April 10, 1951 S. E. TRIBBEY 2,548,451

APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

Filed March 29, 1949 11 Sheets-Sheet 1

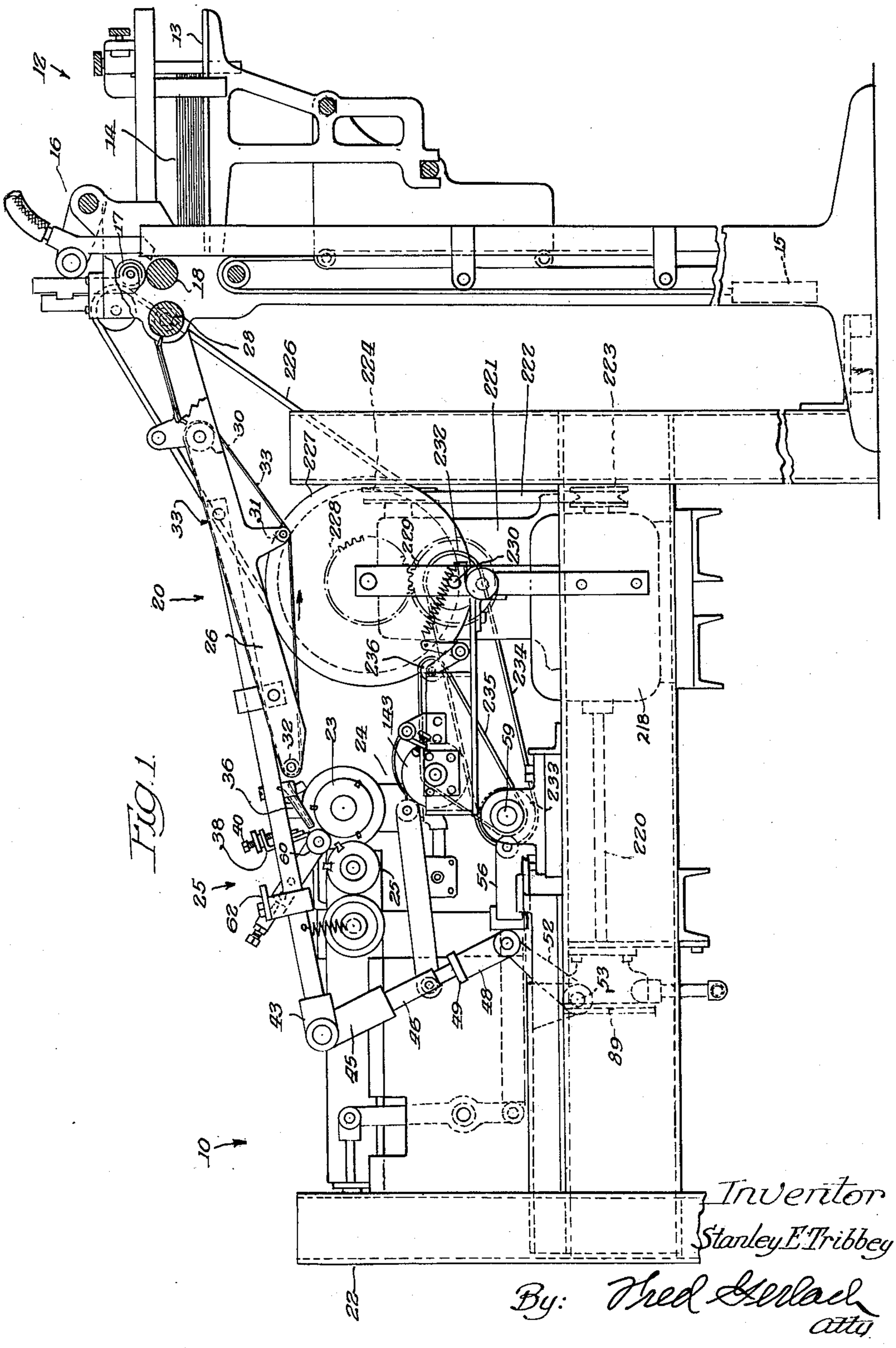

FIG. 1.

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APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

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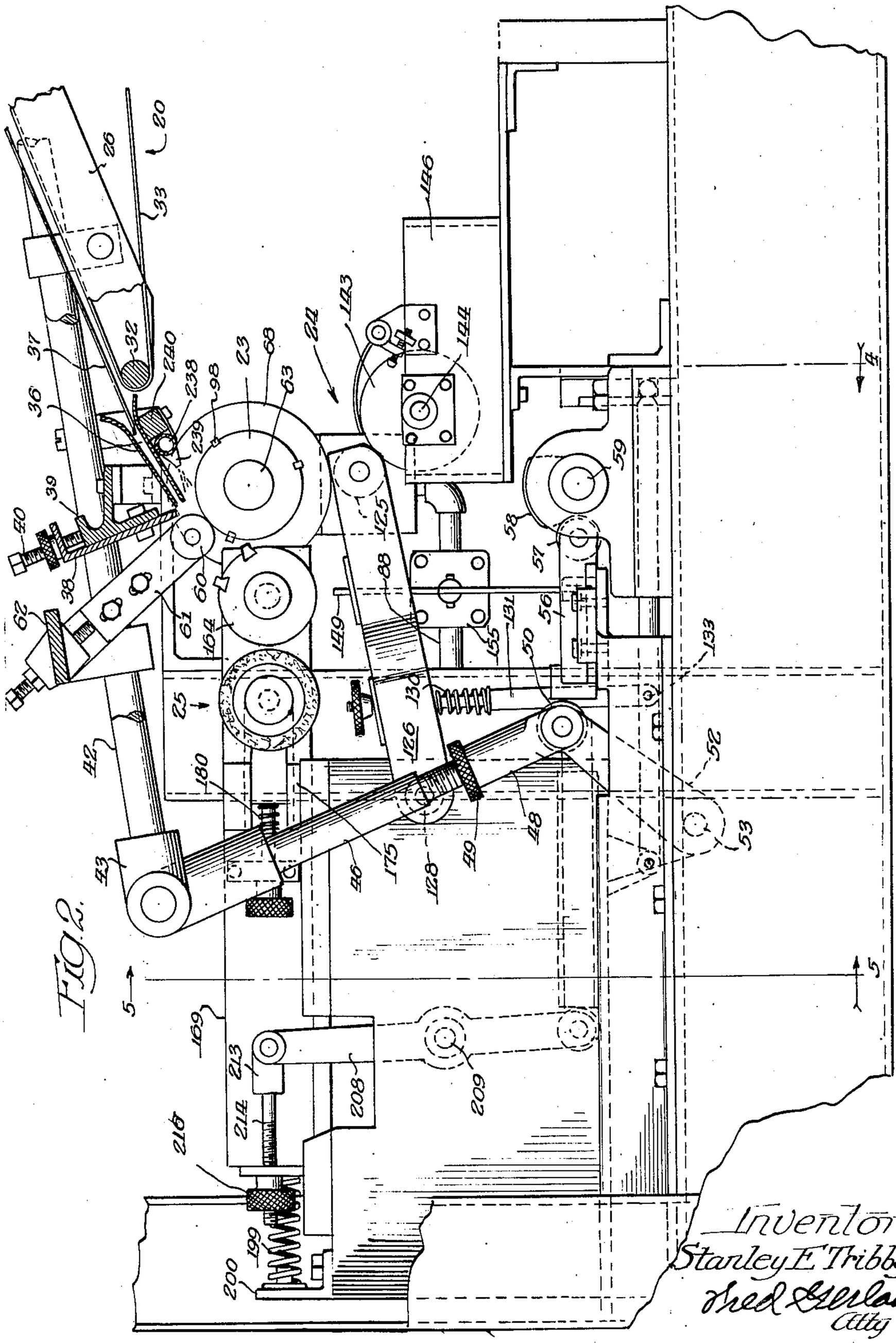

FIG. 2.

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APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

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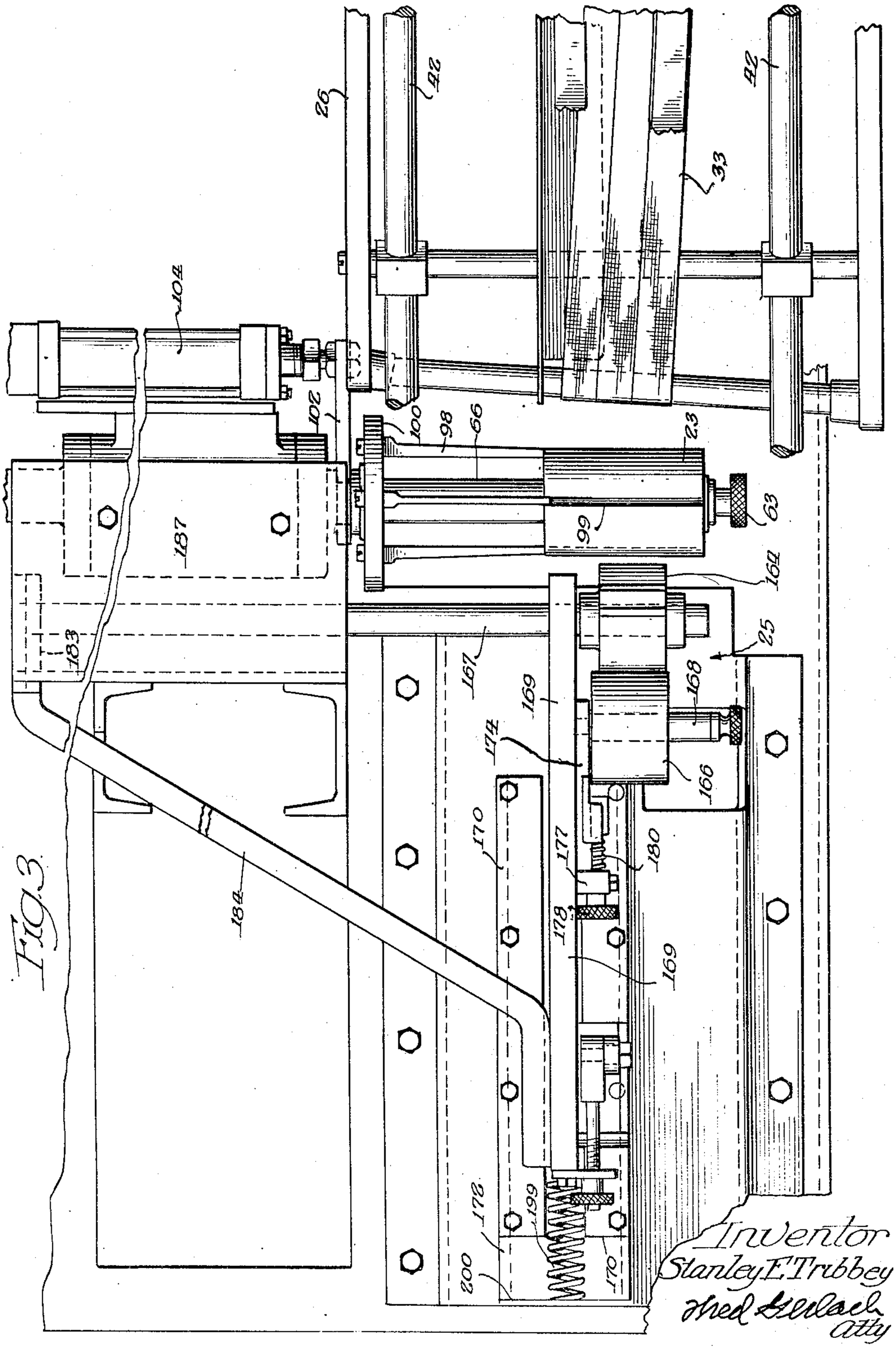

