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J. WINKLER ET AL.  
MANUFACTURE OF ANNULAR PLAIT OR NETTING IN THE FORM OF TUBES.  
FILED APR. 24, 1922.

3 SHEETS-SHEET 1

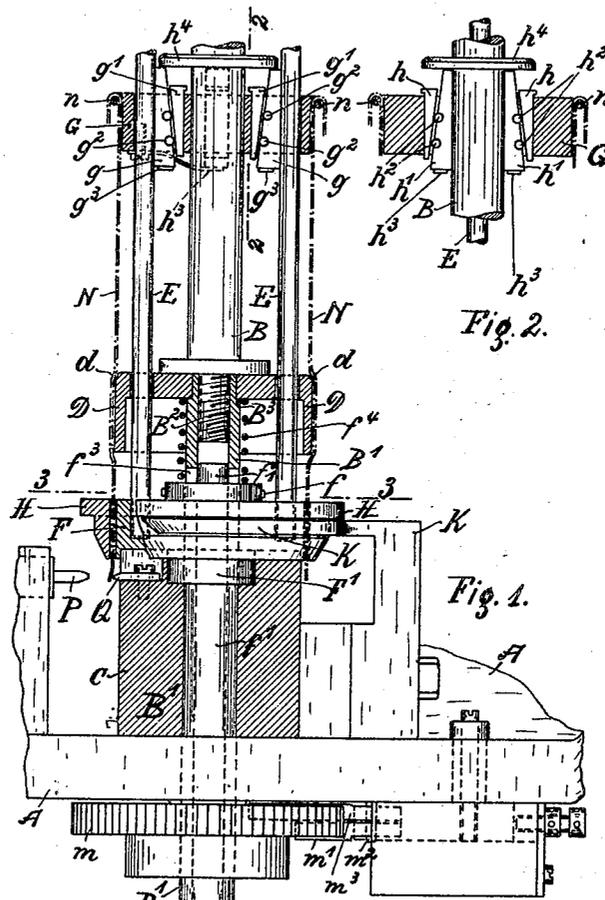
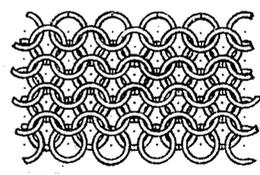
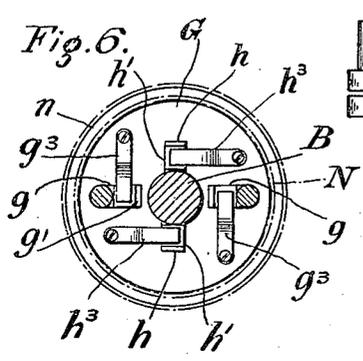


Fig. 2.

Fig. 1.

Fig. 7.



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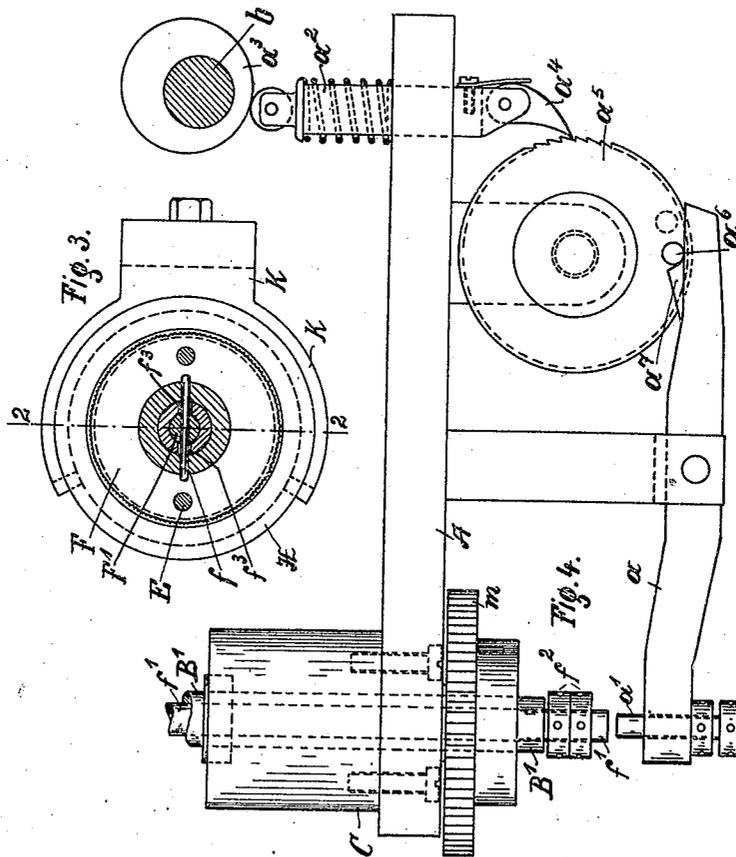
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3 SHEETS-SHEET 2



