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No. 799,175. PATENTED SEPT. 12, 1905.

M. L. & U. F. LUEBBEN.

CYLINDRICAL BALING MACHINE.

APPLICATION FILED SEPT. 2, 1904.

8 SHEETS—SHEET 1.

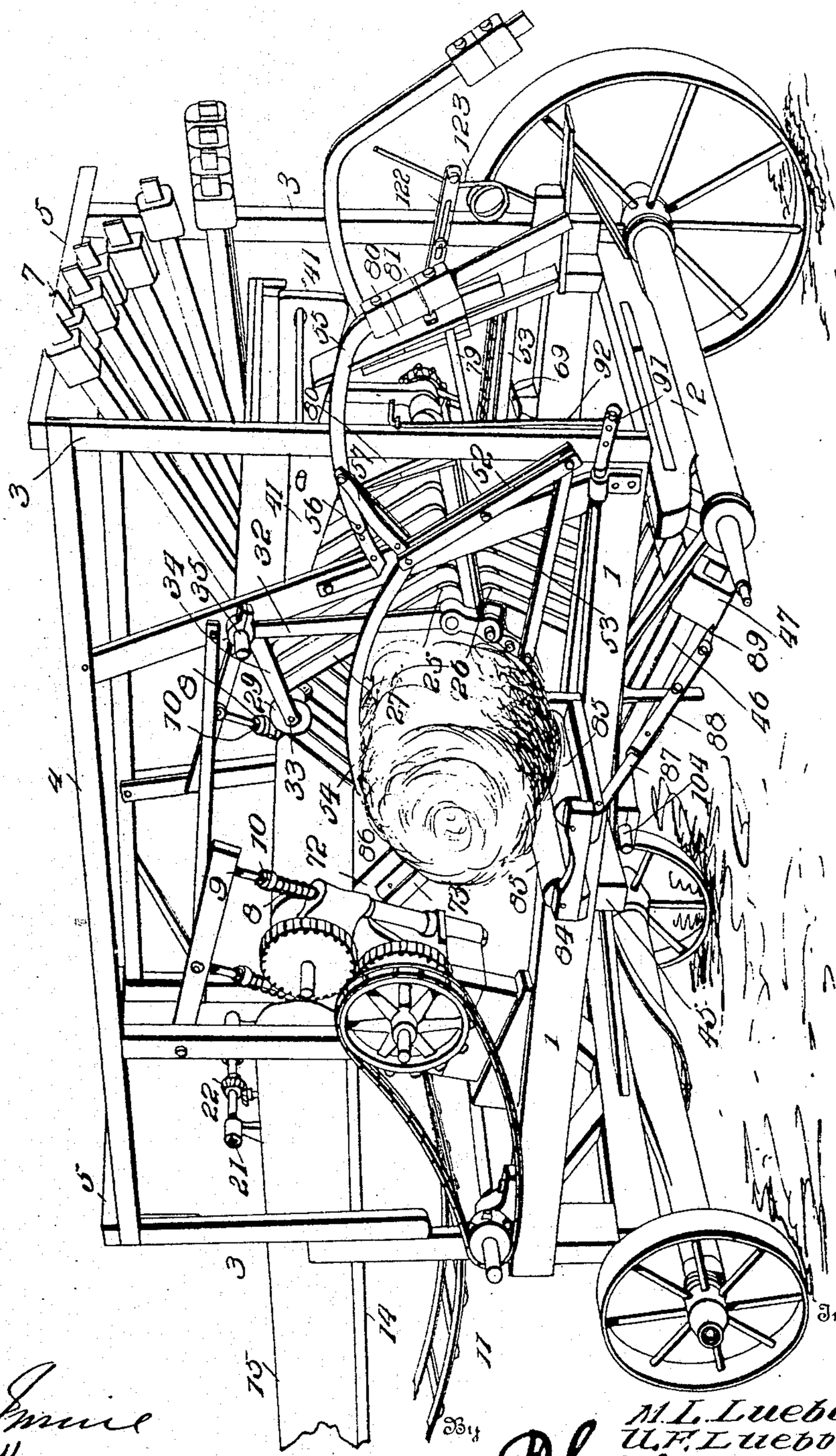

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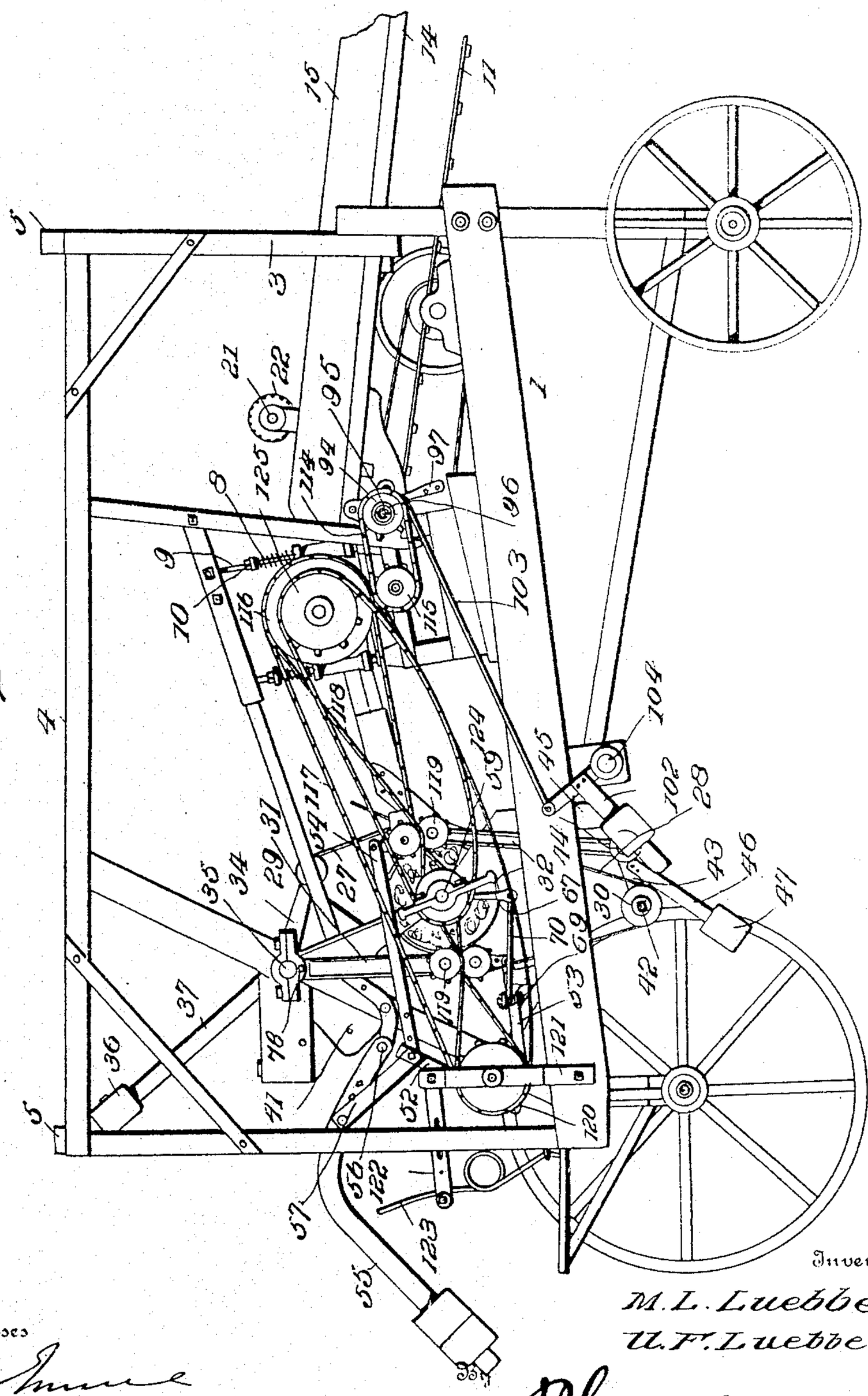
Fig. 2.