FIG 3

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FIG. 4

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APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

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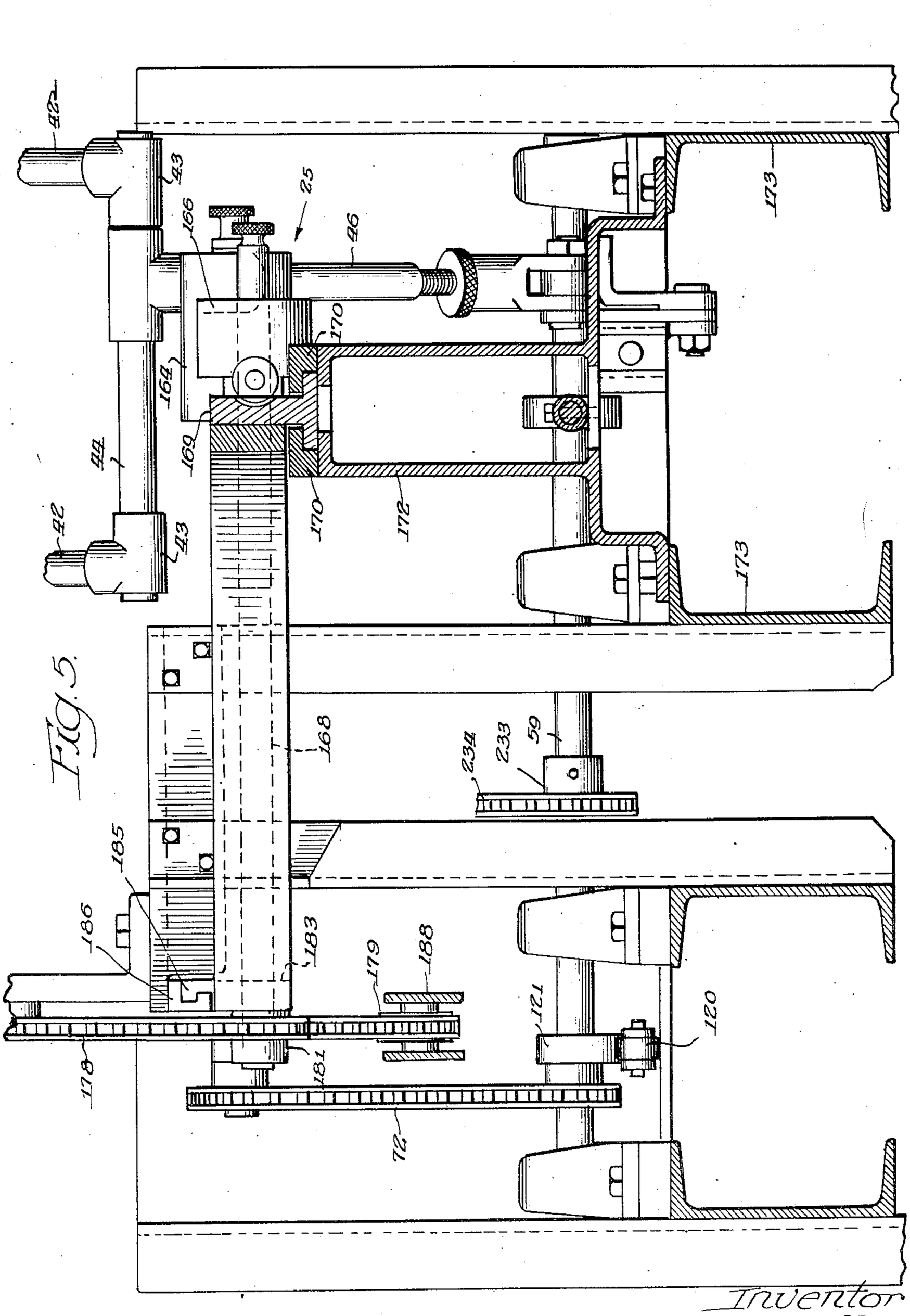

FIG. 5.

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APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

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Fig. 6

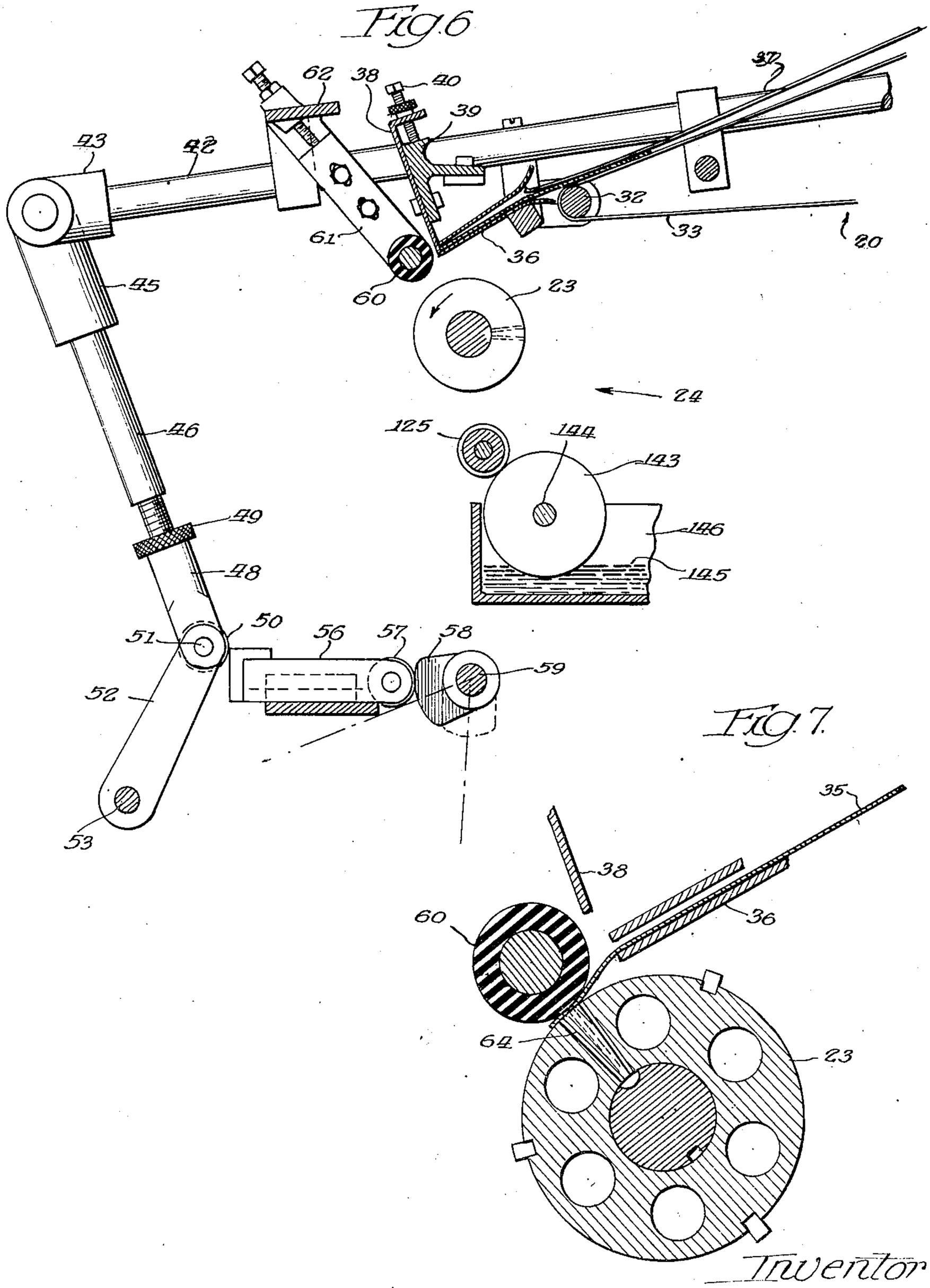

Fig. 7.

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APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

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Fig. 8.

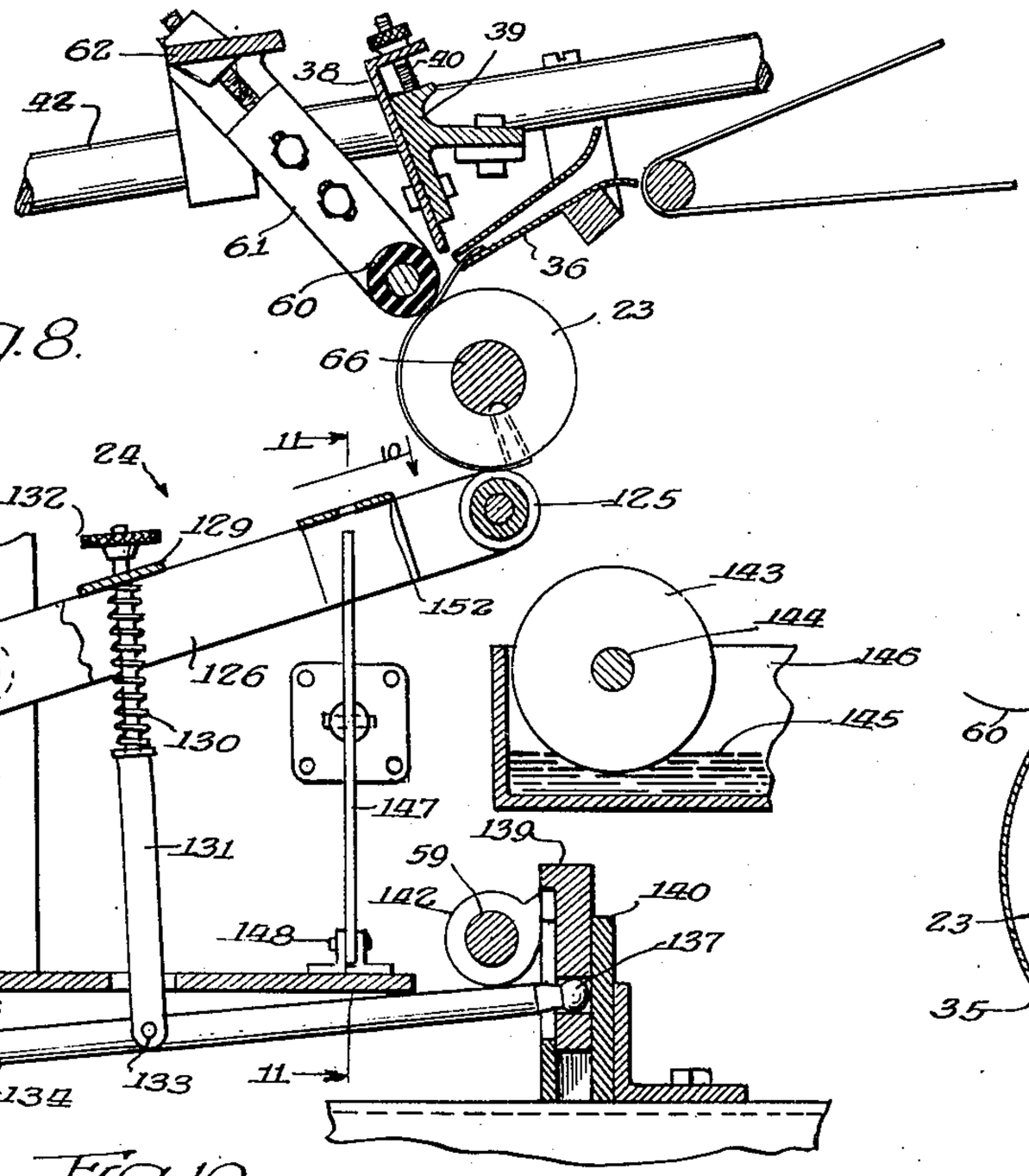


Fig. 9.

