June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

Filed Aug. 27, 1919 15 Sheets-Sheet 1

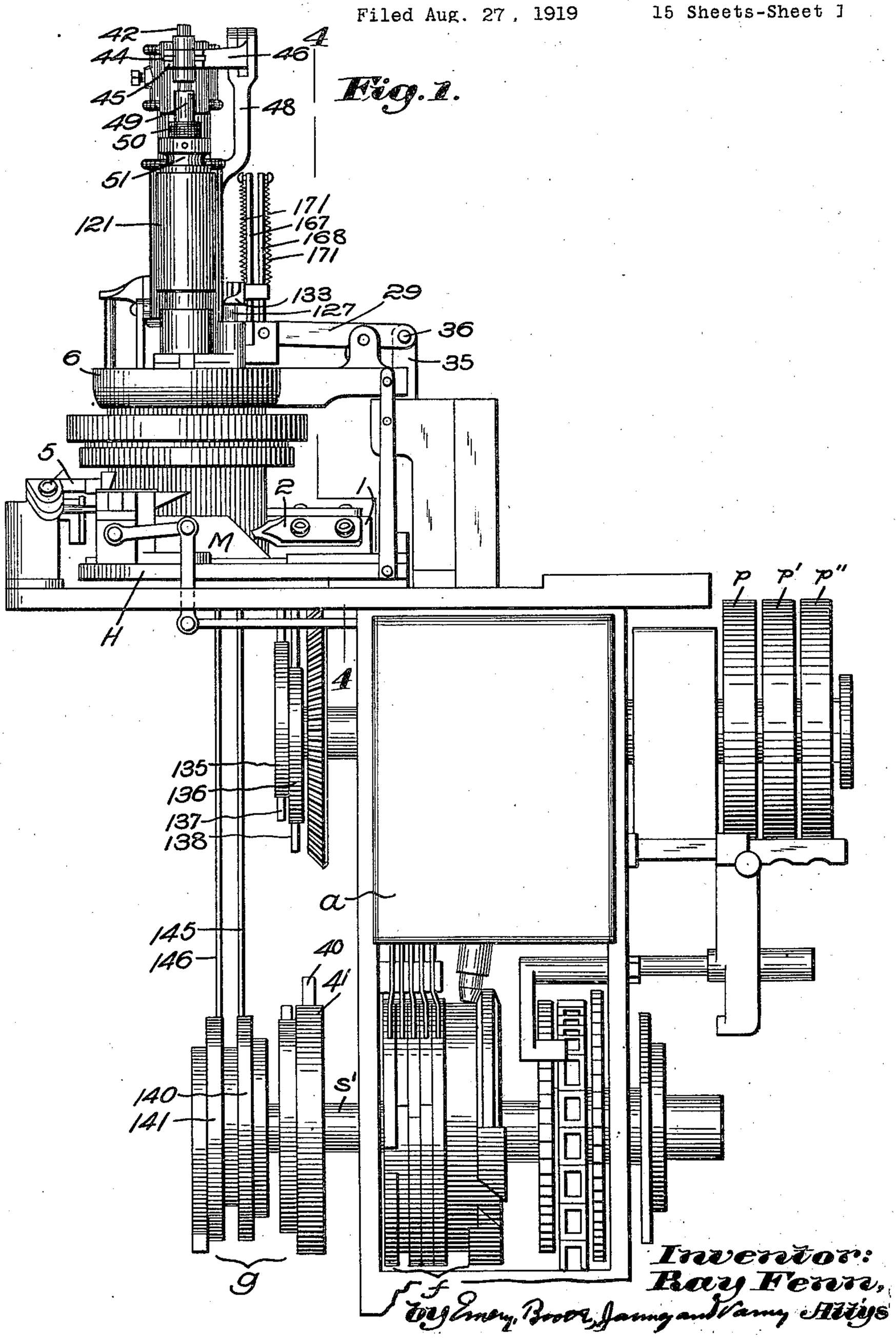

Fig. 1.

Inventor:
Ray Fenn,
by Emery, Booth, Jaung and Varney Attys

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

Filed Aug. 27, 1919 15 Sheets-Sheet 2

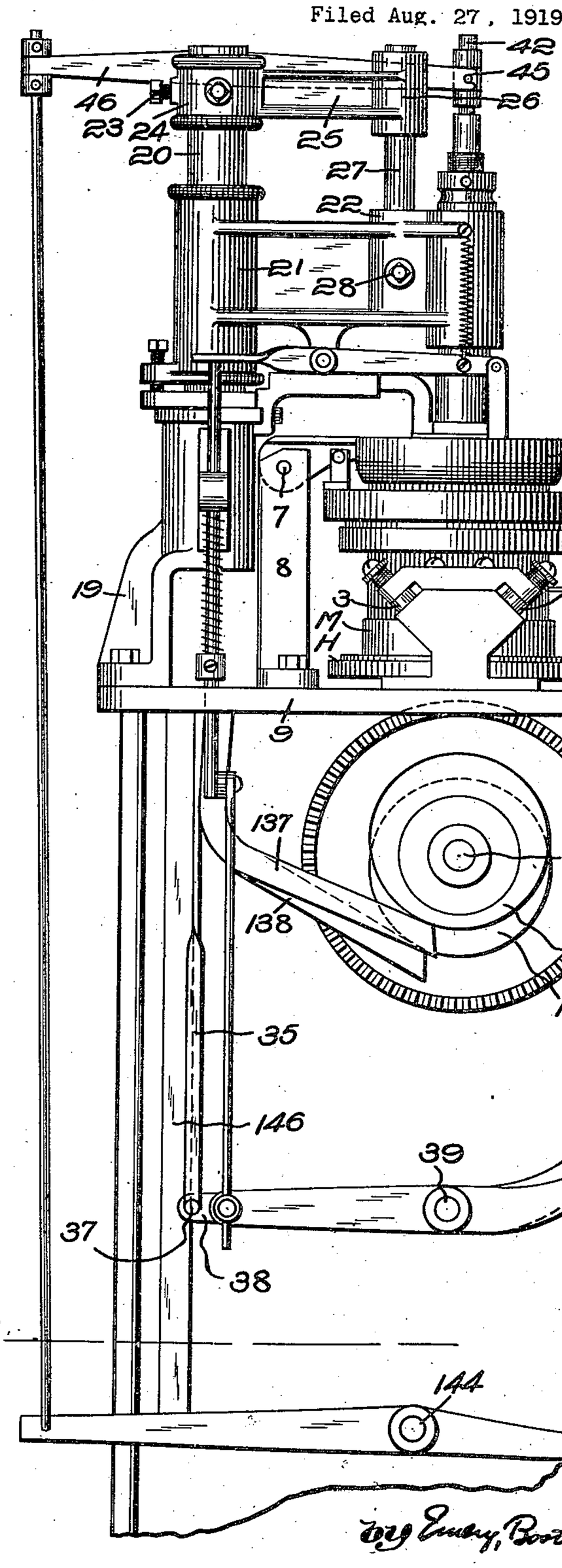

Fig. 2.

Inventor:
Ray Fenn,
by Emery, Booth, Janney and Varney Attys.

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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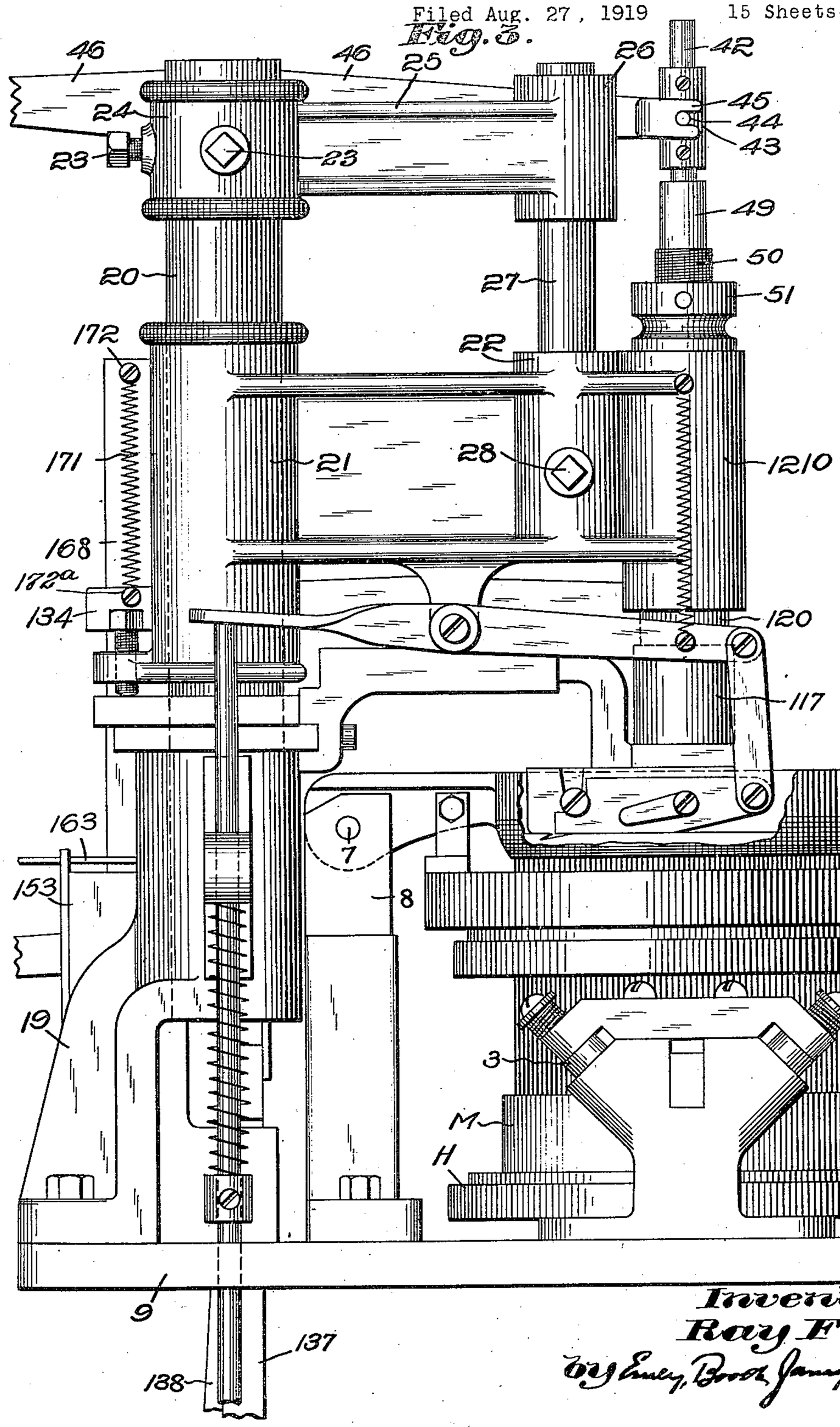
Fig. 3.



Inventor:
Ray Fenn,
by Emery, Booth, Janney and Varney
Attys

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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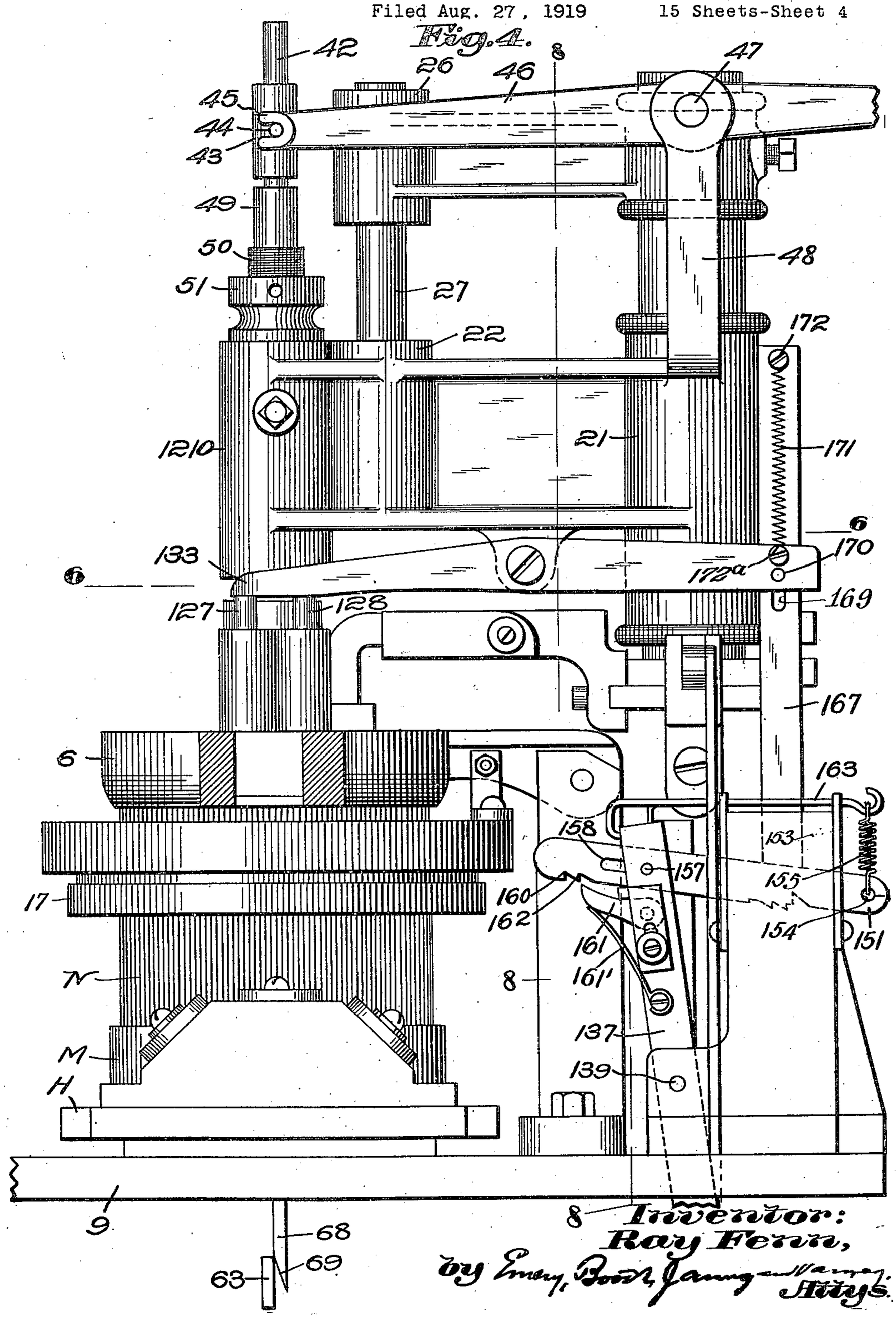
Fig. 4.