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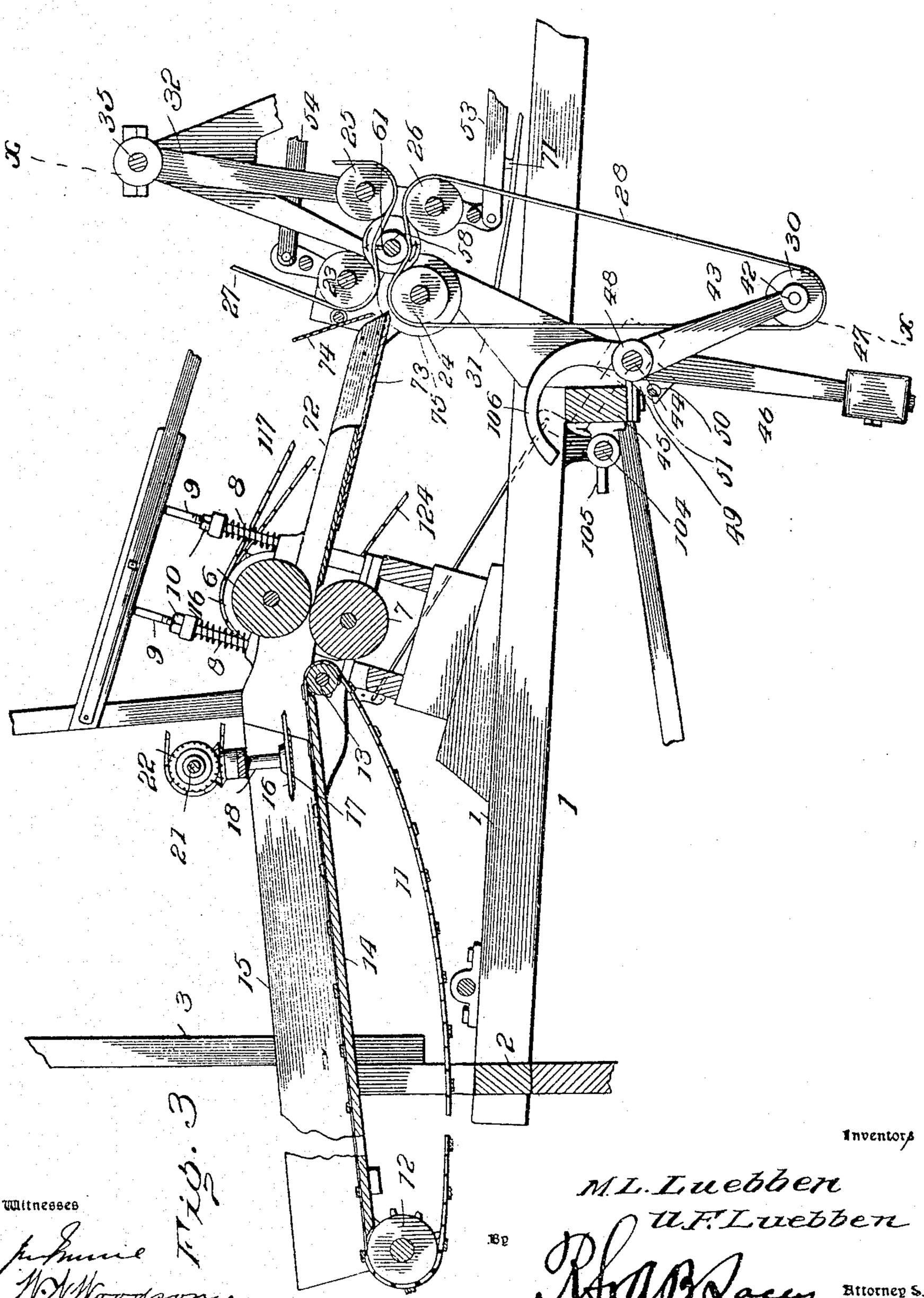

Fig. 2.

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Fig. 4.

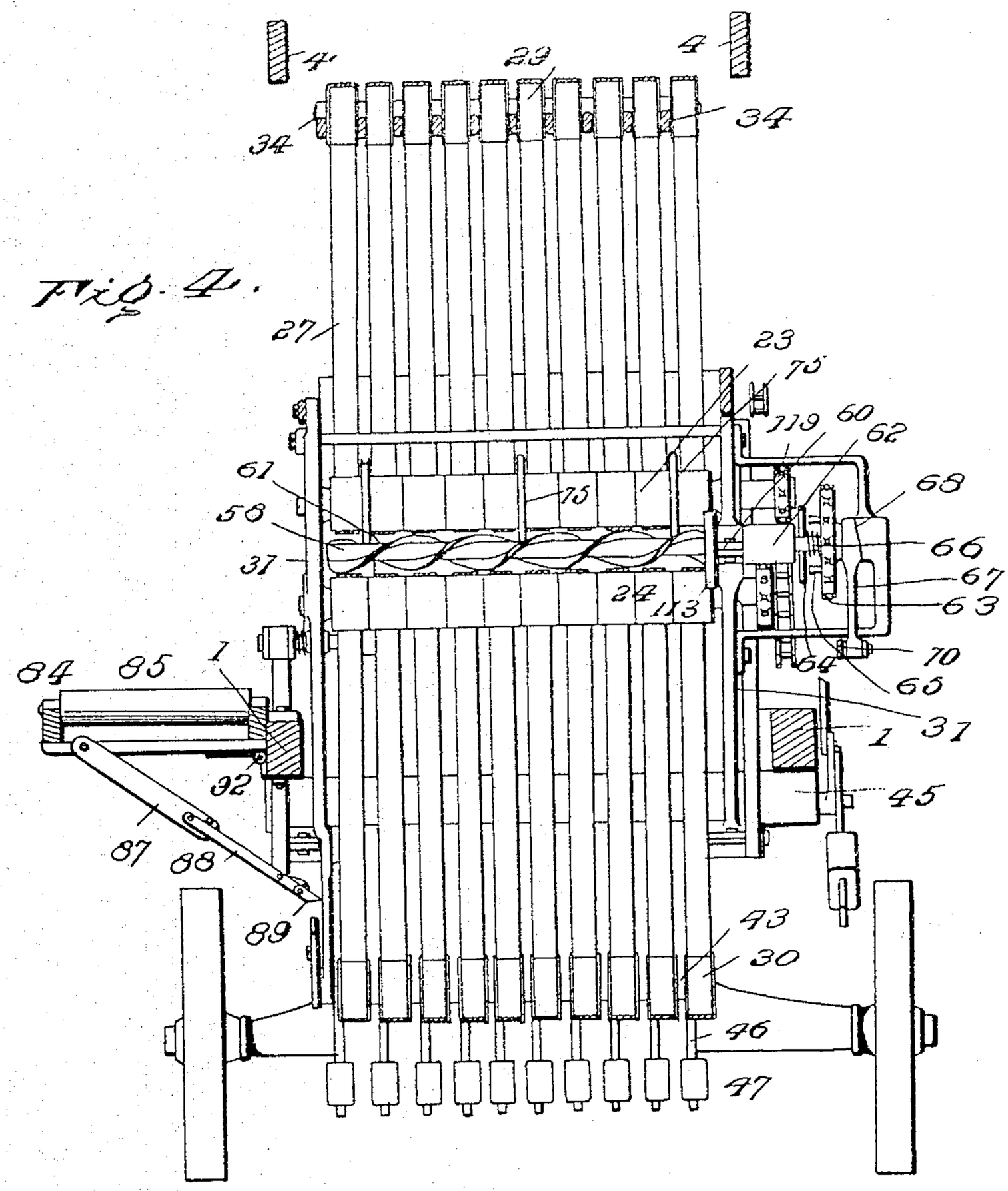
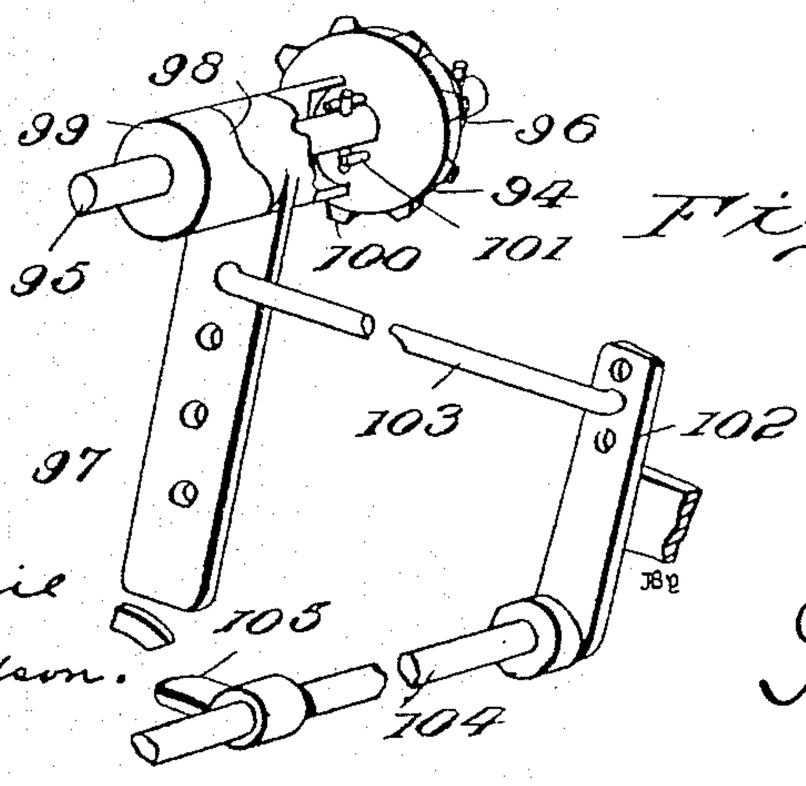


Fig. 5.