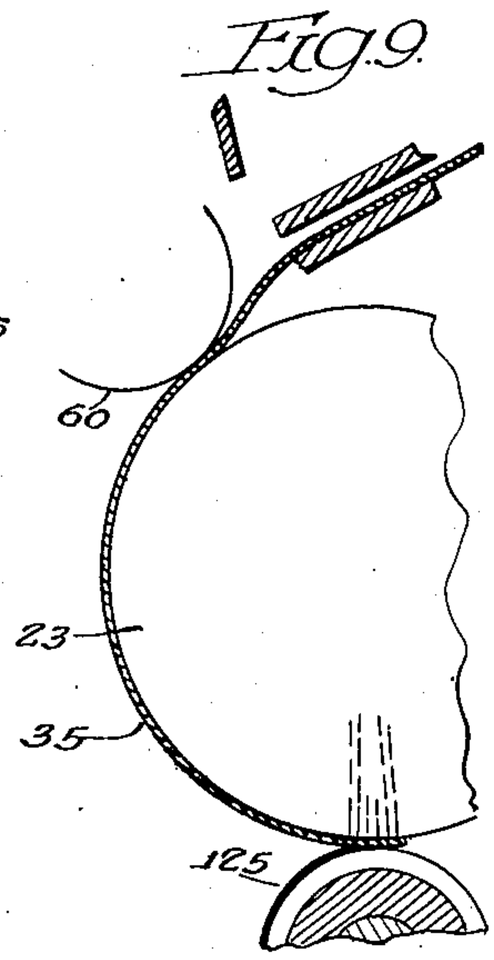


Fig. 10.

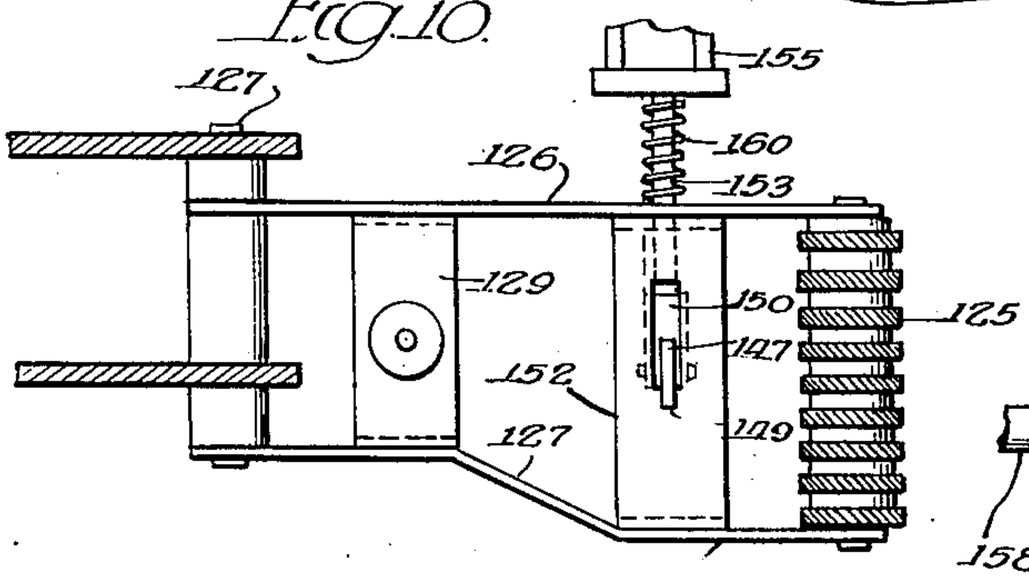


Fig. 11.

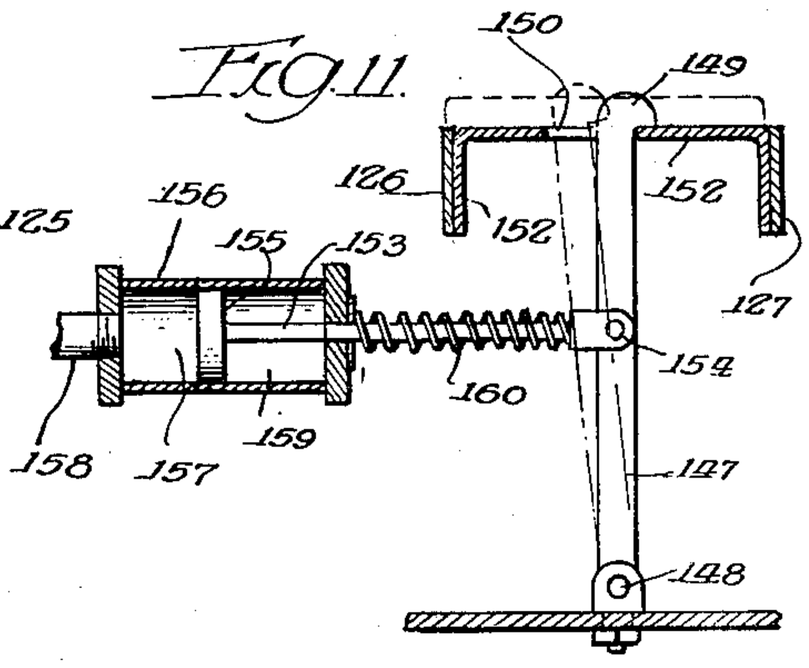
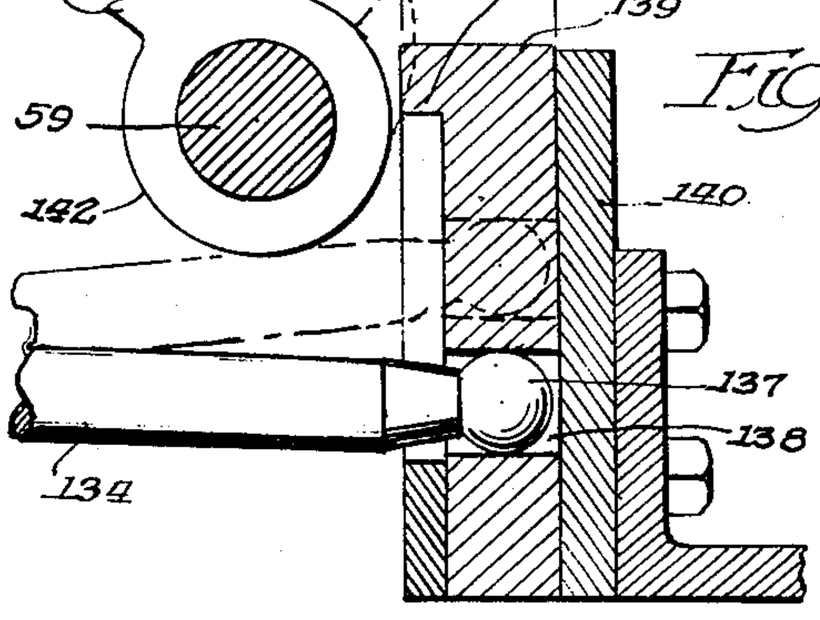


Fig. 12.



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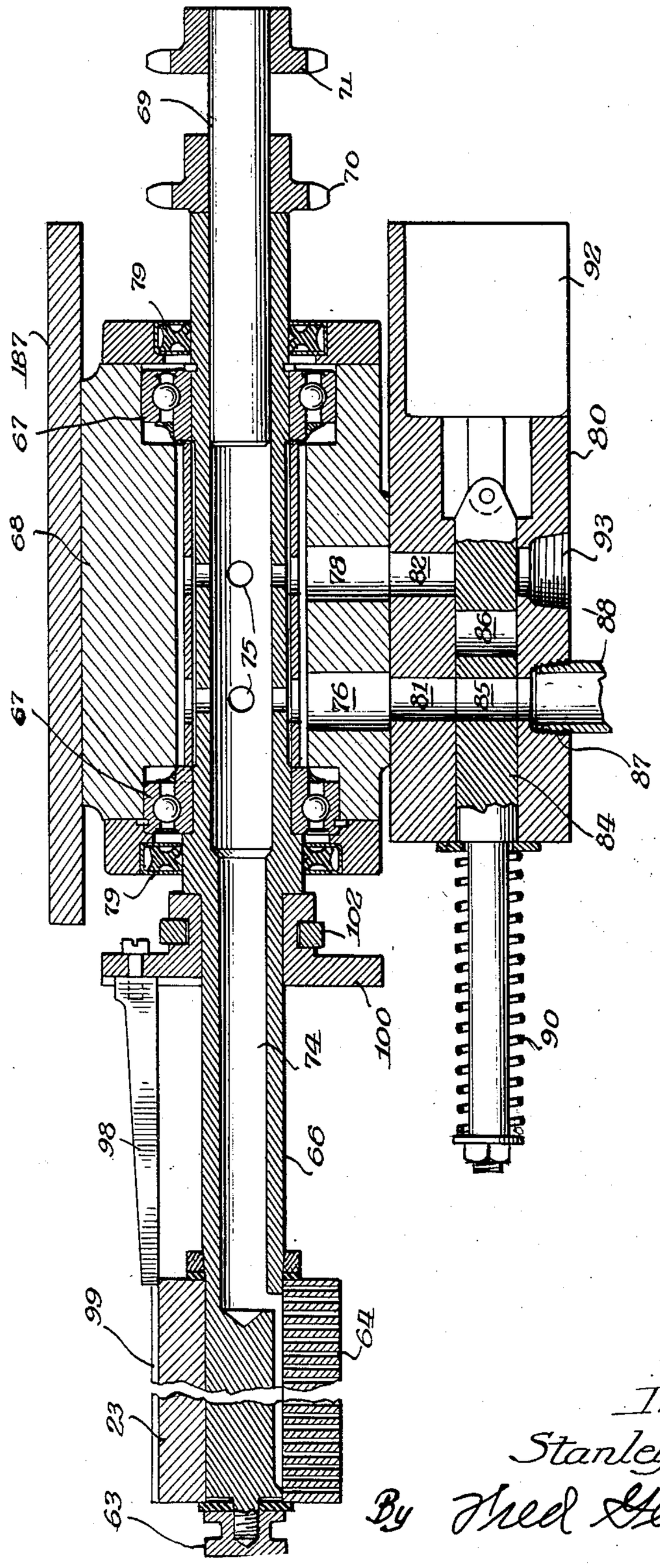

FIG. 13.