Inventor:
Ray Fenn,
by Emery, Booth, Jamieson & Varney
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June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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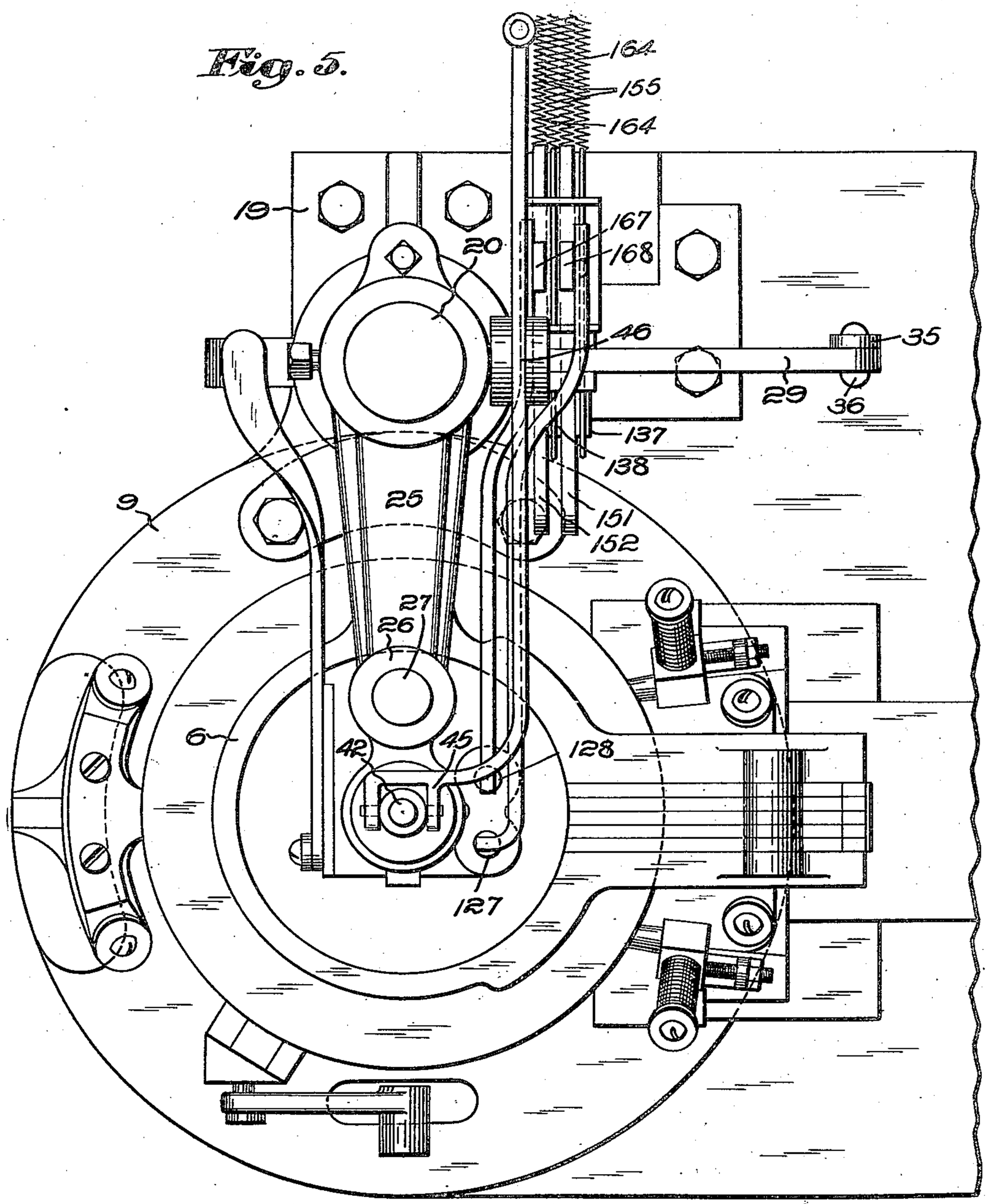
Fig. 5.



Inventor:
Ray Fenn,
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June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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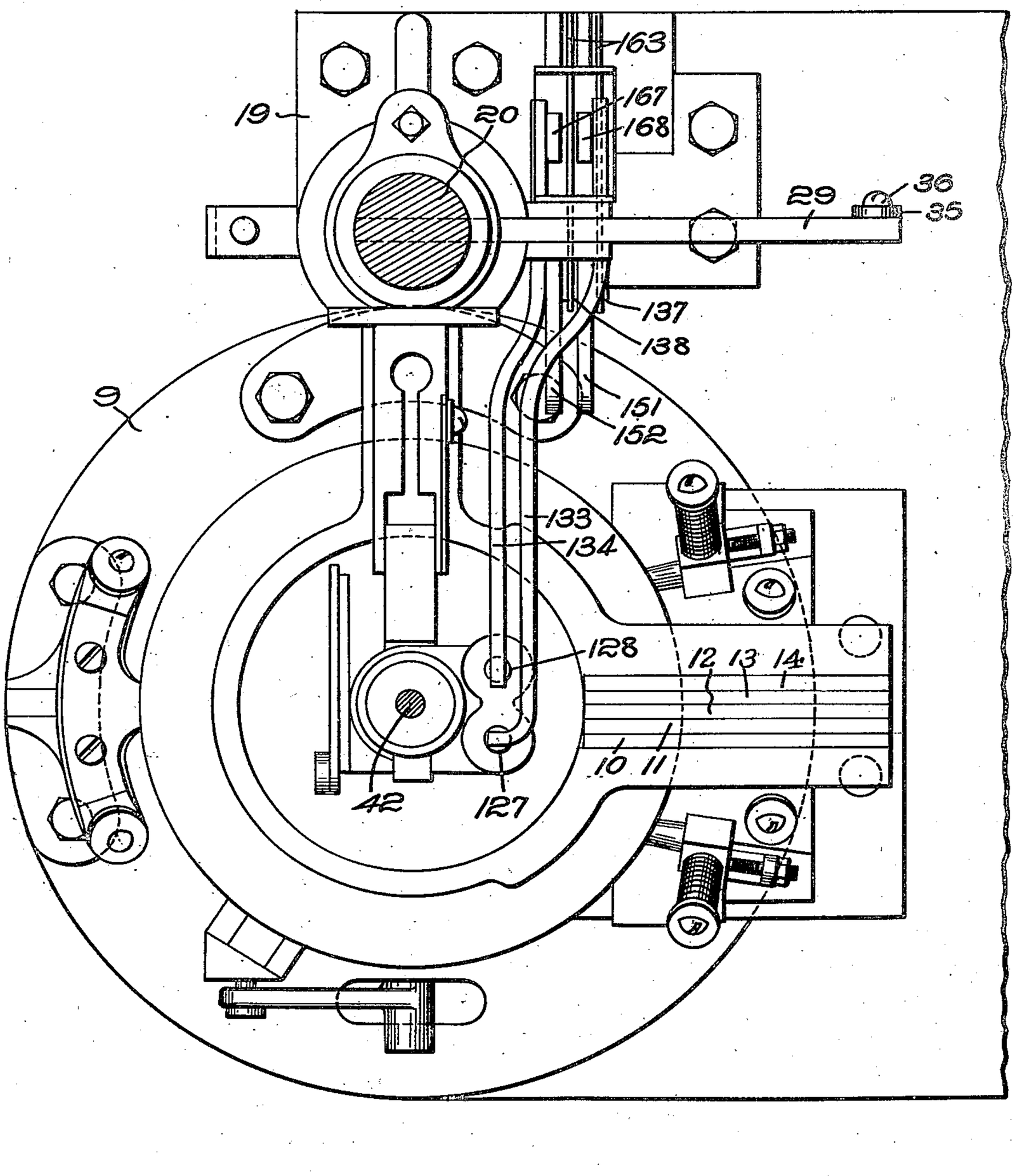
Fig. 6.



Inventor:
Ray Fenn,
by Kenney, Boord, Jamison & Kenney,
Attys.

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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Fig. 2.

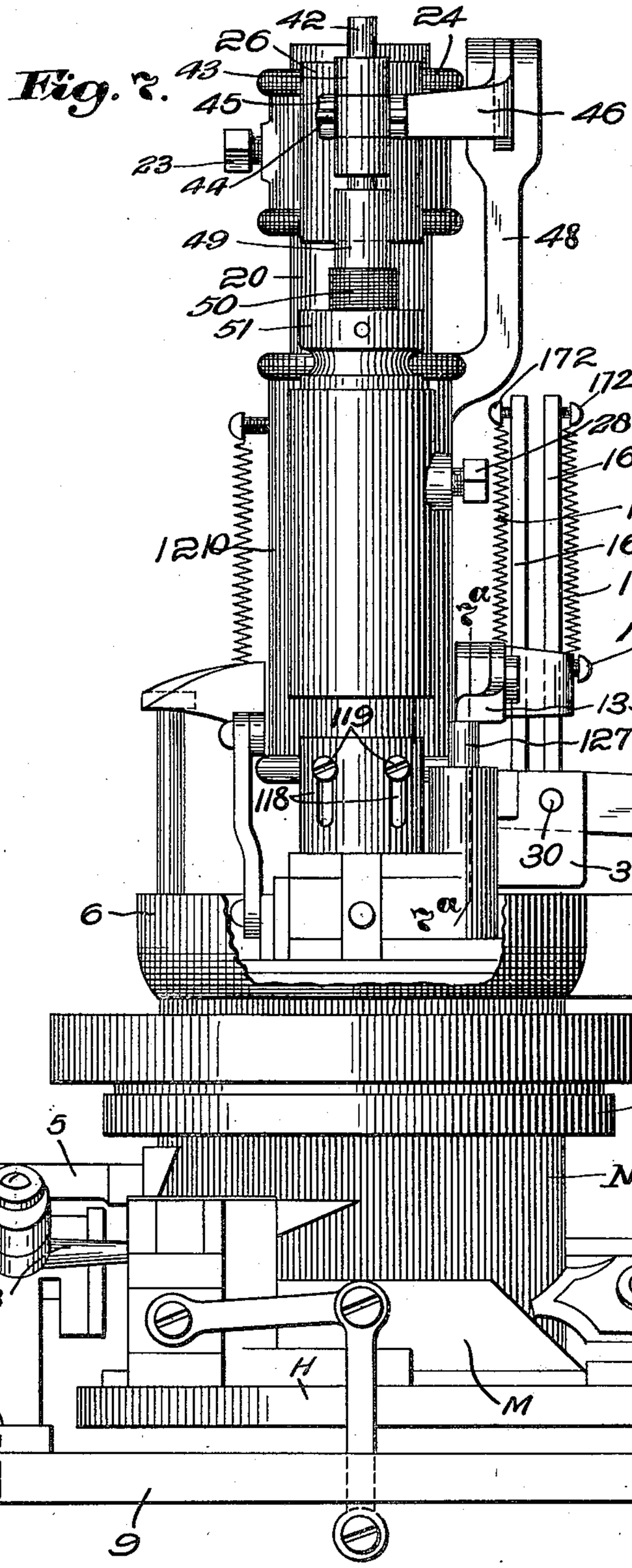
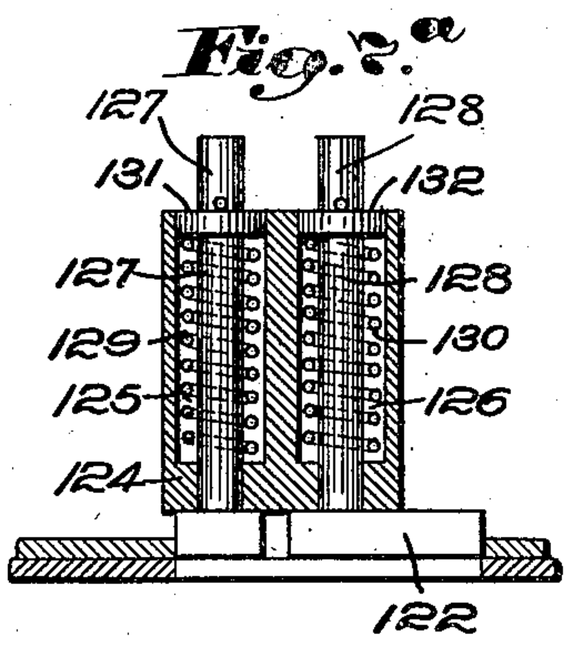


Fig. 2a.



Inventor:
Ray Fenn.
By Emery, Booth, Janney and Varney
Attys.

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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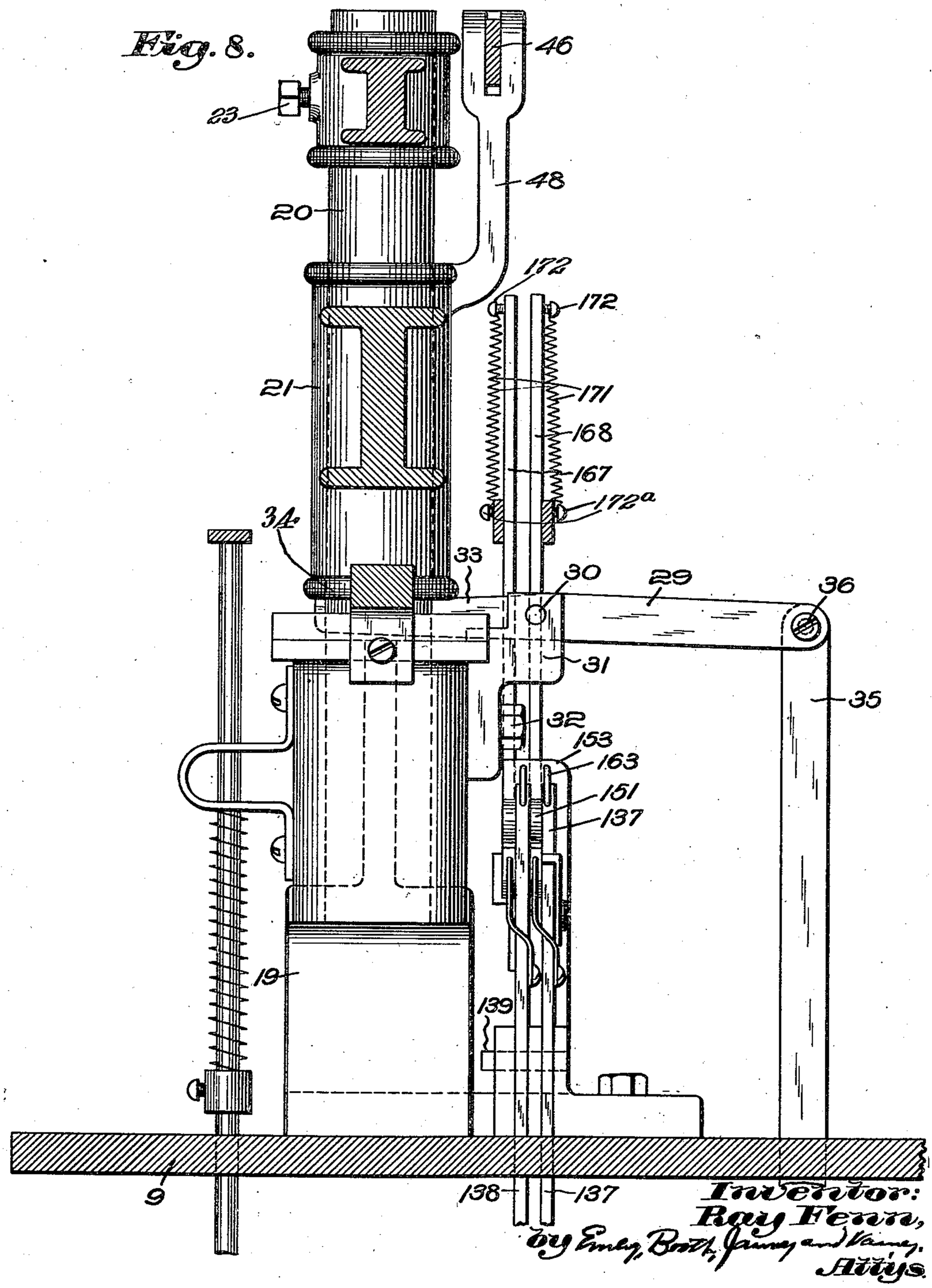
Fig. 8.



Inventor:
Ray Fenn,
by Emery, Booth, Janney and Varney,
Attys.

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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Fig. 9.

