March 7, 1944. W. LARKIN 2,343,776

HORIZONTAL TUBE KNITTING MACHINE

Filed April 18, 1942 8 Sheets-Sheet 1

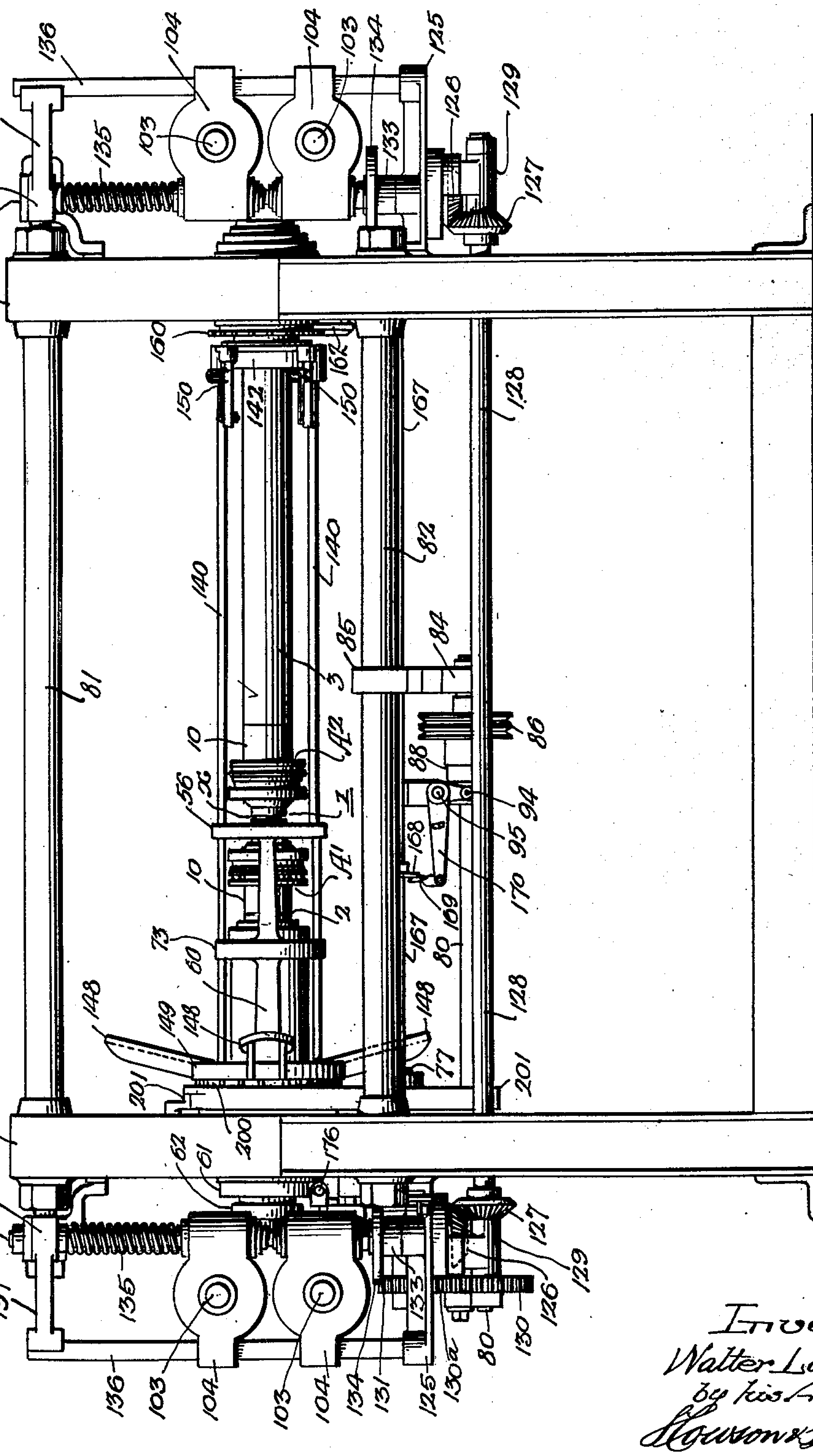

Fig. 1.

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HORIZONTAL TUBE KNITTING MACHINE

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Fig. 3.

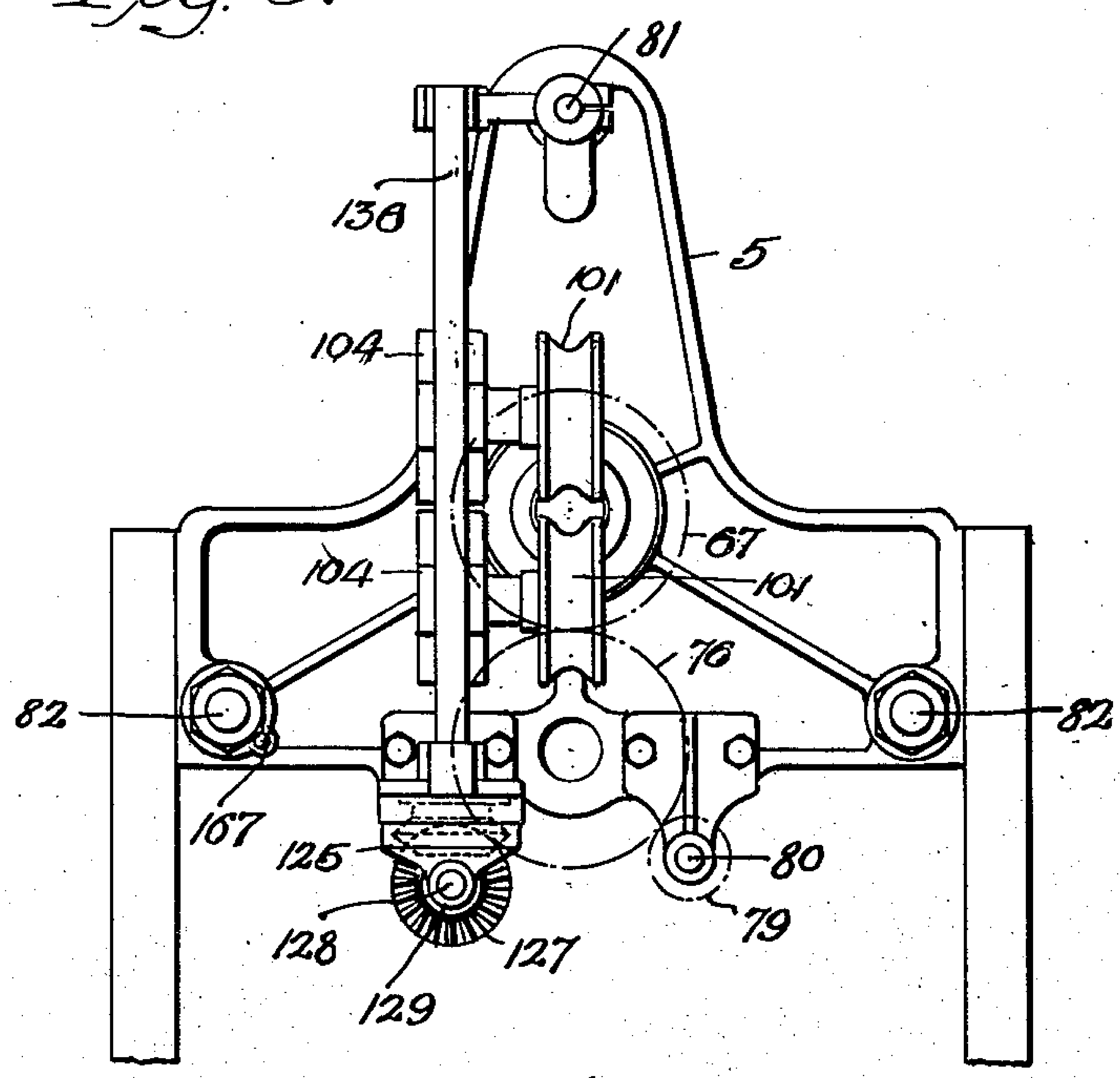
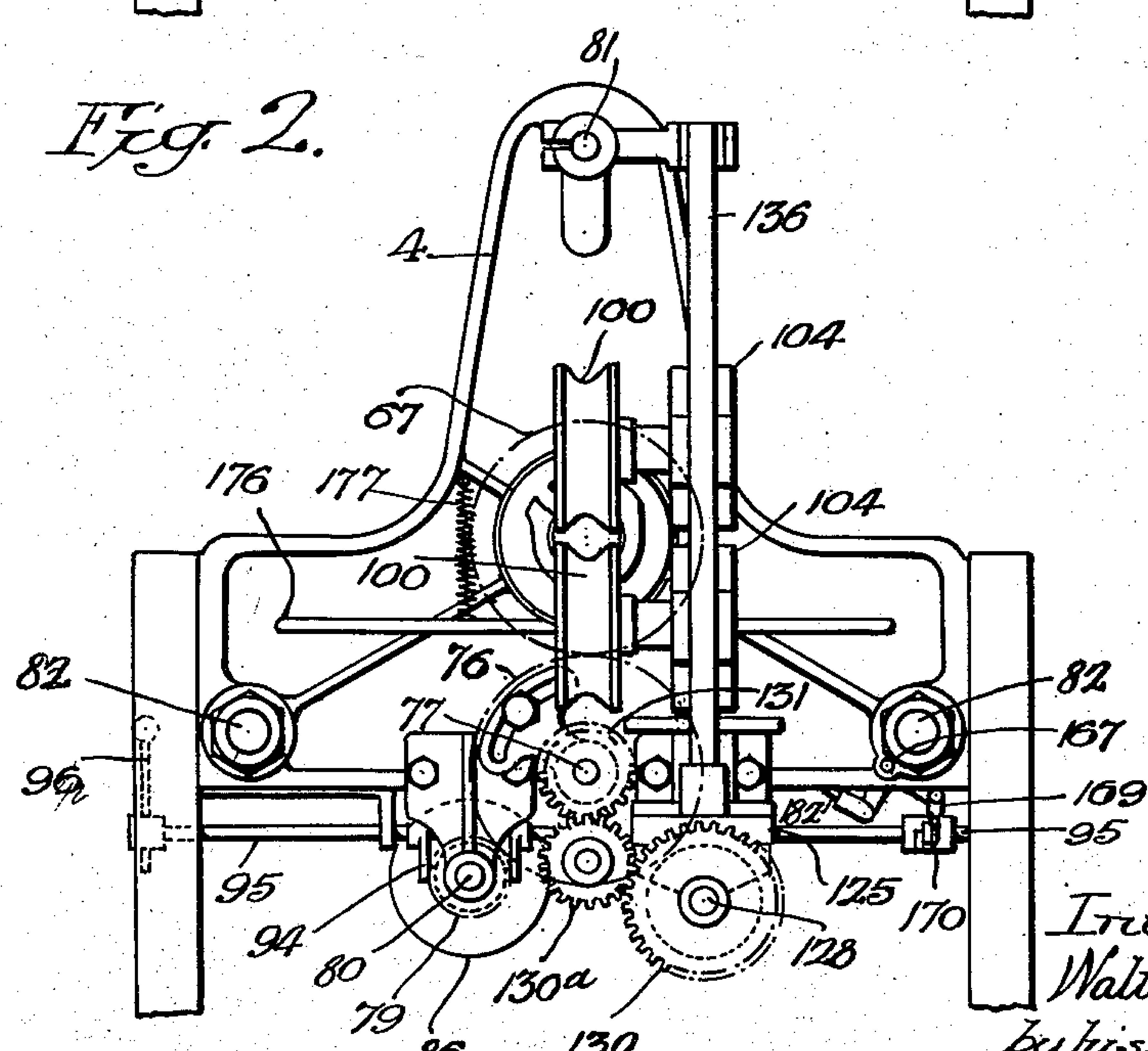


