10, 11, and 12, and has holes n^9 therein.

25 The cams are continuously arranged around the inner turned diameter of the cam-ring and secured thereto by screws passing through said holes n^9 . The cams, while thus circularly arranged and fitted, permit the cylinders A B 30 to freely revolve therein. The pieces forming the cams D are cut away and separated so as to produce the irregular grooves n . By the introduction of the center piece, 11, upper and lower grooves are formed. The latter at their 35 forward end, u' , form a junction with the enlargement u of the groove n . The opposite or front side of each cam, adjacent to the wheels W , is cut away at p to receive the rim of the wheel. (See Figs. 8 and 11.) The said upper 40 cam-groove, in connection with a wheel, W , is adapted to guide some of the traveling needles wholly into the upper cylinder, (see Figs. 2 and 4,) while at the same time the alternate or adjacent needles are guided wholly into the 45 lower cylinder by the aid of the lower cam-groove and said wheel. Each of the needles N has a bent shank, n^2 , loosely fitting the cam-groove, the same projecting into the space p for the purpose of engaging the lugs m' of the 50 spring-arms m . z indicates an opening formed in the center piece, 11, of each cam section, adjacent to the space k , through which is passed a short tube, T . (See Fig. 4, &c.) Said tube also passes through and is secured to the 55 rim c of the cam-ring. Each tube T is adapted to receive the pushing-thread 2 and present the same in front of the adjacent elongated loop at the rear of the needles. (See also Fig. 2.)

60 Referring now more particularly to Figs. 1 and 14, the manner of automatically "taking up" the fabric as fast as knitted, together with the tension device therefor, is as follows: A stud, R , is loosely mounted in the base B^2 at 65 the center thereof, said stud being provided with a fast collar, x' , which supports the loosely-mounted main friction-gear G^2 , the lat-

ter having a circular rim, H^3 , secured to or formed on its under side, which is beveled to frictionally engage the correspondingly bev- 70 eled and leather covered raised rim H^2 , formed on the top of said base. A U-shaped frame or web-carrier, U' , is secured to the upper portion of the stud R . One of the uprights of the web-carrier is provided with upper and 75 lower ears, i^1 , which are drilled to receive an upright shaft, a^1 . The latter in turn has a small wheel, g^2 , secured thereto, intergearing with the large friction gear G^2 . A worm, w , is secured to the upper end of the shaft a^1 , 80 which gears into the worm-wheel w' , secured to the outer end of the beam-arbor w^4 , the latter being fitted to turn freely in the uprights a^2 . Guide-rods a^3 are secured to the said uprights near the top end thereof. The 85 upper ends of the web-carrier are fitted to slide slightly up and down in the lower ends, f^5 , of the two bent arms, f^4 . (See also Fig. 20.) The arms f^4 are oppositely located and are secured to the under side of the circular base- 90 flange f^8 of the lower cylinder, A .

r^2 is a "steady-ring" secured to the said arms, all as clearly shown in Fig. 14. By means of this construction it is evident that the arms, web-carrier, &c., travel in unison with the 95 lower cylinder and at times are wholly supported by it through the medium of the fabric.

By means of the circular creel or bobbin-stand e^4 , as arranged below the frame F , the 100 machine is rendered more accessible to the operator as well as presenting a more symmetrical and mechanical appearance as compared with knitting-machines in which yarn-holders are supported overhead or even when 105 mounted on top of the upper frame.

Now, my improved knitting-machine having been constructed and arranged as represented in the several figures, the operation is as follows: First, however, the two sets of bobbins 110 e e' , containing, respectively, the base-threads 4 and pushing-threads 2, are placed in position and these several threads passed up through the frame F , thence through the respective pivoted yarn-guides v , and finally to the needles. The ends of the base-threads are con- 115 nected with a set of chain-stitch loops already formed upon the needles, as usual. In revolving the cylinders, &c., in the arrow direction a plain knitted fabric is produced, as common. 120 Now, in order to make the plush-faced fabric having both sides substantially alike, (see Fig. 13,) the spring-arms m are alternately arranged in the wheels W —that is to say, assuming there are thirty-two arms in each wheel, 125 sixteen of them would be mounted in the upper side thereof, alternating with sixteen similarly mounted in the under side of the wheel. (See Fig. 11.) By referring to Fig. 8 and to the corresponding line o o of Fig. 2, on which 130 the section is taken, it will be seen that as the needle-carrying cylinders revolve the shanks n^2 of the needles successively engage the spaces g of the wheels, thereby revolving the latter at

the same rate of speed. As the several arms m pass the upper and lower cams, d , the projections d^b thereof cause the arms to alternately deflect the needles from the enlargement u into the mouths u' of the upper and lower cam-grooves, n . From this point the needles are guided by the respective cam-grooves, one needle to pass entirely from the lower cylinder into the upper cylinder, the next needle being retained in the lower cylinder flush with its upper edge while passing the line $W W$ of Fig. 2, the operation being repeated successively at each cam section. By means of this arrangement every other needle is guided up over the opening z and tube T , through which the plishing-thread 2 enters, and the other or alternate needles pass under said opening and tube. Shortly after passing the points just named the two columns of traveling needles unite again in the common cam-groove.