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APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

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Fig 14

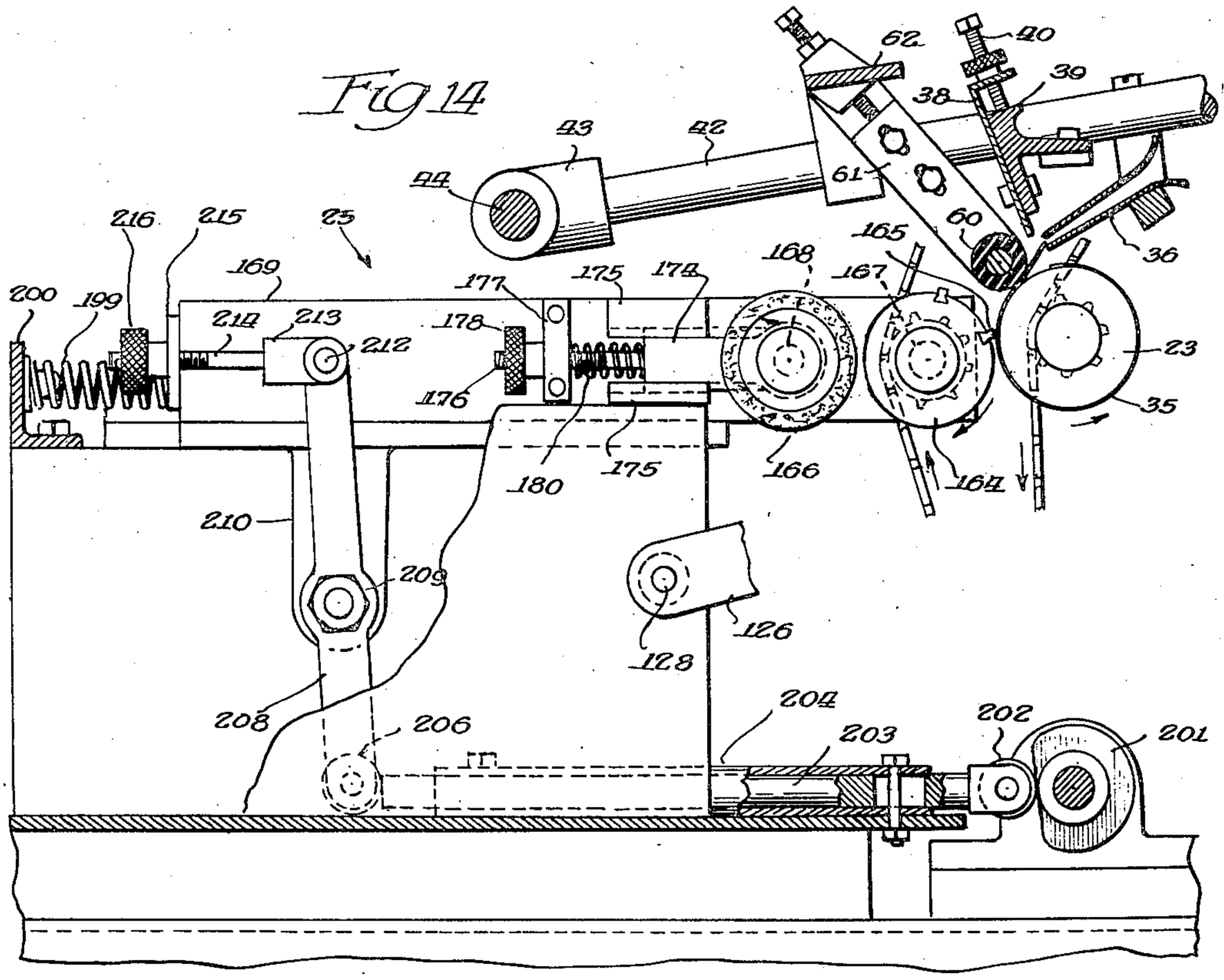


Fig. 15

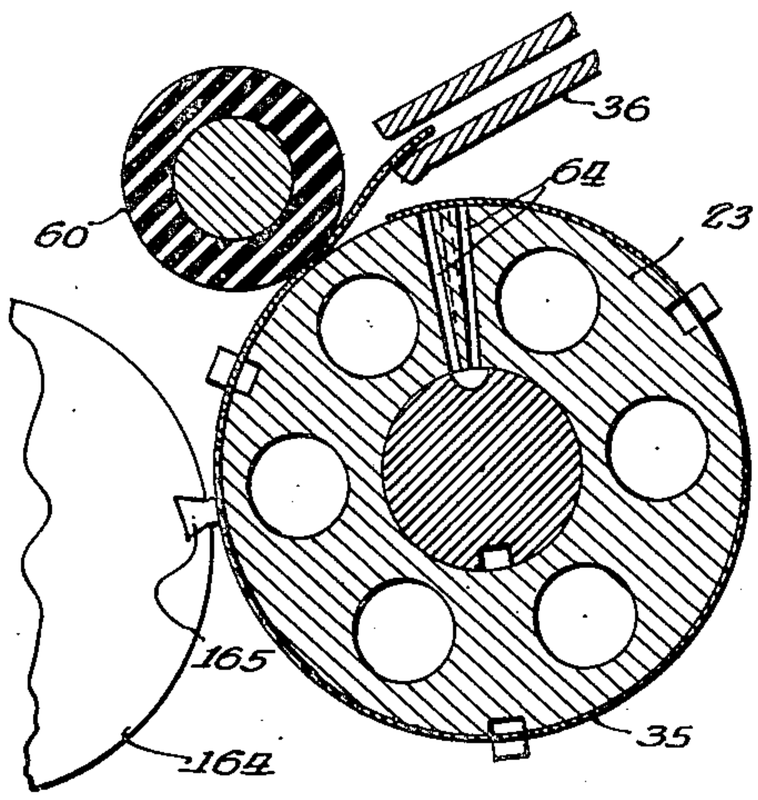
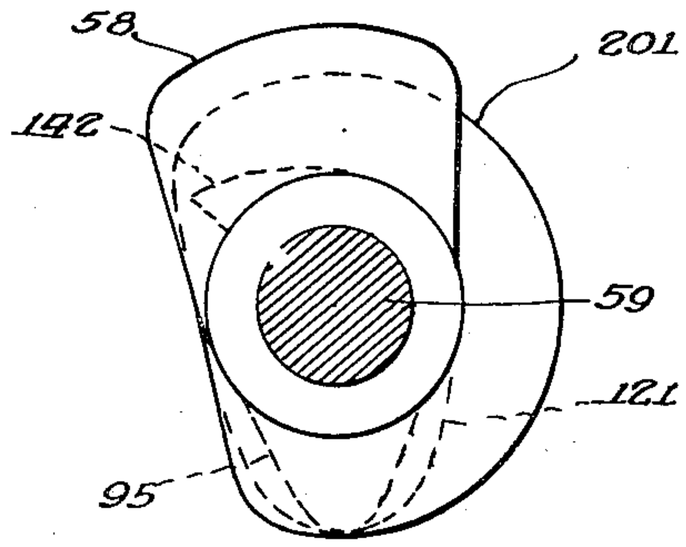


Fig. 16



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APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