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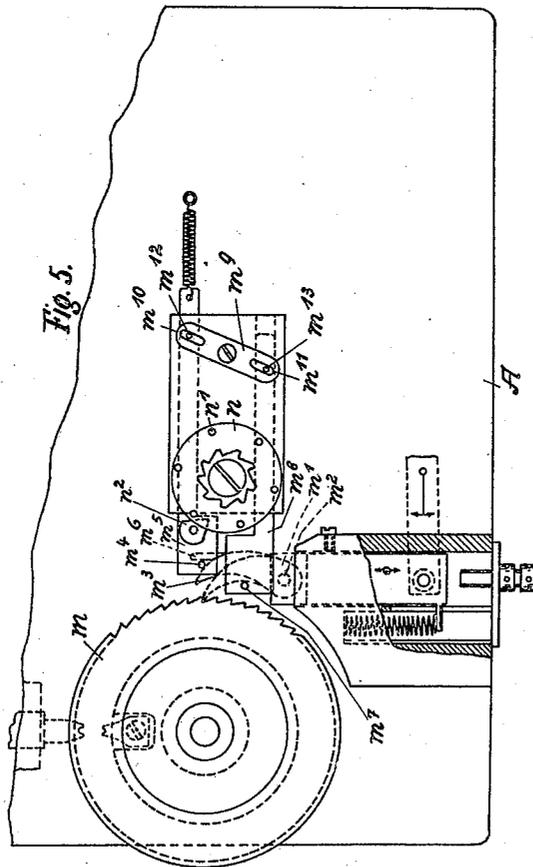
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3 SHEETS-SHEET 3



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# UNITED STATES PATENT OFFICE.

JOSEPH WINKLER AND PAUL KÖNIG, OF PFORZHEIM-DILLWEISSENSTEIN, GERMANY, ASSIGNORS, BY MESNE ASSIGNMENTS, TO ERNST GIDEON BEK MANUFACTURING COMPANY, OF HILTON, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MANUFACTURE OF ANNULAR PLAIT OR NETTING IN THE FORM OF TUBES.

Application filed April 24, 1922. Serial No. 556,342.

*To all whom it may concern:*

Be it known that we, JOSEPH WINKLER, mechanical engineer, and PAUL KÖNIG, mechanical engineer, both citizens of Germany, both residing at Pforzheim-Dillweissenstein, Germany, have invented certain new and useful Improvements in the Manufacture of Annular Plait or Netting in the Form of Tubes, of which the following is a specification.

The present invention relates to a machine for the manufacture of tubular link-mesh fabric. The object of the invention is a machine in which the wire rings or links as they are formed are immediately exposed to view so that any defects in the work can be readily observed. Furthermore the machine is so constructed that these defects e. g. dropped meshes, can be easily made good. A further object is to so arrange the feeding mechanism of the tubular fabric which is fed circumferentially and upward as the successive links and rows of links are formed; that the upward feed can easily be adjusted by hand, as may be, for example, necessary, if the wire is not of absolutely uniform thickness, which causes the automatic upward feed no longer to correspond exactly to the size of the links. The machine is also easily adjustable to various thicknesses of wire and sizes of links. Additional improvements will be apparent from the following description.