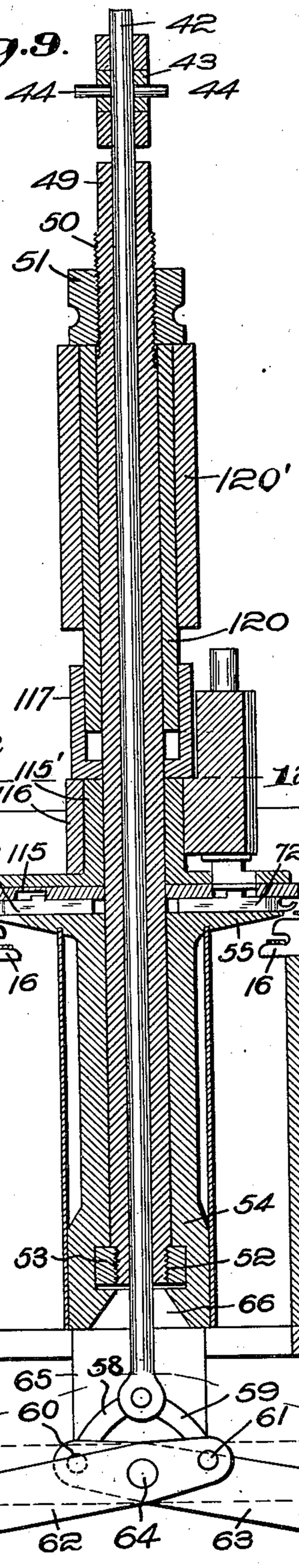


Fig. 11.

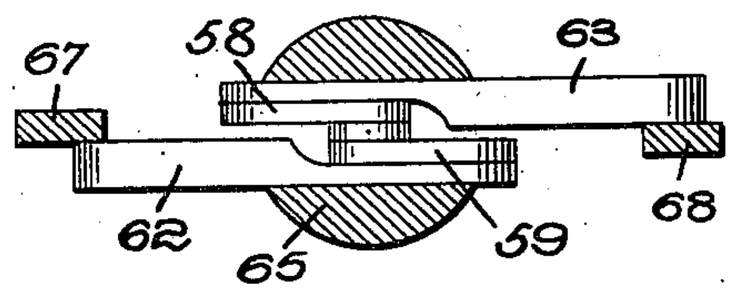


Fig. 12.

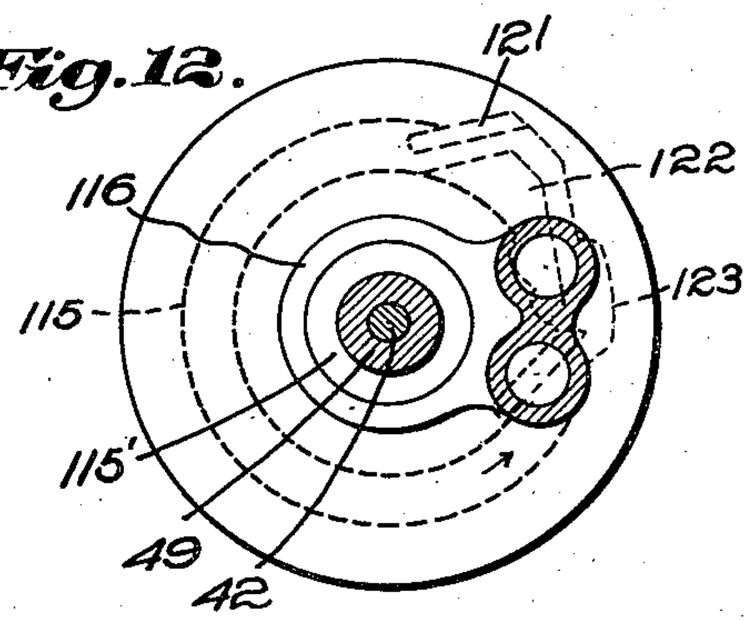
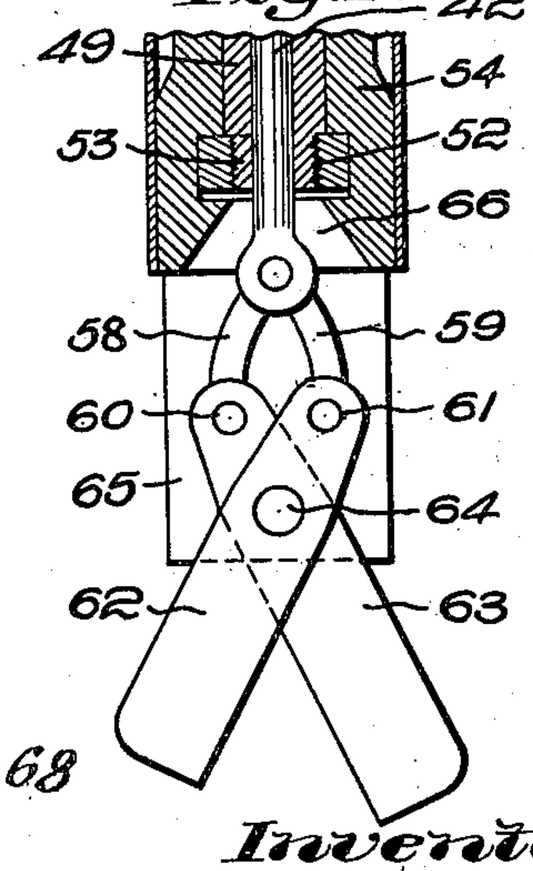


Fig. 10



Inventor:
Ray Fenn,
by Emery, Booth, Jamieson and Varney, Attys.

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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Fig. 13.

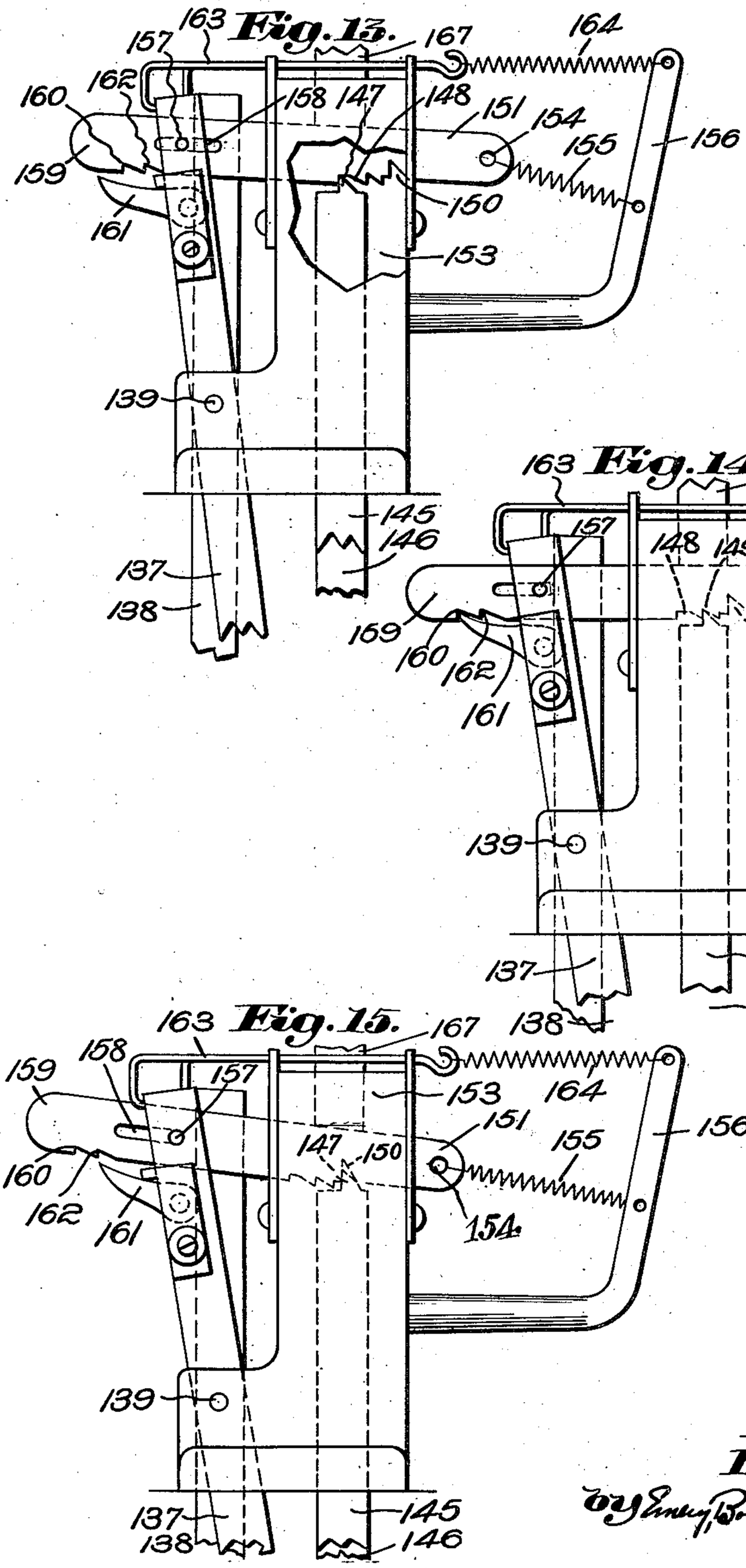

Fig. 14.

Fig. 15.

Inventor:
Ray Fenn,
by Finney, Booth, Janney and Vaney
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June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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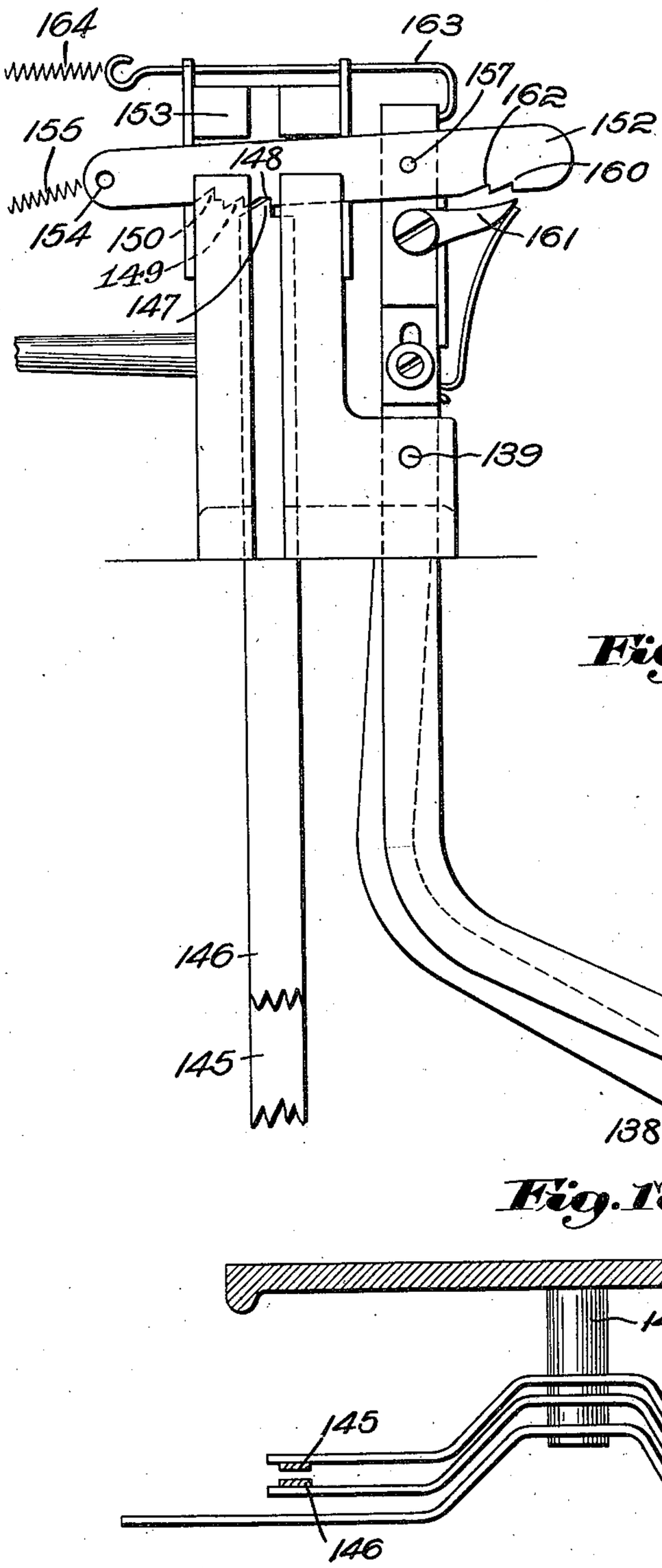

Fig. 16.

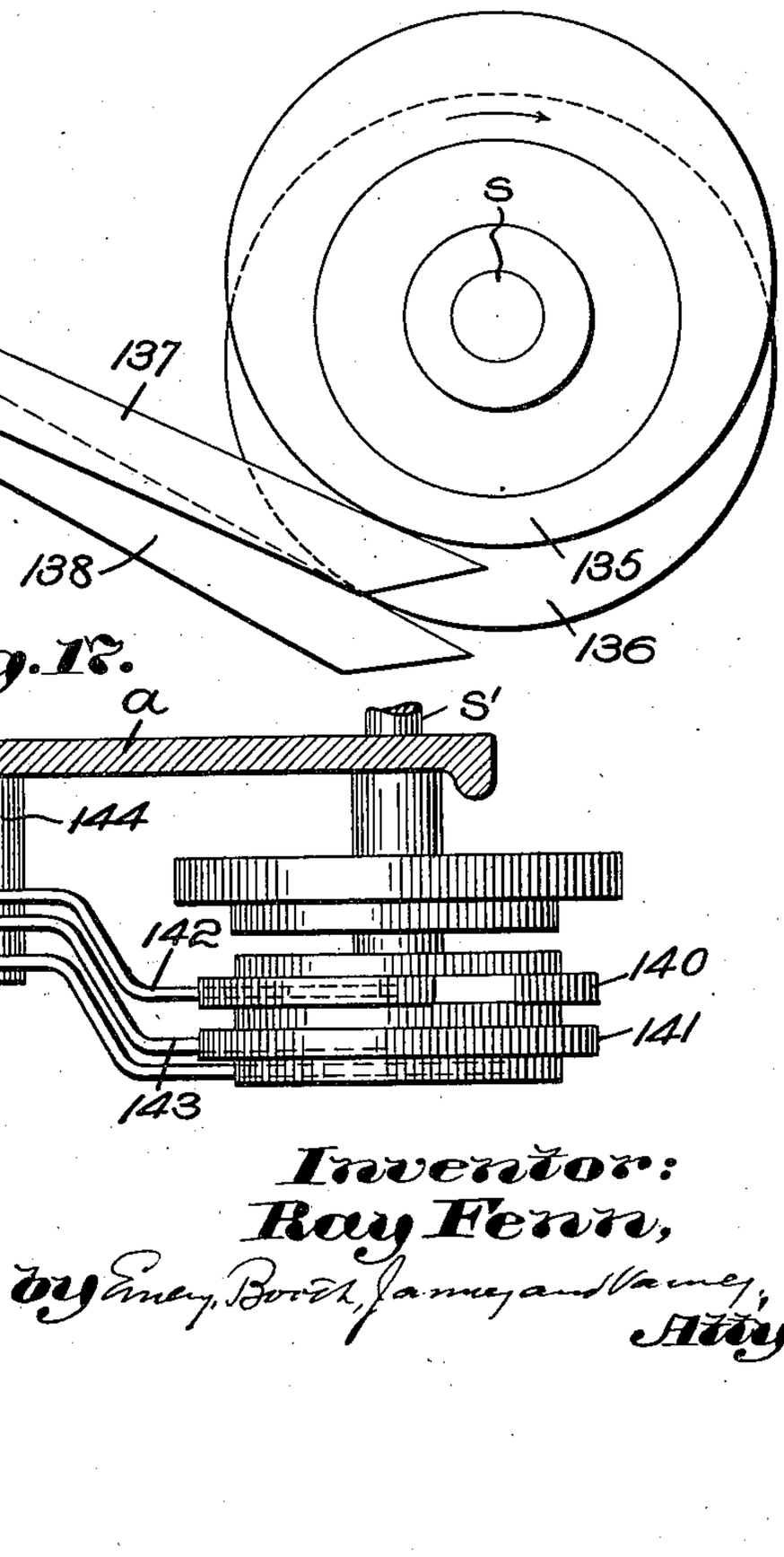

Fig. 17.

