(No Model.) 8 Sheets—Sheet 1.

J. SCHMITT.

KNITTING MACHINE.

No. 421,526. Patented Feb. 18, 1890.

Fig. 1

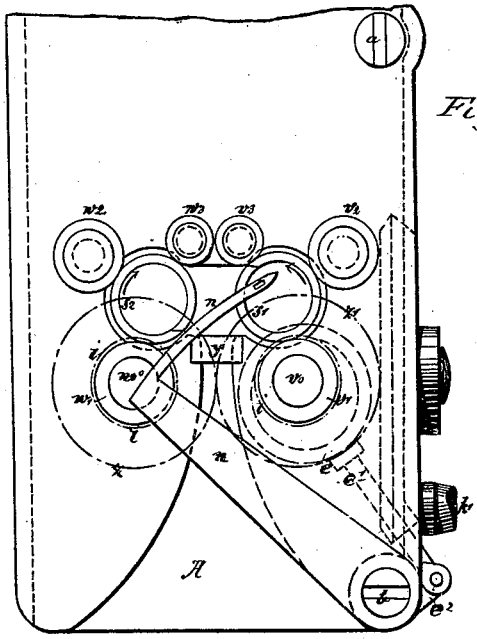
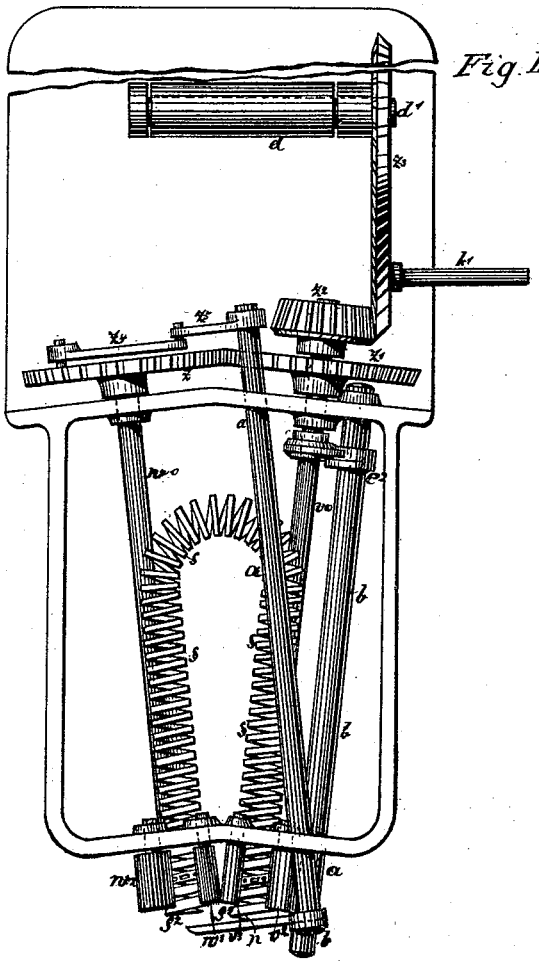


Fig. III



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G. Richter

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by R. Deissler
attorney

(No Model.) 8 Sheets—Sheet 2.

J. SCHMITT.

KNITTING MACHINE.

No. 421,526. Patented Feb. 18, 1890.

Fig. II.

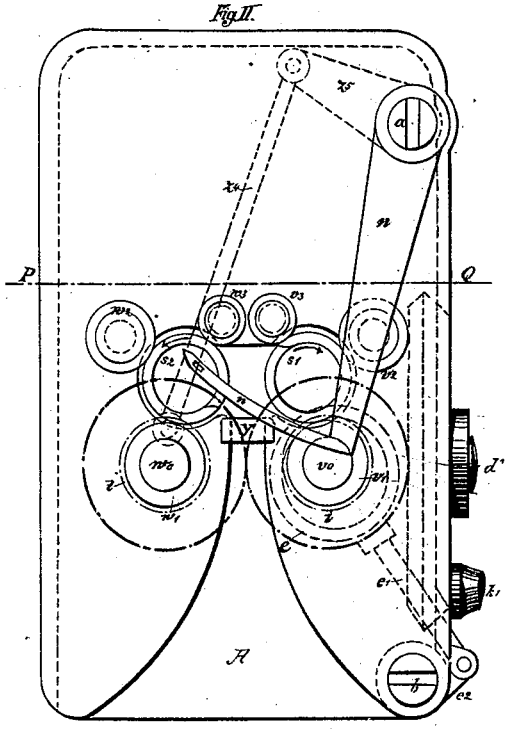
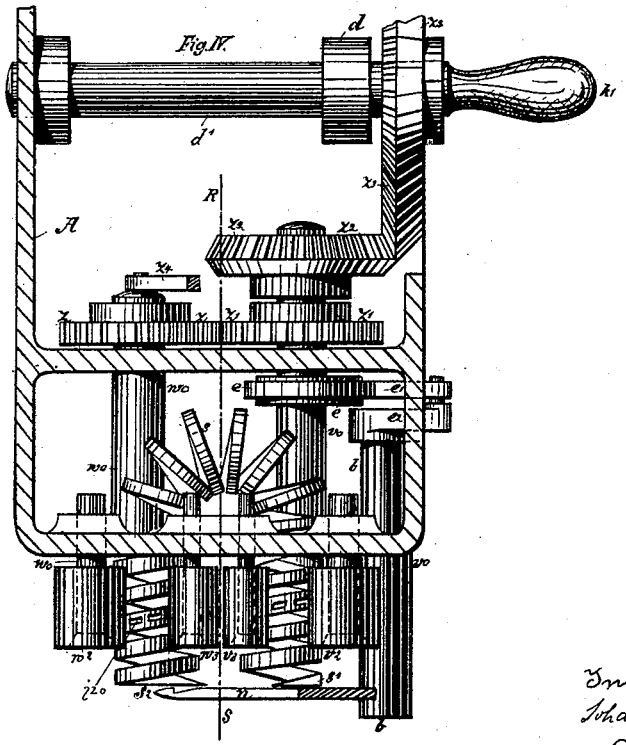


Fig. IV.