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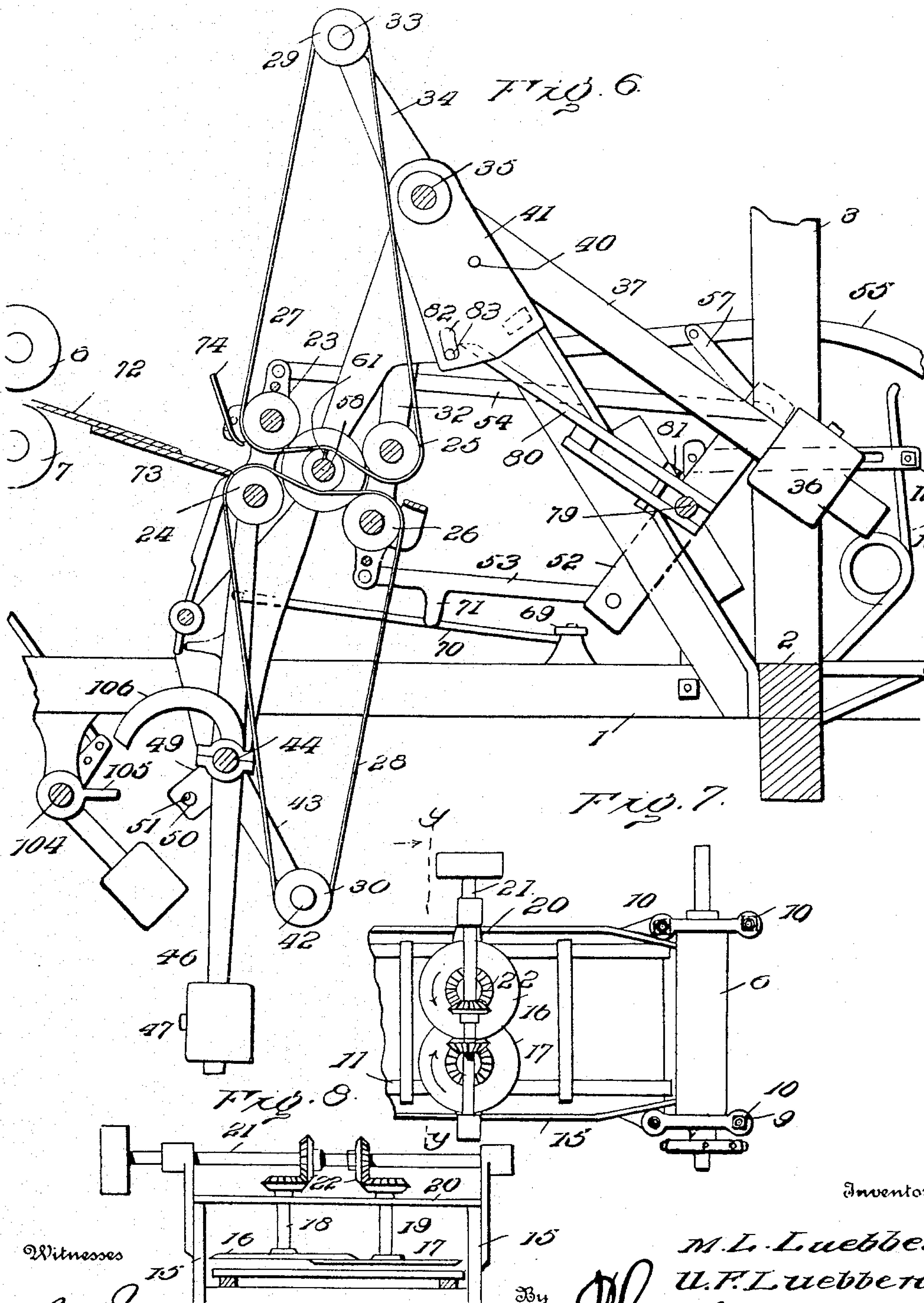

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Fig. 9.