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Fig. 17

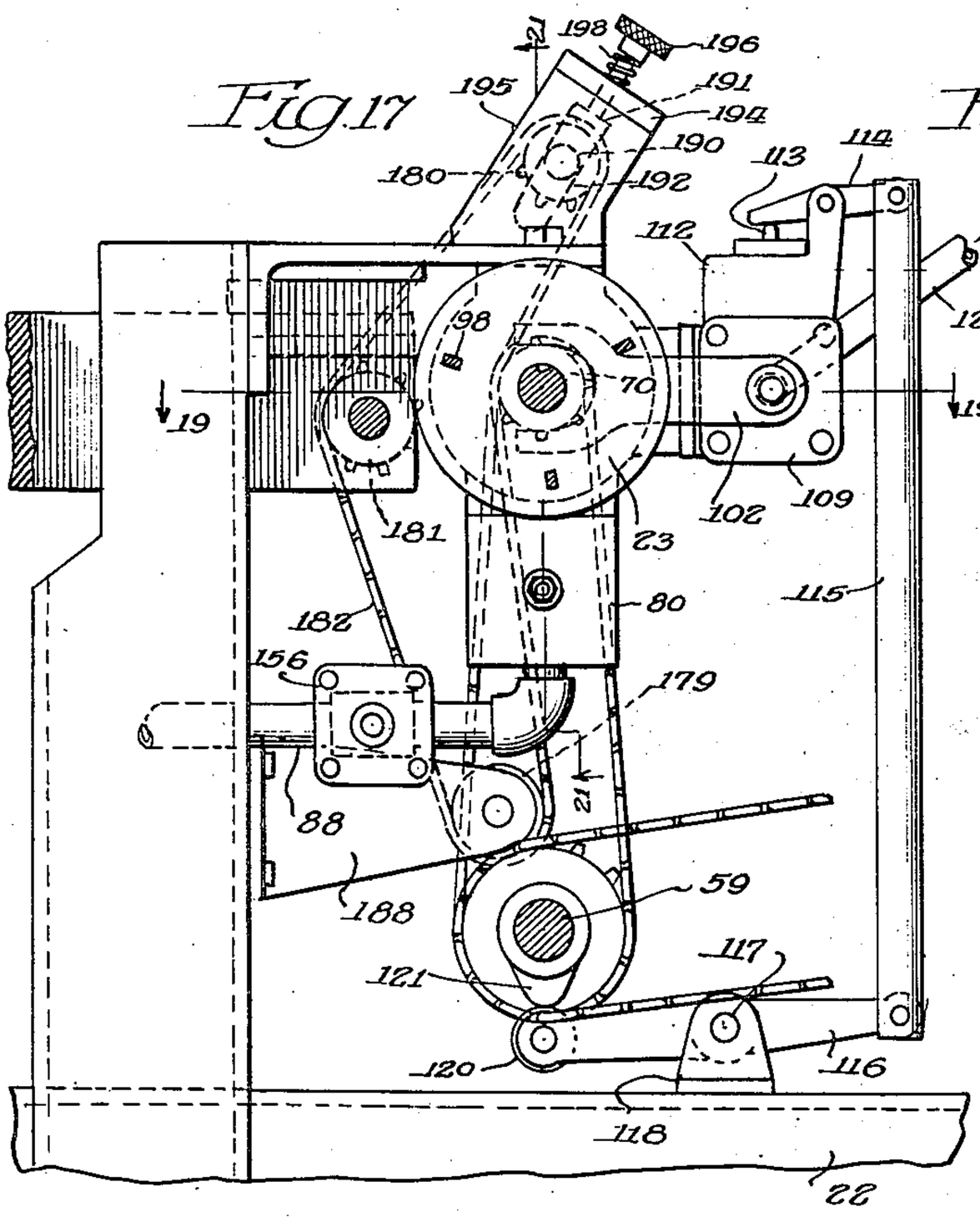


Fig. 18

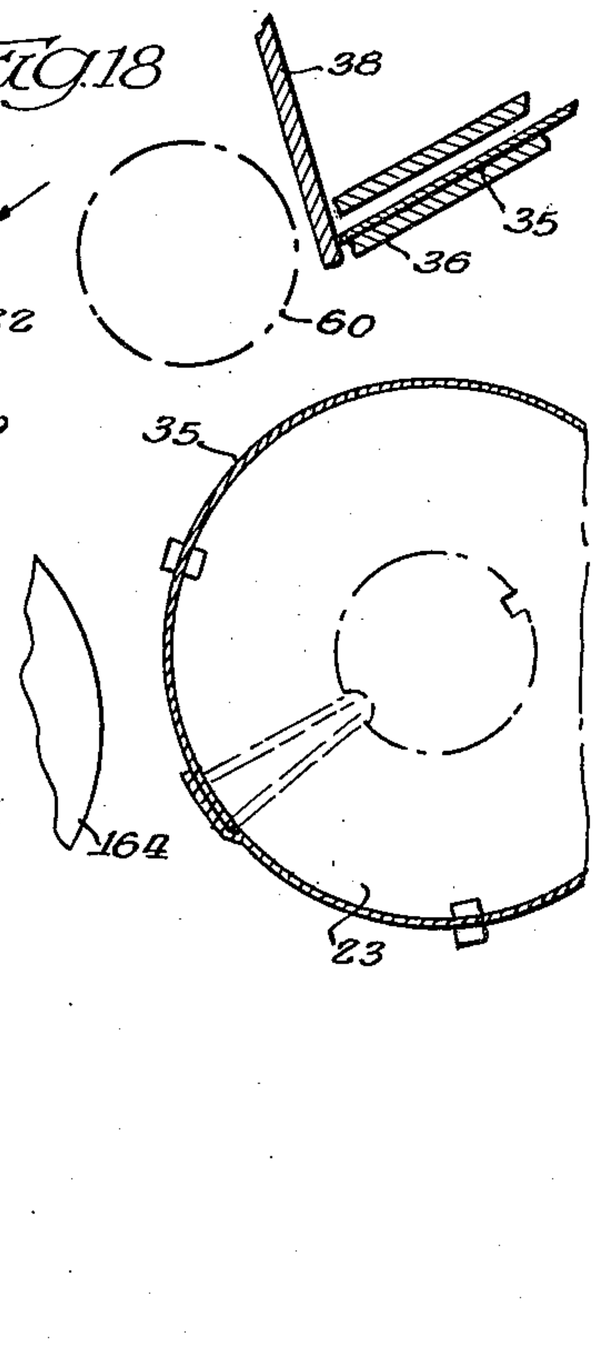
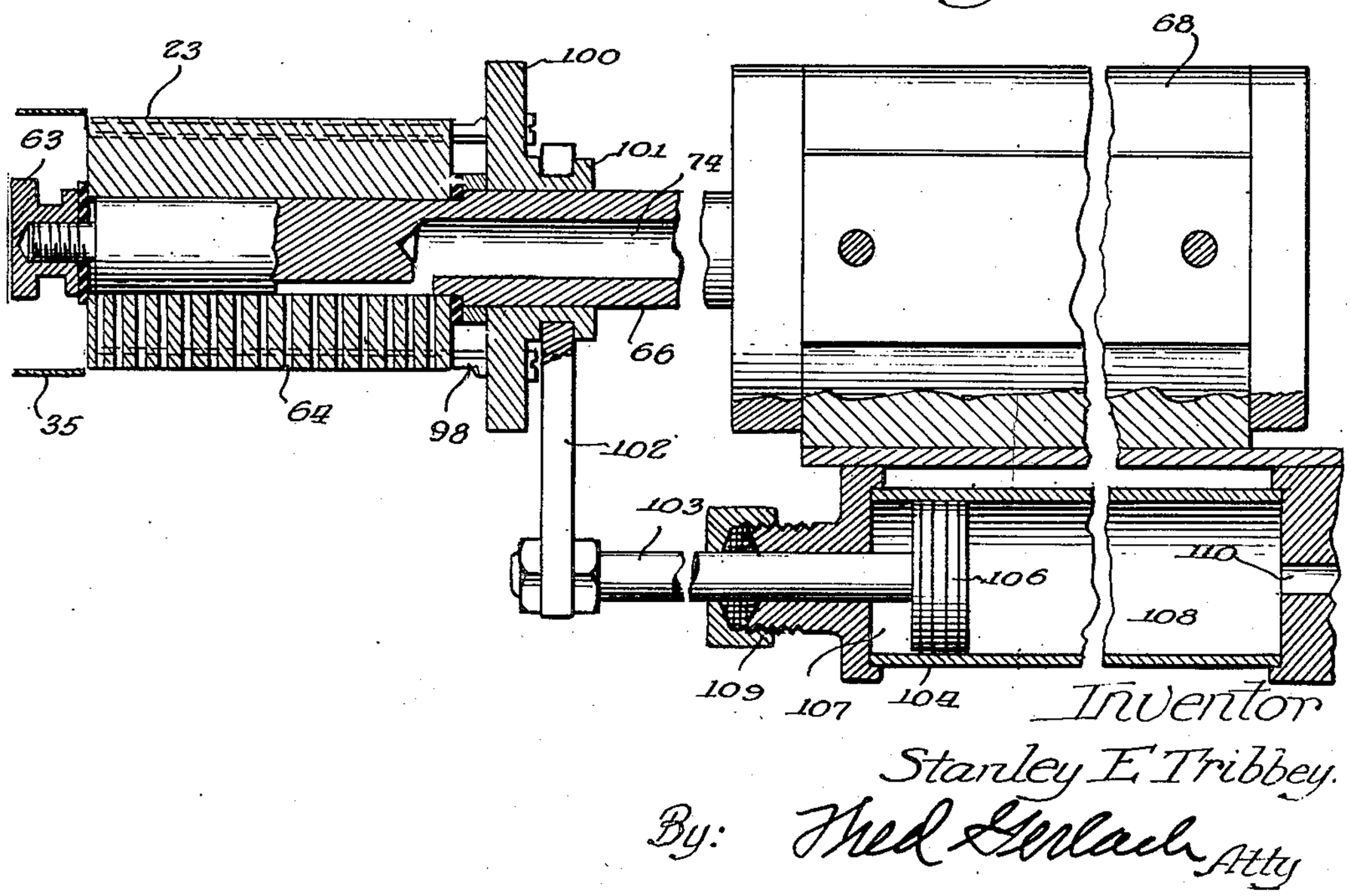


Fig. 19.



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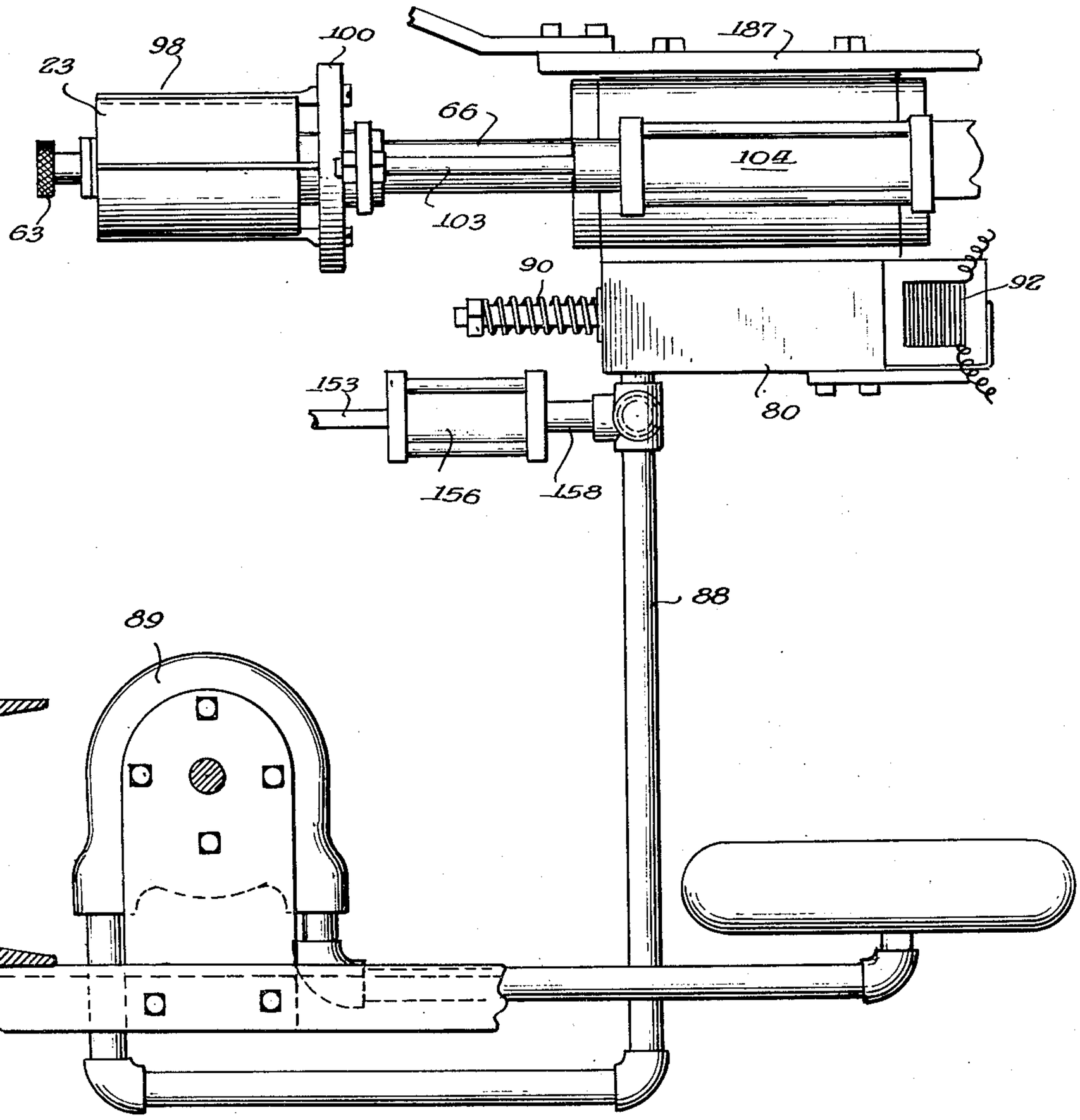
APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

Filed March 29, 1949 11 Sheets-Sheet 11

Fig. 20



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Patented Apr. 10, 1951 2,548,451

UNITED STATES PATENT OFFICE

2,548,451

APPARATUS FOR FORMING PAPER STRIPS INTO CONTINUOUS LABEL FORMING BANDS FOR YARN AND THE LIKE

Stanley E. Tribbey, Chicago, Ill., assignor to Caron Spinning Company, Rochelle, Ill., a corporation of Illinois

Application March 29, 1949, Serial No. 84,186

5 Claims. (Cl. 93—81)

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This invention relates to a machine for making paper bands such, for example, as those used for banding yarn skeins; and the primary object is to provide a machine of that character which is fully automatic and will produce finished bands at a rapid rate.