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(No Model.) 8 Sheets—Sheet 3.

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KNITTING MACHINE.

No. 421,526. Patented Feb. 18, 1890.

Fig. V.

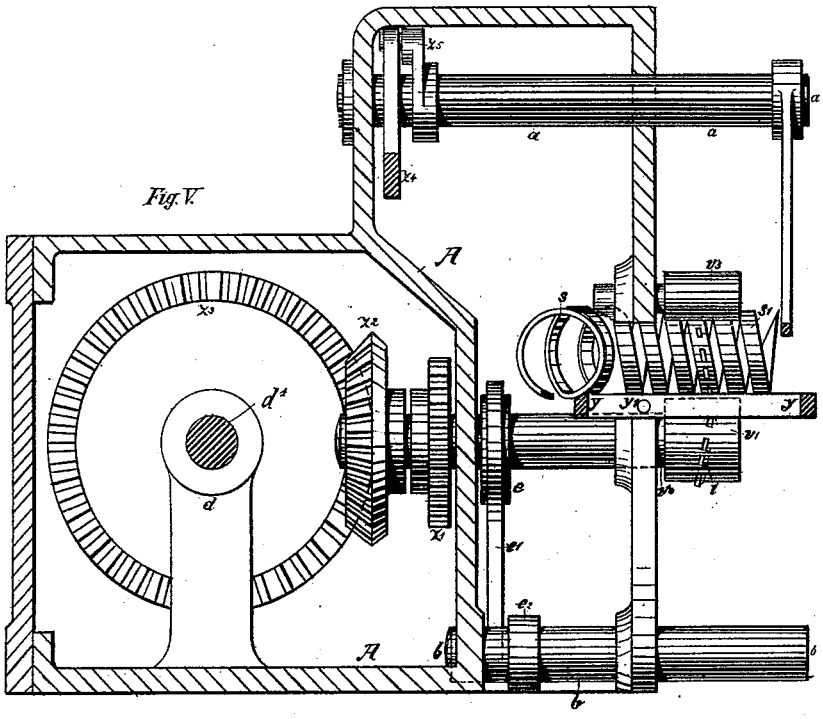
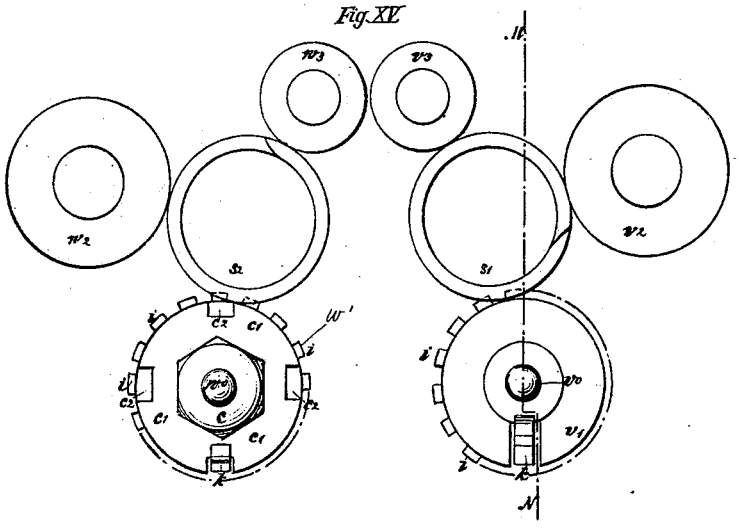


Fig. XV.



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(No Model.) 8 Sheets—Sheet 4.

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KNITTING MACHINE.

No. 421,526. Patented Feb. 18, 1890.

Fig. VI.

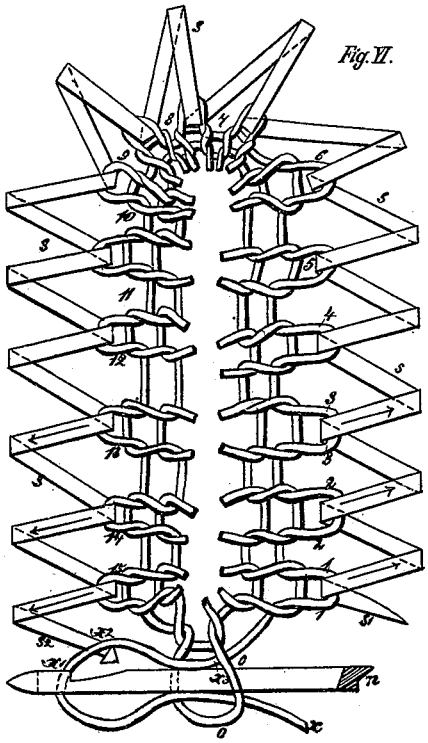


Fig. IX.