Fig. 2.



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HORIZONTAL TUBE KNITTING MACHINE

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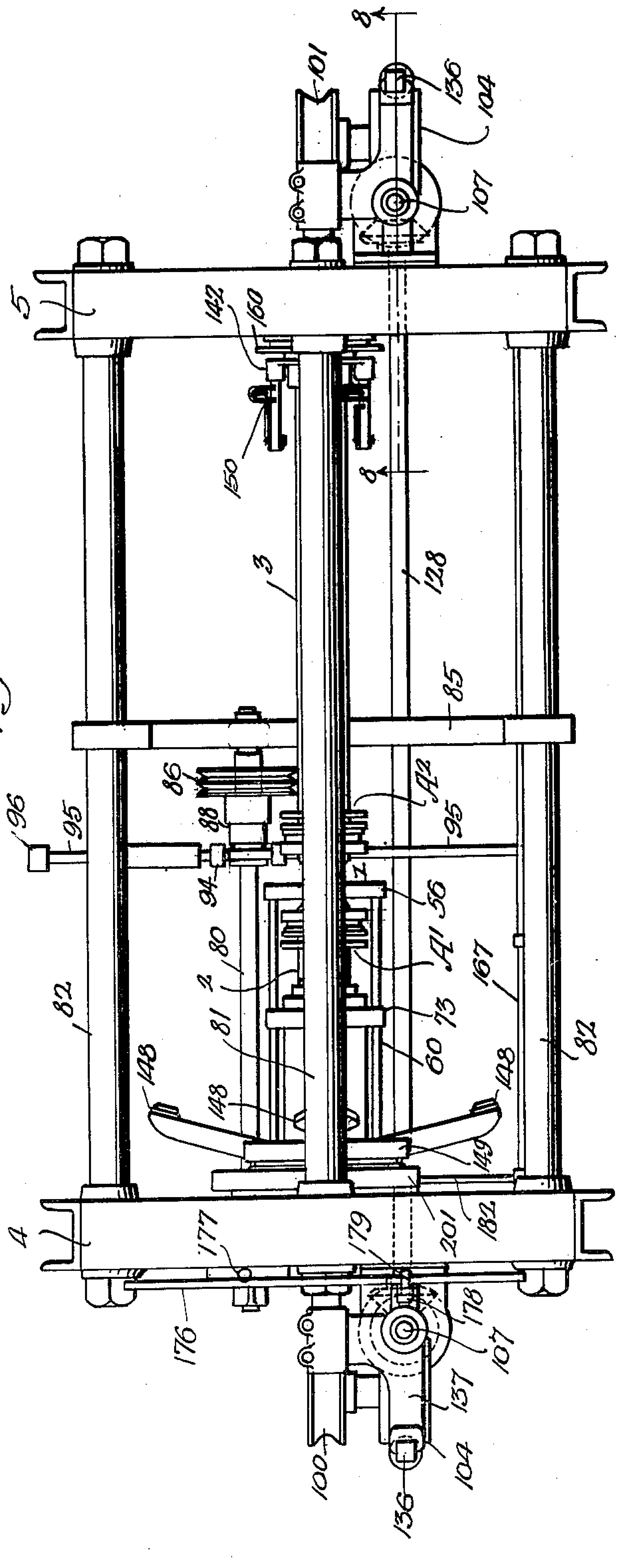
Fig. 4.



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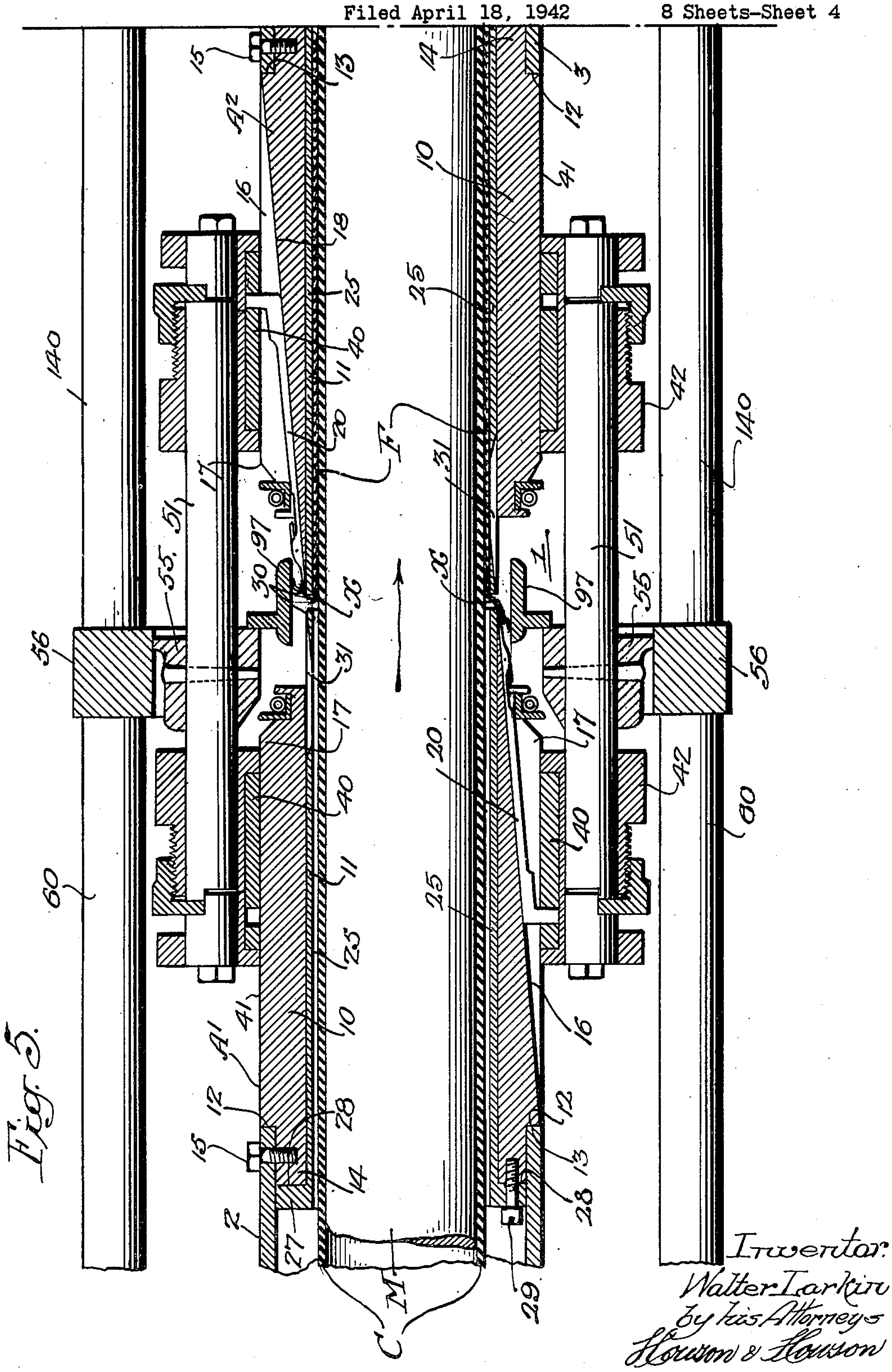
Fig. 5.
15
13
14
3
12
A2
10
41
16
18
25
40
11
20
F
31
140
42
17
51
97
30
X
55
56
60
I
80
A1
12
28
2
27
M
C
29
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HORIZONTAL TUBE KNITTING MACHINE