For this object, the machine is provided with a vertically movable carrier for the tubular net to which the upper portion of the tubular link-mesh fabric is attached. This carrier has two motions: the one circular or circumferential and the other vertical or longitudinal following the completion of a row of links in order to raise the tubular fabric through the interval required between two rows of links. Hitherto, the practice has been to impart to such tubular fabrics a helical movement. The division of the movement into a circular and vertical movement causes the advantageous result indicated to be attained in the following manner.

The vertical motion can be regulated by affixing to the net-carrier a carrier ring, to

which a fine adjustment can be imparted vertically, and from which the net is suspended, so that by shifting the carrier ring compensation may be obtained for inequalities in the wire, and the machine easily adjusted to various thicknesses of the wire. Furthermore the vertical feeding movement of the net carrier can easily be adjusted by means of a screw or similar device. The lower end of the tubular net is conducted between an inner guiding cylinder and an outer ring, and the formation and connection of the individual links is effected below the lower edge of this ring, so that the links, as they are formed, are plainly visible below this lower edge.

In the accompanying drawing, Fig. 1 shows an elevation, Fig. 2 the upper part of the same in section taken on line 2—2 of Fig. 1, Fig. 3 a section taken on line 3—3 of Fig. 1, Fig. 4 a view of a dividing mechanism, Fig. 5 an underside plan of Fig. 1; Fig. 6 is a partial horizontal section substantially on line 6—6 of Fig. 1, looking upward, and Fig. 7 is an enlarged elevation of a portion of a link-mesh fabric such as my invention is designed to produce.

A cylindrical block C is mounted rigidly in the bed plate A. In the block C a tube B<sup>1</sup> is rotatably mounted, incapable of vertical displacement. It carries at its upper end the spreading ring D and the guide column B, which is screwed into the tube B<sup>1</sup> by means of the threaded stub B<sup>2</sup> and presses the spreading ring D rigidly on to a shoulder B<sup>3</sup> near the end of the tube.

On the upper surface of the block C there rests the guide-plate F for the tubular link-mesh fabric, said plate being provided with a projection or collar F<sup>1</sup> extending into a recess in the block C. This plate is connected by means of a pin f with a feed rod f<sup>1</sup> movable upwardly in the interior of the tube B<sup>1</sup>, when the lower end of said rod is engaged by the pin a<sup>1</sup> carried by a feed lever a. f<sup>2</sup> are two adjustable screw nuts; f<sup>3</sup> are two slots in the tube B<sup>1</sup> which permit of the upward and downward motion of the pin f with relation to the tube B<sup>1</sup>. f<sup>4</sup> is a spring which bears at its upper extremity against the spreading ring D and presses

the guide plate F downwards, as soon as the pin  $a^1$  is drawn back downwards.

The net-carrier consists of two feed rods EE, which are screwed into the guide plate F and pass through holes in the spreading ring D, so that they rotate with the latter and with the guide column B.

The plate or ring G for holding the net N, is moved upward intermittently along the column B by means of the feed rods EE. For this purpose two clamp couplings are provided which operate alternately.  $g^1$  are wedges which are arranged in the net holding plate G, and against which two loose wedges  $g$  operate through the action of the rollers  $g^2$  mounted therein, the pressure of the weak springs  $g^3$  bringing said wedges  $g$  into contact with the inner surfaces of the feed rods EE. On the upward movement of the feed rods EE the wedges  $g$ ,  $g^1$  will effect a clutch connection between them and the net retaining plate G, the latter being carried upward with said rods. When the feed rods EE descend this clutch connection is loosened, so that these rods can descend alone. At the same time the plate G which holds the net is held firmly against column B by means of a second wedge connection, which prevents any motion downwards. This second device, shown best in Figs. 2 and 6 consists of the wedges  $h$  on the plate G and the wedges  $h^1$ , which come into contact with the column B under the pressure of the springs  $h^2$ , rollers  $h^2$  being again arranged between the surfaces of the two wedges.