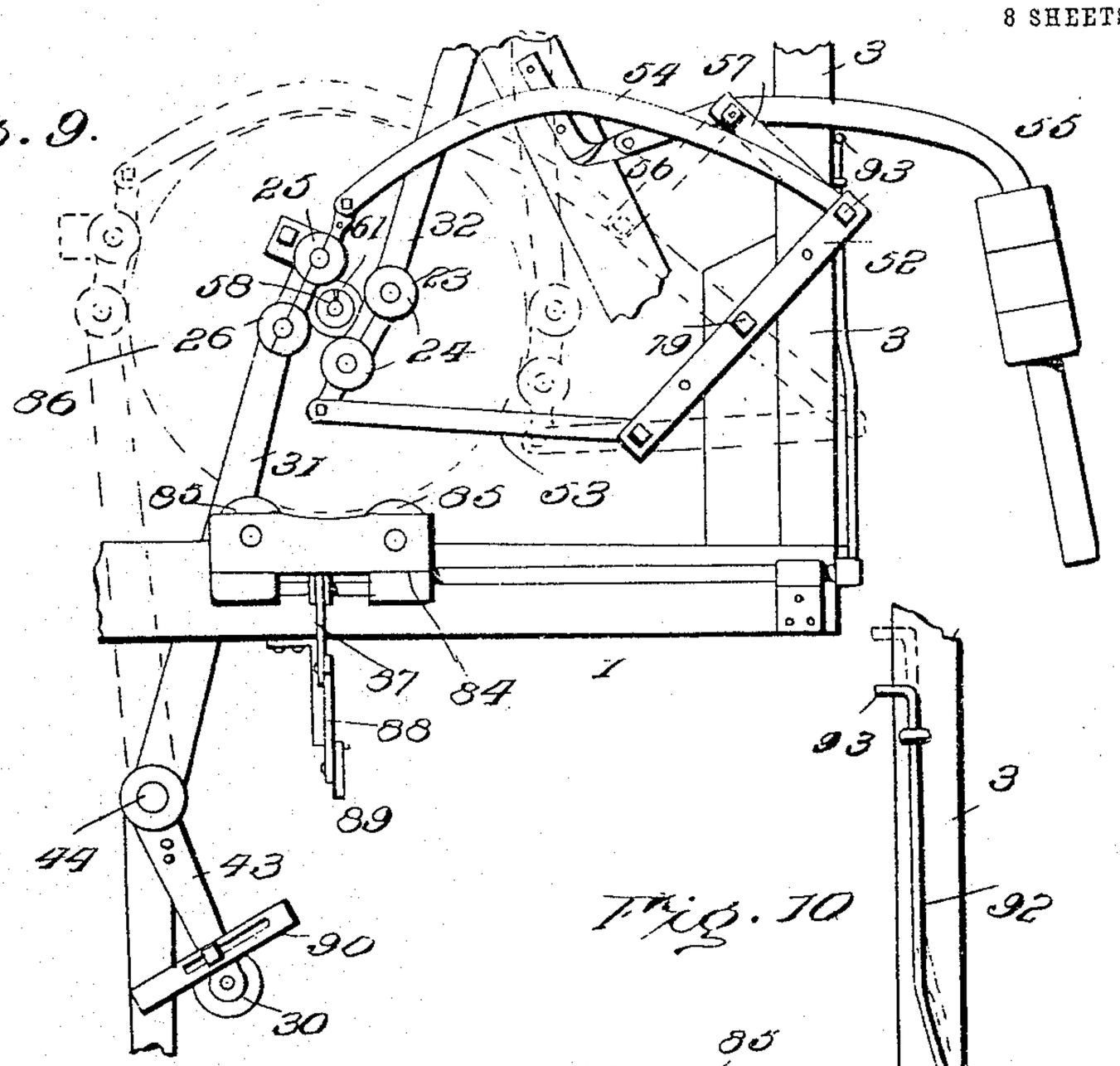


Fig. 10

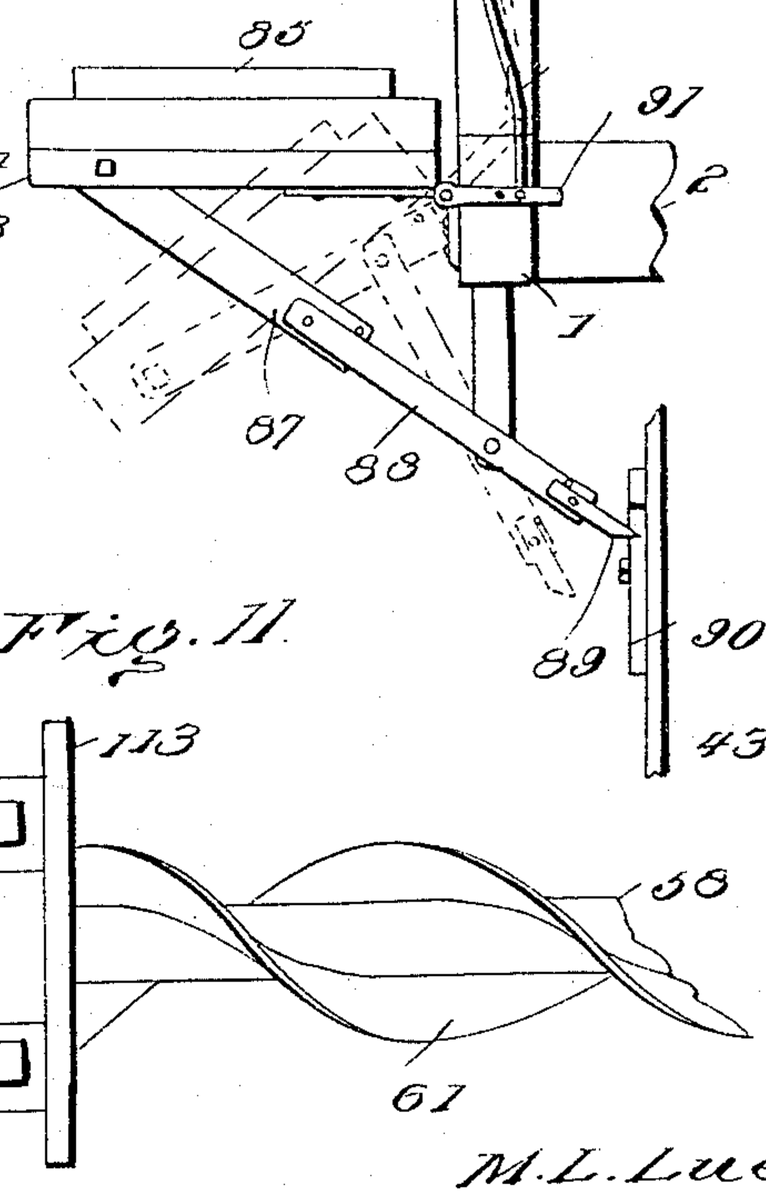
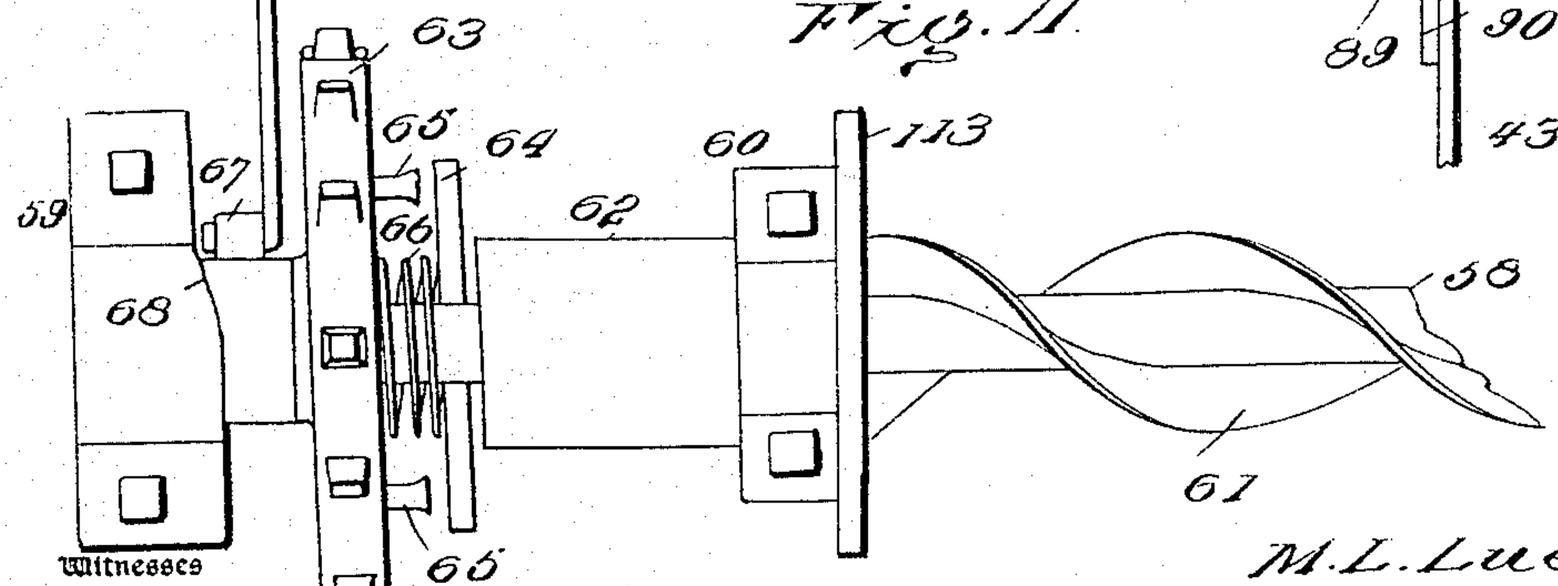


Fig. 11.



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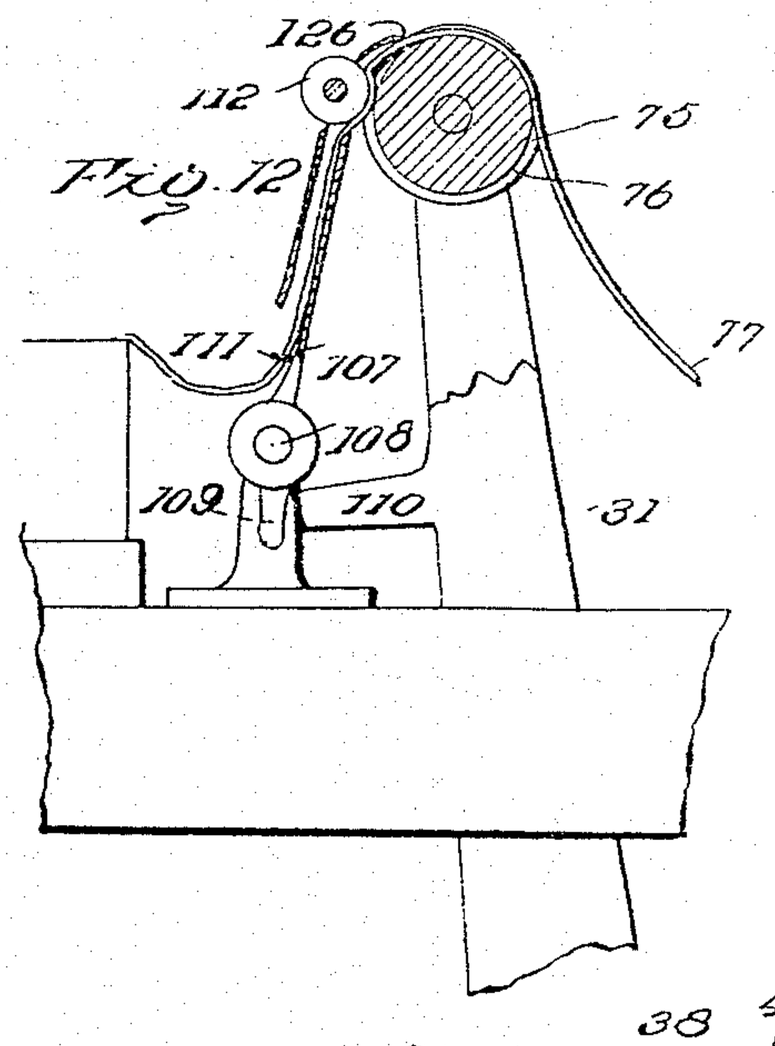

FIG. 12.