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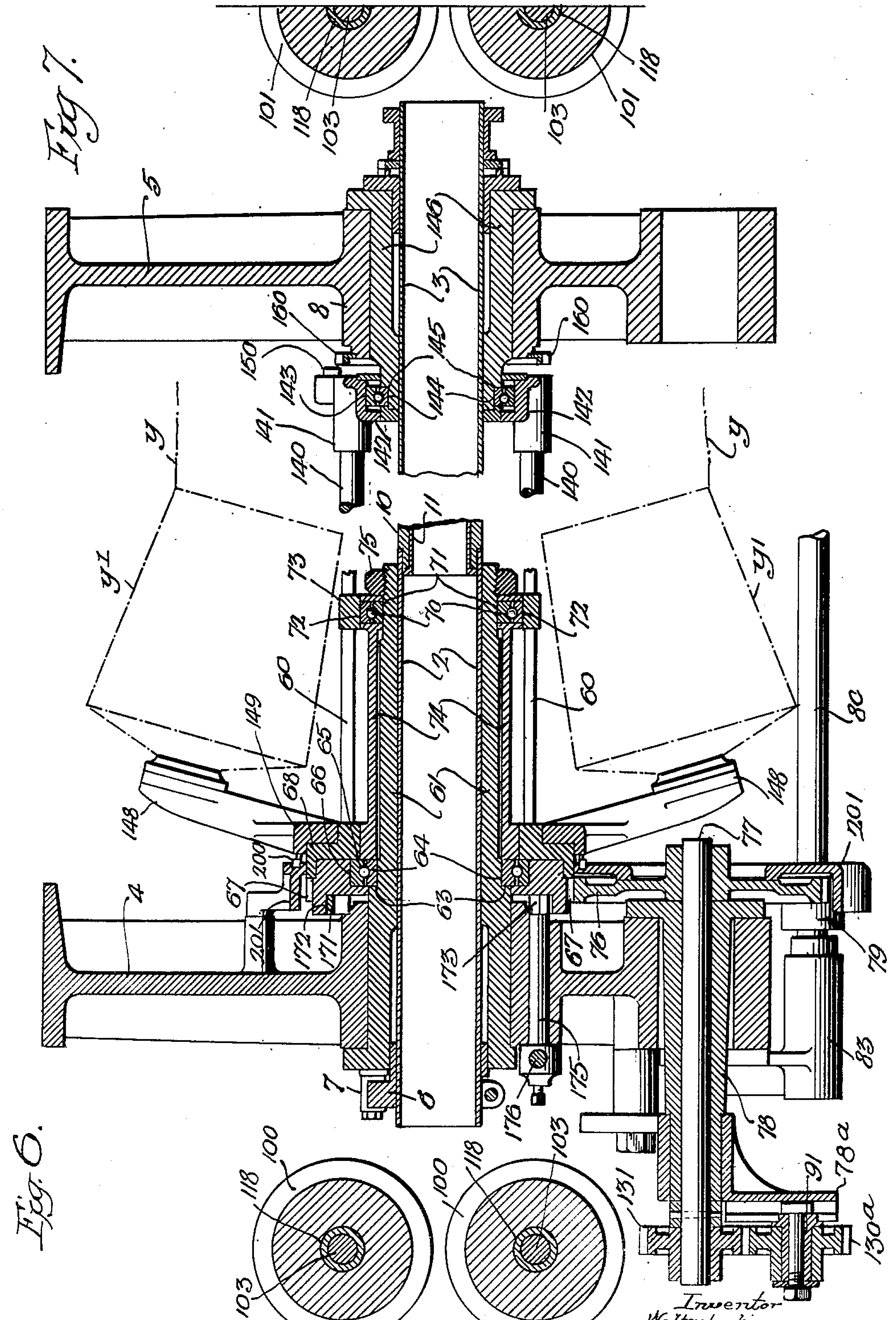

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HORIZONTAL TUBE KNITTING MACHINE

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Fig. 8

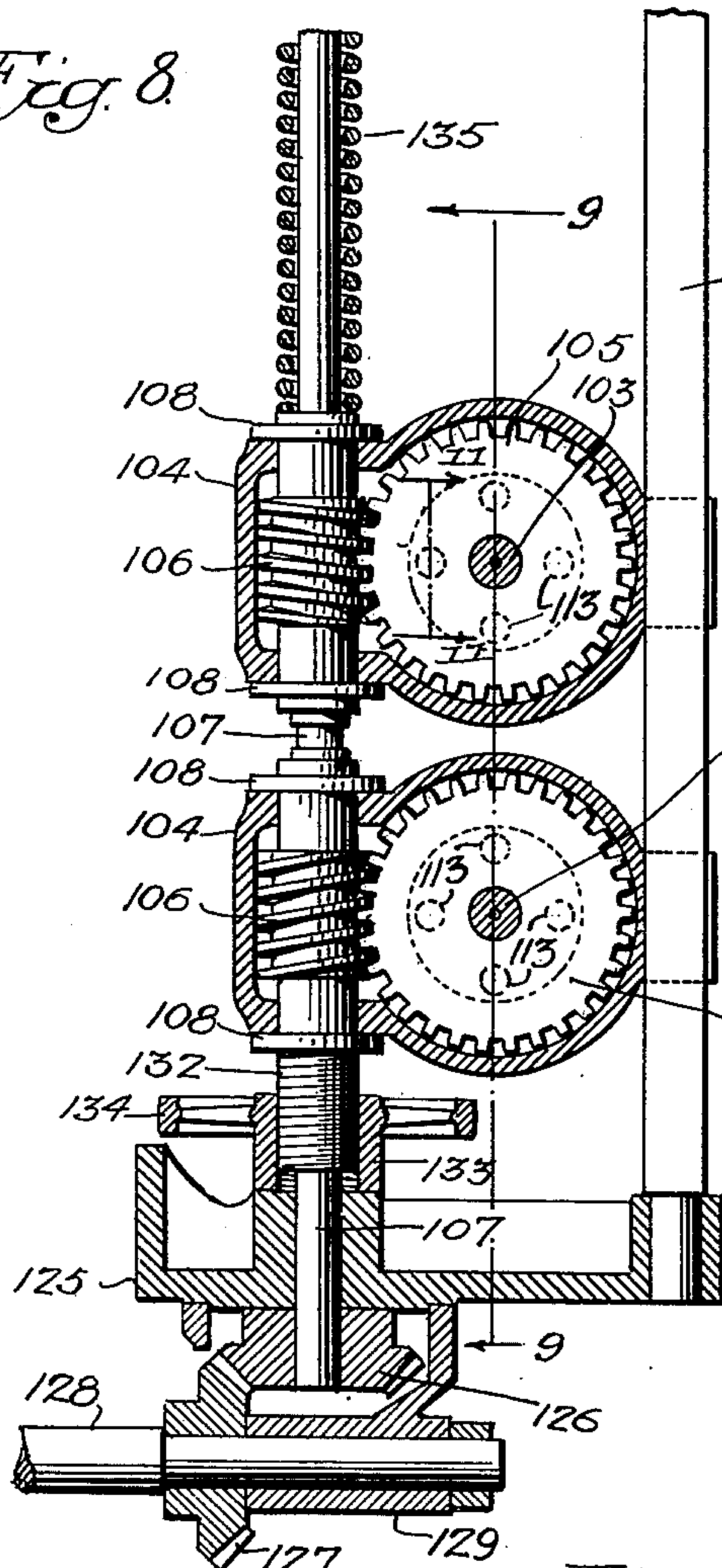


Fig. 9.