Inventor:
Ray Fenn,
by Emery, Booth, Jamieson and Varney,
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June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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Fig. 18.

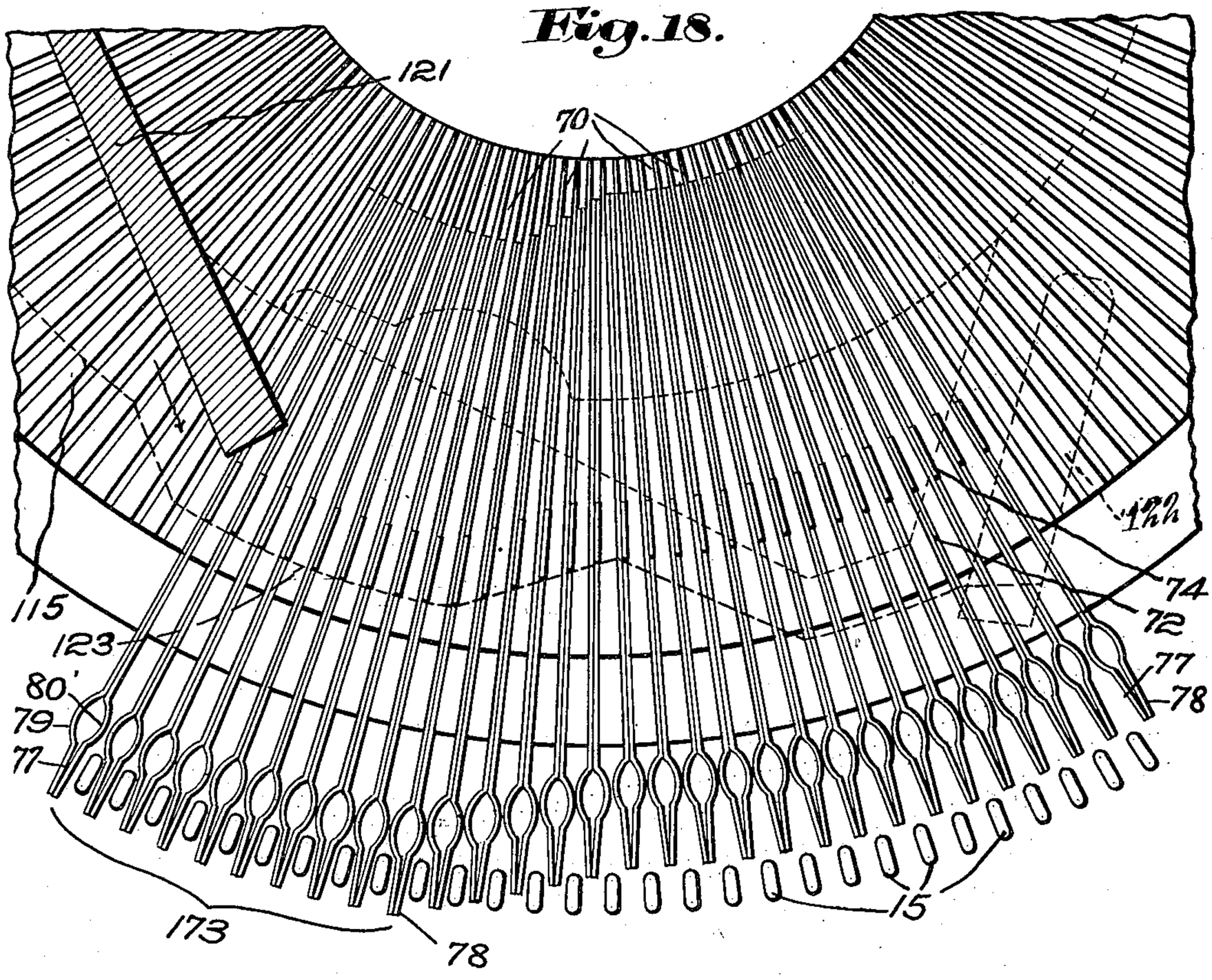
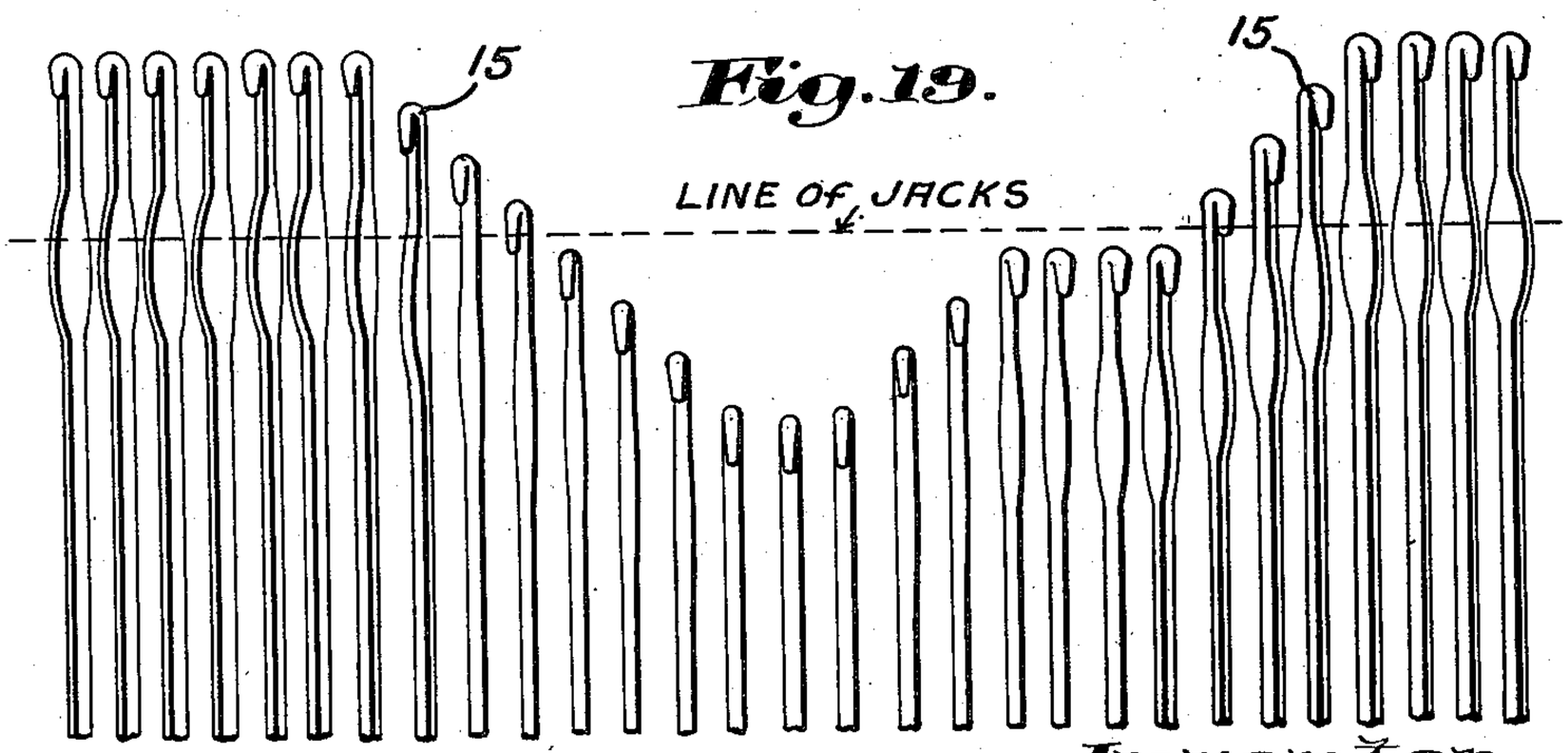


Fig. 19.



Inventor:
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Attys.

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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Fig. 20

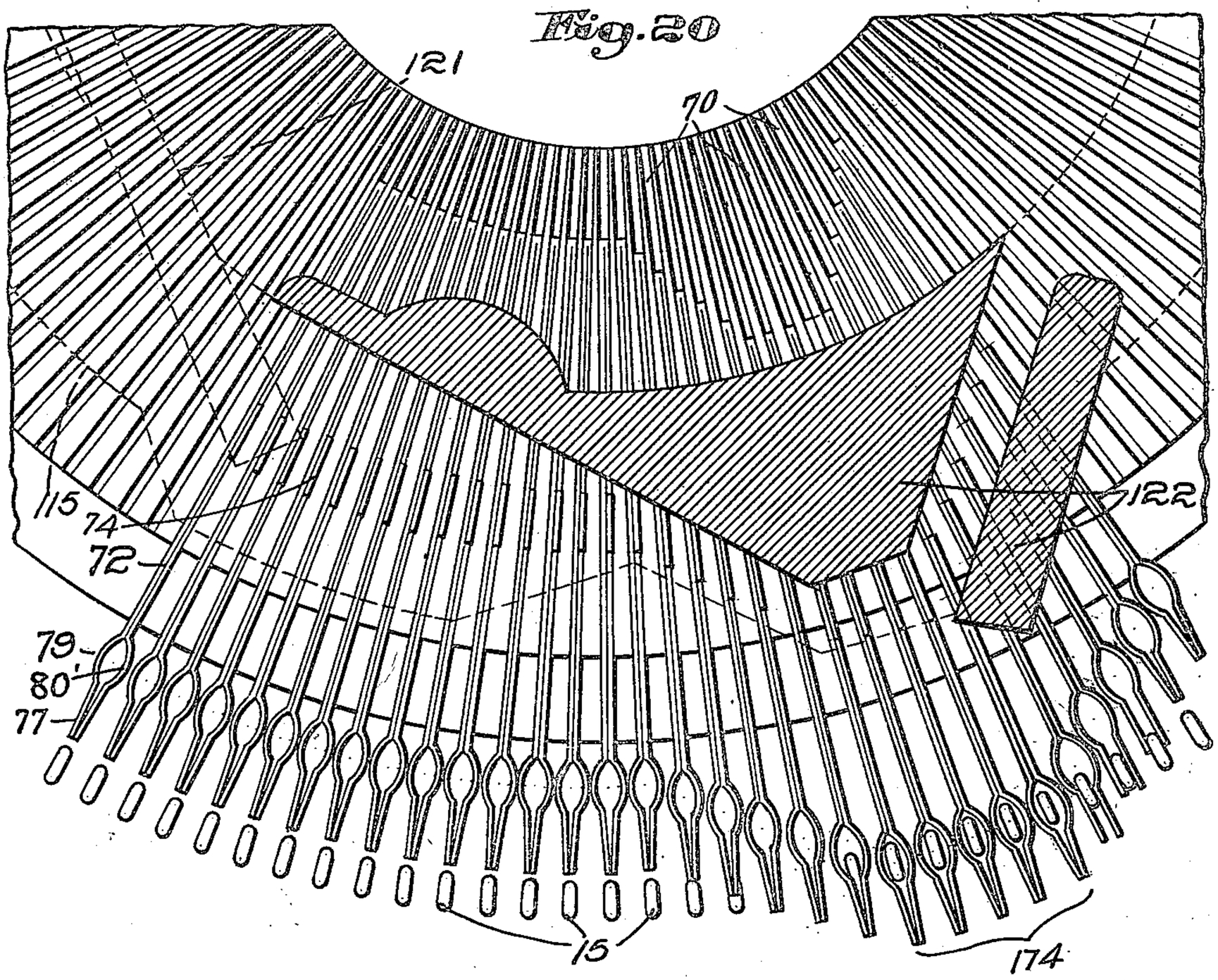
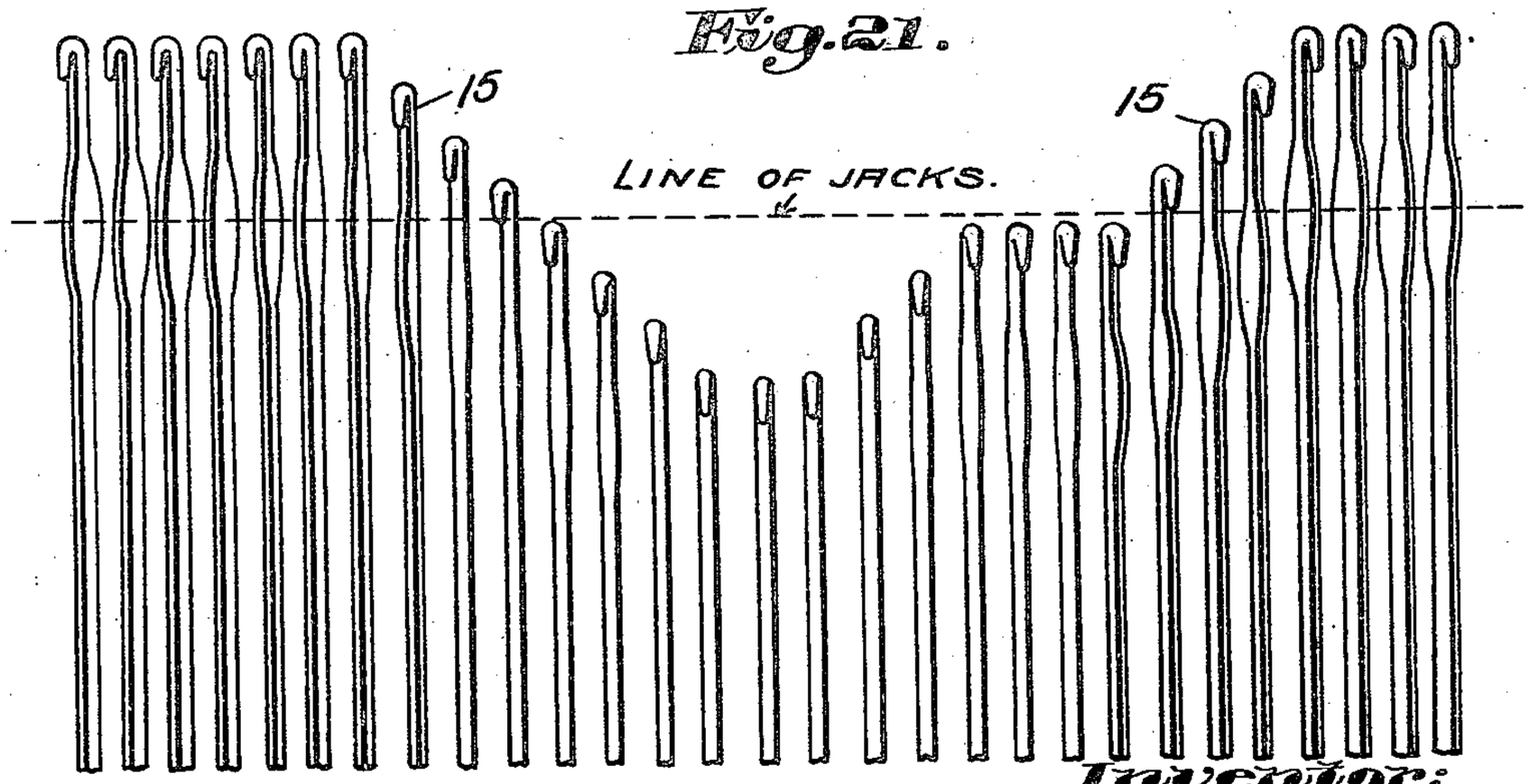


Fig. 21.