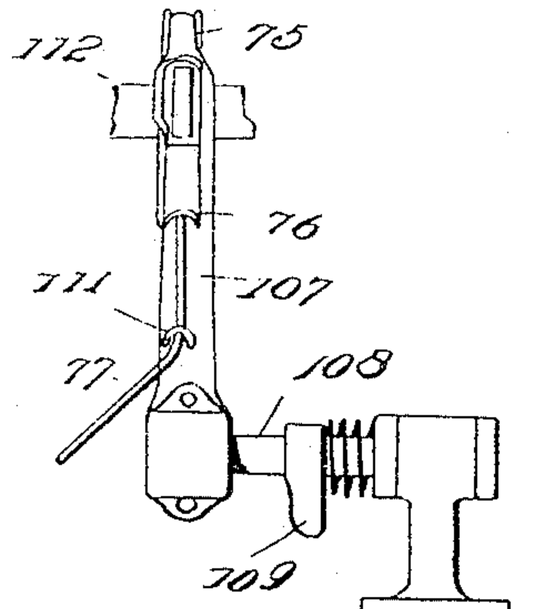

FIG. 13.

FIG. 14.

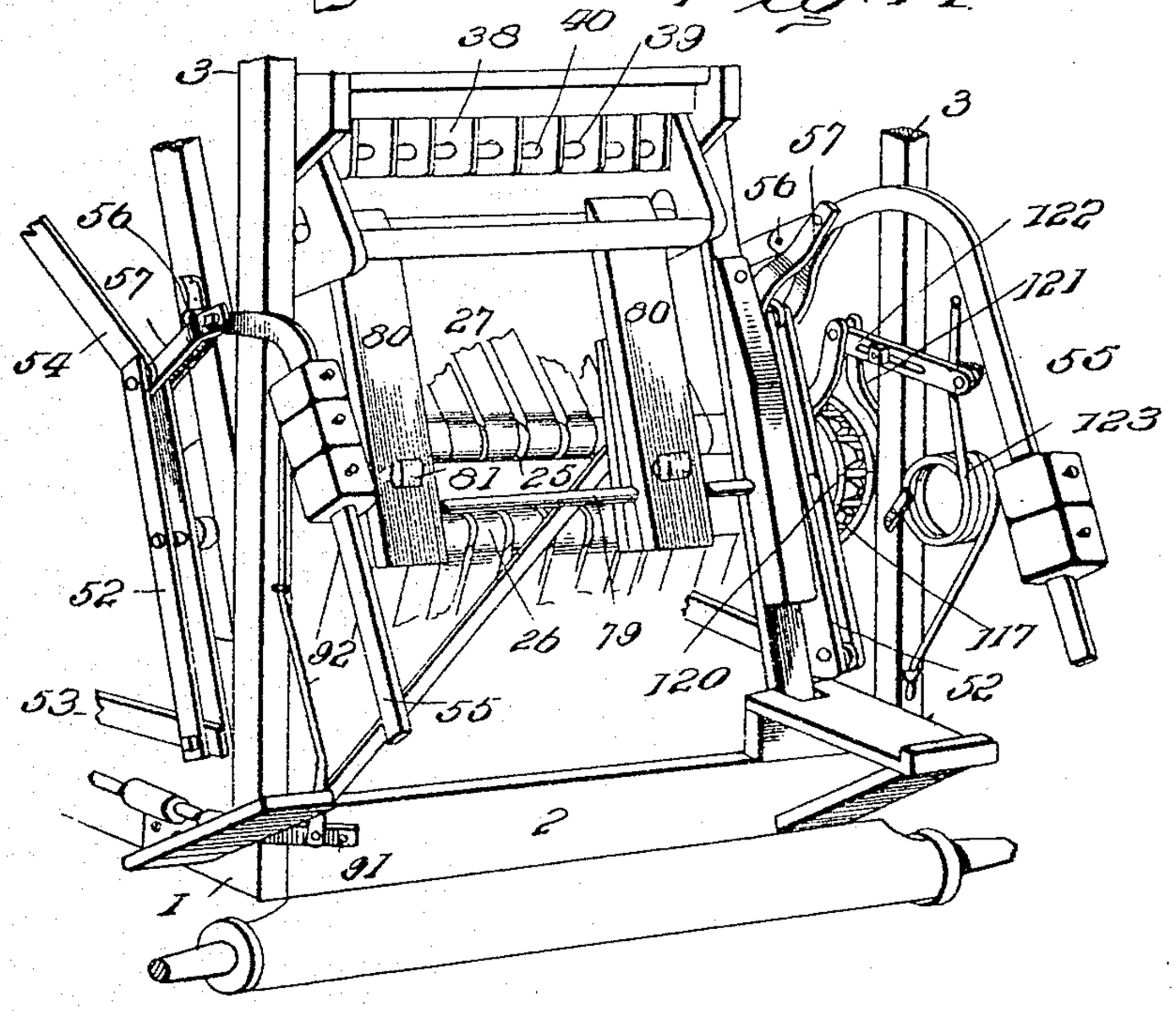

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FIG. 15.

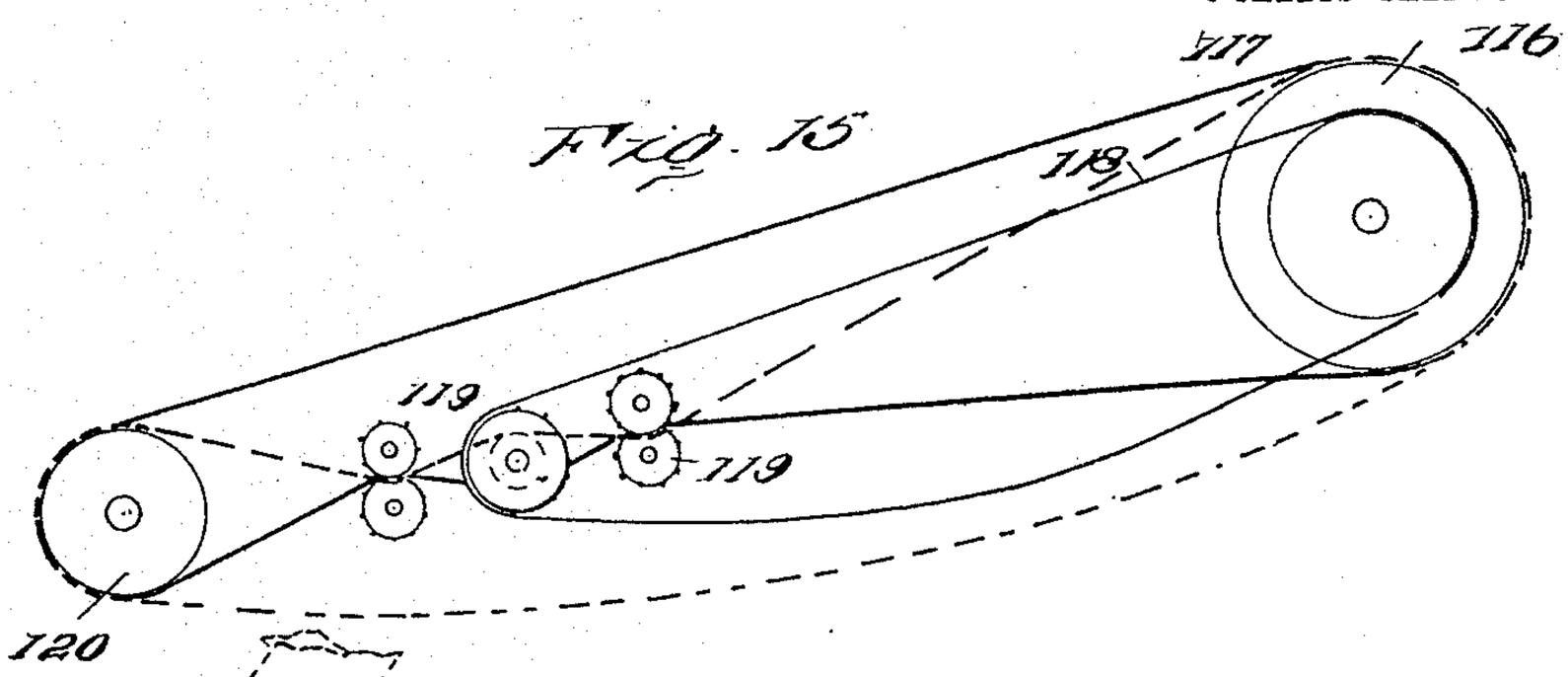


FIG. 17.