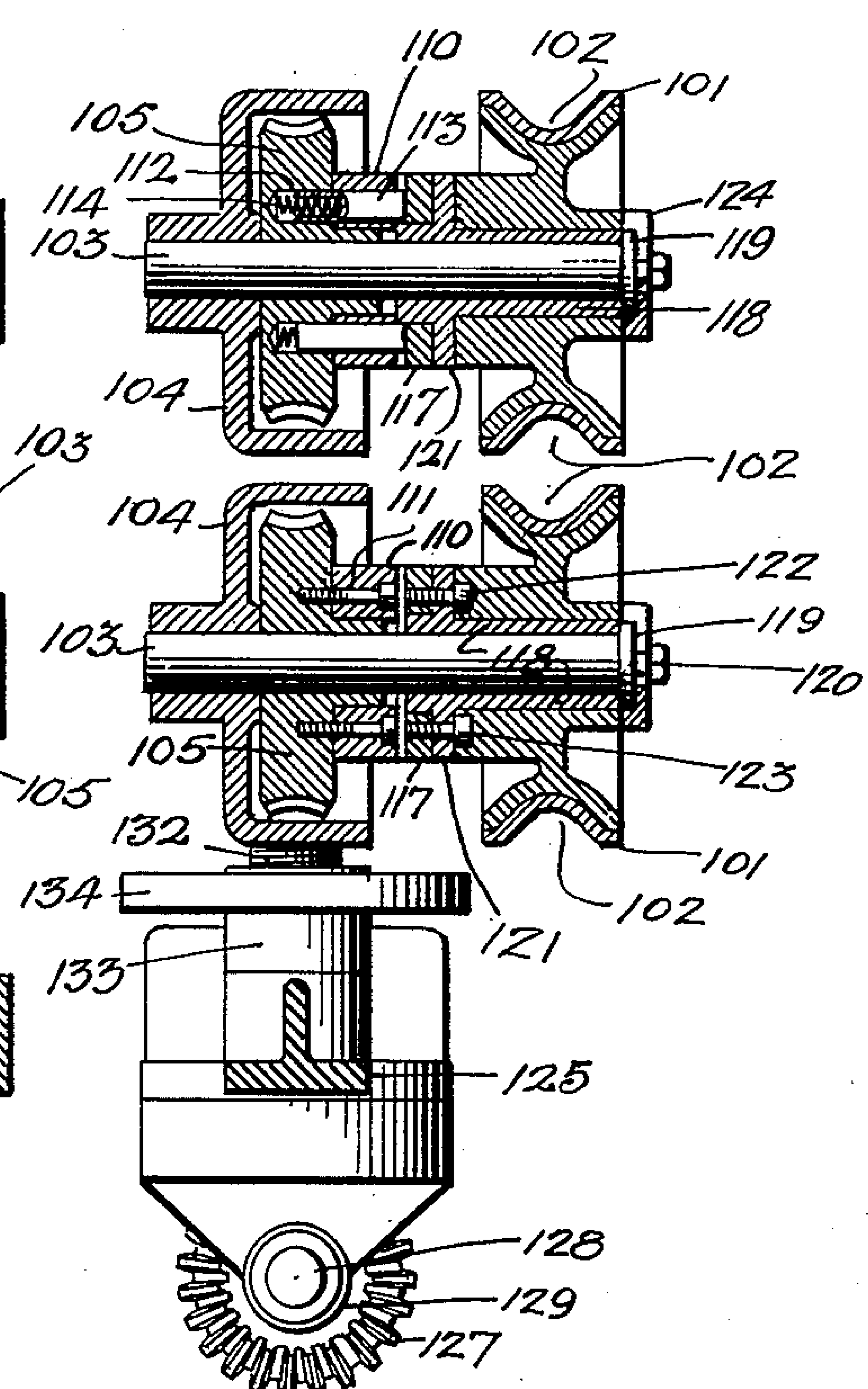


Fig. 10

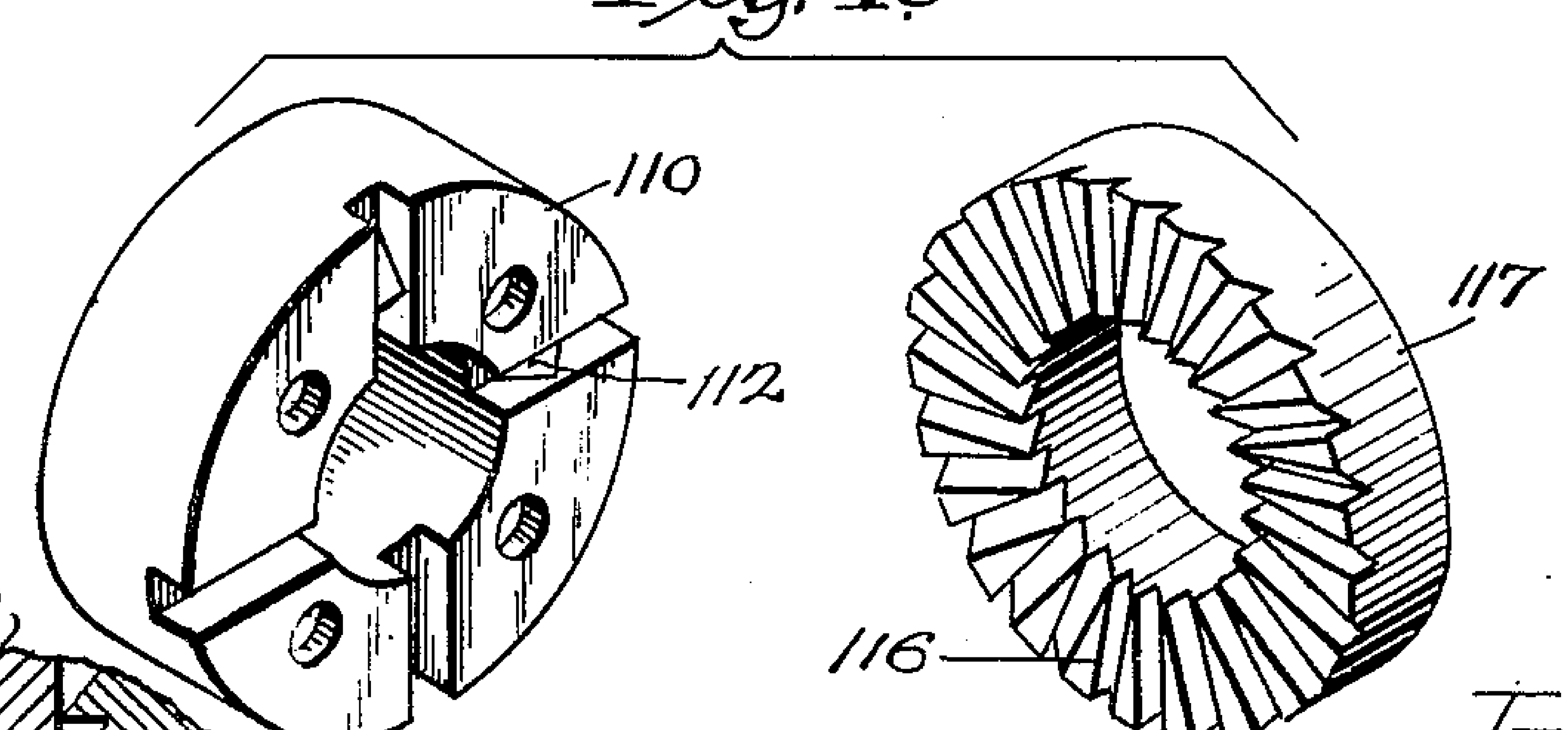
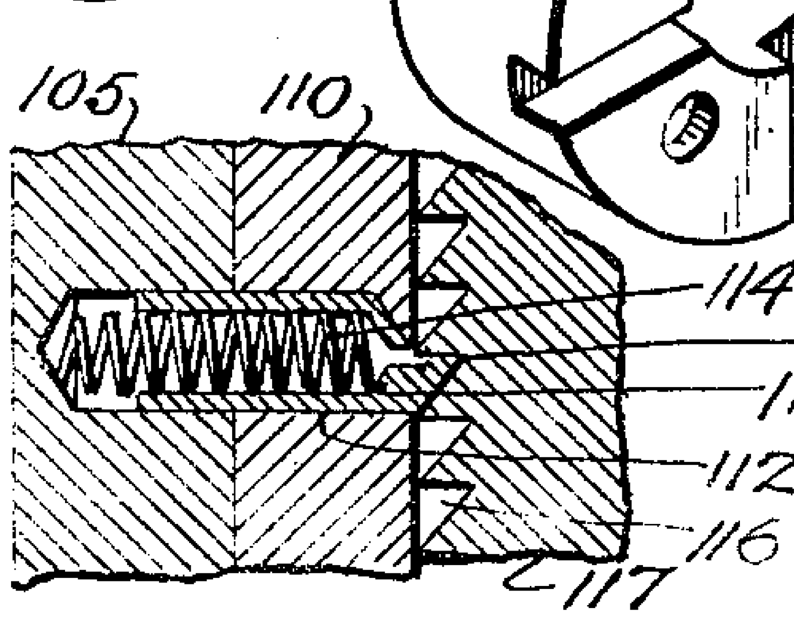


Fig. 11.