It will be noticed, again referring to Fig. 2, that the base-thread 4 is fed to the needles and the knitted loop made in the lower revolving cylinder, A , in the usual manner and as indicated at the right of the figure. Now the needles, or rather the shanks n^2 thereof, successively rise from the lowest point, n^4 , of the cam-groove n into the said enlargement $p u$ thereof, the heads of the needles then engaging the upper cylinder. During said upward movement of the needles through the new loops the latter throw all the latches l^4 down. The loops, however, do not slide entirely therefrom, but rest against them, the weight of the fabric, together with the "take-up" mechanism, producing sufficient tension upon the loops to retain them snugly against the upper edge of the cylinder. As the needle-shanks enter the enlargement $p u$ they engage the rim of the shunting-wheel W . The latter in revolving, as just described, separate the needles. Then as the latter rise in the upper groove to the top thereof the new loops thereon slide from the latches down into the lower bend, n^5 , of the needles. Each needle in passing the highest point in the cam is wholly retained in the upper cylinder, the lower bend being just flush with the lower edge of the cylinder, the loop at the same time being drawn up from the edge of the lower cylinder, and also being considerably elongated thereby. Prior to the meeting of the two columns of needles those of the lower groove rise sufficiently to slip the loops from the latches. It will be noticed that as the needles descend (after meeting) another base-thread is introduced, (practically the beginning of the next cam-section,) which in turn is caught up by the hooks n' and shut in by the latches, the latter movement being effected by "shedding" the next prior set of loops over the ends of the needles, thereby forming the newer loops as the needles successively pass the lowest portion, n^4 , of the cam-groove.

The manner of introducing and interknitting the filling or plish thread 2 between the

several courses and over the front and back of the wales w^3 , Fig. 13, is as follows: The thread 2 is passed from its bobbin e' through a guide, v , thence through and to the rear end of the tube T . The thread, by means of the formed movement of the cylinder, is laid across and in front of the elongated loop and to the rear of the adjacent loop or wale, then front of the next loop, and so on alternately, the filling-thread always passing to the rear side of the needles. It will be seen that the needles, whether descending from the upper cylinder or ascending from the lower one, will always pass in front of the filling-threads. By means of this arrangement the latter-named threads show in front of the wales formed by the upper shunted needles and appear in the rear of the wales formed by the lower shunted needles.

The diagonal or "staggered" effect of the plishing-thread is produced by setting the alternate wheels W so as to cause the needles to travel in a reverse order—that is to say, the needles which were first wholly deflected into the upper cylinder are next guided into the lower cam-groove, and the (former) lower needles at the same time are guided into the upper cam-groove. This arrangement produces the fabric shown in Fig. 13, wherein the same thread 2 appears alternately in front of one wale and at the rear of the next, said thread 2 being knitted into the wales in each horizontal course.

I am enabled to produce a fabric having a figured surface on each side thereof by simply changing the arrangement of the spring-arms m in the wheels W .

The producing capacity of the machine is directly increased by simply multiplying the "feeders." A feeder comprises two threads, 2 4, with the necessary cams, wheels, &c., for operating the needles.

While the machine is running normally, should one or more of the yarns break, either base or filling, the immediate removal of the tension from the pivoted guide v allows the latter to fall, which, engaging the rear end, r^8 , of the nicely-balanced lever r^4 , depresses the same and swings the opposite end, r^5 , thereof into engagement with the teeth t of the revolving cylinder A . (See Fig. 17.) The action of the latter carries the pivoted holder o' in the arrow direction, Fig. 18, and, by reason of its contact with the pin p^5 , in turn forces the shipper-ring e^4 ahead a short distance, which latter, by means of the lever and connections shown in Fig. 19, withdraws the clutch member from the driving-pulley, thereby automatically stopping the machine. After "piecing up" the end or ends, the operator restarts the machine by simply grasping the handle h^9 , secured to the shipper-ring, and turning it (the ring) in the opposite direction, thereby locking the pulley b' to the shaft s^3 . A number of handles h^9 may be conveniently arranged around the shipper-ring, if desired.