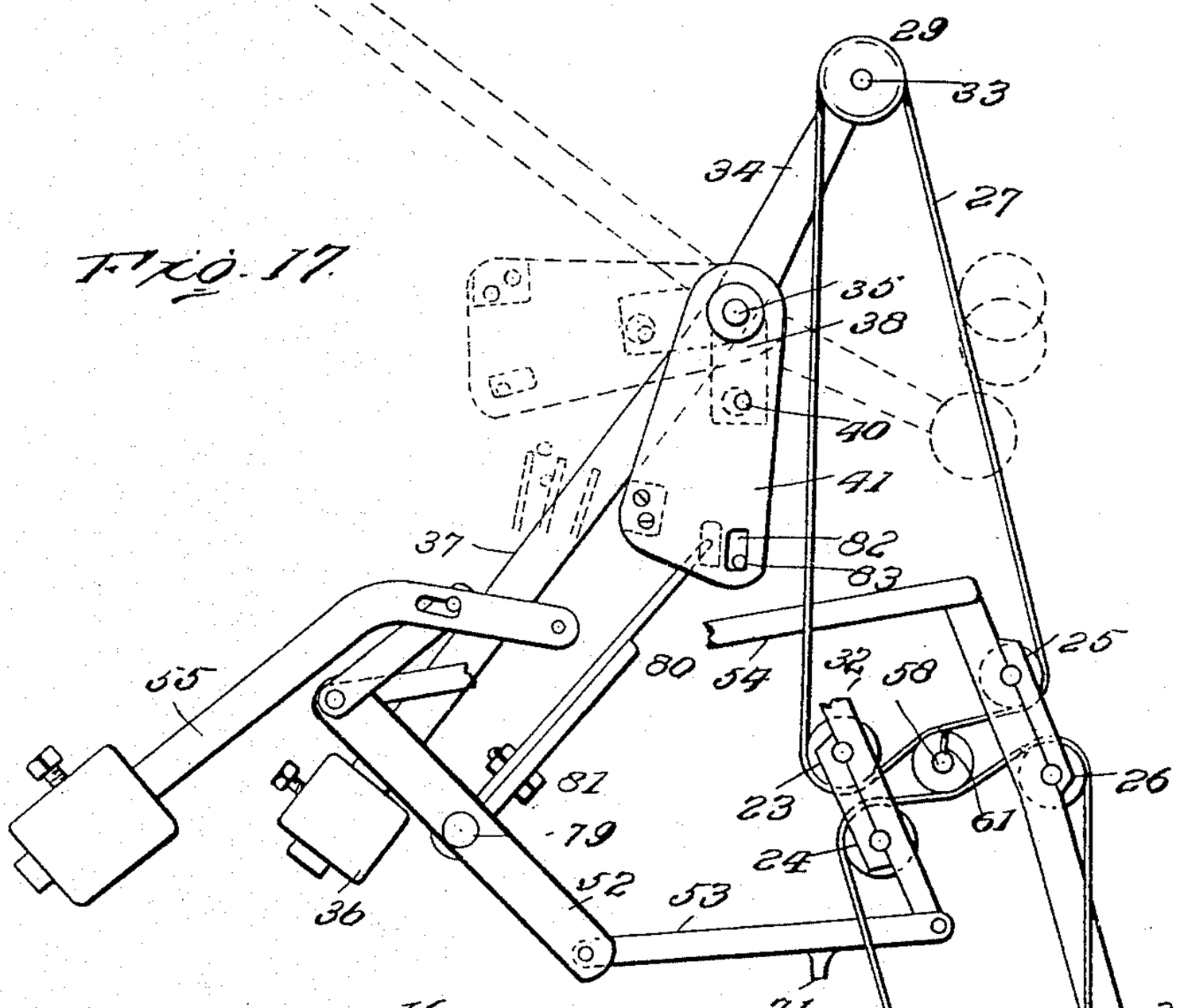
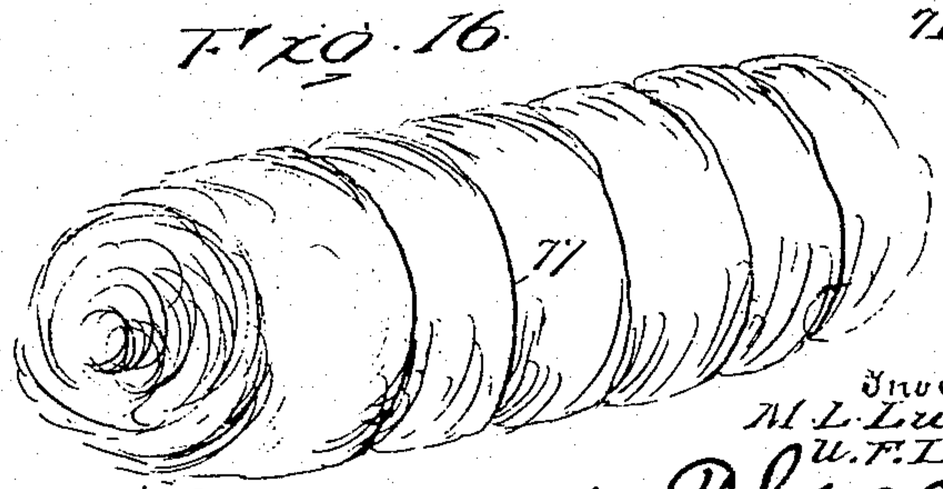


FIG. 16.



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UNITED STATES PATENT OFFICE.

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CYLINDRICAL-BALING MACHINE.

No. 799,175. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed September 2, 1904. Serial No. 223,135.

To all whom it may concern:

Be it known that we, MELCHIOR L. LUEBBEN and UMMO F. LUEBBEN, citizens of the United States, residing at Sutton, in the county of Clay and State of Nebraska, have invented certain new and useful Improvements in Cylindrical-Baling Machines, of which the following is a specification.

This invention relates to the type of machines designed for forming fibrous combustible material into a continuous mat or web and winding the same upon itself to form a cylindrical bale.

A machine embodying the invention is peculiarly adapted for edible fibrous material and enables straw as it is discharged from a threshing-machine and husks as they leave a husking or shredding machine to be formed into a web and rolled upon itself without intermediate handling, thereby materially reducing the cost of marketing such feed stuff.

The object of the invention is to devise a machine of the character aforesaid which will be entirely automatic in its operation and practically continuous in the performance of work and turn out bales of practically uniform size and diameter throughout their length.

For a full description of the invention and the merits thereof and also to acquire a knowledge of the details of construction of the means for effecting the result reference is to be had to the following description and accompanying drawings.