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HORIZONTAL TUBE KNITTING MACHINE

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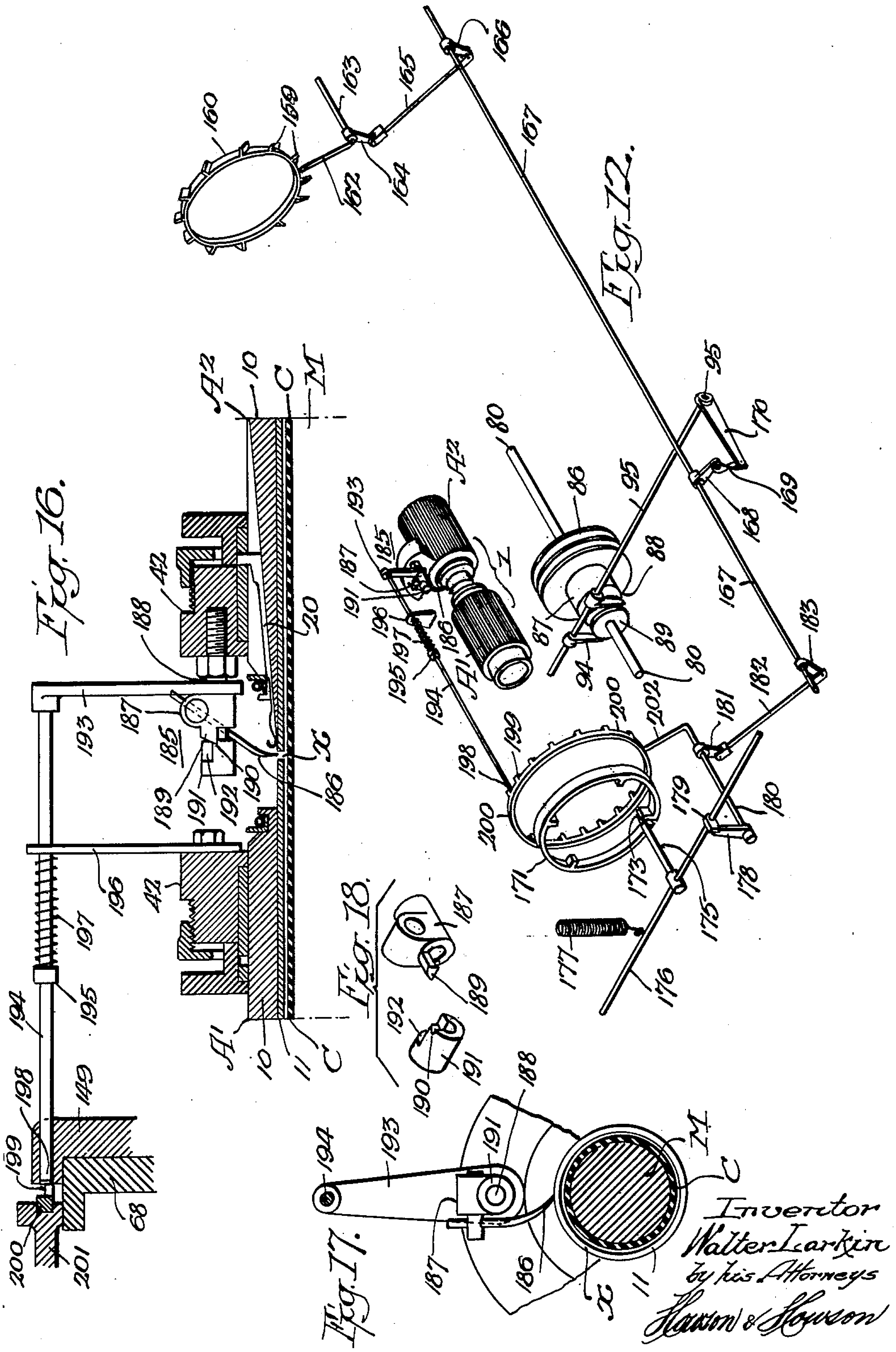

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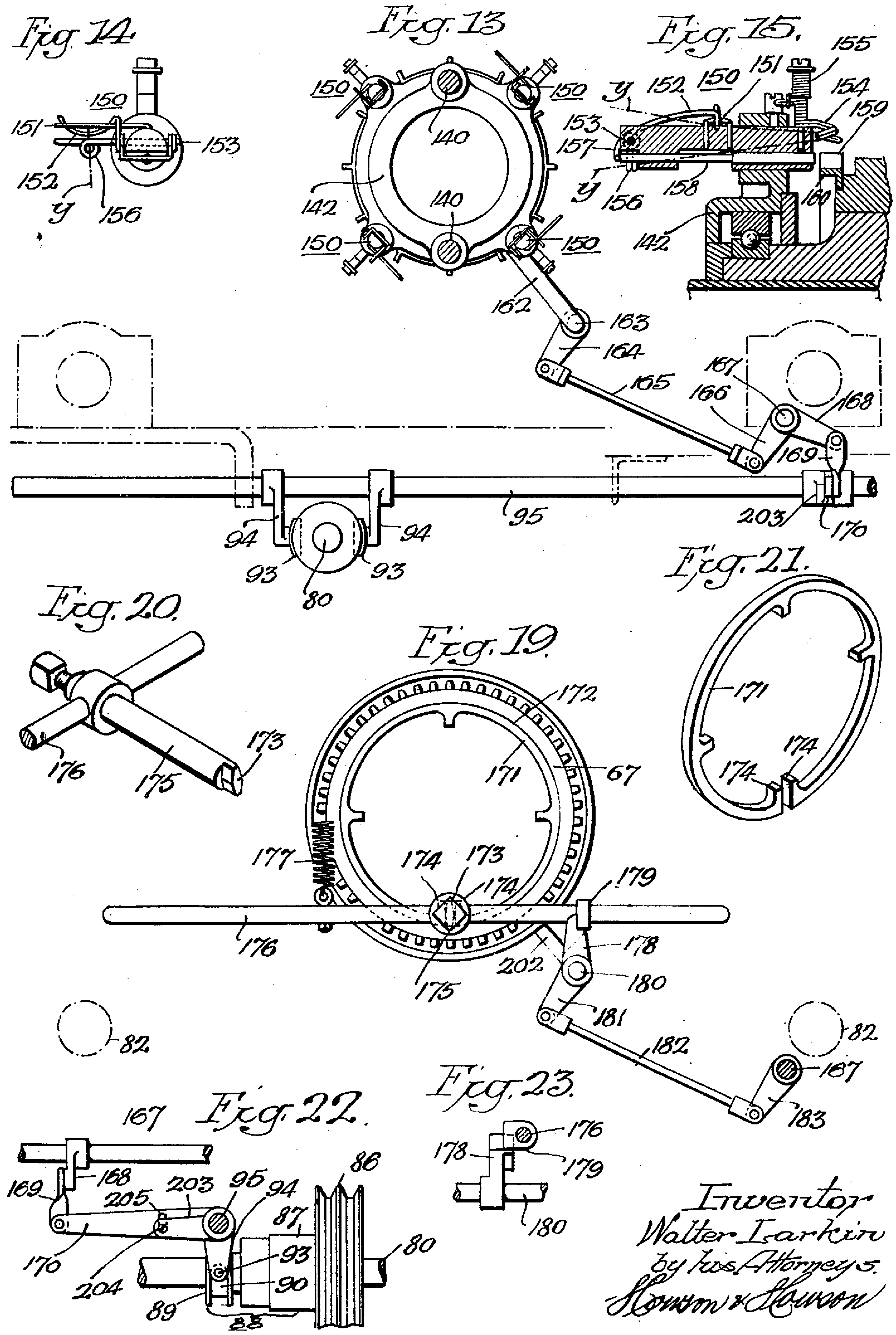

Patented Mar. 7, 1944

2,343,776

UNITED STATES PATENT OFFICE

2,343,776

HORIZONTAL TUBE KNITTING MACHINE

Walter Larkin, Norristown, Pa., assignor to Fidelity Machine Company, Philadelphia, Pa., a corporation of Delaware

Application April 18, 1942, Serial No. 439,572

4 Claims. (Cl. 66—9)

This invention relates to a machine for knitting a seamless tubular fabric jacket about a central core in the manufacture of rubber hose, flexible tubing, cable insulation, and so forth.