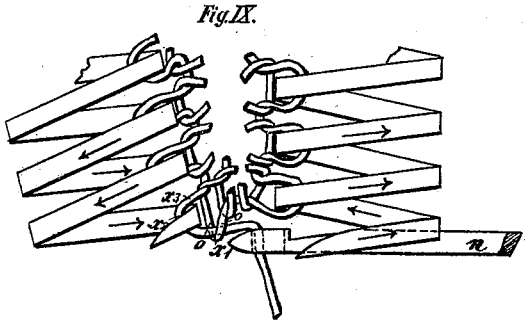
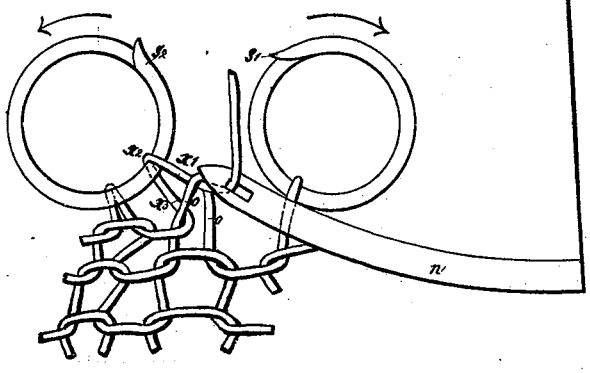


Fig. X.



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KNITTING MACHINE.

No. 421,526. Patented Feb. 18, 1890.

Fig. VII.

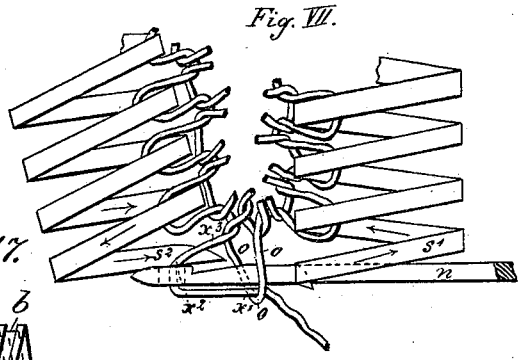


Fig. 17.

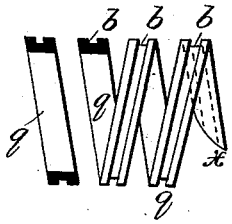


Fig. VIII.

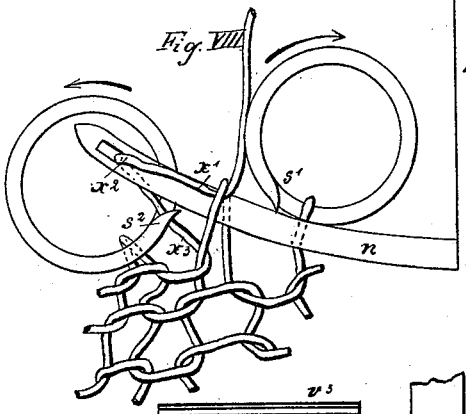


Fig. 20.

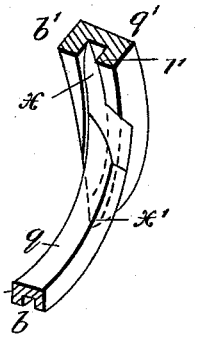


Fig. 19.

Fig. 18.

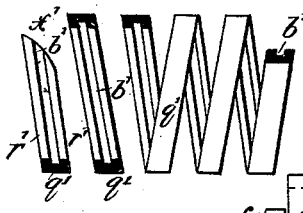


Fig. XVI.

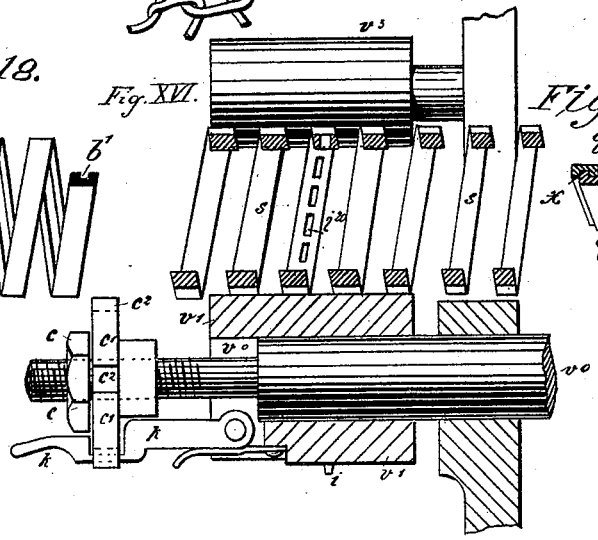
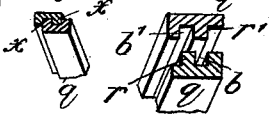


Fig. 21. Fig. 22.



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(No Model.) 8 Sheets—Sheet 6.

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KNITTING MACHINE.

No. 421,526. Patented Feb. 18, 1890.

Fig. XIII.

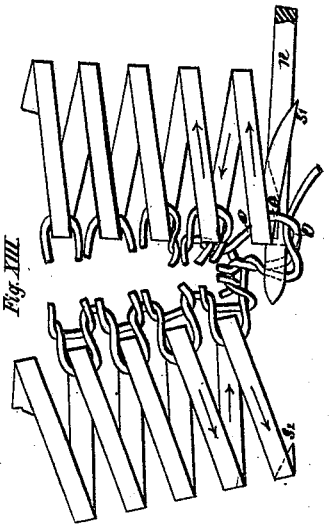


Fig. XIV.