Another object is to provide a band-making machine which will not only make the bands but will, at the same time, print thereon the lot numbers and colors or other identifying information pertinent to each lot or order.

The machine herein described and illustrated in the accompanying drawings automatically feeds strips of paper, one at a time, to a rotating mandrel to which each strip, in turn, is adhered by suction, whereby it is caused to wind around the mandrel to form a band of prescribed diameter. During each rotation of the mandrel, with an attached paper strip, glue or other adhesive is applied to the leading marginal surface of the strip; and thereafter, at the end of a complete revolution of the mandrel, the trailing marginal surface of the paper strip is pressed against the adhesive-coated leading marginal surface, thus securing together the two ends of the band. Immediately following the foregoing band-winding and glueing operation, the finished band is automatically ejected from the mandrel; and another paper strip is thereafter fed to the mandrel. Concurrently with each band-forming operation, the aforementioned printing operation is performed on the band, the mandrel itself serving as a platen.

The novel features of this invention can best be explained with reference to the drawings which accompany this specification, wherein:

Fig. 1 is a view of the machine in side elevation;

Fig. 2 is an enlargement of a portion of Fig. 1, with certain parts shown in section;

Fig. 3 is a fragmentary plan view;

Fig. 4 is a section taken at line 4—4 of Fig. 2;

Fig. 5 is a section taken at line 5—5 of Fig. 2:

Fig. 6 is a detail sectional view taken at line 6—6 of Fig. 4, showing the major components of the machine in the positions which they occupy immediately prior to the commencement of a band-winding operation;

Fig. 7 is an enlarged section taken at line 7—7 of Fig. 4, depicting the commencement of a band-winding operation;

Fig. 8 is a section taken at line 8—8 of Fig. 4 illustrating an intermediate stage of the band-winding operation, wherein adhesive is being applied to the marginal surface adjacent the leading edge of the paper strip;

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Fig. 9 is an enlarged detail of a portion of Fig. 8, illustrating more clearly the application of adhesive to the paper band;

Fig. 10 is a plan view of the adhesive-applying arm and roller, taken at line 10—10 of Fig. 8;

Fig. 11 is a section at line 11—11 of Fig. 8, showing the vacuum-actuated latch mechanism which functions to prevent upward movement of the adhesive applicator in the absence of a strip of paper on the winding mandrel;

Fig. 12 is an enlarged detail of a portion of Fig. 8, depicting the operation of the cam and lever mechanism which actuates the adhesive applicator arm;

Fig. 13 is an enlarged section taken at line 13—13 of Fig. 17;

Fig. 14 is a fragmentary sectional view taken at line 14—14 of Fig. 4, showing details of the printing mechanism;

Fig. 15 is an enlargement of a portion of Fig. 14, showing certain parts in more extensive detail;

Fig. 16 is a transverse section through the camshaft, showing the outlines and relative angular relations of the several cams;

Fig. 17 is a section taken at line 17—17 of Fig. 4, showing the chain drives for both the winding mandrel and the printing roller, and the mechanism for operating the valve by means of which compressed air is admitted, at the end of each cycle of operation, to the pressure cylinder which serves to actuate the band ejector;

Fig. 18 is a diagrammatic showing of the mandrel with a completed band thereon ready for ejection;

Fig. 19 is an enlarged section taken at line 19—19 of Fig. 17, illustrating the band-ejector mechanism; and

Fig. 20 is an elevational view of the winding mandrel and ejector mechanism, together with a showing of the vacuum pump and pipe connections.

Referring first to Fig. 1, the subject band-forming machine is identified as a whole by reference numeral 10; and this is operatively associated with a Davidson suction-type feeder which is identified in its entirety by reference numeral 12. Inasmuch as the feeder is a well-known commercial device used extensively in printing establishments, there is no occasion to describe the same beyond what is necessary to clarify its operative relationship to the machine 10.

The feeder 12 includes a platform 13 on which is supported a stack 14 of paper strips 35 from which the bands are formed; and said platform is automatically moved upwardly by a counterweight 15 as the strips of paper are withdrawn from the top of the stack. A suction pick-up device designated as a whole by reference numeral 16 picks up the strips of paper, one at a time, from the top of stack 14 and feeds them into the bite of feed rollers 17 and 18 by means of which the sheets are transferred to a belt conveyor 20 and thence to the band-forming machine. It is to be understood that the band-forming machine 10 and feeder 12 are mechanically coordinated so that the sheets of paper are passed to the conveyor at the properly timed intervals.

The machine 10 comprises a framework 22 made up of suitable structural steel shapes and plates and designed to provide supports for the various mechanical components.

The focal center of the machine is a continuously rotating mandrel 23, about which the paper strips 35 are wound, one at a time, to form the paper bands; and immediately associated with said mandrel are: a mechanism 24 for applying adhesive to the leading margin of each paper strip, and printing mechanism 25 which automatically imprints a lot number and color or other desirable information on each band. Also associated with the mandrel 23 is means for automatically ejecting the completed bands therefrom.

The conveyor 20 comprises a suitable frame 26 which is pivotally connected at 28 to the feeder 12 and includes rollers 30, 31 and 32 around which passes a multiple strand belt 33. Said belt is continuously driven in the direction indicated by an arrow on Fig. 1 and it serves to convey the strips of paper from the feeder to a spout-like guide element 36 having convergent top and bottom walls, as clearly shown in Figs. 2, 6 and 8. A pair of elongate spring fingers 37 overlie and extend approximately parallel to the belt 33 and are anchored at points remote from guide element 36; and the free ends of said spring fingers are effective to bear down lightly on the paper strips as they enter the guide element 36 and thus serve to hold the paper flat against the belt at the discharge end thereof so that it will be positively propelled through the guide element 36 at the proper instant.

At the discharge end of the guide element 36 there is located a stationary stop plate 38, the lower end portion of which is so positioned that it normally serves to obstruct discharge of the paper strips—the object being to time the discharge of each strip so that it will engage the winding mandrel at the proper instant. The stop plate 38 is carried by a support 39 which, in turn, is attached to the frame of the machine; and said plate is adjustable vertically by means of an adjusting screw 40. The adjustments thus capable of being effected makes it possible easily to delay or advance release of the paper strips from the guide element 36, as will presently be apparent.

The frame 26 of conveyor 20 is rigidly connected to a pair of parallel arms 42, each of which is affixed at one end to an elbow fitting 43, individually. Said fittings 43 are interconnected by a crossbar 44, Figs. 4 and 5, which carries a T-fitting 45, to which is connected, Fig. 6, a link 46, the lower end of which is threaded to a clevis 48 secured against free rotation by a knurled lock nut 49. The clevis 48 is bifurcated to receive a roller 50 which is rotatable on a pin 51 to which is pivotally connected the upper end of a link 52 fulcrumed at 53. The two links 46 and 52, conjointly, form a toggle, with the roller 50 located at the knee thereof.

As most clearly shown in Fig. 6, a slide 56 mounted for lengthwise horizontal reciprocation bears at one end against the roller 50 and is provided at its other end with a roller 57 which engages the periphery of a cam 58 carried by and rotatable with a camshaft 59. As will be apparent from inspection of Fig. 6, the action of cam 58 through slide 56 on roller 50 is such as to cause the toggle, comprising links 46 and 52, to alternate between the two limiting postures illustrated respectively in Figs. 2 and 6. The arms 42 are thus alternately raised and lowered, thereby lifting and lowering the free end of conveyor 20 and the guide element 36 which is supported by the conveyor frame. In Fig. 6 the arms 42 are in elevated posture, and the discharge end of guide element 36 is consequently obstructed by the stop plate 38. Rotation of cam 58 to the angular posture in which it is shown in Fig. 2 results in a withdrawal of lateral support from the knee of the toggle, thereby enabling the toggle to give way and permit the arms 42 to descend under gravity sufficiently to effect displacement of the discharge end of guide element 36 from the position in which it is shown in Fig. 6, relative to stop plate 38, to the alternate open position in which it is shown in Fig. 2. The timing of the feed mechanism is such that there is in each instance a strip of paper 35 within the guide element 36 ready to be discharged immediately prior to each alternate opening of the discharge end thereof, provided the stack 14 has not become exhausted, and further provided the feed mechanism and conveyor are operating properly. The reason for feeding the strips of paper into the guide element 36 at a rate of one strip per each alternate opening instead of one strip per opening will be explained later.

A rubber pressure roller 60 journaled in the lower ends of two parallel supporting arms 61, adjustably connected to a bracket 62, bridged across the arms 42 and carried thereby, is disposed adjacent the periphery of mandrel 23 and movable with the arms 42 toward and away from said mandrel. The alternate positions of said roller 60 are depicted in Figs. 6 and 7 respectively; and as will be self-evident from the latter the function of the roller is to press the strip of paper 35 against the peripheral surface of the mandrel.

The mandrel 23 is provided with two closely spaced rows of peripheral openings 64—see Figs. 13 and 15—extending axiswise of the mandrel, and said openings communicate through the interior of the mandrel and its supporting spindle with a vacuum pump, through a valve which functions automatically to apply and release the vacuum at the appropriate intervals.

Assuming the presence of a strip of paper within the guide element 36, it will be apparent that as the arms 42 are lowered from the posture of Fig. 6, the roller 60 and the guide element 36 will descend to assume the positions in which they are shown in Figs. 2 and 7. The paper strip 35 is thus freed from the obstruction of stop plate 38 and is immediately propelled by the conveyor belt against the roller 60, the rotation of which causes the leading edge of the strip

to be deflected downwardly into the bite between said roller 60 and the peripheral surface of the mandrel. The timing is such that the peripheral openings 64 arrive at a position coinciding with the leading margin of the paper strip, as clearly shown in Fig. 7, and the vacuum is thereupon applied so that the said leading margin of the strip is held firmly against the mandrel, while the latter continues to rotate in the counterclockwise direction. The vacuum is maintained so as to retain the paper strip on the mandrel throughout a complete revolution, after which the vacuum is released for an instant while the band is being ejected from the mandrel.

When the paper strip 35 has partially encircled the mandrel—see Fig. 9—a liquid adhesive is applied to the external leading marginal surface thereof by the adhesive-applying mechanism 24, and the adhesive so applied, although quick setting, remains sufficiently agglutinant so that when the trailing edge of the strip is pressed by the roller 60 against the adhesive-coated marginal surface the two ends of the band are firmly joined. Thereupon the roller 60 is lifted out of contact with the completed band and an ejector mechanism, to be described later, kicks the band off the mandrel into a receptacle, not shown, provided for the purpose.