$h^4$  is a ring loose on the column B and movable lengthwise thereon by hand for the purpose of releasing the two clutches in order to enable the net holding plate G to be adjusted manually. If this ring  $h^4$  is pressed downwards it will strike against the upper ends of the wedges  $g$  and  $h^1$ , thereby loosening the clutch. Instead of the wedge clutch there may be employed, of course any other approved form of friction clutch or connection.

The extent of the upward feed can easily be regulated by means of the pin  $a^1$  in the arm  $a$ . Every time a ring has been formed the slide  $a^2$  is moved downwards by means of an eccentric  $a^3$ , on the main shaft  $b$ , thus turning the toothed wheel  $a^5$  by the pawl  $a^4$ , and when a series or row of rings has been completed, a pin  $a^6$  on said wheel  $a^5$  will act on the cam  $a^7$  of the lever  $a$ , to impart a feeding movement to said lever.

The tubular net N is suspended from the retaining plate G, (on which it is held by means of a groove and a rubber ring  $n$ ) above the spreading ring D. This ring D is grooved to correspond with the size of the links of the link-mesh fabric and is provided on its upper edge with a cone shaped chamfering or bevel  $d$ , and has a somewhat larger diameter than the ordinary

suspended tubular net, so that it will somewhat open or spread such net and the link fabric suspended therefrom (see Fig. 1). When the link-mesh fabric is raised above the ring D, a row of links will thus lie on the chamfering or bevel  $d$ , which thus causes the links to be adjusted horizontally. Underneath the spreading ring D the tubular net N or the tubular link-mesh fabric again becomes narrower, so that at the under edge of the ring D the fabric again tends to contract and conforms to the grooved guide plate F. The latter is surrounded by a guide ring H with an intervening space such as will allow the net just to pass through comfortably. This ring H is mounted loose on a ring support K, so that while held against vertical motion it can rotate freely and be carried round by means of the friction of the rotating net, or may be positively rotated by means of a feed mechanism which is not shown. This ring causes the individual links of the link-mesh fabric to fit exactly into the ribs of the guide plate F, so that every time the corresponding links of the last formed row of links can be brought correctly in front of the link shaping and connecting mechanisms in such manner as may be desired.

The rotation of the guide plate F with the column B and the rods EE is effected by means of a toothed wheel  $m$ . The pawl  $m^1$  engages with the latter, in order, after each link has been formed, to cause the plate F to rotate further through a space equal to the distance between the links.

Since the links of adjacent rows are staggered, it will be obvious that on passing from one row of links to the next, the rotary feed must take place by an amount equal to half the distance between the links of the same row. For this purpose there is mounted on the pin  $m^2$  of the feed pawl  $m^1$  a second feed pawl  $m^3$ , the point of which is distant from the point of  $m^1$  by half the width of a tooth. During the formation of one row of links, the feed pawl  $m^1$  is operative while the feed pawl  $m^3$  is held out of engagement with the ratchet wheel  $m$  by a pin  $m^4$  on the slide  $m^5$  engaging behind the projection  $m^6$  on the pawl  $m^3$ . At the completion of this row of links, the slide  $m^5$  moves forward (towards the left hand—Fig. 5) and thus causes the feed pawl  $m^3$  to engage with the ratchet wheel  $m$ . At the same time, the feed pawl  $m^1$  is lifted off the wheel  $m$  by a pin  $m^7$  on the slide  $m^8$ . This simultaneous movement of the two slides is obtained by an oscillatory connecting lever  $m^9$ , which moves the two slides  $m^5$ ,  $m^8$  in opposite directions by means of the grooves  $m^{10}$ ,  $m^{11}$  and the pins  $m^{12}$ ,  $m^{13}$ . This mechanism is actuated by the ratchet wheel  $n$ , provided with a series of pins  $n^1$  and on the completion of alternate rows of

links (for instance the odd-numbered rows) one of these pins  $n^1$  bears against the rigid projection  $n^2$  on the slide  $m^5$  and thereby moves the slide the necessary amount towards the ratchet wheel  $m$ . This wheel is operated from the machine through any suitable means (not shown). A spring  $o$  connected with the slide  $m^5$  restores the slides and the lever  $m^9$  to their normal position, Fig. 5 after the completion of each of the other (even-numbered) rows of links.