While the essential and characteristic features of the invention are susceptible of modification, still the preferred embodiment of the invention is illustrated in the accompanying drawings, in which—

Figure 1 is a perspective view of a cylindrical-baling machine embodying the invention, the hind wheel on the inner side being omitted. Fig. 2 is a view in elevation of the machine as seen from the reverse side of Fig. 1. Fig. 3 is a central longitudinal section of the feeding, compressing, and bale mechanisms on a larger scale. Fig. 4 is a transverse section of the machine about on the line *x x* of Fig. 3, showing the spindle upon which the bale is formed, the tension-belts, the support for sustaining the bale during its discharge, and the adjunctive drive mechanism. Fig. 5 is a detail perspective view of the instrumentalities for throwing the feeder out of gear when the bale reaches a predetermined size. Fig. 6 is a central longitudinal section of the rear portion of the machine, showing the parts on an enlarged scale. Fig. 7 is a top plan view of the telescopic pan compression rolls, delivery portion of the feeder, and the spreader mechanisms for distributing the material upon the carrier. Fig. 8 is a transverse section of the carrier on the line *y y* of Fig. 7, showing the spreader mechanism in elevation. Fig. 9 is a side view of the lower rear portion of the machine, showing the relation of the parts by full lines prior to the starting of the bale and the relative disposition of the parts by dotted lines after the bale has reached the predetermined size. Fig. 10 is a detail view of the baling-support for sustaining the bale during its discharge, the full lines showing the support in horizontal position and the dotted lines in tilted position to effect delivery of the bale the instant it has cleared the bale-forming mechanism. Fig. 11 is a detail view of an end portion of the spindle, its mountings, and the mechanism for throwing it into and out of gear. Fig. 12 is a sectional detail view showing the means for supplying twine for binding the bale after it has reached the required size. Fig. 13 is a front view of the mechanism illustrated in Fig. 12. Fig. 14 is a view in perspective of the rear portion of the machine. Fig. 15 is a detail view showing the means for imparting rotation to the tension-belts and running parts. Fig. 16 is a detail perspective view of the completed bale. Fig. 17 is a detail view in elevation of the bale-forming mechanism and the tension devices coöperating therewith to insure compact winding of the mat or web to prevent a too rapid movement of the parts when returning to a normal position.

Corresponding and like parts are referred to in the following description and indicated in all the views of the drawings by the same reference characters.

The framework of the machine for supporting the working parts may be of any design, according to the capacity of the machine and the particular work intended. As illustrated, the mechanism is mounted upon a truck, thereby admitting of ready transportation from one place to another, which is essential for field service to enable moving the machine from one locality to another, especially when baling the material direct from a thresher husker, or shredder.

The framework comprises longitudinal timbers 1, transverse beams 2, corner-posts 3, upper longitudinal timbers 4, transverse timbers 5, and intermediate braces or stays, as may be required to provide a substantial structure. The truck and running-gear may be of any design commonly employed in portable farm machinery.

The means for forming the material into a mat or web comprises compression-rolls 6 and 7, mounted so as to relatively yield according to the bulk of material passing between them and driven so that their opposing portions move in the same direction to insure passage of the material therebetween. The lower roll 7 is mounted in stationary bearings, whereas the upper roll is movable, its bearings being forced downward by springs 8, mounted upon guide-rods 9, receiving set-nuts 10, by means of which the tension of the springs 8 is regulated according to the density of the mat or web to be formed.

The feeding mechanism for supplying material to the compressing-rolls of mat-forming mechanism consists of an endless carrier 11, supported by means of rollers 12 and 13, and a table 14, arranged beneath the upper portion of the carrier 11 and provided at its longitudinal edges with guards 15 to prevent lateral displacement of the material during its advancement to the mat-forming mechanism. The carrier 11 may be of ordinary construction, such as employed in mill machinery, so long as it serves to move the material over the table 14.

In order to supply the material so as to form a mat of substantially uniform thickness, it is essential that the same be spread evenly upon the carrier 11, and this is effected by the novel mechanism now to be described and comprising, essentially, two disks 16 and 17, which are arranged a short distance above the table 14 and parallel thereto with their inner edge portions overlapped. The disks 16 and 17 are of such relative diameter as to extend between the guards or side pieces 15 of the feeding mechanism and are secured, respectively, to the lower ends of shafts 18 and 19, mounted in a cross-bar 20, and geared at their upper ends to a transverse shaft 21, preferably by means of beveled gearing 22. The disks 16 and 17 are rotated in opposite directions, as indicated by the arrows in Fig. 7, and in a direction so as to throw the material outward toward the side pieces 15 and insure a uniform distribution upon the carrier and table. The disks are comparatively thin, and their peripheral portions are preferably sharpened to a knife-edge, so as to cut through husks and other material advancing thereto in bulk. In the operation of the machine a part of the material passes beneath the disks 16 and 17 and a part thereover, the upper portion being retarded, whereas the lower portion is moved forward more rapidly, this being due to the unequaled rate of speed at which the carrier and spreading mechanism are driven.

The bale-forming mechanism comprises pairs of rollers 23 and 24 and 25 and 26, tension-belts 27 and 28, idlers 29 and 30, and pivoted arms 31 and 32. The idlers 29 are mounted upon pins 33, projected laterally from counterbalanced arms 34, loosely mounted upon a transverse shaft 35 and having the weights 36 adjustable upon the long arms 37, which arms constitute a part of the levers of which the arms 34 are extensions. The levers, consisting of the arms 34 and 37, are provided with hubs through which the shaft 35 passes. The arms 32 are mounted in coaxial alinement with the shaft 35, and plates 38 are arranged between the hubs of said levers and are likewise mounted upon the shaft 35, the projecting ends of the plates 38 being formed with openings 39, through which a rod 40 passes and is connected at its ends to other plates 41, exterior to the series of counterbalanced levers carrying the idlers 29. The lower idlers 30 are mounted upon pins 42, projected laterally from arms 43, loosely mounted upon a transverse shaft 44, arranged below the plane of the longitudinal timbers 1 and mounted in bearings attached to a cross-timber 45. Each arm 43 is provided with a counterbalanced arm 46, the weight 47 of which is adjustable thereon. The arms 43 and 46 may be of integral formation and are provided with a hub 48 at their point of convergence to receive the shaft 44. Plates 49 are loosely mounted upon the shaft 44 between adjacent hubs 48 and are provided near their outer ends with openings 50, through which a rod 51 is passed.

The part of the tension-belts 28 supported between the rollers 24 and 26 constitutes a traveling bed to support the bale and assists in the formation thereof. The part of the tension-belts 27 supported between the rollers 23 and 25 constitutes a compressing means and supplements the traveling bed in rotation of the bale to roll the mat or web. The bed and compressing means travel in opposite directions, as indicated most clearly by the arrows in Fig. 3. The space between the pairs of rollers 23 and 24 constitutes a throat through which the mat or web passes into the baling-spaces formed between the oppositely-traveling portion of the tension-belts 27 and 28. As the bale increases in size the space formed between the pairs of bale-forming rollers proportionately increases, this being effected by forcing arms 31 and 32 apart, the distance between the rollers of each pair remaining the same. As the arms 31 and 32 are forced apart the idlers 29 and 30 are drawn together, with the result that the weights 36 and 47 are elevated in an arcuate path, thereby proportionately increasing the compression of the bale to its increase in diameter. By

having the idlers 29 and 30 separately mounted upon individual counterbalanced arms, the respective tension-belts are operated upon to insure uniform compression of the bale at every point, thereby compensating for inequalities in the surface resulting from the nature of the material being baled. In this connection it must be remembered that it is practically impossible to provide a smooth surface when baling such material as hay, straw, or fodder. Hence the advantage of the individual tension-belts and the separate mounting of the respective idlers therefor.

A lever 52 is arranged at each side of the machine and is pivotally supported intermediate of its ends. A bar 53 connects one end of the levers 52 with the lower end of the corresponding arm 32, and a bar 54 connects the opposite end of the levers 52 with the upper end of the respective arms 31. When the baling-space is empty, the levers 52 occupy the position shown most clearly by the full lines in Figs. 6 and 9, and when the bale has reached the predetermined size the levers 52 assume the position shown by the dotted lines in Fig. 9. Weighted arms 55, pivotally supported at 56, are connected by links 57 to the upper ends of the levers 52. As the opposing ends of the arms 31 and 32 separate the levers 52 approach the perpendicular, with the result that the weighted arms 55 are moved upward at their free ends. When the levers 52 and links 57 are in alinement, the weighted arms 55 have reached their highest position, and a continued separation of the arms 31 and 32 moves the pivotal connection between the parts 52 and 57 out of a straight line passed through the pivotal support of the levers 52 and the pivotal connection of the links 57 with the weighted arms 55. When this occurs, the superior force of the weighted arms 55 causes their outer ends to gravitate and to throw the upper ends of the levers 52 toward the bale and their lower ends away from said bale, thereby pushing the pairs of baling-rollers apart, as indicated most clearly by the dotted lines in Fig. 9, preliminary to the ejectment of the bale, which is thereby facilitated.