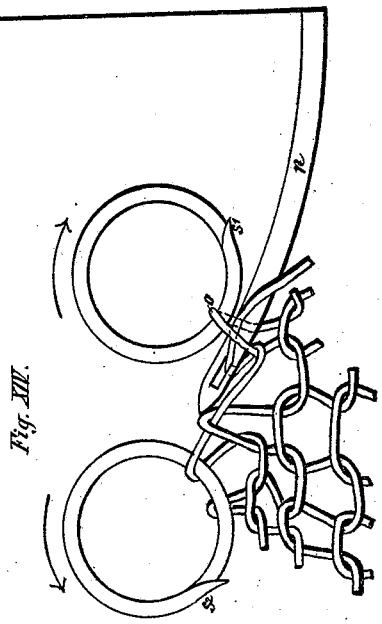


Fig. XI.

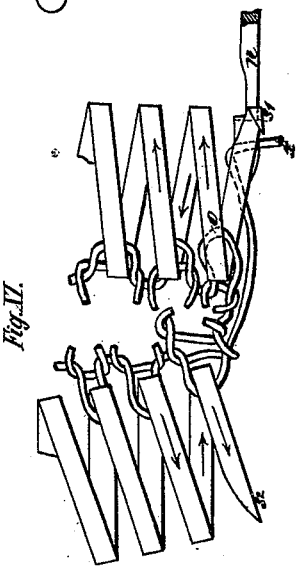
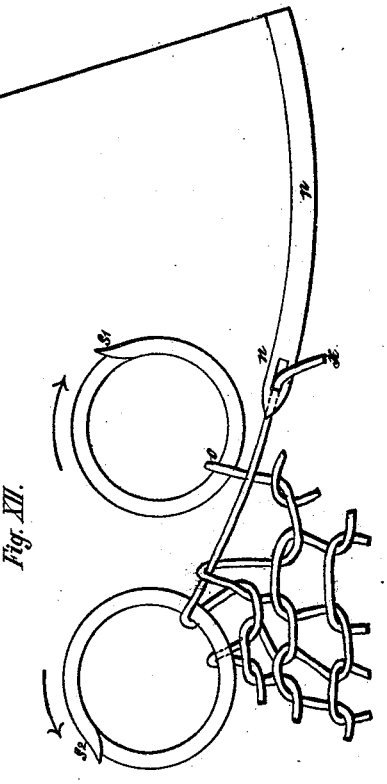


Fig. XII.



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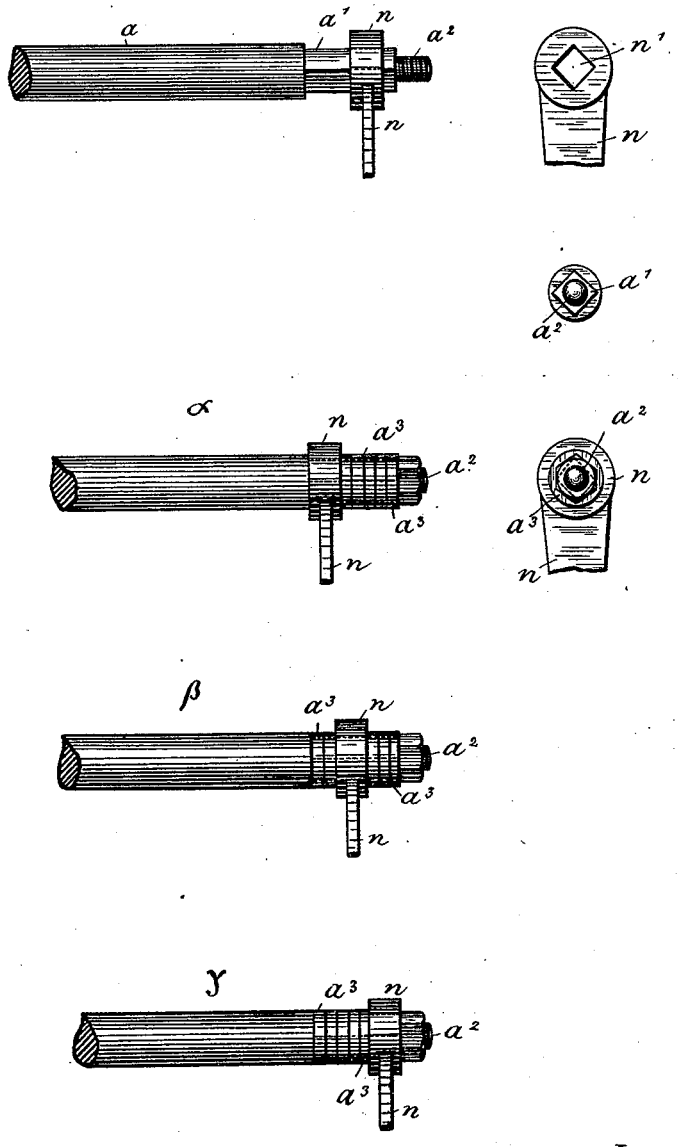
(No Model.) 8 Sheets—Sheet 7.

J. SCHMITT.

KNITTING MACHINE.

No. 421,526. Patented Feb. 18. 1890.

Fig. 23.



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E. F. Scheler.

Inventor:
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& from A. Kuhl & R. Deissler
his attorney

(No Model.) 8 Sheets—Sheet 8.

J. SCHMITT.

KNITTING MACHINE.

No. 421,526. Patented Feb. 18, 1890.

Fig. 27.