Inventor:
Roy Fenn
by Emery, Booth, Janney and Varney,
Attys.

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

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Fig. 22.

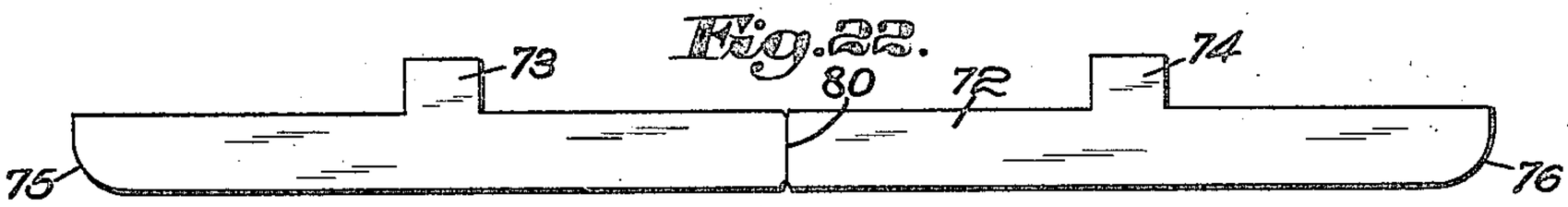


Fig. 23.

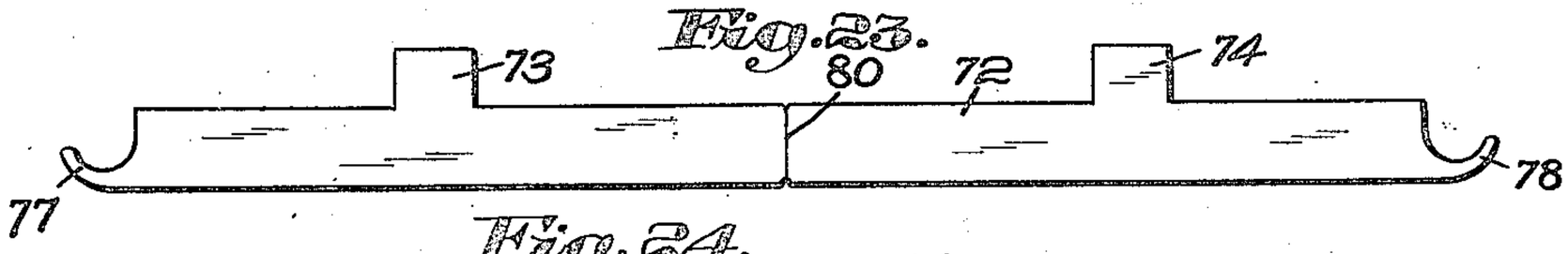


Fig. 24.

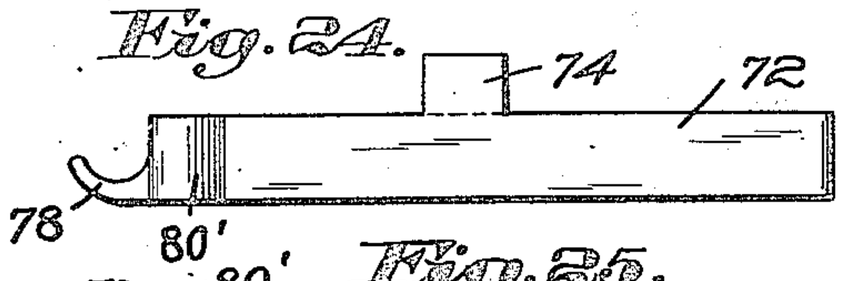


Fig. 26.

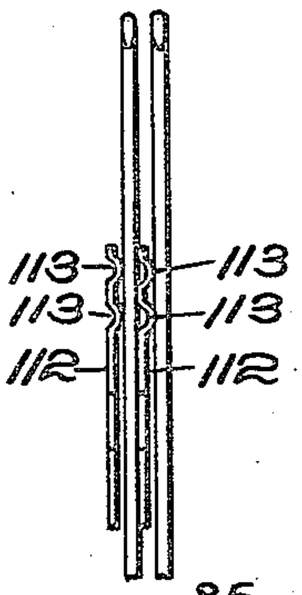


Fig. 25.

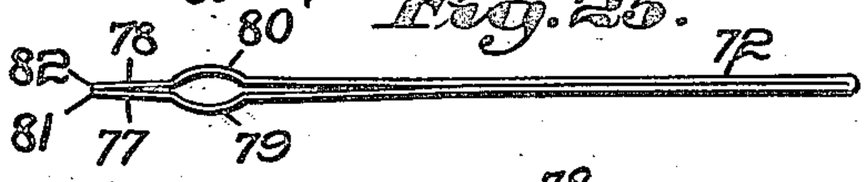


Fig. 24a.

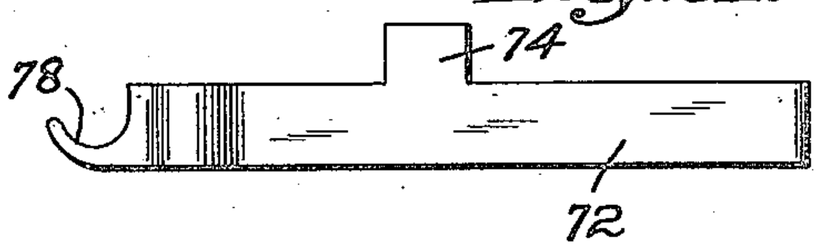


Fig. 27.

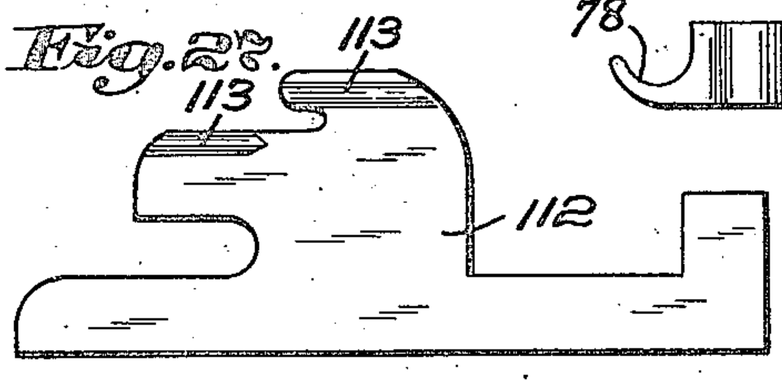


Fig. 28.

Fig. 29.

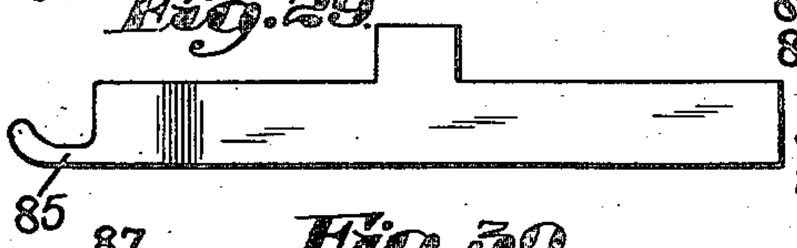


Fig. 30.

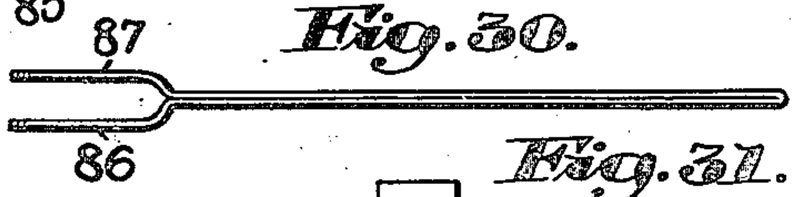


Fig. 31.

Fig. 32.

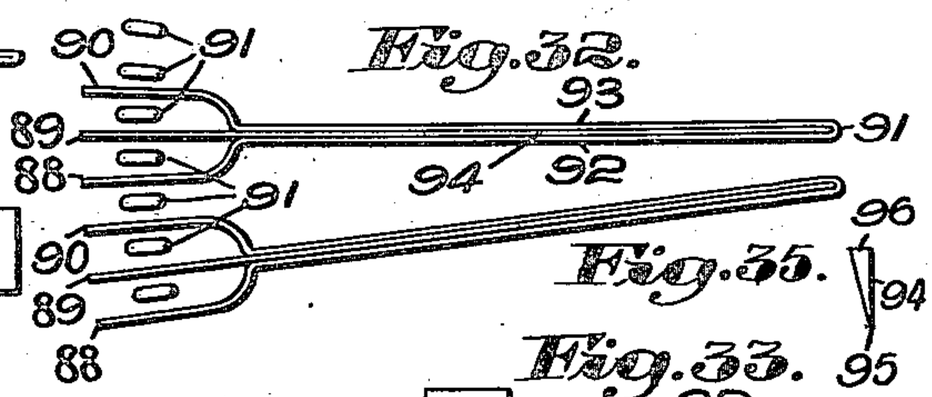


Fig. 35.

Fig. 33.

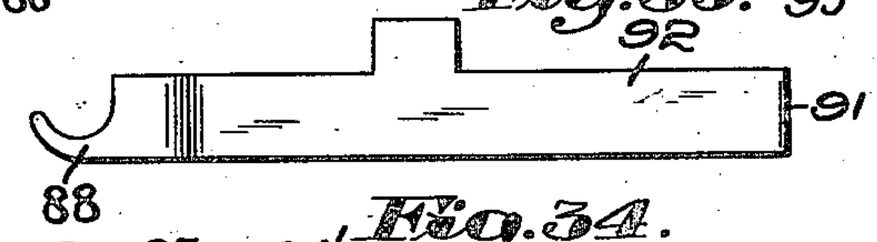


Fig. 34.

Fig. 36

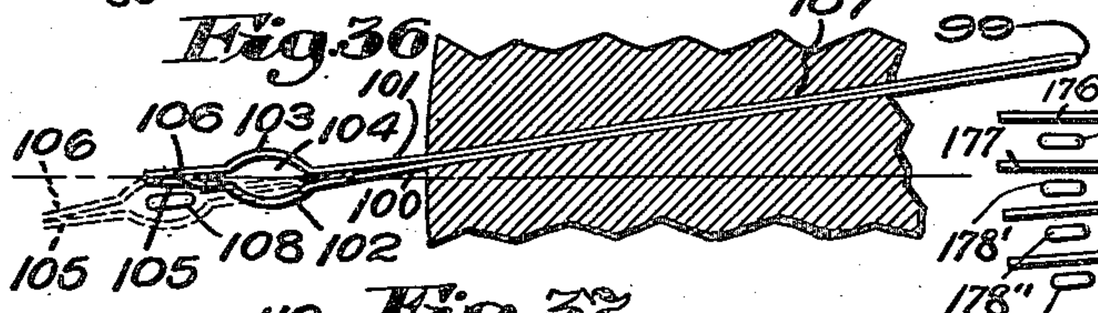


Fig. 38.

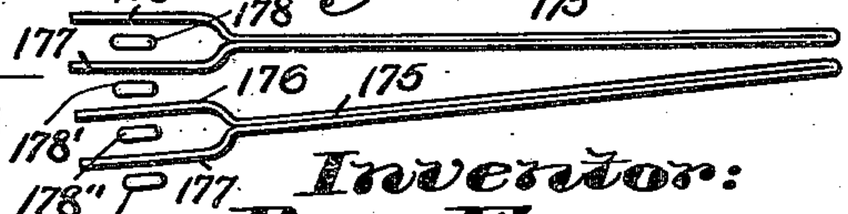
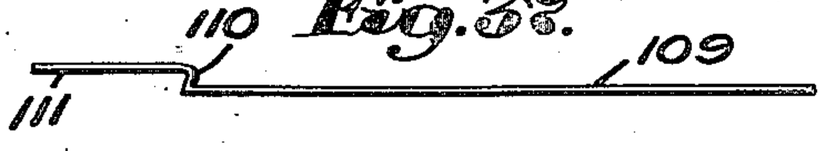


Fig. 37.



Inventor:
Ray Fenn,
by Emery, Booth, Jamy & Varney
Attys.

June 19, 1923. 1,459,446

R. FENN

INTURNED WELT KNITTING MACHINE

Filed Aug. 27, 1919 15 Sheets-Sheet 15

Fig. 39.

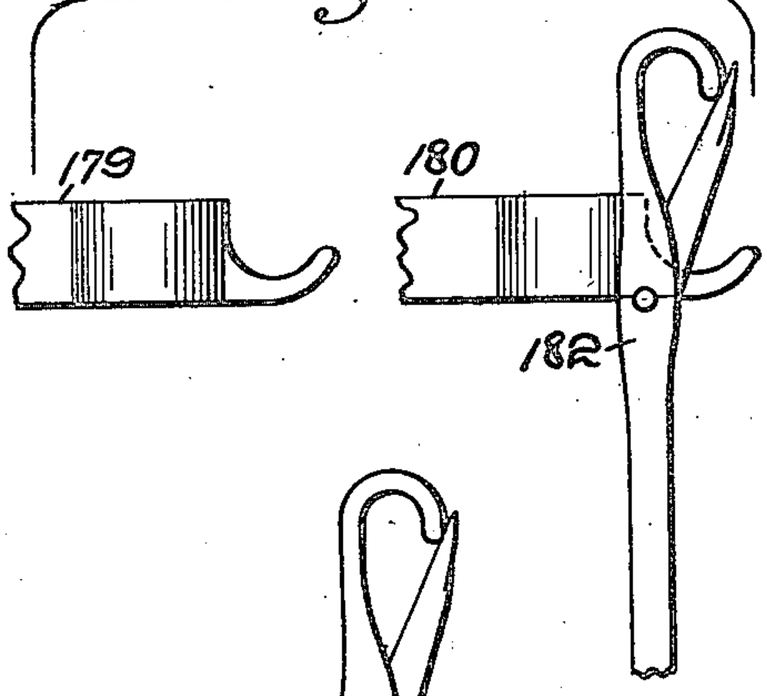


Fig. 40.