In the present instance, the invention is disclosed as being employed in the manufacture of rubber hose or flexible tubing according to the principles set forth in my prior U. S. Patent, No. 2,264,213, dated November 25, 1941, while using a knitting head of the type shown in my prior U. S. Patent No. 2,259,384, dated October 14, 1941.

The object of the present invention is to provide a knitting machine wherein the axis of the knitting head is disposed horizontally, or substantially so, to meet certain requirements in the manufacture of rubber hose, for example, wherein a rubber core tube is first placed on or formed around a suitable mandrel having the form of a longitudinally elongated rod-like structure, and wherein a fabric reinforcement is placed or formed around the core tube, prior to the application of an outer layer of rubber thereto, while the mandrel, due to its length and rigidity, is necessarily retained in a horizontal position.

In the present instance, the fabric reinforcement is knitted around and in close contact with the outside of the core tube, while the mandrel advances longitudinally through the knitting machine in a horizontal plane.

In the present instance, the knitting machine includes a novel feeding means and take-off means for controlling the passage of the mandrel and the core tube into one end of, through, and out the opposite end of the knitting head; it being noted that these mandrels are normally in excess of 50 feet in length for making rubber hose in 50 foot sections. However, these lengths may be increased or decreased according to requirements without departing from the spirit of the invention.

The construction and operation of the machine will be fully disclosed hereinafter, references being had to the accompanying drawings of which:

Fig. 1 is a side elevation;

Fig. 2 is a left end elevation;

Fig. 3 is a right end elevation;

Fig. 4 is a plan view;

Fig. 5 is a sectional elevation of the knitting head, enlarged;

Fig. 6 is a sectional elevation, enlarged, of the feed end of the machine;

Fig. 7 is a sectional elevation, enlarged, of the take-off end of the machine;

Fig. 8 is a sectional elevation of the driving mechanism for the take-off rolls, the section being taken on the line 8—8, Fig. 4;

Fig. 9 is the sectional view taken on the line 9—9, Fig. 8;

Fig. 10 is a detached perspective view of the ratchet clutch drive for the take-off rolls;

Fig. 11 is a sectional view through th ratchet clutch shown in Fig. 10, taken on the line 10—10, Fig. 8;

Fig. 12 is a diagrammatic perspective view of a stop motion employed in the machine;

Fig. 13 is an end elevation, partly in section, of the broken thread detecting mechanism of the stop motion;

Figs. 14 and 15 illustrate details of the apparatus shown in Fig. 13;

Fig. 16 is a partial sectional elevation illustrating the broken needle or knot detecting mechanism of the stop motion;

Figs. 17 and 18 illustrate details of the apparatus shown in Fig. 16;

Fig. 19 is an end elevation of the brake mechanism of the stop motion;

Figs. 20 and 21 illustrate details of the apparatus shown in Fig. 19; and

Figs. 22 and 23 illustrate details of the power clutch mechanism of the stop motion.

As previously noted, the knitting head of the present machine corresponds with that disclosed in the aforesaid U. S. Patent No. 2,259,384, and is particularly adapted for knitting tubes of relatively small diameters, with the stitch wales of the fabric disposed in close lateral relation to each other, to produce a compact fabric in close firm contact with the rubber core tube C carried by the mandrel M as the two move concurrently through the knitting head 1.

The knitting head 1 is supported at one end by a tubular shaft 2, and at its opposite end by a tubular shaft 3; said shafts being in axial alignment with each other and rigidly supported by end frames 4 and 5 of the machine (see Figs. 6 and 7). The knitting head (see Fig. 5), comprises a pair of identical needle cylinder units A^1 and A^2, respectively secured, at one end of each unit, to the tubular shafts 2 and 3.

Each of the cylinder units A^1 and A^2 comprises an outer part 10 and an inner part 11, concentrically arranged. The outer part 10 is in the form of a hollow cylinder or sleeve and is provided with an annular shoulder 12 which is adapted to rest against the inner end 13 of the tubular shaft 2 or 3, as the case may be. Beyond the shoulder 12, each outer cylinder element 10 is reduced in diameter to form a neck 14, which is adapted to fit snugly into the supporting tube 2 or 3. Any suitable means may be provided for securing the outer cylinder element 10 to its supporting tubular shaft such, for example, as by screws 15.

Each of the outer cylinder elements 10 is provided, on its outer peripheral surface, with a plurality of axially extending needle grooves 16, in planes radiating from the axis of said element. The grooves 16, 16 are spaced apart circumferentially of the element 10, with partitions 17, 17 therebetween. The base surfaces 18 of the needle grooves 16 are disposed at an angle to the axis of the element 10 and converge toward a work slot x formed by and between the adjacent ends of the inner parts 11, 11 of the units A^1 and A^2, respectively.

The inner element 11 of each of the cylinder units A^1 and A^2 is composed of a relatively thin tube 25, which is adapted to fit snugly within the interior bore of the outer element 10. One end of the tube 25 in each instance is provided with an annular flange 27 which is adapted to bear against the end surface 28 of the neck 14, to which said flange is secured by screws or bolts 29.

The opposite end of each of the inner elements 11, i. e., the end adjacent the work slot x, is circumferentially beveled, as indicated at 30, on an angle corresponding to that of the base surfaces 18 of the needle grooves 16 in the outer element 10, for supporting the needles 20, immediately adjacent the work slot x, when said needles are moved longitudinally in the slots 16, with their hooked ends crossing the work slot x during the knitting operation.

Beyond the beveled surface 30, each inner element 11 is provided with a plurality of circumferentially spaced longitudinally extending recesses or slots 31. The slots 31 in each of the units A^1 and A^2 are positioned in alignment with the needle grooves 16 of the other of said units, to receive the hooked ends of the needles 20 when projected across and beyond the work slot x.

As a result of the above construction, a fabric tube F is knitted in close firm contact with the rubber core tube C, with the stitch wales in close laterally spaced relation to each other to form a close compact fabric around the core tube.

As shown in Fig. 5, the needles 20, 20 are reciprocated in their slots 16, 16, to effect the knitting operation, by ordinary cylindrical cams 40, 40 rotating on the outer peripheral surfaces 41 of the needle cylinder elements 10, 10. The cams 40 are secured, in the usual manner, in cam rings 42, 42. Rotation of the cam rings 42, 42, in unison, is effected by means of posts 51, 51 which are secured in and project in opposite directions from a ring 55. The ring 55 is secured to a ring 56 which forms part of a rotating frame 60, which revolves about the axis of the tubular shaft 2.

As shown in Fig. 6, the tubular shaft 2 is slidably mounted in a sleeve bracket 61, carried by the end frame 4. Secured to tubular shaft 2, is a ring 6 which is engaged by a clamp 7 for securing the tubular shaft 2 in position. Axial adjustability of the shaft 2 is thus permitted for accurately determining the width of the work slot x. The bracket 61 is provided with an annular shoulder 63, against which the inner race 64 of a ball bearing 65 rests. The outer race 66 of the ball bearing 65 is fitted in an annular recess formed in a ring gear 67. The rotating frame 60 is provided with an annular base 68 which is secured to the ring gear 67, and by which rotation of the cam rings 42, 42 is effected through the ring 56 of the rotary frame 60.

The rotary frame 60 is supported for rotation about the tube shaft 2, adjacent the knitting head 1, by a ball bearing 70, the inner race 71 of which is fitted on the sleeve bracket 61 while the outer race 72 of the ball bearing 70 is fitted in a ring 73 forming part of the rotary frame 60. The ball bearing 70 is spaced from the ball bearing 65 by a sleeve 74, and the ball bearings 65 and 70 are held in position, against axial movement, by a nut 75 threaded onto the projecting end of the sleeve bracket 61. The inner race 64 of the bearing 65 is thereby held firmly against the annular shoulder 63 of the sleeve bracket 61.

The ring gear 67 meshes with an idler gear 76, which is secured to one end of a shaft 77. The shaft 77 is rotatably mounted in a bearing 78 carried by the end frame 4. The idler gear 76 meshes with a pinion 79 (see Fig. 2) secured to the main drive shaft 80 of the machine.

The end frames 4 and 5 are held in laterally spaced relation to each other by an upper spacer rod 81 and a pair of lower spacer rods 82, 82 (see Fig. 1). One end of the drive shaft 80 is rotatably mounted in a bearing 83 carried by the end frame 4, while the opposite end of said shaft is rotatably mounted in a bearing 84 carried by or forming part of a bracket or a cross frame 85 which is supported by the spacer rods 82, 82, intermediate the end frames 4 and 5.