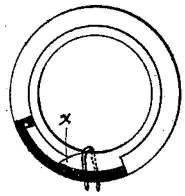


Fig. 28.

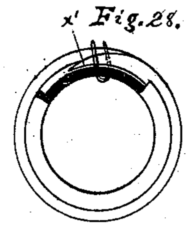


Fig. 25.

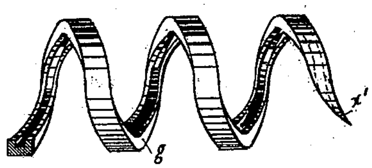
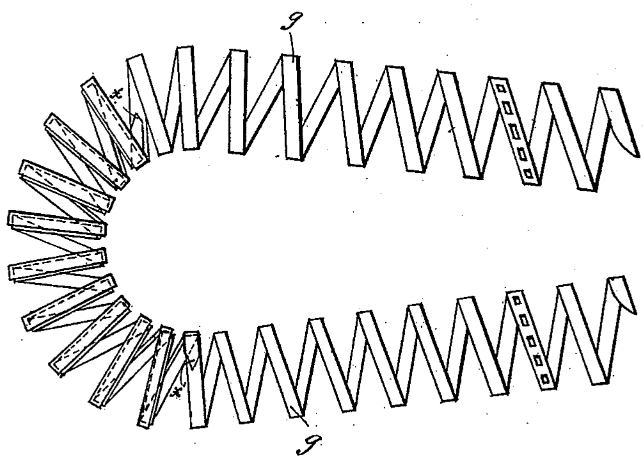


Fig. 26.

Fig. 24.



Witnesses:

Inventor
Johann Schmitt
by

UNITED STATES PATENT OFFICE.

JOHANN SCHMITT, OF COBLENZ, GERMANY, ASSIGNOR OF ONE-THIRD TO JEAN B. COBLENZER, OF SAME PLACE, AND CARL GUSTAV ROMMENHÖLLER, OF ROTTERDAM, NETHERLANDS.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 421,526, dated February 18, 1890.

Application filed May 12, 1887. Serial No. 238,021. (No model.) Patented in Germany April 18, 1886, No. 41,076, and November 26, 1886, No. 41,271; in Belgium February 21, 1887, No. 76,436; in England February 21, 1887, No. 2,648; in France February 21, 1887, No. 181,697; in Luxemburg February 21, 1887, No. 806; in Austria-Hungary February 21, 1887, No. 28,694 and No. 56,778; in Sweden February 21, 1887, No. 1,246, and in Spain February 21, 1887, No. 10,653.

To all whom it may concern:

Be it known that I, JOHANN SCHMITT, a subject of the King of Prussia, German Emperor, residing at Coblenz, in the German Empire, have invented certain new and useful Improvements in Knitting-Machines, (for which I have received patents in Germany, No. 41,076, dated April 18, 1886, and No. 41,271, dated November 26, 1886; in Belgium, No. 76,436, dated February 21, 1887; in Great Britain, No. 2,648, dated February 21, 1887; in France, No. 181,697, dated February 21, 1887; in Luxemburg, No. 806, dated February 21, 1887; in Austria-Hungary, No. 28,694 and No. 56,778, dated February 21, 1887; in Sweden, No. 1,246, dated February 21, 1887, and in Spain, No. 10,653, dated February 21, 1887,) of which the following is a specification.

The invention described hereinafter relates to knitting-machines in which the knitted meshes are formed on and held by a rotating spiral. This rotating spiral has already been presented in the German Patents No. 14, August 5, 1877, and No. 11,402, February 7, 1880, relating to knitting-machines. The use of a needle or needles which catches or catch up the meshes falling off the one end of the spiral, and which needle hangs new meshes onto the other end of the spiral, is likewise known. In this case I have presented improvements by which it is possible not only to knit tubular work in the common way, but to knit flat surfaces by means of one and the same machine.

The improvements consist in the construction of the machine with an oscillating needle which is displaceable and movable in such a manner that the two different courses which may be described or traveled over by it incline from opposite directions to a plane which must be considered as laid through the axis of the bent spiral.

The improvements further relate to the construction of the spiral itself, and in this respect consist in giving it a certain cross-sectional shape for the purpose of conducting the meshes more surely over the joints between the main body and the adjustable ends of the spiral than heretofore.

For giving a better understanding of my invention I will first describe the well-known principle on which knitting-machines of the class to which my present invention belongs are based.

The spiral of the machine is made to revolve by means of some suitable mechanism, whereby the two ends of the spiral s' s^2 are turned in contrary directions, as may be well understood by looking at Figure VI of the accompanying drawings. If now a common piece of knitting is suspended to the spiral, so that each coil or bow of the spiral holds a mesh of the knitted fabric, and if the spiral is made to rotate, (no alteration in the position of the axles of the spiral takes place when revolving,) the mesh on the last bow of the spiral end s' will be moved forward toward the needle n and will finally fall off from the spiral end s'. The needle n, threaded with yarn, is under the spiral end s' at the moment in which the mesh falls off, and said needle n receives and takes up said mesh. During the ensuing forward motion of needle n to the left the mesh, which, owing to its connection with the following meshes, is kept nearly in its old position on the right, will slide along the needle until its position is that of mesh o in Fig. VI. Needle n now occupies the position within the mesh o in which it is represented in Fig. VI, and its yarn, coming directly from the yarn-spool, forms a loop x' x^2 x^3, which will be caught by the point of the spiral end s^2, rotating in the direction of the arrows. Thus a new mesh is formed, and as the spiral keeps on revolving in the direction indicated new meshes will be continuously strung up on end s^2 by means of the needle, and old meshes will fall off the end s'—that is to say, meshes 1 2 3, and so forth, must move toward the needle and approach the latter, whereas the meshes 15 14 13, and so on, will recede from the needle and from spiral end

s^2. These movements of the needle, of the knitting, and of the spiral will become clearer by looking at Figs. VII to XIV, which show the different positions of the parts referred to.