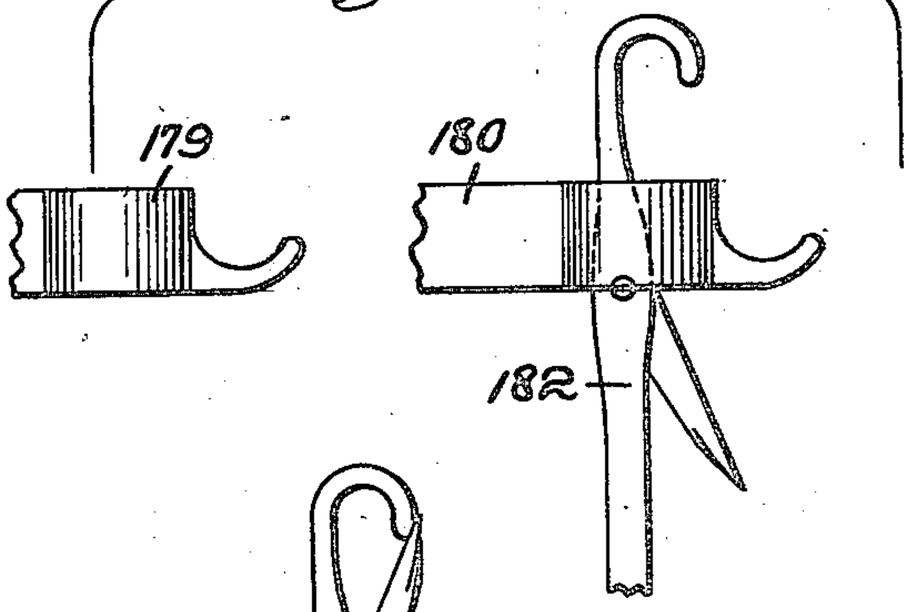
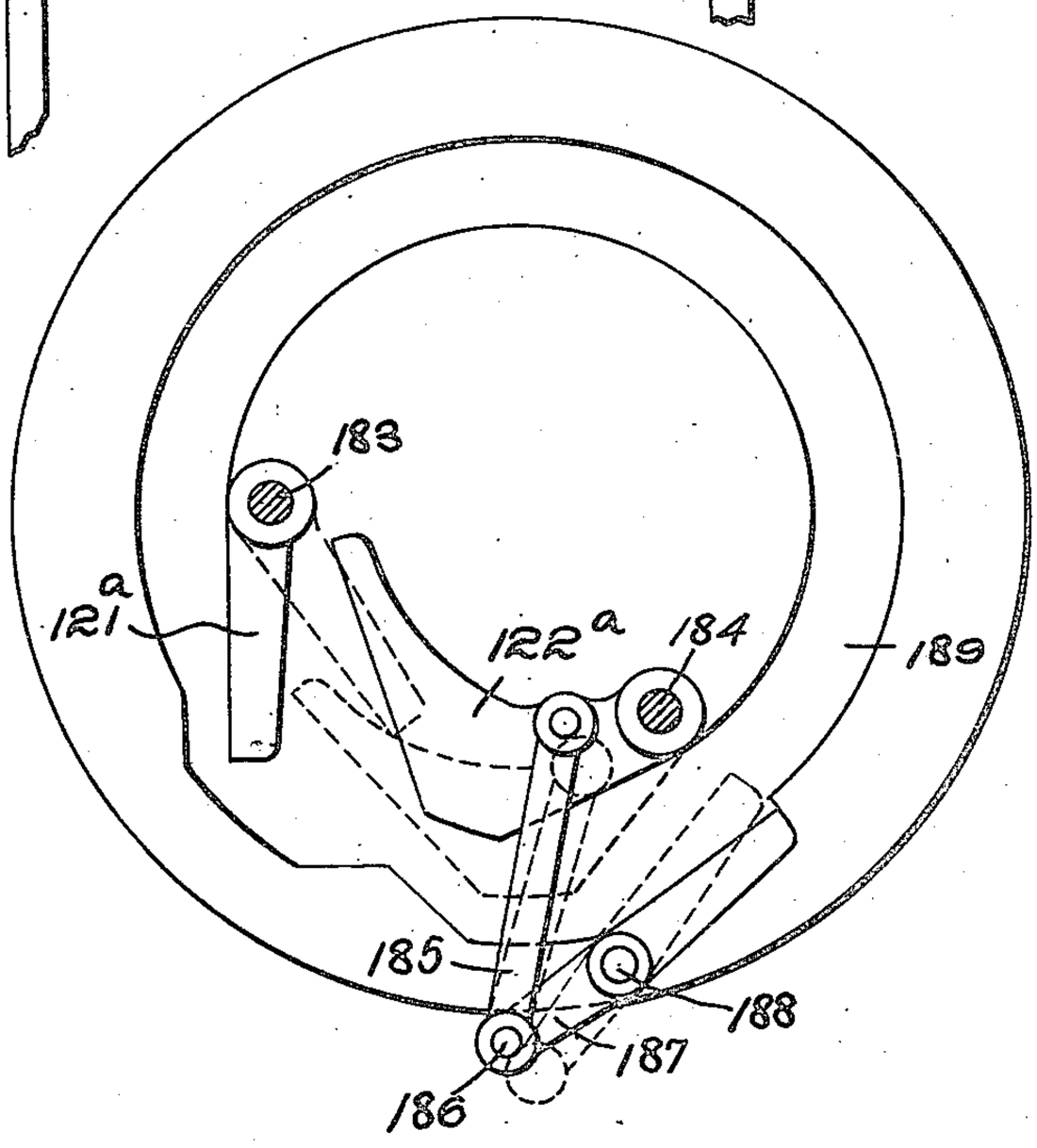


Fig. 41.



Inventor:
Roy Fenn,
by Emery Booth, Janney and Vaney,
Attys.

Patented June 19, 1923. 1,459,446

UNITED STATES PATENT OFFICE.

RAY FENN, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO HEMPHILL COMPANY, OF CENTRAL FALLS, RHODE ISLAND, A CORPORATION OF MASSACHUSETTS.

INTURNED WELT-KNITTING MACHINE.

Application filed August 27, 1919. Serial No. 320,311.

To all whom it may concern:

Be it known that I, RAY FENN, a citizen of the United States, and a resident of Providence, in the county of Providence and State of Rhode Island, have invented an Improvement in Inturned-Welt-Knitting Machines, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

This invention relates to knitting machines for forming turned welts integral therewith and particularly for forming inturned welts integral with the top of seamless stockings.

In order that the invention may be clearly understood, I have disclosed a single type or embodiment thereof in the accompanying drawings, wherein—

Fig. 1 is a front elevation of a knitting machine having my welt forming attachment applied thereto;

Fig. 2 is an end elevation of the mechanism shown in Fig. 1;

Fig. 3 is a side elevation of the so-called head of the mechanism shown in Figs. 1 and 2;

Fig. 4 is a side elevation of the said head on the broken line 4—4 of Fig. 1, viewed from the side opposite Fig. 3;

Fig. 5 is a plan view of the head, certain parts being shown in transverse section;

Fig. 6 is a plan view of a portion of a head but viewed upon the horizontal section line 6—6 of Fig. 4;

Fig. 7 is a front elevation of the head, parts being broken away;

Fig. 7ª is a detail in vertical section of a part of the plunger mechanism controlling certain of the cams;

Fig. 8 is a vertical section of the head upon the line 8—8 of Fig. 4;

Fig. 9 is a vertical, central section taken through the needle cylinder, the head and closely adjacent parts;

Fig. 10 is a detail in vertical, central section of the construction shown in the lower part of Fig. 9, but representing the parts in different position from that of Fig. 9;

Fig. 11 is a transverse section upon the line 11—11 of Fig. 9;

Fig. 12 is a transverse section upon the line 12—12 of Fig. 9;

Figs. 13, 14 and 15 are details of the ratchet mechanism controlling the loading and transferring devices and showing the parts in different positions, said parts being viewed from the right;

Fig. 16 is a left hand side elevation of the said ratchet mechanism and also showing the operating hand mechanism therefor;

Fig. 17 is a plan view with certain parts in section of the operating levers shown in Fig. 2;

Fig. 18 is a plan view of a part of the dial for the transferring jack and showing the latter in position for loading;

Fig. 19 is a front elevation of the construction shown in Fig. 18;

Fig. 20 is a view similar to Fig. 18 but representing the jack in position for transferring;

Fig. 21 is a front elevation of the construction shown in Fig. 20;

Fig. 22 is a side elevation of a blank from which the jack may be formed;

Fig. 23 is a similar view of the blank in a more nearly complete state of manufacture;

Fig. 24 is a side elevation of a complete jack formed by bending the blank shown in Fig. 23 upon a vertical central line;

Fig. 24ª is a similar view of a slightly modified form of jack, embodying my invention;

Fig. 25 is a plan view of the completed jack shown in Fig. 24;

Fig. 26 is a front elevation representing a pair of needles and the sinkers or web holders cooperating therewith;

Fig. 27 is a side elevation of one of said sinkers or web holders;

Figs. 28 and 29 are respectively a plan view and a side elevation of a very slightly modified form of my invention and constituting the preferred form thereof;

Figs. 30 and 31 are respectively a plan view and a side elevation of a still further modified form of my invention;

Fig. 32 is a plan view representing a plurality of jacks of still another form of my invention, in their relation to the needles;

Fig. 33 is a side elevation of one of the jacks shown in Fig. 32;

Fig. 34 is a plan view of still another form of jack of my invention;

Fig. 35 is a vertical section taken through the jack shown in Fig. 34;

Fig. 36 is a plan view representing a jack constituting still another form of my invention and showing in full lines the jack

in position for loading and in dotted lines in position for transferring;

Fig. 37 is a plan view of a jack constituting still another form of my invention.

Fig. 38 is a plan view similar to Fig. 30 of still another form of my invention;

Fig. 39 is a detail in side elevation representing two needles and related jacks as positioned during the loading operation;

Fig. 40 is a similar view of the parts as positioned for the transferring operation; and

Fig. 41 is a plan view showing the modified arrangement of cams for operating the jacks for loading and for transferring.

My invention in its preferred embodiment constitutes an attachment for a circular knitting machine, and it may with or without modification be applied to various types of circular knitting machines. It may, for example, be applied to a machine wherein the needle cylinder rotates and the cam ring is stationary, or to a machine wherein the cam ring rotates and the needle cylinder is stationary. The knitting machine to which the invention is applied is preferably employed for knitting stockings, though within the scope and purpose of my invention a welt may be formed upon any desired knitted article. Preferably, however, my invention is employed upon a machine for knitting a seamless stocking having heel and toe pockets, though with or without modification, my invention may be applied to other types of knitting machines.

While my invention may be used upon any desired or suitable type of knitting machine, I have represented it as applied to or embodied in a circular knitting machine of the so-called Banner type, one form of which is disclosed in the patent to Hemphill, No. 933,443, September 7, 1909, to which reference may be made for a complete disclosure of parts not herein necessary to set forth in detail.

I shall proceed to describe my invention as applied to a machine of the Banner type, but it is to be understood that such specific description is in no sense a limitation upon the scope of the invention.

In as much as certain general parts of the mechanism herein shown may be and preferably are the same as those shown in the said patent to Hemphill, No. 933,443, I have designated such parts by the same reference characters that are employed in the said patent. Thus the machine frame is marked *a*, the rotatable needle cylinder is marked N in Fig. 9, the non-rotatable cam carrier is marked H, and the annular portion or ledge of the cam carrier is marked M. The pulleys for the driving band are marked respectively *p*, *p'*, *p''* (quick speed, slow speed and loose), and at *s*, in Fig. 2, is indicated the main shaft on which the said pulleys are mounted. The pattern shaft is indicated in Fig. 2 at *s'*, *f* and *g* shown in Fig. 1 being the pattern or cam drum or barrels upon the said shaft. Upon said drum or barrel *s* is preferably provided a pattern ring engaging the clutch shifting lever whereby the clutch is shifted so as to operate by rotary or round and round knitting throughout the formation of the leg and preferably the foot of the stocking, and by reciprocating knitting throughout the formation of the heel and toe in a manner not herein necessary more fully to describe. In the disclosed application or embodiment of my invention, the needle cylinder rotates and reciprocates and the cam ring is stationary, though obviously and as above stated, the reverse construction and operation may be employed. Moreover my invention may be embodied and practised in other types of machine, such, for example, as those adapted to knit so-called split foot hosiery or even in machines that reciprocate throughout, as in the production of gloves or of full fashioned stockings. So far as my invention is concerned, it is merely necessary to provide for a relative movement between the needle carrier and the needle operating cams.

Upon the usual cam block diagrammatically indicated at 1, in Fig. 1, are mounted the usual stitch cams indicated in outline at 2 and preferably upon said block are also mounted the usual narrowing pickers 3, as shown in Fig. 2. At a suitable point upon the cam ring is mounted the usual in-step cam to lower all the needles and there are also preferably provided a levelling cam and widening picker mechanism, the latter here embodied in two pickers, one of which is shown at 5. These pickers preferably operate substantially as shown in the said Hemphill patent, but if desired a single widening picker may be employed instead and operated in a manner not herein necessary more fully to describe.

Preferably and as indicated in Figs. 1, 5, 7, 9, etc., the knitting machine is equipped with a latch ring indicated at 6, and which is herein represented as pivoted at 7 upon a suitable standard or bracket 8 rising from the bed plate 9 of the machine. The machine is provided with suitable thread guides which may be and preferably are of the general type shown in the said Hemphill patent and herein for that purpose I have represented a series of thread guide levers 10, 11, 12, 13, 14 in Fig. 6, the thread lever 12 preferably being employed to guide to the needles the thread that is employed in knitting the top and leg of the stocking. The thread lever 13 may be used for the high splice, the thread lever 14 for the heel and toe, and the thread levers 10 and 11 as desired, and if desired one of the levers may be used to feed only the thread for the so-called

garter top if employed. Obviously my invention is not limited in this respect.

The needle cylinder N is provided with suitable needles 15 (see Fig. 9) which are preferably, but not necessarily, latch needles. My invention peculiarly cooperates with latch needles. Preferably I provide suitable sinkers or web holders 16 mounted to slide in suitable radial grooves in the sinker ring 17 surrounding the needle cylinder at the top thereof. These sinkers or web holders may be of any suitable construction, but preferably are of substantially the form shown in Figs. 26 and 27. Overlying the sinker ring 17 and the sinkers therein, I provide the sinker cap ring 18 having preferably usual cams for operating the sinkers.

The mechanism to which my invention more particularly relates may be supported in any suitable manner. Preferably and as herein shown, I secure to the base plate 9 a stand or bracket 19, which is suitably formed for the reception of a post or spindle 20 fast therein and upon which is loosely mounted for sliding vertical movement a sleeve 21 integrally formed with or suitably connected to a sleeve 22. Bolted or otherwise suitably secured to the post or spindle 20, as by set screws 23 is a collar 24 having an arm 25 formed therewith or attached thereto and itself provided with a sleeve 26, which is adapted to slide upon a spindle 27 positioned in vertical parallelism with the post or spindle 20. The said spindle 27 is received in a socket or opening in the sleeve 22 and is made fast therein by one or more bolts 28. I preferably provide the spindle 27 and adjacent parts to prevent turning movement of the sleeve 24, the arm 25 and the sleeve 21.

I provide suitable means for elevating periodically the sleeve 21 and connected parts, and for this purpose have herein represented as most clearly shown in Fig. 8, a lever 29 pivoted at 30 upon a bracket 31 secured by bolt 32 to the stand 19, one arm 33 of said lever taking under the lower end 34 of said sleeve 21, so as to impart vertical sliding movement thereto and to the parts connected therewith. The said lever 29 is operated in any suitable manner, as by means of a link or slide 35 pivoted thereto at 36 and at its lower end connected at 37 to a lever 38 pivoted at 39. Said lever 38 is provided with a head 40 adapted to be acted upon by a suitable cam 41 upon the shaft s'. When the parts are in the position shown in Fig. 2, the sleeve 21 and connected parts are in their lower position.

In parallelism with the rod or spindle 20 and the spindle 27 is mounted the head constituting the support for the instruments that cooperate with the knitting needles in the formation of the welt, as well as the support for the operating cam therefor and like parts.

Referring more particularly to Figs. 3, 4 and 9 to 12 inclusive, it will be observed that axially of the needle cylinder there is positioned a rod 42, to which is secured near the upper end a collar 43 having laterally projecting pins 44 adapted to be engaged by the recessed end 45 of a lever 46 pivoted at 47 upon a bracket 48. The rod 42 is mounted loosely in a long sleeve 49, the upper portion thereof being threaded at 50 to receive a nut 51, and the lower portion being threaded at 52 to receive a nut 53. The nut 53 is positioned in a suitable recess in the spindle or sleeve portion 54 of a dial 55. The nuts 51 and 53 are provided, together with the sleeve 49, to hold the parts in position. The lever 46 as shown clearly in Fig. 2 is connected at its outer end to an upright link or rod, the lower end whereof is connected to a lever pivoted at 44, and which, as shown in Fig. 2 and also in Fig. 17, is adapted to be acted upon at suitable times by a cam on the shaft s', thereby to cause said rod 42 to be raised or lowered and the dogs 62, 63 to engage the lugs 67, 68 shown in Figs. 9 and 11.