Rotatably mounted on the drive shaft 80 (see Fig. 22), is a driving pulley 86, which carries one element 87 of a clutch 88, such for example, as a disc clutch of any suitable kind. Splined to the shaft 80 is a second member 89 of the clutch 88 by which the clutch discs may be engaged and disengaged. Power may be supplied to the driving pulley 86 from any suitable source.

The clutch element 89 is provided with the circumferentially extending groove 90 for the reception of inwardly projecting elements 93 which are carried by clutch release levers 94 on a clutch controlling shaft 95. The control shaft 95 extends transversely of the machine and is mounted in suitable bearings carried by the frame 85, located intermediate the end frames 4 and 5. The control shaft 95 is also provided with a suitable control handle 96 (Fig. 2).

Knitting yarn is supplied to the needles 20, 20 by one or more thread guides 97 mounted on the rotating ring 55 by which the cams 40 are rotated about the cylinder units 10 (Fig. 5).

In the present instance, the core element C is placed on or formed around the elongated mandrel M, prior to being inserted into the one end of the knitting machine. The encased mandrel is then axially aligned with the knitting head 1, and is supported in such position, by any suitable means, at the left end of the machine, as viewed in Fig. 1. The encased mandrel is then moved axially until the leading end thereof is engaged by and in the bight of a pair of feed rolls 100, 100 (Fig. 6) which are located outside the end frame 4. The rolls 100, 100 advance the encased mandrel through the tubular shaft 2 into and through inner elements 11, 11 of the knitting head 1, and through the tubular shaft 3 into the bight of a pair of take-off rolls 101, 101 located outside the opposite end frame 5 (Fig. 7).

The feed rolls 100 and the take-off rolls 101 are of similar construction and are positively driven by similar means, one of which is disclosed in Figs. 8 to 11, inclusive. As shown in

Fig. 9, these rolls are provided with circumferential grooves 102, 102, shaped and sized to obtain a firm purchase on the outer surface of the assemblage carried by the mandrel M. For example, in the case of the feed rolls 100, the rubber core element C would be engaged by the transversely curved surfaces of the circumferential grooves 102, 102 with sufficient force to advance the mandrel and the core tube through the knitting head 1, at a uniform rate of speed, in accordance with the knitting speed of the head 1, i. e., the number of courses produced per minute by said head. In this manner, the fabric tube F is formed around and along the length of the core tube C.

In the case of the take-off rolls 101, 101, these rolls would engage the fabric tube F, and rotate in unison with the feed rolls 100 to advance the mandrel, and its assemblage, in the manner noted, until the tail end of the mandrel passed from between the feed rolls 100, 100, after which the axial movement of the mandrel, etc., would be effected entirely by the take-off rolls, 101, 101.

Preferably, however, the mandrels are fed into the machine in immediate succession, with the head end of one mandrel butting against the tail end of the preceding mandrel and for all intents and purposes forming a direct continuation thereof, in order that the knitting operation may proceed uninterruptedly. After each mandrel and its assemblage passes out of the bight of the take-off rolls 101, 101, the outer fabric jacket F may be severed to release the mandrel from the next succeeding one.

In each instance, each roll 100 and 101, as the case may be, is rotatably mounted on a fixed stud shaft 103 carried by an adjustable housing 104. Loosely mounted, for free rotation, on each stud shaft 103 is a worm wheel 105. Each worm wheel 105 is driven by a worm 106 which is rotatably mounted in the frame 104. Each worm 106 is splined to a vertical shaft 107 which passes through the pair of housings 104, 104 associated with the feed rolls 100, or the take-off rolls 101, as the case may be. The opposite ends of each of the worms 106 abut against flanged bearings 108, 108 which are secured in the housing 104, and by which axial movement of the worm 106 relative to the housing 104 is prevented in each instance. As the rolls 100, 100 or 101, 101 of each pair are moved toward or away from each other, to effect engagement with or disconnection from a mandrel passing through the machine, the housings 104, 104 with their enclosed worms 106, 106 will be correspondingly moved. In this manner, mandrels of various diameters may be readily handled by the machine.

Secured to each of the worm wheels 105 is a pawl carrier disc 110, secured thereto by screws 111. The worm wheel 105 and disc 110 in each instance are provided with axially aligned bores 112 in which are slidably mounted pawl plungers or detents 113 having springs 114 constantly urging the tooth-like ends 115 of the pawls 113 outwardly beyond the face of the disc 110. The ends 115 of the pawls 113 are adapted to engage ratchet teeth 116 formed in one face of a ratchet disc 117.

Each ratchet disc 117 is carried by a hub element 118, in the form of a sleeve, which is freely rotatably mounted on the stud shaft 103. A washer 119, secured by screw 120 to the end of the stud shaft 103 prevents outwardly axial movement of the hub sleeve 118 on the stud shaft 103. Each hub element 118 is provided with a flange 121, against which the ratchet disc 117 is fitted and held by screws 122. The heads of the screws 122 project outwardly beyond the flanges 121 in a direction parallel to the axis of the stud shafts 103, to enter recesses 123 formed in adjacent end faces of the rolls 100 or 101, as the case may be, whereby each roll is keyed to its associated hub element 118 for rotation therewith. The roll is detachably held against axial movement on the hub sleeve 118 by a washer 124, held in place by the screw 120.

The drive shaft 107 for each pair of worms 106, 106, is rotatably mounted at its lower end in a bracket 125 carried by the end frame 4 or 5, as the case may be. Secured to the lower end of each of the vertical drive shafts 107 is a miter gear 126. Each gear 126 meshes with a miter gear 127 secured to a horizontal feed shaft 128 which is rotatably mounted in bearings 129 carried by the brackets 125, 125.

The feed shaft 128 is rotated at a predetermined rate of speed, with respect to the speed of rotation of the cam rings 40 of the knitting head 1, in order to synchronize the axial movement of the mandrel M etc. with the rotations of the cam rings 40 for producing the desired number of courses of stitches per inch, longitudinally of the mandrel.

In the present instance, the feed shaft 128 is provided, on one end, with a gear 130 which meshes with the gear 131 on the shaft 77 through an idler gear 130*a* (see Fig. 2). The shaft 77, as previously noted, is rotated from and by the main shaft 80 through the gears 79 and 76. The ratio of the gears 130, 130*a* and 131 may be varied to suit the spacing of the stitch courses, as desired. Obviously, any suitable speed change mechanism may be substituted for the changeable gears 130 and 131, as desired, for accomplishing the same purpose. In the present instance, the idler gear 130*a* is rotatably mounted on a pivot stud 91 which is radially adjustable to the shaft 77 on a bracket 78*a* which is rotatably adjustable on the bearing 78.

In order that the rolls 100 and 101 may receive mandrels of different diameters, or in order that rolls of different diameters may be employed to grip mandrels of different diameters, the lowermost bushing 108 of each of the housings 104 is provided with a screw threaded extension 132 on which is threaded a nut 133. Each of the nuts 133 is provided with a hand-wheel 134, by which the nut may be turned to raise or lower the housing vertically, until the center of radius of the transverse curvature of the circumferential groove of the lower feed or take-off roll, as the case may be, coincides with the axis of the knitting head 1.

The upper housing 104, in each instance, is adapted to slide freely along the shaft 107 with a spring 135 tending to force the housing, and the roll carried thereby, downwardly until the roll makes contact with the mandrel, thereby providing the necessary grip or bight between the cooperating feed or take-off rolls.

The worm gear housings 104 are guided in their vertical movements along the shafts 107 by posts 136 which are secured in the brackets 125 at their lower ends and in brackets 137 at their upper ends, the top brackets 137 being, in turn, secured to the end frames 4 and 5 and having bearings 138 for the upper ends of the shafts 107.

In order to steady the rotation of the frame 60 and the knitting cams, etc., carried thereby, the ring 56 of said frame is provided with axially extending rods 140, 140 which extend parallel to the axis of the knitting head, with the ends of the rods adjacent the end frame 5 secured in bosses 141 formed on a ring 142 (see Fig. 7). The ring 142 is provided with an annular cavity in which is mounted the outer race 143 of a ball bearing 144. The inner race 145 of the ball bearing 144 is mounted on one end of a sleeve 146 which is secured in the end frame 5 and provides support for the tubular stud shaft 3.

The knitting threads y are drawn from cones $y1$, $y1$, which are supported by arms 148, 148 projecting radially from a ring 149 secured to and rotatable with the rotating frame 60.

From the cones $y1$, the knitting threads y pass to broken or slack thread detectors 150 which are carried by the rotating ring 142 (see Figs. 13, 14 and 15). Each thread y passes under a slotted arm 151, formed by a wire bent into the form of a hair pin with the ends of its legs carried by the ring 142, and over a trip lever 152 which lies between said legs and is pivotally mounted at 153 on the ring 142. The trip lever 152 is held, by the thread y, against outward movement under centrifugal force produced by the rotation of the ring 142.