As can be seen, the links are formed below the lower edge of the cylinder  $F$  and the ring  $H$ , and hang open, so that defects can not only be detected at once but can also be repaired.

Now what we claim and desire to secure by Letters Patent is the following:

1. A machine of the class described, comprising a holder for a tubular link-mesh fabric, said holder being mounted to turn about its axis and also movable lengthwise of said axis, mechanism for turning said holder about its axis as individual links are formed, and means for moving the holder lengthwise of its axis after the completion of a circumferential row of links.

2. A machine of the class described, comprising a holder for a tubular link-mesh fabric, said holder being mounted to turn about an upright axis and also movable lengthwise of said axis, mechanism for turning said holder about its axis step by step as individual links are formed, and means for moving the holder upward lengthwise of its axis after the completion of a circumferential row of links.

3. A machine of the class described, comprising a holder for a tubular link-mesh fabric, said holder being mounted to turn about an upright axis and also movable lengthwise of said axis, mechanism for turning said holder about its axis step by step as individual links are formed, means for moving the holder upward lengthwise of its axis after the completion of a circumferential row of links, a guide located below said holder and arranged to engage the lower portion of the tubular fabric, and link-forming mechanism located below said guide.

4. A machine of the class described, comprising a holder for a tubular link-mesh fabric, said holder being mounted to turn about an upright axis and also movable lengthwise of said axis, mechanism for turning said holder about its axis step by step as individual links are formed, means for moving the holder upward lengthwise of its axis after the completion of a circumferential row of links, a guide plate, ribbed at its edge, located below said holder and arranged to engage the lower portion of the tubular fabric, a guide ring surrounding said plate and spaced therefrom to allow

the tubular fabric to pass between them, and link-forming mechanism located below said plate and ring.

5. A machine of the class described, comprising a holder for a tubular link-mesh fabric, said holder being movable upwardly, a guide located below said holder and adapted to engage the lower portion of the tubular fabric, and link-forming mechanism located below said guide.

6. A machine of the class described, comprising a holder for a tubular link-mesh fabric, said holder being movable upwardly, a guide located below said holder and adapted to engage the lower portion of the tubular fabric, said guide having grooves to fit the links of the fabric, and link-forming mechanism located below said guide.

7. A machine of the class described, comprising a holder for a tubular link-mesh fabric, and a guide located below said holder and adapted to engage the lower portion of the tubular fabric.

8. A machine of the class described, comprising a holder for a tubular link-mesh fabric, a guide located below said holder and adapted to engage the lower portion of the tubular fabric, said guide comprising a plate having grooves to fit the links of the fabric, and a guide ring surrounding said plate and spaced therefrom to allow the tubular fabric to pass between them.

9. A machine of the class described, comprising a holder for a tubular link-mesh fabric, said holder being movable upwardly, a guide member located below said holder and connected to move in unison therewith, and adapted to engage the lower portion of the tubular fabric, and link-forming mechanism below said guide.

10. A machine of the class described, comprising a holder for a tubular link-mesh fabric, said holder being movable upwardly, a guide plate located below said holder and connected to move in unison therewith, and a guide ring surrounding said plate and spaced therefrom to allow the tubular fabric to pass between them.

11. A machine of the class described, comprising a guide, a holder movable along said guide, to support a link-mesh fabric, mechanism reciprocating up and down, and two connecting means operating in conjunction with said holder to cause it to be locked to the reciprocating mechanism during the upward movement thereof and to the guide during the downward movement of said mechanism.

12. A machine of the class described, comprising a guide, a fabric-holder movable along said guide, mechanism reciprocating longitudinally with respect to said guide, and two wedge devices tapering lengthwise of the path of said mechanism in opposite directions respectively, one of them adapt-

ed to lock the holder to said mechanism during the working stroke thereof, while the other wedge device is adapted to lock the holder to the guide during the return stroke of said mechanism.