The rod 42 at its lower end extends through the sleeve 54 of the dial 55 and below the needle cylinder N and the driving gear 56 for the latter. To the lower end of the rod 42 are pivoted at 57 two links 58, 59 respectively pivoted at 60, 61 to two levers 62, 63, themselves pivoted at 64 in the depending part 65 of the sleeve portion 54 of the dial 55. Preferably the lower part of the sleeve 54 is cut away or recessed as indicated at 66 in Fig. 10. The driving gear 56 for the needle cylinder is provided with two diametrically opposite lugs 67, 68 shown most clearly in Fig. 9, and which, as indicated at 69 in Fig. 4, are both bevelled or tapered upon those faces thereof that are adapted to be engaged by the levers 62, 63.

When the levers 62, 63 are in the position shown in Fig. 10, they are out of engagement with the lugs 67, 68, and hence the dial and related parts have no movement of rotation with the needle cylinder. When, however, the rod 42 is moved to bring the levers 62, 63 into engagement with the lugs 67, 68, the dial 55 and connected parts moved synchronously with the needle cylinder. It will be observed that the levers 62, 63 are shown as of different lengths, this construction preferably being employed to permit the shorter arm 62 first to engage its lug 67 and upon further movement of rod 42 to permit the lever 63 to engage its lug 68. This avoids all difficulty incident to causing engagement of each lever with its lug.

I have stated that the lugs 67, 68 are tapered or beveled as indicated at 69 (see Fig. 4). It will therefore be evident that when the levers 62, 63 are moved from the full line position shown in Fig. 9 to the dotted line position shown in said figure,

they move upward along the beveled or inclined faces of said lugs 67, 68. The effect of this is to impart a very slight movement of partial rotation to the dial 55 and connected parts, this movement being about one half a needle space and is for the purpose of bringing the transferring instruments from their loading position to their transferring position as hereinafter set forth. Any other suitable means may, however, be provided to impart relative movement of partial rotation with respect to the needle cylinder and the dial 55. It is clear from the foregoing description that the dial 55 is moved from the levers 62, 63 by the mechanism hereinbefore described and including the spindle 27, sleeve 26 and connected parts. By means of the construction herein described, the jacks are positioned at a loading level to receive the loops to be held during the knitting of the welt and are subsequently moved to a transferring level for effecting the transfer of the loops to the needles at the completion of the welt.

The upper surface of the dial 55 is provided with grooves 70 in which are mounted the instruments, various forms whereof are shown in Figs. 22 to 37 inclusive.

These instruments, which I term jacks or transferrers, are equal in number to the number of the needles, so that in the operation of my invention I effect the transfer of all the loops or stitches of a course of the knitted fabric;—that is to say, in the operation of my invention I form a seamless, tubular web having an inturned welt or hem, each and every loop or stitch of a course of the inturned portion being integrally united with the wales of the body web. In certain forms of my invention, as, for instance, when using those forms of jacks or transferrers indicated in Figs. 30 and 32, I employ a fewer number of such instrumentalities than the entire series of needles. Nevertheless in such cases I effect the transfer of each and every loop or stitch of the course as hereinbefore stated, since such jacks or transferrers are equipped in toto with a number of points equal to the number of needles, so that said instruments in the loading position receive a number of loops equal to the number of needles, whereby in the transferring position each and all of said loops may be transferred to the needles, each needle thus receiving one loop.

Before describing the illustrated means for operating the jacks or transferrers, I will describe certain forms of said jacks or transferrers, with particular reference to Figs. 22 to 37 inclusive.

In Fig. 22, I have indicated at 72 a blank from which one form of my jack or transferrer may be constructed. This blank is preferably formed of highly resilient sheet metal, such as steel, which may be of extreme thinness, particularly when I employ as many as 220 or 240 needles in the needle cylinder. This blank, as stamped out, is provided with one or two butts 73, 74 and with curved ends 75, 76. I next preferably cut out the ends of the blanks so as to form the hooks 77, 78 as clearly shown in Fig. 23. I next preferably form the loops 79, 80′ by suitably offsetting the metal, and then I suitably treat the metal to remove the burrs. I then preferably fold the blank along the vertical line 80, the metal, if desired, being slightly nicked at the upper and lower edges to indicate the line for bending. The instrument then has the form shown in Fig. 25, and I thereupon set up the points while soft so as to make the same perfect, and if desired I then cut off one half the length of the butts on one half the instruments for a purpose hereinafter set forth. If desired, I may in that form of my invention shown in Figs. 22 to 25 wholly remove one of the butts 73, 74, or stamp out the blank in such manner as to provide only a single butt, since, when it is folded into the form shown in Figs. 24 and 25, I have found that a single butt is sufficient to cause the operation of the instrument.

In that form of my invention shown in Figs. 24 and 25, the points 77, 78 are essentially parallel with each other, and particularly do they touch at their outer ends 81, 82, as clearly indicated in Fig. 25. The offset portions 79, 80′ of the instrument form the eye, such eye being of substantially curved form, as shown in Fig. 25, wherein the curve is represented as taking the form substantially of an ellipse. The offset portion constituting the eye of the instrument does not include any portion of the points 77, 78, as is clearly evident from Fig. 25. Each of the points 77, 78 is preferably curved at its upper and lower edges, and such hooks are of reduced or slight vertical extent compared with the vertical extent of the body of the instrument, as is evident from Figs. 23 and 24.

In Figs. 28 and 29, I have represented another form of instrument constituting a jack or transferrer. Such instrument is preferably formed by the same operations that I have described at length with respect to Figs. 22 to 25. The points 83, 84 are in this form of my invention absolutely in contact from end to end thereof, that is, from the forward end of the eye 85 to the extreme forward end of said points or hooks 83, 84.

In that form of my invention shown in Figs. 30 and 31, I preferably provide two hooks 86, 87 spaced apart as shown in Fig. 30. These hooks in side elevation partake preferably of the form shown in Fig. 31, and in that respect do not differ substantially from the form shown in Figs. 25 and 29.

The instrument shown in this form of my invention is preferably formed from a blank that is doubled at midlength in a manner similar to that described with reference to Figs. 22, 23, etc. In using the jack shown in this form of my invention, I may employ one half as many jacks as I do needles, but each of the separated hooks of the jack takes a loop and hence I provide as many loops as I employ needles, so that in forming the welt each and every loop or stitch of the course in question is integrally united with the wales of the body web. That form of my invention shown in Figs. 32 and 33 differs from that shown in Figs. 30 and 31 in that each jack is provided with three hooks 88, 89, 90, each preferably having the form in side elevation shown in Fig. 33. Preferably each of these jacks is formed from a sheet of metal folded midlength upon itself at 91 and between the members 92, 93 is inserted a piece 94 that may be secured by a rivet, brazing or otherwise to the members 92, 93. The piece 94 is provided with a hook 89 similar to the hooks 88, 90, and when the implements are projected as indicated in Fig. 32, the needles 91 have the relation thereto indicated in said figure. It will thus be evident that as many loops are provided upon the total number of hooks 88, 89, 90 as there are needles 91, the result being that all the loops or stitches of a course of the inturned portion of the welt are integrally united with wales of the body web.

In that form of my invention shown in Figs. 34 and 35, the instrument is composed of a member 94′ having a thin under edge 95 and a preferably flat and relatively thick upper edge 96, the member being preferably wedge shaped in vertical section. Near its outer end the member is vertically recessed as indicated at 97 for the passage of the needle to which the loop is to be transferred in completing the welt and the forward end of the member terminates in a hook 98, which may be upturned like the hook shown in Figs. 24, 29, 31 and 33.

In that form of my invention shown in Fig. 36, the instrument is preferably composed of a blank bent upon itself at 99 to provide the two members 100 and 101 occupying a face to face relation in substantial contact as shown in Fig. 25. Each of said members is offset at 102, 103, to form an eye 104, and in addition the eye together with the hooks 105, 106 are bent at an angle which is preferably seven degrees with respect to the direction of the members 100, 101. In such case, and as indicated in Fig. 36, the groove 107 in the dial is not radial, but is at an angle of substantially seven degrees to a radius. The result of this is that when the instrument is in its retracted position indicated in full lines in Fig. 36, the two hooks 105, 106 are at one side of the needle 108 and such pair of hooks receives a single loop, so that the number of loops received on the total number of instruments equal the total number of needles. When, however, the instruments are projected into the full line position indicated in dotted lines in Fig. 36, the eye 104 comes directly over the needle 108, which may rise therethrough to take the loop from the hooks 105, 106, when the instrument is retracted.

In Fig. 37, I have shown still another form of my invention, wherein the instrument comprises a body portion 109 with a bend or offset 110 near the front end, and in advance of which is a hook 111 that in side elevation is preferably of the same form as the hook shown in Figs. 24, 31, 33.

It is exceedingly important, especially when operating with a large number of needles, such as 220, or 240, in a cylinder having a diameter of about 3½ inches that the needles rise in perfect spacing or in other words that they are not deflected or bent out of their true vertical position. In accordance with my invention I have provided means for truing the needles as they rise. While this result, which I believe to be broadly new, may be accomplished in various ways, I preferably provide each sinker, which may be of a general form indicated at 112 in Fig. 27, with one or a plurality of lateral formations 113 of ridge-like character. These formations may be provided by corrugating or similarly shaping the sinkers or web holders 27 when stamping them out or as a subsequent step in the operation. The said formations 113 are of relatively slight depth and may be either horizontal or somewhat inclined. They should, however, be so positioned as to engage the needles and preferably both as they rise and as they descend, to which end, they may be positioned upon different parts of the sinker, as indicated in Fig. 27.

Referring again to the construction shown in Fig. 9, it will be observed that directly above the dial 55 is positioned a circular disk or cam plate 114, in which is provided a path 115 for the butts 73, 74, of the jacks or transferrers of any of the forms shown in Figs. 22 to 37 inclusive.

Overlying the plate 114 is a circular disk having formed therewith an upwardly extending sleeve 115′ and surrounding the same is a sleeve 116 carrying certain plungers in sockets therein to be described. Directly above the sleeves 115, 116 is another sleeve 117 which, as most clearly shown in Fig. 7, is provided with vertical slots 118 to receive screws 119, said screws entering a long sleeve 120′ surrounding the sleeve 49, and surrounding said sleeve 120 is still another sleeve 1210. In order to elevate the

cam plate 114 slightly, as for the purpose of removing a broken jack, the screws 119 are loosened sufficiently to slide the sleeve 117 upward the length of the slot 118. This permits access to the cam plate 114, since the sleeves 115′, 116 may now be lifted.

I have referred to the cam plate 114 as having in its under surface a groove 115. This groove is concentric with the rod 42, that is, with the needles 15, throughout the greater portion of its extent, but it is shaped to receive two cams which I term respectively the loading cam and the transferring cam, and which are respectively indicated at 121, 122 in Fig. 18. These cams preferably are not formed integrally with the plate 114, but in a part overlying the same, so that they may be lifted into inoperative position when desired. The groove or track 115 is shaped as indicated at 123, so as to co-act with said cams when they are brought into operative relation to the butts of the jack.

Any suitable means may be provided to operate the cams 121, 122 for effecting the loading of the jacks and the subsequent transfer of the loops so loaded to the needles. Obviously these cams operate respectively at the commencement and at the close of the formation of the welt. I have provided the following mechanism for this purpose, to which, however, my invention is in no wise restricted.

Referring more particularly to Figs. 4, 5, 7ª and 12 to 17 inclusive, it will be observed that upon the sleeve 116, and as indicated in section in Fig. 7ª, I have formed an enlargement 124 having therein two sockets or recesses 125, 126, receiving spindles 127, 128, carrying at their lower ends respectively the said cams 121, 122. Surrounding said spindle 127, 128 are springs 129, 130 between the bottom of said socket and suitable collars 131, 132. The said spindles 127, 128 extend upwardly clear of the enlargement 124 as indicated most clearly in Fig. 4, and their upper ends are adapted to be engaged at the proper time by operating levers 133, 134 respectively, whereby the cams 121, 122 are respectively at the proper times forced downwardly into operative relation to the butts of the jacks or transferrers against the tension of the springs 129, 130. When said levers 133, 134 are moved from the position shown in Fig. 4, the cams 121, 122 are restored to inactive position by their springs 129, 130. Preferably one half of the butts of the jacks constituting desirably a complete semi-circle of the jacks are cut away or reduced in length to permit the engagement of the descending cams with the butts, or in other words, to provide a formation permitting the interengagement of the cams with the butts upon the descent of the former. Otherwise the cams would merely ride upon the tops of the butts.

In order to operate the levers 133, 134, I have shown the following mechanism.

Upon the shaft *s* I have mounted two cams or eccentrics 135, 136 which act upon levers 137, 138, pivoted at 139 upon the framing, the lever 137 constituting the lever co-acting with the loading cam and the lever 138 co-acting with the transferring cam. Upon the shaft *s′* as indicated in Fig. 17, I have mounted two cams 140 and 141 adapted to act upon two levers 142, 143 which respectively cooperate with the loading cam 121 and the transferring cam 122 of the dial head. Said levers 142, 143 are pivoted upon a suitable stud 144 projecting from the framing, and at their opposite ends, they are connected to suitable slides 145, 146, which, as shown in Fig. 16, occupy a vertical position, and at their opposite ends are each provided with a point or projection 147 adapted to engage certain notches 148, 149, 150 that are formed in each of two slides 151, 152. These slides are mounted for movement in guides or brackets 153, and at their outer ends are connected at 154 to coil springs 155 which are themselves connected to arms or brackets 156. The construction is such that said slides are normally drawn rearwardly or outwardly into what I term the knitting position indicated in Fig. 13.

The levers 137, 138 are respectively connected at their upper ends by means of pins 157 and slots 158 to the slides 151, 152, and the construction is such owing to slots preferably provided therefor, that the levers 137, 138 during the normal knitting operation merely rock to and fro upon their pivot 139 without effect upon the slides 151, 152. When, however, either slide 151 or 152 is elevated by reason of the upward movement of the slide 145 or 146, the projection 147 of such slide enters the notch 148 of the corresponding slide 151 and tilts the inner end 159 thereof downwardly, so that the first notch 160 at such end of the slide engages a pawl or projection 161, upon the corresponding lever 137 or 138. Pressing upon the pawl or projection 161 is a suitable spring 161′, shown only in Figs. 4 and 16 and omitted from other figures to avoid confusion. The result is that said lever 137 or 138 in its ensuing movement moves the slide 151, 152 inwardly or to the left, viewing Fig. 13, so as to bring the slide into the position shown in Fig. 14, at which time the projection 147 engages the second notch 149 in the slide 151 or 152. The next forward movement of the lever 137 or 138 causes the pawl or projection 161 thereof to engage with the projection 162, inasmuch as the slide 151 or 152 has been held in its advanced position by reason of the engage-

ment of the projection 147 with the notch 148, and thereupon said projection 147 engages the notch 149.

Each of the levers 137, 138 is provided with suitable means tending to move the upper end to the left viewing Fig. 13. For this purpose, I have represented each of said levers as having connected thereto a wire 163, the opposite end whereof is connected by a coil spring 164 to the arm or bracket 156.

When either slide 151 or 152 is moved into the position shown in Fig. 15, and its outer end is thereby elevated, a slide 167 or 168 resting respectively on slides 151 or 152 is lifted, thereby elevating the right hand end viewing Fig. 4 of the corresponding lever 133, 134, thus depressing the spindle 127 or 128 carrying the loading cam 121 or the transferring cam 122 and bringing it or them into active position. The slides 167, 168 rest at their lower ends upon the slides 161, 162. Each of said slides 167, 168 is provided with a slot 169 (Fig. 4) with which engages a pin 170 laterally extending from each lever 133, 134. Said slides 167, 168 are normally held down by suitable coil springs 171 connected to pins 172 at their upper ends and to screw 172^a on lever 133.