The thread y then passes around a tension or sweep arm 154, which is pivoted to the ring 142 and is rocked in one direction, to place the thread y under tension, by coiled spring 155. From sweep arm 154, the thread or yarn y passes through an eye 156 to one of the thread guides 97 carried by the ring 55, adjacent the work slot x.

The trip lever 152 is provided with a short arm 157 which bears against one end of an axially extending trip pin 158. The trip pin 158 is slidably mounted in the ring 142. The opposite end of the trip pin 158 is adapted to be projected into the path of one of a series of projections 159, which extend radially from a floating ring 160. The floating ring 160 is supported by, and is free to rotate on, one end of the bearing 8 on the end frame 5 in which the sleeve 146 for the tubular stud shaft 3 is mounted and secured against axial and rotary movement, (see Fig. 7).

Should one of the threads y break, while the knitting machine is in operation, or become excessively slack, the trip lever 152 will be released and will be swung outwardly by centrifugal force, causing the arm 157 thereof to slide the trip pin 158 axially until said pin projects outwardly beyond the ring 160. Continued rotation of the ring 142 would cause the trip pin 158 to engage one of the projections 159 on the floating ring 160 and thereby effect rotation of said floating ring.

As shown in Fig. 12, rotation of the floating ring 160 will cause one of the projections 159 thereon to engage a lever 162, thereby effecting a rocking motion of the lever 162 about its pivot shaft 163. A lever 164, which is secured to the pivot shaft 163 of the lever 162, is connected by a link 165 to a lever 166 which is secured to the stop motion shaft 167. Also secured to the stop motion shaft 167 is a lever 168, which is connected by a link 169 to the outer end of a clutch operating lever 170. The lever 170 is mounted on the clutch control shaft 95.

Thus, it will be seen that rotation of the floating ring 160 by one of the trip pins 158, through the mechanism just described, effects a rocking of the clutch shaft 95, and a consequent releasing of the clutch 88, by which the main shaft 80 of the machine is released from the driving pulley 86, stopping the machine.

In order to effect rapid stopping of the machine when the clutch 88 is released, an annular brake element 171, which is carried by the end frame 4 (see Fig. 6), is expanded into braking contact with a circular wall 172 formed in a recess in the ring gear 67. Expansion of the brake shoe 171 (see Figs. 19, 20 and 21) is effected by a substantially flat blade 173, which is formed on the inner end of a brake operating shaft 175, and is disposed between the substantially parallel ends 174, 174 of the brake shoe 171. The brake shaft 175 carries a lever 176, to which is secured one end of a brake spring 177.

Normally the brake applying lever 176 is held in an ineffective position by a latch 178, which bears against the under side of a block 179 secured to the lever 176. The latch 178 is secured to a short shaft 180, to which is also secured a lever 181. The lever 181 is connected by a link 182 to a lever 183, which is secured to the stop motion shaft 167.

From the above, it will be clear that when the stop motion shaft 167 is rocked to release the clutch 88, such motion will also cause the latch 178 to move from under the block 179 on the brake lever 176, whereupon said brake lever, under the influence of the spring 177, will rotate the brake shaft 175 and effect expansion of the shoe 171 into contact with the ring gear 67, which will result in a quick stopping of the machine.

The stop motion also includes means for releasing the clutch 88 and applying the brake 171, to stop the machine, if a needle breaks or if the knitting yarn piles up or knots at the work slot x. For this purpose, the machine is provided with a broken needle and knot detector 185 (see Fig. 16). This detector includes a pointed needle-like implement 186, which projects substantially into the work slot x to be engaged by any knots or needles which may be projecting across said slot in the path of the pointed implement 186 as the cam rings 42, 42 revolve about the cylinder units A^1, A^2.

The detecting implement 186 is carried by a block 187, which is slidably mounted on a stud 188 carried by one of the cam rings 42. The block 187 is provided with an axial projection 189, with an outer beveled end normally seated in a notch 190 formed in the head 191 on the outer end of the stud 188.

Should the detecting implement 186, during its rotary movement about the axis of the cylinder units A^1, A^2, strike a broken needle or a knot in the work slot x, the inner end of the implement 186 will be stopped by such interception, while the cam ring 42 continues to revolve. Thus, the block 187 will be caused to rotate about the stud 188 and dislodge the projection 189 from the notch 190 in the stud-head 191, bringing the projection 189 into alignment with a recess 192 of the head 191, whereby axial movement of the block 187 relative to the stud 188 is permitted.

The block 187 is provided with an arm 193, the outer end of which is connected to one end of a rod 194. The opposite end of the rod 194 is slidably mounted in the base ring 149 of the bobbin carrier. The rod 194 is provided with a collar 195, between which and a fixed abutment 196, carried by the second of the cam rings 42, is a spring 197. When the block 187 rotates on the stud 188, in the manner previously noted, the spring 197 slides the rod 194 axially, causing the end 198 thereof to be projected into the path of a series of lugs 199 which are formed on a floating ring 200. The ring 200 is rotatably mounted in the outer surface of a casing 201 which is secured to the end frame 4 and normally conceals the gears 67, 76, and 79.

Also projecting between the lugs 199 and the floating ring 200 is a lever 202, which is carried by the shaft 180. When the end 198 of the trip rod 194 is projected between lugs 199 on the floating ring 200, while the cam rings 42, 42 are revolving, the trip rod 194 will engage one of the lugs 199 and effect rotation with the ring 200. Rotation of the ring 200 will rock the lever 202 and consequently the shaft 180, thereby operating the stop motion shaft 167 to throw without the clutch 88. At the same time the brake lever 176 will be released permitting the spring 177 to rotate the brake shaft 175 and thereby expand the brake shoe 171 into contact with the ring gear 67.

As shown in Fig. 22, and as previously noted, the lever 170 is mounted on the clutch controlling shaft 95. This lever, however, is not directly secured to said shaft, in order that the clutch control shaft 95 may be actuated manually, through the lever 96, to stop and start the machine without effecting the stop motion. For this purpose, the lever 170 is positioned adjacent a shorter lever 203, which is secured to the control shaft 95. The lever 203 is provided with a projection 204, which extends into an arcuate slot 205, formed in the lever 170. In this manner, the lever 203 is permitted sufficient movement relative to the lever 170 to disengage the clutch 88 without disturbing the lever 170. However, when the machine is in operation, the projection 204 of the lever 203 lies in the lower end of the slot 205 in the lever 170. Thus, any movement of the lever 170, as effected by the stop motion, will be applied to the lever 203 to rock the control shaft 95 and release the clutch.

I claim:

1. A circular knitting machine comprising a knitting head having an axial bore extending completely through said head, means supporting said head with its axis substantially horizontal, means for passing a core element axially through said bore comprising a pair of nip rolls at at least one end of said head, means for operating said head to knit a seamless tubular covering on said core element in transit through said head, means for driving one of said nip rolls in contact with one side of said core element, means for resiliently pressing the other of said nip rolls into contact with the opposite side of said core element to effect said advancing thereof, and means for adjusting the first of said nip rolls perpendicularly to the axis of said head to accommodate core elements of different diameters.

2. A circular knitting machine comprising a knitting head having an axial bore extending completely through said head, means supporting said head with its axis substantially horizontal, means for passing a core element axially through said bore, comprising a pair of nip rolls at at least one end of said head, means for operating said head to knit a seamless tubular covering on said core element in transit through said head, means for driving said nip rolls in contact with diametrically opposite portions of said core element, means for positively adjusting one of said nip rolls to align said core element with the axis of said head, and means resiliently pressing the second of said nip rolls into driving contact with said core element.

3. A circular knitting machine comprising a knitting head including a pair of axially aligned needle cylinder structures spaced apart axially to provide a work slot therebetween, a pair of tubular supports for and axially aligned respectively with said structures, a pair of spaced end frames supporting said tubular supports with the aligned axes of said tubular supports and said structures disposed horizontally, means for passing a core element axially through said supports and said knitting head, means for operating said knitting head to knit a seamless tubular cover about said core element through said work slot during transit of said element past said slot, and means for supporting one of said tubular supports for axial movement in its supporting end frame for governing the width of the work slot between the adjacent ends of the needle cylinder structures respectively supported by said tubular supports.

4. A circular knitting machine comprising a knitting head including a pair of axially aligned needle cylinder structures spaced apart axially to provide a work slot therebetween, a pair of tubular supports for and axially aligned respectively with said structures, a pair of spaced end frames supporting said tubular supports with the aligned axes of said tubular supports and said structures disposed horizontally intermediate said end frames, rotary frictional gripping means carried on the outside of said end frames beyond the outer open ends of said tubular supports for supporting and passing a rigid core element axially through said supports and said knitting head, and means for operating said knitting head to knit a seamless tubular cover about said core element through said work slot during transit of said element past said slot.

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