13. A machine of the class described, comprising a guide, a fabric-holder movable along said guide, mechanism reciprocating longitudinally with respect to said guide, two wedge devices tapering lengthwise of the path of said mechanism in opposite directions respectively, one of them adapted to lock the holder to said mechanism during the working stroke thereof, while the other wedge device is adapted to lock the holder to the guide during the return stroke of said mechanism, and rolling members co-operating with said wedge devices.

14. A machine of the class described, comprising a guide, a fabric-holder movable along said guide, mechanism reciprocating longitudinally with respect to said guide, two wedge devices tapering lengthwise of the path of said mechanism in opposite directions respectively, one of them adapted to lock the holder to said mechanism during the working stroke thereof while the other wedge device is adapted to lock the holder to the guide during the return stroke of said mechanism, and a manually operatable device for releasing both wedge devices.

15. A machine of the class described, comprising a guide, a fabric-holder movable along said guide, mechanism reciprocating longitudinally with respect to said guide, two wedge devices tapering lengthwise of the path of said mechanism in opposite directions respectively, one of them adapted to lock the holder to said mechanism during the working stroke thereof while the other wedge device is adapted to lock the holder to the guide during the return stroke of said mechanism, and a slide movable lengthwise of said guide and adapted to release both wedge devices.

16. A machine of the class described, comprising a guide, a fabric-holder movable along said guide, mechanism reciprocating longitudinally with respect to said guide, two wedge devices tapering lengthwise of the path of said mechanism in opposite directions respectively, one of them adapted to lock the holder to said mechanism during the working stroke thereof while the other wedge device is adapted to lock the holder to the guide during the return stroke of said mechanism, and a releasing slide movable lengthwise of said guide and arranged to engage the thin end of one wedge of each of said devices.

17. A machine of the class described, comprising a guide, a holder movable along said guide, to support a link-mesh fabric,

mechanism reciprocating up and down, two connecting means operating in conjunction with said holder to cause it to be locked to the reciprocating mechanism during the upward movement thereof and to the guide during the downward movement of said mechanism, and a manually operatable device for releasing both connecting means.

18. A machine of the class described, comprising a rotatable guide column, a fabric-holder movable along said column, means for connecting the holder with the column and disconnecting it therefrom, means for rotating the column and the holder and mechanism for moving the holder lengthwise of the column.

19. A machine of the class described, comprising a rotatable guide column having a hollow end, a fabric-holder movable along said column, means for connecting the holder with the column and releasing it therefrom, means for rotating the column and the holder, a rod movable lengthwise in said hollow end of the column, and connections between said rod and the holder to move the latter lengthwise of the column.

20. A machine of the character described, comprising a rotatable guide, a fabric holder movable along said guide, rods arranged to reciprocate lengthwise of the said guide, a fabric guide movable in unison with said rods both lengthwise of said rotatable guide and around the same, means for locking said fabric holder alternately to said rods and to said rotatable guide, means for rotating said fabric guide, and separate means for moving said fabric guide, lengthwise of the rotatable guide.

21. A machine of the character described, comprising a rotatable guide, a fabric-holder movable along said guide, rods arranged to reciprocate lengthwise of the said guide, a fabric-guide movable in unison with said rods both lengthwise of said rotatable guide and around the same, means for locking said fabric-holder alternately to said rods and to said rotatable guide, means for rotating said fabric-guide, separate means for moving said fabric guide lengthwise of the rotatable guide, and an auxiliary fabric-guide located between the first-named fabric guide and the holder, said auxiliary guide being rotatable but held against longitudinal motion and said rods passing through said auxiliary guide with a sliding fit.

22. A machine of the character described, comprising a rotatable guide, a fabric-holder movable along said guide, a fabric-guide movable along said rotatable guide, connecting means movable in unison with said fabric-guide and extending therefrom to said fabric-holder, means for locking the holder to said connecting means as the latter moves lengthwise of the rotatable guide in one di-

rection, while during the return movement of the connecting means the holder is released therefrom and locked to the said rotatable guide, means for rotating said fabric-guide, and separate means for moving said fabric-guide lengthwise.