It will readily be understood from a consideration of Fig. 15, which shows the conditions obtaining immediately prior to the completion of a band, that it is not practicable to feed another paper strip to the mandrel concurrently with the completion of each band because by the time a completed band has been ejected the openings 64 will have passed beyond the point of possible registration with the leading margin of the next paper strip; and it would involve much complication to provide additional rows of vacuum openings, angularly displaced from openings 64, for the reason that no adequate suction could be created at one group of openings while the other group remained uncovered unless a relatively intricate valve arrangement were provided for controlling the vacuum to each group individually. And even if the necessary additional valves and valve-actuating mechanism were not enough to render unfeasible the provision of a second group of openings closely following the existing group, there are still other factors which contribute additionally to the undesirability of so doing. It is for that reason that the paper feed mechanism is timed to feed one strip of paper to the conveyor for each two revolutions of the mandrel. By the time the group of openings 64 has completed another revolution, following ejection of a completed band, and has again arrived at the angular position illustrated in Fig. 7, a succeeding strip of paper 35 is delivered to the bite between roller 60 and mandrel 23, and the formation of another band is thus initiated.

The band-winding mandrel

The construction of the mandrel 23 and its spindle 66 together with the spindle bearings and the vacuum-control valve and valve-actuating mechanism is most fully illustrated in Fig. 13; and the band-ejecting mechanism is also shown in part in that figure and in part in Fig. 19. It will be observed that the spindle 66 is mounted for rotation in ball-bearings 67 which, in turn, are mounted in a bearing block 68 secured to a plate 187 which is supported by the frame 22. A stub shaft 69 is pressed into one end of spindle 66 and carries two chain sprockets

70 and 71, the latter of which is driven by a chain 72, Fig. 4, from a sprocket 73 on the camshaft 59. The sprocket 70 serves as a driving sprocket for the printing mechanism, which is to be described later.

The spindle 66 has an axial bore 74 connected with the group of openings 64 and in communication through openings 75 with ports 76 and 78 in the bearing block 68. Annular seals 79 are provided at the two ends of bearing block 68 to render the interior thereof vacuum tight. A vacuum control valve 80 is attached to the bearing block 68 and has ports 81 and 82 in registration with the ports 76 and 78 respectively. A valve slide 84 is mounted within the body of valve 80 and is reciprocable lengthwise. Said slide has two ports 85 and 86, the former of which registers with the port 81 when the slide is in that one of its two limiting positions in which it is shown, while the latter registers with port 82 when the slide is in its alternate limiting position. The threaded opening 87 is connected to a pipe 88 which, as shown in Fig. 20, connects with a vacuum pump 89. The slide 84 is biased by a spring 90 toward the position in which it is shown in Fig. 13, wherein the ports 81 and 85 are in registration. It will be evident that vacuum is applied to the bore 74 of spindle 66 and thus to the openings 64 when the valve slide 84 is in its normal position as per Fig. 13. To the end of valve slide 84 remote from spring 90 there is connected the plunger of a solenoid 92 which when energized moves the slide to its alternate position wherein the port 86 registers with port 82 and the port 85 is out of registration with port 81. The threaded opening 93 may communicate directly with the ambient atmosphere or, if it is desired to suppress the noise of recurrently inrushing air said opening may be connected to a pipe extending to the exterior of the building or to a noise-suppressing muffler.

The winding of solenoid 92 is connected in circuit with a normally open switch 94—see Fig. 4—which is adapted to be closed momentarily by a cam 95 on camshaft 59, once per revolution of said camshaft. Since the mandrel 23 and its spindle 66 are driven from camshaft 59 through chain 72 at twice the speed of the camshaft, this is equivalent to saying that solenoid 92 is energized momentarily once every other revolution of mandrel 23. The energization occurs upon completion of each band.

The mandrel 23 preferably is removable from spindle 66, as will be clear from inspection of Fig. 23. It is held on the spindle by a knurled nut 63 and located rotationally by means of a key. Mandrels of various diameters may be provided and interchanged to condition the machine for the making of bands of diverse sizes. However, if mandrels of different diameters are interchanged it obviously is necessary to provide for corresponding radial adjustments of the ejector fingers 98. This can be accomplished by moving the ejector fingers outwardly or inwardly along the face of the sleeve 100 or by providing a variety of sleeves with ejector fingers located at variant radial distances from the axis of rotation.

The band ejector

The mechanism for ejecting the finished bands from the mandrel 23 comprises three ejector fingers 98 equally spaced about the mandrel and arranged to slide in grooves 99 milled in the periphery thereof and extending axiswise of the mandrel. The three fingers 98 are attached at

one end to a sleeve 100 which is slidable on the spindle 66 and rotatable therewith. In Fig. 13 said sleeve and fingers do not overlap the mandrel sufficiently to interfere with the band-winding operation. The sleeve 100 has an integral annularly grooved collar 101 which is engaged by a forked shifter arm 102 secured to and movable with a piston rod 103, Fig. 19, extending into a pressure cylinder 104 and connected therein to a piston 106. Compressed air is admissible to the cylinder chamber 107 through a port, not shown, passing through the cylinder head 109, and is alternately admissible to the cylinder chamber 108 through a port 110. Normally the chamber 107 is under air pressure, as a result of which the fingers 98 are retracted as per Fig. 13. But at the instant when a finished band is to be ejected from the mandrel the pressure is released from chamber 107 and compressed air admitted to chamber 108 through port 110. The fingers 98 are consequently moved abruptly to eject the finished band; and the air control valve acts immediately thereafter to restore pressure to chamber 107 and release the pressure from chamber 108. The fingers accordingly move forward and back in quick succession. Control of the inflow and discharge of air to and from cylinder chambers 107 and 108 is effected by a valve 112 which is best shown in Fig. 17, but also visible in Fig. 4. Said valve includes a plunger-type valve stem 113, Fig. 17, arranged for actuation by a walking beam 114 one end of which is pivotally connected to a vertical valve rod 115 the lower end of which is pivotally connected to a second walking beam 116 fulcrumed at 117 on a bracket 118. The free end of the walking beam 116 carries a cam follower in the form of a roller 120 in apposition to a cam 121, Figs. 5 and 17, mounted on and rotatable with the camshaft 59. It will be seen that once per revolution of camshaft 59 the valve stem 113 is momentarily depressed by cam 121 operating through the two walking beams 114 and 116 and the valve rod 115; and it will be apparent from the configuration of cam 121 that the interval of actuation of the ejector fingers 98 corresponds to but a very small part of a complete cycle. Compressed air is supplied to valve 112 through a pipe 122, Fig. 17, which extends to a compressed air supply tank, not shown in the drawings.

The adhesive applying mechanism

The adhesive-applying mechanism 24 is detailed principally in Figs. 8–12 inclusive and comprises a roller applicator 125 carried by a pair of arms 126 and 127 which are fulcrumed at 128. A plate 129 bridged across said arms affords an abutment for a spring 130 which is mounted on a stem 131 and bears at its lower end against a shoulder formed on said stem. The upper end of the stem 131 extends through an aperture in plate 129 and is threaded to receive a knurled retainer nut 132. The lower end of stem 131 is pivotally connected at 133 to an actuating arm 134 fulcrumed at 135 to a bracket 136. Said arm 134 is provided with a hardened steel spheroidal tip 137 which is seated in a circular opening 138 in a vertically reciprocable slide 139 mounted in a suitable guide 140. The slide 139 is disposed immediately adjacent a lifter cam 142 mounted on and rotatable with camshaft 59, and said cam has a radially projecting tooth 142*a* which is effective during each revolution of camshaft 59 to engage a shoulder 139*a* on slide 139—see Fig. 12—and abruptly lift and then release the slide. The result of this action is to lift the arm 134, the movement of which is transmitted through stem 131, spring 130 and plate 129 to the arms 126 and 127 carrying the roller 125. Said roller 125 normally rests on the peripheral surface of a continuously rotating drum 143 mounted on an axle 144 and partially immersed in a pool of liquid adhesive 145 contained in a receptacle 146.

The abrupt upward movement of roller 125 causes it to effect momentary contact with the strip of paper on mandrel 23 and the timing is so adjusted that the contact is made with the leading marginal surface of the strip, applying adhesive thereto.

Obviously, it would not be permissible to allow adhesive to come into contact with the surface of the mandrel; but in the absence of the preventative provision about to be described the adhesive applicator 125 would make contact with the mandrel should there be any interruption of the flow of paper strips while the machine remains in operation. The provision referred to comprises a latch bar 147 pivotally anchored at 148 and having a hook 149 at its upper end which is adapted to pass through a slot 150 in a bridge member 152 interconnecting the two arms 126 and 127. When the latch bar 147 is postured as shown in full lines in Fig. 11 it is operative to prevent the arms 126 and 127 rising sufficiently to enable roller 125 to make contact with the mandrel; but when, on the other hand, said latch bar is postured as shown in dot-dash outline in the same figure, it interposes no obstruction to the upward movement of arms 126 and 127, as will be apparent. When the latch bar is in its effective full-line position the actuating arm 134 is still free to rise because of the compressibility of spring 130.

A piston rod 153 having one end pivotally connected at 154 to the latch bar 147 is attached at its other end to a piston 155 which is reciprocable in a cylinder 156 having a chamber 157 which is connected through a branch pipe 158 to the pipe 88, Fig. 20, communicating with the vacuum pump 89. Whenever the openings 64 in the mandrel 23 are obstructed by reason of a strip of paper on the mandrel a sufficiently reduced pressure obtains in chamber 157 so that the atmospheric pressure in chamber 159 will move piston 155 against the opposition of spring 160 and thus shift the latch bar 147 to the posture in which it is shown in dot-dash outline, wherein it is ineffective. But whenever the openings 64 are not covered by a paper strip there is insufficient pressure reduction in chamber 157 to offset spring 160 and, accordingly, the latch bar 147 remains in or assumes its full-line posture, Fig. 11, wherein the hook 149 is positioned to obstruct full upward movement of roller 125. Thus, it will be seen that the adhesive-applying roller 125 can never make direct contact with the peripheral surface of mandrel 23.

The printing mechanism

The printing mechanism 25 and the drive therefore are most clearly illustrated in Figs. 3, 5, 14, 15, 17 and 18 to which attention is now directed. A continuously rotating cylindrical type carrier 164 is provided with peripheral dovetail grooves extending lengthwise thereof to receive strips of type 165 the faces of which are brought into contact with each paper strip 35 as it is being wound on the mandrel 23. At the rear of type carrier 164 is located an ink roller 166 positioned to contact the type faces during each revolution

of the type carrier. The type carrier 164 and ink roller 166 are rotatably mounted on shafts 167 and 168 respectively, the former of which is journaled at one end in a slide 169 of inverted T cross-section, Fig. 5, mounted for lengthwise reciprocation between two complementary guide strips 170 mounted on a bed casting 172 which, in turn, is supported by channel members 173 constituting component parts of the machine frame. The stud shaft 168 supporting ink roller 166 is secured at one end to a secondary slide 174 which is attached to slide 169 by means of guide strips 175 which permit movement of slide 174 lengthwise of slide 169, thus enabling ink roller 166 to be moved bodily toward and away from type carrier 164. A feed screw 176 swivel-connected to slide 174 passes through an opening in an anchor block 177 attached to slide 169 and is provided with a knurled adjusting nut 178. A compression spring 180 encircling the feedscrew 176 bears at one end against anchor block 177 and at its other end against slide 174. Manual rotation of nut 178 is effective to move ink roller 166 toward and away from type carrier 164, thus providing for adjustment of the pressure with which the ink roller bears against the faces of type strips 165.