The fabric is automatically wound as pro-

duced upon the wooden arbor w^5 by means of the pinion g^2 , traveling around the stationary gear G^2 , in conjunction with the revolving worm and its wheel w' . When, however, the tension upon the fabric exceeds the frictional contact of the gear G^2 upon the leather-covered rim H^2 , the said gear is automatically lifted a short distance, thereby allowing the gear, &c., to travel in unison, the beam then not revolving on its axis, the action being intermittently repeated during the filling of the beam.

It is evident that by a slight modification the axes of the cylinders, &c., may be placed and operated horizontally instead of vertically, as represented.

The fabric, as drawn, (see Fig. 13,) is very loosely knitted for the purpose of readily tracing out the several threads. Practically, however, the fabric is so closely knitted that the base-threads are almost wholly concealed. Said fabric after being properly "fulled" and "carded" presents a blanket-like surface on each side, having the base-threads entirely concealed.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent, is—

1. A knitting-machine having upper and lower needle-carrying cylinders, mechanism for revolving the cylinders in unison, needles mounted in said cylinders adapted to retain the loops of the fabric in the lower ends thereof while the needles are in the upper cylinder, and means for separating the column of needles and guiding them from a common path into diverging paths leading to the upper and lower cylinders, respectively, from whence the paths converge and again unite in a common path, substantially as hereinbefore described, and for the purpose specified.

2. The improvement in knitting-machines, the same consisting in the combination of upper and lower cylinders, needles mounted to move vertically therein, and mechanism for revolving said cylinders in unison with a series of cams, each adapted to guide a portion of the needles from a common path wholly into the upper cylinder, and to retain the rest of the needles in the lower cylinder, the needle-guides subsequently uniting again in a common path, and a needle-shunting device mounted, arranged, and adapted to intermittently deflect said needles into the divergent cam-path, substantially as hereinbefore described, and for the purpose specified.

3. A knitting-machine having two grooved needle-carrying cylinders traveling in unison, needles mounted therein, cams having grooves therein formed to divert the needles from one cylinder to the other, and shunting-wheels mounted and arranged to intermittently engage the needles and guide them into said

grooves of the cams, substantially as hereinbefore described.

4. The needle-shunting wheel hereinbefore described, having a grooved flanged rim, spring-arms engaging the grooved rim, and nuts secured to the hub of the wheel adapted to retain said spring-arms in position.

5. The combination, with the grooved cylinders A B, mounted to revolve, shanked needles N, fitted to slide endwise in said grooves, and a series of stationary cams adapted to receive the shanks of the needles, of the loosely-mounted spring-arm carrying shunting-wheels W, engaging said shanks, and upper and lower adjustably-mounted stationary cams d , for deflecting the spring-arms of the shunting-wheels, substantially as shown and hereinbefore described.

6. The cam D, hereinbefore described, having a groove, n , adapted to receive the shanks of the needles, said cam-groove extending up from its lowest point, n^t , and formed with the enlargement u , thence branching therefrom at u' in two directions, (up and down,) thence meeting at a common point and continuing in a single groove down to the lowest point or beginning, n^t , of the next cam-section, substantially as shown, and for the purpose specified.

7. The combination of the upper and lower needle-carrying cylinders, B A, separated by a space, k , a cam, D, having a tube, T, mounted therein adapted to introduce a plushing-thread at the rear of the needles in front of the loops at that point, cams having cam-grooves formed, as described, to guide a portion of the needles up over the end of the tube T and at the same time to guide the other needles below the tube, a shunting-wheel, W, formed with a grooved rim and having spring-arms, as described, and oppositely-mounted cams adapted to engage the spring-arms mounted in the wheel, whereby the cylinders in revolving automatically actuate the shunting-wheel to deflect the needles into the respective cam-grooves, substantially as shown and hereinbefore described.

8. The yarn-guide and stopping device hereinbefore described, consisting of the base or holder o' , adapted to be pivoted to the framing of the machine, and having a lateral extension, the two-arm lever r^t , pivoted therein, adapted to engage a revolving needle-carrying cylinder, said lever also having the flattened lateral extension r^s , and the looped wires or guides v , pivoted to the sides of the holder, adapted in falling to engage the flattened end of the lever r^t , substantially as shown, and for the purpose specified.

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

LEVI E. SALISBURY.

Witnesses:

CHARLES HANNIGAN,
GEO. H. REMINGTON.