The formation of the mesh begins in Figs. XI and XII, which are a top and a side view, respectively, of the parts mentioned, they showing needle n as it commences to move forward and passes beneath the last bow of the spiral end s'. In Figs. XIII and XIV the needle has advanced close under the spiral end s'. By the rotation of the spiral the mesh o has approached nearer the end s', and hangs now down from the last bow of the spiral end s', and needle n has entered the mesh o. By the further revolution of the spiral mesh o will fall down from end s', (see Figs. VII and VIII,) and will be held by needle n only, which has advanced till to the soul or center of spiral end s^2, and till its yarn has formed loop $x' x^2 x^3$, as has been already told. Figs. IX and X show the new mesh $x' x^2 x^3$ strung up to the end s^2 after needle n has receded. At the same time the old mesh o, which has been held till then by the needle, is now borne by the newly-formed mesh $x' x^2 x^3$. The formation of a correct knitting-mesh is then concluded, and that of new meshes will keep on as long as the spiral is revolving and the needle reciprocating.

In the formation of meshes just described it was presumed that the needle came from the right and advanced under the spiral end s' toward end s^2, and it was further presumed that the spiral rotated in the direction as indicated by the arrows in Figs. VI to XIV; but let it be supposed now that the spiral is moved in a direction contrary to that described above, and that the needle advances from the left to the right—that is, from s^2 to s'. Then the needle takes off meshes from s^2 and hangs new meshes onto s', as can be plainly understood without giving further details.

Having thus explained the principle on which knitting-machines with spirals operate, I shall now proceed to describe my new improvements in such machines. These improvements are shown in the accompanying drawings, in which similar letters of reference indicate similar parts throughout the several views, and in which drawings—

Fig. I is a front elevation of the machine, needle n being arranged in such a manner that it may take off the meshes from the left spiral end s^2 and hang them up on the right spiral end s'. Fig. II shows a front elevation of the machine, needle n being arranged in a position the opposite of that shown in Fig. I, which position of the needle is also that of all other views of the drawings, excepting Fig. I. Fig. III is a plan of the machine, parts of the frame-work being removed. Fig. IV represents a section on line P q of Fig. II. Fig. V is a section on line R S of Fig. IV. Fig. VI shows the spiral with the knitting. Figs. VII to XIV are top or side views of the spiral ends and the needle, illustrating the different positions of these parts when working or operating the machine. Fig. XV is a front elevation of the bearings or guides for the spiral. Fig. XVI shows a section on line M N of Fig. XV. Figs. XVII and XVIII show the form of the spiral with regard to its cross-sectional form. Fig. XIX shows a modification of the form. Fig. XX illustrates the two spiral parts of Figs. XVII and XVIII when shoved one in the other. Fig. XXI shows these spirals lying close together. Fig. XXII illustrates another modification of the form of the spirals, and Fig. XXIII shows the manner in which the needle is fastened to its shaft. Fig. XXIV shows in plan view the manner in which the two spirals fit to each other, the spiral g fitting into the spiral g'. Fig. XXV is a detail view of the outside spiral g and its ribs, while Fig. XXVI is a detail view of the inside spiral g' and its ribs. Figs. XXVII and XXVIII are cross-sections of the spirals, illustrating the manner in which the meshes pass over the points of the spirals and how the ribs protect the meshes from being caught by the points of the spirals.

The machine is shown as it will be constructed in practice only in Fig. III. All the other views of the machine show the spiral with its ends in the same plane or substantially in parallel planes; but this is only to enable me to show the sectional views more clearly and to compare the latter more easily with the other views. I also had to shorten the machine in Figs. IV and V for want of room.

d is a bearing on the frame A for the driving-shaft d'. On shaft d' is mounted a beveled wheel z^3, which is turned by means of the crank-handle k'. Wheel z^3 gears into bevel-wheel z^2, which is mounted on shaft v^0. On shaft v^0 and behind the toothed wheel z^2 another toothed wheel z' is wedged up, which gears into wheel z on shaft w^0 on this said wheel z, having pivoted to a crank-pin on its outer side the connecting-rod z^4, connected with lever z^5, which is fastened to shaft a, the latter shaft being mounted above and to the right of shafts $v^0 w^0$. By the rotation of wheels $z^3 z^2 z'$ and by means of the connecting-rod z^4 an oscillating motion of shaft a is caused. As needle n can be fixed to the front end of shaft a (see Fig. XXVI) an oscillating motion of the needle is effected by the gearing just described, needle n being caused to make one forward and one backward motion during one revolution of shafts $w^0 v^0$. One revolution of the shafts $w^0 v^0$ produces one revolution of the bent spiral s, and therefore one turn of the spiral takes place in the same time in which a double oscillation of the needle n is accomplished.

The motion of the spiral s is caused by the following mechanisms: Shafts w^0 and v^0 have each a toothed drum or box $w' v'$, which rotate with their shafts. (See Figs. I and V.)