When the loading cam 121 is moved downwardly into active position, it occupies the position indicated in Fig. 18, and it acts upon the butts of the jacks to project them into loading position as indicated at 173 in Fig. 18. When the jacks occupy this position, the hooks of said jacks are positioned between the needles or the vertical paths thereof so that the needles as they descend, as indicated in Fig. 19 each take a loop of the thread and a loop is also received by each jack. That is to say, and referring to that form of jack of my invention shown in Fig. 25, the two hooks 77, 78 thereof together take a single loop of the thread and retain the same until the welt is completed. After the jacks have passed the loading position indicated at 173, they are retracted because of the shape of the shape of the groove 123 as indicated by the right hand portion of Fig. 18, and they retain this position of retraction until they are projected for transferring. After all the jacks have been loaded by being successively brought to the position 173, the cam 121 is lifted so that said jacks are no longer projected, but remain in their retracted position until the welt has been made of sufficient length. When a sufficient length of web has been knitted to provide for the desired length of welt, the transferring cam 122 is moved downwardly into axial position by the mechanism described or in any other suitable manner, and the jacks are thereby brought into the position indicated at 174 in Fig. 20; that is to say, the jacks are brought into such position that the needles 15 rise through the eyes formed by the offset portions 79, 80 of the jacks and as the jacks are retracted, the loops are taken off the jacks by the needles and united with the wales of the body web. This union as stated occurs with every loop or stitch of a course of the inturned portion of the welt.

In commencing the formation of the stocking, the proper thread is fed thereto precisely as disclosed in the said patent to Hemphill No. 933,443, that is to say, the thread is introduced to each and every needle in the customary and usual manner, and if desired, two, three or more courses of plain knitting are thus formed at the top of the stocking. Thereupon the cam 121 is moved downwardly into action in the described manner, so as to operate the jacks to effect the loading of each and every one thereof with a loop and preferably two revolutions of the needle cylinder are made to effect such loading. Then the desired length of welt is knitted, this being determined by the cams indicated in Fig. 17. Thereupon the transferring cam 122 is moved down into active position so that the jacks are thereby projected into the transferring position indicated in Fig. 20. At preferably substantially the same time, the dial 55 is moved one half a needle space as already described, so as to bring the jacks from a position between the needles to a position where the eyes are over the needles. This effects as described the transfer of each and every loop from the jacks to the entire series of needles, so that each needle receives a loop from the corresponding jack. Thereafter knitting proceeds in the regular or any desired manner.

In Fig. 38, I have shown a form of my invention differing from that shown in Figs. 32 and 33, in that the jack 175 is provided with two hooks 176, 177, to pass upon opposite sides of the needles 178, 178′, 178″, 178‴ as indicated. In using this form of my invention I so operate the jacks as to act upon alternate needles; that is to say, in the position of the parts shown in Fig. 18, the needles 178, 178″ are active and upon the next operation the needles 178′, 178‴ are active.

In Figs. 39, 40, I have represented upon an enlarged scale the position of the needles and jacks for loading and for transferring respectively. In Fig. 39, two jacks are indicated at 179, 180 and two needles at 181, 182. The needle 181 is shown in its lowest position and the needle 182 in its highest position, where it is at one side of the jack 180, as indicated at 173 in Fig. 18.

In Fig. 40, I have shown the same jacks

179, 180 and the same needles 181, 182, but have represented the needle 182 as between the hooks or members of the jack 180 for transferring as indicated at the position 174 in Fig. 20.

In Fig. 41, I have represented a modified form of loading and transferring cams. In said figure, I have represented the loading cam at 121ª as mounted for oscillation in a horizontal plane upon a shaft 183. This shaft is oscillated in any suitable manner by means not herein shown, so as to swing the cam 121ª from the full line to the dotted line position, and the reverse. The transferring cam is indicated at 122ª and is mounted for oscillation in a horizontal plane upon a shaft 184 adapted to be oscillated in any suitable manner by means not shown to swing the said cam from the full line to the dotted line position and the reverse. Pivotally connected to the cam 122ª is a link 185 pivoted at 186 to a lever 187 pivoted upon a stud 188 and constituting a portion of the cam track when in the dotted line position indicated. The construction and operation are such that when the transferring cam 122ª is moved to the dotted line position, it will move the jacks forward for transferring and at the same time the lever 187 is thrown into the dotted line position, so that the jacks immediately after having been moved forward for transferring are guided in the path or track 189. It will be understood that when the loading cam 121ª is in its active or full line position, the transferring cam 122ª is in its idle or full line position.

Having thus described one illustrative embodiment of my invention, I desire it to be understood that although specific terms are employed, they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

1. A welt knitting machine comprising in combination, a circular series of needles, a needle cylinder therefor, a circular series of jacks having loop receiving ends, a supporting dial for the jacks having a depending sleeve-like member within the needle cylinder, and means fixed circumferentially with respect to the needle cylinder and dial respectively to effect a slight turning movement of the dial and its jacks relative to the needle cylinder and its needles.

2. A welt knitting machine comprising in combination, a circular series of needles, a circular series of jacks equal to the number of needles and having loop receiving ends and closed eyes inwardly from said ends, means to project said jacks to receive loops upon the ends, means to move said jacks to another location and to project them so that their said eyes are brought into the path of the needles, whereby the loops may be taken by the needles and the welt completed by incorporating the loops integrally with the wales of the body web.

3. A welt knitting machine comprising in combination, a circular series of needles, a circular series of jacks having loop receiving ends, a supporting dial for the jacks, means to project said jacks to receive the loops at the commencement of the welt, and means to move the dial and the jacks circumferentially to a slight extent, whereby upon projection of the jacks at the completion of the welt, the needles co-act to withdraw the loops therefrom.

4. A welt knitting machine comprising in combination, a circular series of needles, a circular series of jacks arranged inside the series of needles, a supporting dial for the jacks, means to project said jacks between the needles to receive loops, means to retract the jacks into loop holding position, means slightly to turn the said dial and the jacks, and means to project the jacks for transferring, whereby the needles withdraw the loops from the jacks and incorporate the same integrally with the wales of the body web.

5. A welt knitting machine comprising in combination, a circular series of latch needles, a circular series of jacks having end hooks and eyes in the rear thereof, a supporting dial for the jacks, means to project said jacks, so that the hooks thereof receive loops, and means to turn said dial and jacks substantially one half needles space, whereby the needles rise through the eyes of the jacks to take the loops therefrom and incorporate them into the wales of the body fabric.

6. A welt knitting machine comprising in combination, a circular series of latch needles, a circular series of jacks equal to the number of needles, said jacks having end hooks and closed eyes in the rear thereof, means to project the jacks between the needles, whereby the jacks receive a number of loops equal to the number of needles, means to retract the jacks, and means to project the jacks, so that the needles rise through the eyes thereof, take the loops from the hooks and incorporate them into the wales of the body fabric.

7. A welt knitting machine comprising in combination, a circular series of latch needles, a dial carrying a circular series of jacks having hooks at their outer ends and closed eyes in the rear thereof, means to project said jacks between the needles, so that loops are received upon the eyes thereof, means to retract the jacks, means to move the jacks and to turn them and their supporting dial substantially one half a needle space, and means to project the jacks, so that the eyes thereof receive the needles during the ascent

of the latter, whereby the loops are incorporated integrally with the wales of the body fabric.

8. A welt knitting machine comprising in combination, a circular series of needles, a dial, a circular series of jacks carried thereby, a loading cam for the jacks, means to move said cam into operative relation with the jacks and thereafter to withdraw it from such operative relation, means to turn said dial and the jacks substantially one half a needle space, a transferring cam, means to move said cam into operative relation to the jacks, and means to withdraw said transferring cam out of operative relation.

9. A welt knitting machine comprising in combination, a circular series of needles, a dial within said series of needles, a circular series of jacks supported by said dial and having outer hooks and closed eyes in the rear thereof, said jacks equalling the number of needles, a loading cam and a transferring cam above said jacks, means to move said cams successively into co-acting relation with said jacks, and means to turn said dial and its jacks into loading and transferring positions respectively.

10. A thin, flat sinker or web holder the body whereof lies wholly in one plane, and having a needle-truing formation.

11. A sinker or web holder for an independent needle knitting machine, adapted to be positioned in the machine, transverse to the path of reciprocation of an adjacent needle of the machine and so that said needle in its movement relative to the sinker or web holder crosses a face of said sinker or web holder, said face having a needle-truing formation.

12. A sinker or web holder for an independent needle knitting machine, adapted to be positioned in the machine, transverse to the path of reciprocation of an adjacent needle of the machine and so that said needle in its movement relative to the sinker or web holder crosses a face of said sinker or web holder, said face having a needle-truing corrugation extending lengthwise of said face.

13. A flat sinker or web holder for knitting machines, adapted to be positioned for operation in the machine transverse to the longitudinal axis of an adjacent needle of the machine, said sinker having a needle-truing formation extending from a face thereof.

14. An instrumentality such as a sinker or web holder adapted to be received between guiding grooves of two adjacent needles and having a ridge extending from at least one face thereof in a direction substantially transverse to the line of reciprocation of said needles and adapted to be engaged by a needle deflected laterally from its true course toward said instrumentality.

15. A loop or bight detaining implement consisting of a body or shank folded upon itself to bring the members of the body or shank substantially into face contact, said implement having a pair of terminal hooks in substantially face contact.

16. A loop or bight detaining implement consisting of a body or shank bent at substantially midlength to bring its two portions into face contact, said implement having an eye near its forward end and terminal loop receiving formations.

17. A loop or bight detaining implement consisting of a body or shank folded upon itself at about midlength to provide two portions brought into face contact, one or both of said portions being offset to provide an eye near the front end, said portions having loop receiving hooks.

18. A loop or bight detaining implement consisting of a strip of sheet metal folded upon itself to provide two portions in face contact, each of said portions being offset near their forward end to provide an eye, each of said portions having a terminal hook.

19. A loop or bight detaining implement comprising a body or shank of thin sheet metal folded at substantially midlength to provide two portions in face contact, each of said portions being offset, together to provide an eye near the front end of the implement, the extreme forward end of the implement being fashioned into a hook, the members whereof are in engagement at their tips.

20. A loop or bight detaining implement consisting of a body or shank of thin sheet metal folded upon itself at substantially midlength to provide two portions in face contact, said portions each being offset to provide an eye and each having a hook in advance of said eye, said hooks being in face contact throughout substantially their entire length.

21. A welt knitting machine comprising in combination, a circular series of needles, a needle cylinder therefor, a dial positioned concentrically within said series of needles, a circular series of hooked jacks supported by said dial, one or more lugs in fixed relation with the needle cylinder, an element extending axially of said dial and needle cylinder, and means carried thereby periodically to engage said lugs, thereby to lock the dial with the needle cylinder, said lugs and means being shaped to effect slight turning of the dial with its jack.

22. A welt knitting machine comprising in combination, a circular series of needles, a needle cylinder therefor having a pair of depending lugs, a dial within the cylinder having welting jacks, and an element carried by the dial and having a part adapted

periodically to be moved into engagement with said lugs, said part and lugs being shaped to effect slight circumferential movement of the dial with its jacks.

23. A welt knitting machine comprising in combination, a needle cylinder, a circular series of needles supported thereby, a dial within said cylinder, welting jacks carried by the dial, a rod having relative movement axially of the dial, and means carried by said rod periodically to engage a part fixed with relation to the needle cylinder, thereby to cause synchronous movement of said needle cylinder and dial, said means and part fixed with relation to the needle cylinder being shaped to effect slight turning movement of the dial with its jacks.

24. A knitting machine having a needle cylinder provided with a series of needles, one or more lugs tapered in cross section and rigid with relation to said cylinder, a dial arranged within the cylinder, said dial having means adapted to engage with different portions of the tapered surface of said lug or lugs, whereby the dial is locked to the needle cylinder in different positions of circumferential relation.

25. A knitting machine comprising in combination, a needle cylinder, a circular series of needles therefor, a pair of lugs depending from said cylinder and downwardly tapered in cross section, a dial within the cylinder, a rod axially of the dial, and a pair of levers moved by said rod into engagement with different portions of the tapered surfaces of said lugs, thereby to effect the locking of the dial in different positions of circumferential relation with respect to the needle cylinder.

26. A welt knitting machine comprising in combination, a needle cylinder having a driving gear, a pair of lugs depending therefrom, a dial within said cylinder having a series of jacks, a rod positioned axially of the cylinder within said dial and cam plate, and levers connected to the lower end of said rod and adapted upon movement of the latter to be projected into engagement with said lugs, said lugs and levers being shaped to effect slight turning movement of the dial with its jacks.

27. A welt knitting machine comprising in combination, a circular series of needles, a needle cylinder therefor, a circular series of jacks having loop receiving ends, a supporting dial for the jacks, and means fixed circumferentially with respect to the needle cylinder and dial respectively to effect a slight turning movement of the dial and its jacks relative to the needle cylinder and its needles.

28. A welt knitting machine comprising in combination, a circular series of needles, a needle cylinder therefor, a dial positioned concentrically within said series of needles, a circular series of loop receiving instruments supported by said dial, a part extending from the dial and adapted periodically to engage a formation on the needle cylinder, and means periodically to cause the engagement of said part with said needle cylinder formation, thereby to insure a slight turning movement of the dial relative to the needle cylinder and then to secure synchronous movement of the dial with the needle cylinder.

29. A welt knitting machine comprising in combination, a series of needles, a needle cylinder therefor, a series of cooperating jacks to receive loops for the formation of the welt, a dial 55 supporting said jacks and having a depending sleeve-like portion 54 within the needle cylinder, a sleeve 49 within the dial and its sleeve-like portion 54, a rod 42 within the sleeve 49, means to move said rod axially, movable projections carried by the lower end of said rod 42 and opposed lugs depending from the needle cylinder, the shape of said projections and lugs being such as upon engagement to effect a slight circumferential turning movement of the dial relative to the needle cylinder.

30. A welt knitting machine comprising in combination, a series of needles, a needle cylinder therefor, a series of cooperating jacks to receive loops for the formation of the welt, said jacks having closed eyes and hooks in advance of said closed eyes, a dial 55 supporting said jacks and having a depending sleeve-like portion 54 within the needle cylinder, a sleeve 49 within the dial and its sleeve portion 54, a rod 42 within the sleeve 49, means to move said rod axially, movable projections carried by the lower end of said rod 42 and opposed lugs depending from the needle cylinder, the shape of said projections and lugs being such as upon engagement to effect a slight circumferential turning movement of the dial relative to the needle cylinder, thereby to move the closed eyes of said jacks from a circumferential position between the needles to a circumferential position in the vertical plane of the needles.

31. A welt knitting machine comprising in combination, a series of needles, a needle cylinder therefor, a series of cooperating jacks to receive loops for the formation of the welt, said jacks having closed eyes and hooks in advance of said closed eyes, a dial 55 supporting said jacks and having a depending sleeve-like portion 54 within the needle cylinder, a sleeve 49 within the dial and its sleeve portion 54, a rod 42 within the sleeve 49, means to move said rod axially, movable projections carried by the lower end of said rod 42 and opposed lugs depending from the needle cylinder, the shape of said projections and lugs being such as upon

engagement to effect a slight circumferential turning movement of the dial relative to the needle cylinder, thereby to move the closed eyes of said jacks from a circumferential position between the needles to a circumferential position in the vertical plane of the needles, together with a transferring cam 122 co-acting to project said jacks substantially as the dial is turned circumferentially, so as to project the closed eyes of said jacks radially sufficiently to bring them over the needles.

In testimony whereof, I have signed my name to this specification.

RAY FENN.