It is necessary to reciprocate the slide 169 in a manner to cause the type carrier 164 to move toward and away from mandrel 23 at appropriate uniform intervals; and it is further necessary to rotate the type carrier in timed relation with the mandrel so that the type will contact the paper strips on the mandrel at the correct instants. Consequently, there must be provided a drive means for rotating the type carrier 164 which will permit of relative lateral movement between the type carrier and the mandrel and at the same time maintain a constant rotational relationship therebetween so that the type will in each instance register with the specific surface areas of the paper band on which the printed matter is intended to be impressed. The arrangement by which the type carrier is rotated synchronously with the winding mandrel is illustrated most fully in Fig. 17 and comprises a chain belt 182 which passes around two idler sprockets 179 and 180 and engages sprocket 70 on stub shafts 69—see Fig. 13—and a sprocket 181—see Fig. 5—on shaft 168, which latter is journaled in slide 169 and extends across the machine to an extent sufficient to enable sprocket 181 to be placed in alignment with sprockets 70, 179 and 180. The outboard end of shaft 167, Figs. 3 and 5, is journaled in a bearing block 183 supported by an arm 184, which bearing block is cast integrally with a slide member 185 designed to slidably engage a guide strip 186 secured to the under side of a horizontal plate 187 constituting a component part of the machine framework. The arm 184 is affixed at one end to the slide 169 and moves bodily therewith, the outboard end being slidably supported by the guide strip 186. The idler sprocket 179 is rotatably mounted on a bracket 188 attached to the machine frame; and the sprocket 180 is rotatably supported on a stud shaft 190 projecting from and carried by a block 191 which is slidably mounted in an inclined guideway 192 and attached to a stud 193 which passes through an aperture in an anchor plate 194 carried by a bracket 195 and is threaded at its outer end to receive a knurled adjusting nut 196 between which and the anchor plate 194 there is interposed a compression spring 198. The chain belt 182 is driven by sprocket 70, the position of which is fixed, as is that of idler sprocket 179. But sprocket 181 moves with slide 169 and at the same time sprocket 180 moves together with its supporting stud shaft 190 and carrier block 191 lengthwise of the guideway 192. It will be apparent that as slide 169 recedes from the winding mandrel 23, sprocket 180 is pulled downwardly along the guideway 192 against the opposition of spring 198, and that said sprocket 180 is urged upwardly by said spring as slide 169 moves toward the mandrel. Although the speed of rotation of type carrier 164 is caused to deviate from constancy as a result of the reciprocatory movement of slide 169, this does not give rise to any variation in the angular relationship between the type carrier and mandrel as respects the recurrent instances when the type makes contact with the successive paper strips on the mandrel and, consequently, registration of the type faces with the areas on the paper strips intended to receive the impressions is not adversely affected.

The slide 169 and all parts carried thereby are biased toward the mandrel 23 by a compression spring 199 which is interposed between the rear end of the slide and an angle iron abutment 200 secured to the frame of the machine. Retraction of slide 169 is effected by a cam 201 carried by and rotatable with camshaft 59, adjacent which cam is a rotary cam follower 202 attached to one end of a cam follower rod 203 which is reciprocable lengthwise in a tubular guide 204 secured to the frame of the machine. The left hand end of rod 203 bears against a roller 206 carried by and connected to the lower end of a rocker member 208 which is fulcrumed at 209 on an arm 210 depending from and movable with slide 169. The upper end of rocker member 208 is pivoted at 212 to a clevis 213 to which is affixed a rod 214 which extends through an opening in a plate 215 and is threaded to receive a knurled nut 216. The plate 215 is secured to the rear end of slide 169 and movable therewith. The rocker member 208 serves to transmit to the slide 169 the movement in one direction of rod 203 in response to cam 201, the return of said rod, together with the slide, being effected by spring 199. As shown in Fig. 14, the slide 169 is in its forward-most position wherein the face of one of the type strips 165 is in contact with a paper band 35 on the mandrel 23. It is necessary to be able to adjust the contact pressure between the type and the paper strips to offset slight variations which may occur from time to time, and such adjustments are effected by means of the knurled nut 216. It will be seen that the cam 201 functions as a stop to limit the forward travel of slide 169, and it will be apparent that by rotating nut 216 in one direction or the other the relative position of the slide can be altered independently of the cam. The length of travel of the slide is unchanged but its limiting positions are altered. The same result might be accomplished by adjustably moving the type carrier relatively to the slide, but to do so would involve moving both ends of shaft 167 in order to maintain alignment and that would not be nearly as convenient as the arrangement described. It also is necessary to make a similar adjustment whenever there may be substituted a mandrel 23 of different diameter.

It will be observed that all the five cams heretofore identified are mounted on and rotatable with the common camshaft 59, which is journaled in four pillow blocks 217 secured to the frame of the machine.

Power for driving the machine is obtained from a motor 218, Fig. 1, which is connected to the vacuum pump 89 through a shaft 220 and to a speed reducer 221 through a belt 222 and pulleys 223 and 224. The feeder 12 is driven through a belt 226 by a pulley 227 which is connected to the speed reducer 221 through gears 228 and 229. The latter gear is mounted on and rotatable with the speed-reducer take-off shaft 230 on which is also mounted a sprocket 232 which is connected with a sprocket 233 on camshaft 59 through a chain belt 234.

The drum 143 is continuously rotated by a chain belt 235, Fig. 1, which runs over an idler sprocket 236 and a driving sprocket 237 mounted on camshaft 59 and rotatable therewith—see Fig. 4.

It is found that setting of the adhesive coating on the paper bands can be hastened by blowing hot air onto the adhesive-coated surface just before the two ends are overlapped; and to that end there may be provided a hot air supply pipe 238, Fig. 2, to which is connected a suitable blast nozzle 239. The pipe 238 may be supported by a block 240 attached to the guide element 36 and is preferably connected to the hot air supply line through a flexible hose, not shown.

While I have illustrated and described only one embodiment of my invention, it will be manifest that numerous modifications and alternatives are included within the scope and purview thereof and accordingly, I do not wish to be limited otherwise than as clearly indicated by the terms of the appended claims.

What is claimed is:

1. The combination in a band forming machine, of a rotary spindle, a mandrel carried by said spindle and rotatable therewith, said mandrel having a peripheral opening communicating with a vacuum pump by way of a passageway through said spindle, a pressure roller adjacent said mandrel and movable bodily toward and away from said mandrel, said pressure roller and mandrel being operative conjointly to grip a strip of paper, the arrangement being such that a strip of paper fed to said mandrel is adhered thereto at its leading edge portion by external atmospheric pressure resulting from a partial vacuum within said passageway, the adherence of the paper to the mandrel being sufficient to cause the paper strip to be wound around the mandrel, an adhesive applicator operative to apply a coating of adhesive to the external leading marginal surface of the paper strip during passage of same around the mandrel, means operative in timed relation with the rotation of the mandrel to move said pressure roller into contact with the paper strip on the mandrel and to maintain said contact while the paper strip is being wound on the mandrel, said pressure roller being operative in conjunction with said mandrel to press together the two ends of the paper strip whereby to effect firm adherence therebetween, said last-mentioned means being further operative to withdraw said roller from contact with the paper strip following completion of the band, one or more ejector elements movable axiswise of said mandrel and operative when moved in one direction to engage one end of the paper band and eject the same from the mandrel, means operative in timed relation with said mandrel to actuate said ejector element following completion of each band, and further operative to retract said ejector element following each actuation thereof in the direction to eject a band, a mechanical feeder synchronized with said mandrel and operative to feed strips of paper to said mandrel one at a time at the rate of one strip for every two revolutions of the mandrel, a continuous conveyor interposed between said feeder and said mandrel for transferring the strips of paper from the feeder to the mandrel, a gate normally obstructing the discharge end of said conveyor for delaying delivery of paper strips to said mandrel, and mechanism operative in timed relation with said mandrel for opening said gate at predetermined intervals so spaced apart and so interrelated with the movements of said ejector elements and said mandrel that each strip of paper is released to said mandrel after the mandrel has been cleared of a previously finished band and concurrently with the arrival of said peripheral opening at a position to effect registration with the leading edge portion of the strip.

2. The combination according to claim 1, comprising adhesive-applicator means including an applicator element, means supporting said element for movement toward and away from said mandrel, a cam operative in timed relation with said mandrel for urging said element into momentary contact with the external leading marginal surface of a paper strip on said mandrel while said mandrel and the paper strip thereon continue to rotate, yieldable means inter-coupling said cam with said element supporting means and effective to enable said adhesive applicator means to be restrained against movement into contact with said mandrel, latch means operative in one position to obstruct said adhesive-applicator means against movement into contact with said mandrel, and vacuum-actuated means operative to move said latch means to an ineffective position in response to a predetermined degree of applied vacuum, said vacuum-actuated means being connected to the same vacuum-producing source as said peripheral opening, the arrangement being such that said latch means is moved to its ineffective position by said vacuum-actuated means when and only when said peripheral opening is obstructed, as by a paper strip embracing said mandrel.

3. The combination in a band-forming machine, of a camshaft, a motor for continuously rotating said camshaft, a spindle driven from said camshaft at twice the angular speed thereof, a feeder mechanism operative to feed pre-cut paper strips to said conveyor one at a time at the rate of one strip for every two revolutions of said spindle, a mandrel carried by and rotatable with said spindle, said mandrel having a row of peripheral openings extending axiswise thereof, said openings being connected through said spindle to a source of vacuum, a valve for controlling application of vacuum to said openings, a belt conveyor for transferring paper strips from said feeder mechanism to said mandrel and having its discharge end situated adjacent said mandrel, mechanism for raising and lowering the discharge end of said conveyor, a stationary gate positioned to obstruct the discharge end of said conveyor when said discharge end is in elevated position, said discharge end being unobstructed when in its lowered position, a cam rotatable with said camshaft and operative to actuate said mechanism in timed relation with said mandrel, the arrangement being such that said row of openings effects registration with the leading marginal surface of each paper strip as the paper strip is released from said conveyor, and a second cam rotatable with said camshaft and opera-

tive to control said valve in timed relation with said mandrel whereby to cut off the vacuum to said openings upon completion of each band and to restore the vacuum thereto prior to the commencement of a successive band-forming operation.

4. A band-forming machine in accordance with claim 3 including a pressure roller mounted adjacent said mandrel and operable by said mechanism to effect intermittent osculatory contact with a strip of paper on said mandrel in timed relation with the rotation of the mandrel, means operative to apply adhesive to the leading marginal surface of each paper strip as the strip is being wound around the mandrel, and a cam rotatable with said camshaft and operative to actuate said adhesive-applying means in timed relation with said mandrel.

5. A band-forming machine in accordance with claim 3 including mechanism for printing upon the paper strip while it is being wound on the mandrel, said printing mechanism comprising a reciprocable slide, a cam rotatable with said camshaft for reciprocating said slide toward and away from said mandrel, and a rotary type carrier movable with said slide toward and away from said mandrel.

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