23. A machine of the character described, comprising a rotatable guide, a fabric-holder movable along said guide, a fabric-guide movable along said rotatable guide, connecting means movable in unison with said fabric-guide and extending therefrom to said fabric-holder, means for locking the holder to said connecting means as the latter moves lengthwise of the rotatable guide in one direction, while during the return movement of the connecting means the holder is released therefrom and locked to the said rotatable guide, means for rotating said fabric-guide, separate means for moving said fabric-guide lengthwise, and an auxiliary fabric-guide located between the first-named fabric-guide and the holder, said auxiliary guide being mounted to turn in unison with the first-named fabric-guide, but held against longitudinal movement.

24. A machine of the character described, comprising a holder for a tubular fabric, said holder being mounted to turn about its axis and also movable lengthwise of said axis, a rotary and longitudinally-movable fabric-guide for engaging said fabric, means for giving said holder and fabric-guide a rotary and a longitudinal movement, and a spreading ring arranged to engage and expand the tubular fabric between said holder and said fabric-guide.

25. A machine of the character described, comprising a holder for a tubular fabric, said holder being mounted to turn about its axis and also movable lengthwise of said axis, a rotary and longitudinally movable fabric-guide for engaging said fabric, means for giving said holder and fabric-guide a rotary and a longitudinal movement, and a spreading ring arranged to engage and expand the tubular fabric between said holder and said fabric-guide, said ring having a beveled edge toward the holder.

26. A machine of the character described, comprising a holder for a tubular fabric, said holder being mounted to turn about its axis and also movable lengthwise of said axis, a rotary and longitudinally-movable fabric-guide for engaging said fabric, means for giving said holder and fabric-guide a rotary and a longitudinal movement, and a spreading ring arranged to engage and expand the tubular fabric between said holder and said fabric-guide, said ring being mounted to turn.

27. A machine of the character described, comprising a holder for a tubular fabric, said holder being mounted to turn about its

axis and also movable lengthwise of said axis, a rotary and longitudinally-movable fabric-guide for engaging said fabric, means for giving said holder and fabric-guide a rotary and a longitudinal movement, and a spreading ring arranged to engage and expand the tubular fabric between said holder and said fabric-guide, said ring being mounted to turn but held against longitudinal motion.

28. A machine of the character described, comprising a holder for a tubular fabric, said holder being mounted to turn about its axis and also movable lengthwise of said axis, a rotary and longitudinally-movable fabric-guide for engaging said fabric, means for giving said holder and fabric-guide a rotary and a longitudinal movement, and a spreading ring arranged to engage and expand the tubular fabric between said holder and said fabric-guide, said ring being mounted to turn and having ribs to fit the meshes of the tubular fabric.

29. A machine of the character described, comprising a holder for a tubular link-mesh fabric, said holder being mounted to turn about its axis and also to move lengthwise of said axis, means for moving said holder lengthwise after the completion of a row of links, and two separate mechanisms for giving the holder a step-by-step rotation during the formation of a row of links, said mechanisms being adapted to operate respectively during the formation of alternate rows of links, the positions of the holder obtained by the operation of one of said mechanisms being staggered with reference to the positions obtained by the operation of the other mechanism.

30. A machine of the character described, comprising a holder for a tubular link-mesh fabric, said holder being mounted to turn about its axis and also to move lengthwise of said axis, means for moving said holder lengthwise after the completion of a row of links, two separate mechanisms for giving the holder a step-by-step rotation during the formation of the row of links, said mechanisms being adapted to operate respectively during the formation of alternate rows of links, the positions of the holder obtained by the operation of one of said mechanisms being staggered with reference to the positions obtained by the operation of the other mechanism, and a connection between said mechanisms to throw either of them out of action when the other is thrown into action.

In testimony whereof we affix our signatures, Pforzheim-Dillweissenstein, this 23rd day of March, 1922.

JOSEPH WINKLER. [L. s.]

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