On these drums rests the bent spiral s, which is kept in position by rollers w^2 w^3 v^2 v^3, as can be seen in Figs. I to V and XV, and which rollers are journaled on the frame A of the machine. Teeth i on the drums or boxes pass into the perforations i^{20} of spiral s, as is shown in Figs. V, XV, and XVI, and the spiral is rotated by these boxes w' v', whereby it is held in position by means of the teeth i, and its points are therefore continually describing circles in one and the same plane. It must be also mentioned that to insure such a motion it is necessary to set the teeth i to a certain angle, as can be best seen in Fig. V—that is, contrary to that of the holes or the angle of the spiral.

In the same manner in which the needle-shaft a is made to oscillate by the parts marked z^5 z^4 z z' z^2 z^3 an oscillating motion is given to shaft b, located below and to the right of shafts v^0 w^0. On the rotating shaft v^0 is for this purpose fixed an eccentric e, which is connected through a strap e' with a lever e^2 on shaft b. Needle n, when desired, may be mounted in the same way on shaft b as on shaft a. The means of securing the needle in place on either shaft can be best seen in Fig. XXIII of the accompanying drawings. The shaft a or b has on its end a square part a', fitting in the square opening n' of the needle n, which is secured on the same by a nut screwed on the threaded part a^2.

The way in which the machine operates is as follows: When the needle n is mounted on shaft a and the machine is put into operation the needle n oscillates under the spiral end s' and takes the mesh from off the latter, while the needle hangs up a new mesh on spiral end s^2, and the knitting is moved in a circle from s' to s^2. If the needle is mounted on shaft b and the machine is turned in opposite direction, the meshes are hung up on spiral end s', (see Fig. I;) but in both cases a continuous hose is made if the machine is worked continually with the needle in one of its positions. If it is desired to knit a surface or flat piece onto the knitting (for example, to the leg or hose of a stocking) without lengthening the whole knitting, so many meshes as the surface has to have in breadth must be knitted alternately with the needle in position as in Fig. II, and alternately with the needle in position Fig. I, whereby the rotatory direction of the spiral must be changed accordingly. The knitting will therefore be moved to and fro within the breadth of the surface that is being knitted on, and the result will be a surface formation of meshes or an open knitting. The needle n need not be unthreaded and rethreaded for this operation, only its position to the spiral must be altered by displacing it on the respective axles by ninety degrees. In both positions the needle moves in such a way that it passes the outside of the next spiral end until it stands before the center of the other spiral end. By these like motions of the needle in both positions exact meshes are formed on either of the spiral ends. The motion of the needle-axles a b is communicated from the axles v^0 w^0, and as these axles v^0 w^0 also produce the rotary motion of the spiral ends s' s^2 by means of the gearing-rollers w' v' the oscillation of the needle is in such a relation to the rotatory motion of the spirals that each rotation of the spirals and each dropping of a mesh corresponds with one forward and one backward motion of the needle, or, in other words, with the taking up of the old mesh and the hanging up of a new mesh. The meshes hang down like a hose and are taken up inside the ring y, Fig. II, which is arranged horizontally, fixed to the frame of the machine. To the lower end of the knitted hose is suspended a weight for the purpose of drawing down the new-formed meshes.

If I should construct my machine in such a manner that the ends of the spiral run in parallel planes, as in Fig. IV, (but which figure I have only drawn in this way for the reasons stated above in the description of the figures,) the distance between the two ends s' s^2 of the spiral would be too great, for the needle could not pass both ends at the proper points, and would thus fail to catch or fail to hang up the meshes. I therefore employ these two spirals, which incline to each other at an angle of thirty degrees, and the ends of which come pretty close together.

Another improvement of this knitting-machine consists in the arrangement of mechanisms by which the machine can be made to knit closer or looser. The improvements consist in the application of two adjusting contrivances to the two spiral ends s' s^2, which latter incline to each other, as mentioned above and as shown in Fig. III. It will be evident without further explanation that if the two spiral ends which incline toward each other are drawn forward axially they will approach each other, owing to their inclined arrangement. The distance between the two spiral ends s' s^2 will become smaller, and closer meshes than usual can be made with the spiral ends in this new position, because the distance that the meshes have to travel between the two spiral ends is shorter than when the latter are in their usual position. The needle must of course be moved forward in the same way on the axle a or b, so as to suit the displacement of the spiral ends and so as to be in its proper position. The displacing is done in the simplest way by altering its position on the axle a or b, on whichever it may be at the time. For this purpose a number of washers a^3 (see Fig. XXIII) are used, which have square openings corresponding to the square parts of the shafts, and which washers are shoved on the square part of the shaft a or b, either before or behind or partly before and partly behind the needle n, according as the case may be. (See positions $\alpha\beta\gamma$ of Fig. XXIII.) The shaft a is oscillated, as may be seen by reference to Figs. II and III,

by the lever z^3, which is operated by a rod z^4, connected eccentrically to the wheel z, while the shaft b is oscillated by a lever e^2, which is operated by an eccentric e and eccentric-rod e', the eccentric e being fastened to the shaft v^0. The shifting or displacing of the spiral ends must, however, be carried out by a special mechanism, which is shown in Fig. XV in cross-section and in Fig. XVI in a front view. These two figures show that the actual transporting-rollers v' and w', which make the spiral ends rotate by means of their teeth i, are fixed to the respective axles v^0 and w^0 and are coupled to these axles by a special mechanism. The arrangement of the two axles v^0 and w^0 is the same. The axles v^0 and w^0 have such a screw-thread, on which is a disk or plate c', provided with notches c^2. This disk or plate c' can be held fast in any position by the lock-nut c, Fig. XVI. On the right-hand side of Fig. XV the lock-nut c and the disk c' are removed from shaft v^0. The toothed rollers v' w' have each a spring-actuated catch k, which engages one of the notches c^2 of the disk c'. By means of this catch k the toothed rollers v' or w' are firmly connected with the axles v^0 w^0, and are thus secured from being displaced longitudinally or being turned round the axle. The longitudinal displacement of v' or w' is prevented by the catch k being **U**-shaped and by its reaching over the disk c'. If after easing up the lock-nut c the disk c' is moved, or rather turned, further toward the end of the axle v^0 or w^0, the catch k, with the roller v' or w', must necessarily follow, and the catch k, after having caught again in one of the notches c^2, holds the roller fast in the new position; but the rollers v' w' gear with their teeth into the perforation of the spirals, and consequently the latter are likewise forced to move in the same direction. Both ends of the spiral may be moved by this adjusting contrivance, and the inclined spiral ends are brought as close together as may be desirable.

Another improvement in this knitting-machine consists in the form of the spiral when viewed in cross-section. (See Figs. XVII, XVIII, XIX, XX, XXI, and XXII.)

The working of the machine is as follows: Suppose a piece of common knitted ware to be on the spring, as shown in Fig. V, in such a manner that each coil of the spring passes through a mesh, so when the spring is revolved its length remains the same, but the mesh 1 is moved forward toward the needle n, and at last falls off the point s' of the spiral. If at this moment the needle n, in which the knitting-yarn is threaded, is opposite the point s', the mesh 1 is caught by the needle n, and by the motion of the same toward the left the mesh 2 is drawn off the spring and in the same manner is caught by the needle n as the mesh 2 is to be seen in the drawings.

x shows the free end of the knitting-yarn as it comes from the reel. As to be seen, the motion of the needle itself forms a loop x' $x^2 x^3$, in which the end s^2 of the spring catches, and the loop x' x^2 x^3 is wound onto the spiral as a finished mesh. This is the manner in which the single meshes are formed. By the rotation of the spiral in the direction of the arrow new-formed meshes are caught up by the end s^2 and old meshes fall off the end s'. It is necessary that during the motion of the needle once backward and forward the spiral must make one complete revolution round its axis. It has been proved that the smaller spiral often springs out of the larger, and that the ends of the spirals do not lie close against the turns of each other, the consequence of which was that either the meshes were broken or got in between the two spirals and prevented the knitting from being transported. In order to prevent this, the spirals are made from ribbed wire, and so made that the ribs of the smaller or inside spiral are on the outside and those of the larger or outside spiral are on the inside, the ribs of the one fitting against the ribs of the other. In addition to this, the ends of the two spirals are beveled off and are protected or covered by the ribs of the opposite spiral, and thus prevented from springing out. As to be seen by Fig. XX, the point x of the inside spiral is protected by the ribs of the outside spiral q', and the point x' of the outside spiral is protected by the ribs of the inside spiral q. By this arrangement the springs are prevented from springing away from each other and the yarn at the same time prevented from getting between the turns of the two spirals.

The form of the spirals—that is, when viewed in section—may be modified. Figs. XVII, XVIII, XX, and XXI represent all the same form. Fig. XIX shows one of the modifications, and Fig. XXII another one, in which latter case the spirals are provided with two ribs and two grooves, and this construction of the spirals I prefer before all others, as the spirals are most firmly locked into each other and are very lasting.

In the detail drawings (Figs. XXIV to XXVIII) of the knitting-spiral, g represents the smaller one or inner spiral, which is fitted with ribs on its outside, while g' represents the larger or outside spiral, which is fitted with ribs on its inside. The spiral g screws into the spiral g', the ribs of the inner spiral catching in the ribs of the outer spiral and preventing the two spirals from flying asunder as they are revolved. The ends of both spirals are tapered off, as shown at x x' in Figs. XXIV to XXVIII.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I claim as new and desire to secure by Letters Patent—

1. A bent spiral s, two rollers w' w', having teeth i, which enter perforations of said spiral s, and means for rotating said rollers in opposite directions, in combination with a needle n, shafts a and b, to which said needle

may be fixed alternately, and means for oscillating the shafts, substantially as and for the purpose set forth.

2. The combination of shafts a and b, a needle n, which may be secured to either of said shafts, a rotating shaft v^0, provided with wheel z' and an eccentric e, a rotating shaft w^0, provided with a similar wheel z, a connecting-rod z^4, crank z^5 on shaft a, crank e^3, eccentric-strap e', and means for rotating shaft v^0, with the bent spiral and means for rotating the same from shafts v^0 w^0, all as and for the purpose substantially as described.

3. The combination of a bent spiral provided with perforations with two axles v^0 and w^0, arranged parallel to the ends of said spiral and provided with screw-threads on their ends and with rollers or collars v' w' near their ends, the collars being provided with teeth i and spring-actuated catches k, lock-nuts c, screwed on said screw-threaded ends of shafts v^0 w^0, and disks c', provided with notches c^2, in which the catches k engage, for moving the spirals forward and backward and securing the same in any position, substantially in the manner and for the purpose as described.

4. A spiral g, provided with ribs on its outside surface and terminating in a point x at one end, in combination with another spiral g', provided with ribs on its inner surface and terminating in a point x' at one end, the said two spirals being shoved in each other, in the manner and for the purpose substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

JOHANN SCHMITT.

Witnesses:
O. MÜHLNER,
B. ROI.