The spindle 58, upon which the mat or web is wound, is free at one end and is journaled at its opposite end in bearings 59 and 60 and is provided with a spiral flight or rib 61, which is utilized for ejectment of the bale after same has been completed. A collar 62 is loosely mounted upon a part of the spindle adjacent to the bearing 60 and forms a support for a portion of the drive-chain employed to impart rotation to the bale-forming mechanism. A sprocket-wheel 63 is loose upon an end portion of the spindle 58, and a clutch mechanism is interposed between said sprocket-wheel and spindle to cause the two to rotate in unison after the bale has acquired the given size, so as to rotate the spindle at a higher rate of speed than the bale, with the result that the bale is forced from the spindle by the action of the spiral flight or rib 61. The clutch consists of a pin 64, passed transversely through an opening of the spindle 58, and lugs 65 project laterally from the sprocket-wheel 63. A spring 66, mounted upon the spindle and interposed between the clutch elements, normally holds the parts 64 and 65 separated. An arm 67 is mounted upon the end portion of the spindle 58 adjacent to the bearing 59, and the side of its hub portion facing the bearing 59 is provided with a cam portion 68 to coöperate with a corresponding cam portion of said bearing 59, whereby in the movement of the arm 67 in one direction its cam portion 68, riding upon the companion cam portion of the bearing 59, effects a lateral movement of the arm 67 and the sprocket-wheel 63, thereby throwing the clutch elements 65 and 64 into engagement and causing the spindle 58 and sprocket-wheel 63 to rotate together. For operating the pivotally-mounted arm 67 a lever 69 is provided, one end of said lever being connected by means of a pitman 70 with the arm 67, and the opposite end of the lever 69 projecting into the path of a stop 71 of the bar 53 at the side of the machine.

Between the mat-forming mechanism and the bale-forming devices is arranged a support for directing the mat into the throat formed between the bale-forming rollers 23 and 24. This support consists of a pan composed of similar sections 72 and 73, which have a telescopic arrangement, this being rendered necessary because of the variation of the space between the mat-forming and baling mechanisms incident to the pivotal movement of the arms 31 and 32. The section 72 of the pan is stationary, whereas the section 73 is attached to the arms 31 and moves therewith. The side pieces of the pan are inwardly inclined at the ends adjacent to the arms 31, so as to reduce the width of the mat and compress the edge portions preliminary to its entering the throat leading to the baling-space. A guard 74 is provided at the delivery end of the pan and is inclined upwardly and away from the bale-forming rollers 23 and 24 and insures delivery of the mat or web into the space formed between them.

To prevent loosening of the winds of the mat or web and to insure formation of a bale that will practically maintain its form while being used, the disks 75 are strung upon the shaft supporting the rollers 24 and are loose upon said shaft and project beyond the rollers and upper portion of the tension-belts 28 to insure pressing a portion of one wind into the previous wind or layer. These indenting-disks may be provided in any number and are arranged between adjacent belts. The indenting-disk 75, adjacent to the delivery side of the machine, has its peripheral portion grooved,

as shown at 76 in Figs. 12 and 13, to receive the binding-twine 77.

As the mat is wound upon the spindle 58 in the formation of the bale it is compressed by the action of the tension-belts 27 and 28, the opposing portions of which are pressed against opposite sides of the bale, but principally by the method by which they draw together the rollers, by means of the weighted arms 37 and 46. The weighted arms 55 also serve to compress the bale by offering a resistance to the separation of the pivoted arms 31 and 32, as will be readily comprehended. The action of these weighted arms is further supplemented by friction devices, which also serve to prevent a too rapid return of the parts to a starting position after the bale has been ejected. The friction device coöperating with the arms 31 and 43 comprises plates 49, which are strung upon the shaft 44 between the hub portions of said arms, a set-screw 78 serving to confine the parts upon the shaft 44, so as to obtain the desired object. The rod 51, passing through the openings 50 of the friction-plates 49, serves to limit the independent movement of the arms 31 and 43, the play being sufficient to enable the arms 31 to move so as to take up the slack in the tension-belts 28 as the bale clears them in its ejectment from the machine. The friction device coöperating with the arms 32 and 34 is similar to that coöperating with the arms 31 and 43 and comprises the plates 38 and the rod 40, as hereinbefore described. The openings 39 in the friction-plates 38 provide for a limited movement of the arms 34, so as to take up any slack in the tension-belts 27, as when the bale clears the same during its discharge.

The levers 52 are secured to a shaft 79, which turns therewith, and upon said shaft 79 is mounted a retarder or friction device consisting of companion arms 80, of resilient material, so as to have a slight spring action. The arms 80 are frictionally mounted upon the shaft 79, so as to turn thereon upon the application of a force sufficient to overcome the frictional contact between the parts 79 and 80. The frictional engagement of the arms 80 with the shaft 79 may be regulated by the set screw or bolt 81. The arms 80 may be of wood or metal, the latter being preferred, and having an end portion bent so as to encircle the shaft 79 and having a terminal portion extended about parallel with the arm and spaced therefrom and connected thereto by the said bolt or screw 81. The plates 41 are connected to the shaft 35 and turned therewith and are provided with elongated openings 82, in which is supported a rod or bar 83. As the bale increases in diameter the plates 41 and rod 83 move away from the baling-space, whereas the arms 80 move toward the baling-space, the two parts 41 and 80 moving in opposite directions. The ends of the arms 80 coming in contact with the rod 83 offer a resistance to the separation of the arms 31 and 32, as will be readily comprehended. As the parts 41 and 80 move in arcuate paths the parts 80 and 83 will clear each other at a point in the movement of the parts 80 and 41, and this occurs at about the time the bale is completed. The rod 83 moves in the openings 82 when riding upon the extremities of the arms 80, and after clearing the latter said rod drops in the openings 82, so as to engage with the extremities of the arms 80 upon the reverse movement of the parts 80 and 41 during the return of the operating parts of the machine to a starting position, so as to prevent their too-rapid movement. When the bale clears the bale-forming mechanism and the arms 31 and 32 approach each other under the action of the weights 36 and 47, the parts 80 and 83 come in contact and regulate the speed of the return movement.

A support 84 is hinged or pivoted at the side of the machine from which the bale is discharged and is provided with companion rolls 85, upon which the bale 86 rests during its ejectment. A sectional brace holds the pivoted support 84 in the horizontal position, as shown most clearly in Fig. 10, the sections of the brace being indicated at 87 and 88. A trip 89 is pivoted to the lower projecting end of the section 88 and is adapted to be struck by the outermost pivoted arm 43, or rather by a stop 90 connected thereto. As the bale clears the last set of tension-belts the arms 31 and 32 close and the counterbalanced arms 34 and 43 correspondingly move, with the result that the stop 90, coming in contact with the trip 89, breaks the joint of the sectional brace sustaining the support 84 and permits the latter to drop at its outer end, as indicated by the dotted lines in Fig. 10, whereby delivery of the bale is effected. An extension 91 projects from the support 84, and a rod or bar 92 is in contact therewith and is moved upward as the support 84 drops. The upper end of the rod or bar 92 is bent laterally, as shown at 93, and extends across the path of the adjacent weighted arm 55 and lifts the latter. As soon as the support 84 is relieved of the weight of the bale the weighted arm 55 returning to a normal position presses downward upon the rod 92 and resets the support 84, as indicated by the full lines in Fig. 10. When the bale has acquired the given size, the feeding mechanism is automatically thrown out of gear to prevent a supply of material during the binding and discharge of the bale. The instant the bale has cleared the machine the feeding mechanism is automatically thrown into gear. These portions are effected by the mechanism now to be described.

A sprocket-wheel 94 is loosely mounted upon the shaft 95 of the inner supporting-roller 13 of the carrier 11 and is normally

pressed outward by means of a spring 96, mounted upon the shaft 95 and confined between the sprocket-wheel 94 and a pin or stop of said shaft. An arm 97 is loosely mounted upon the shaft 95, and its hub end is provided with a cam portion 98 to coöperate with a corresponding cam portion of a collar 99 in coaxial alinement with the shaft 95. A clutch is interposed between the shaft 95 and sprocket-wheel 94 and, as shown, consists of a pin 100, fitted in an opening of the shaft 95, and lugs 101, projected laterally from the sprocket-wheel 94. Upon turning the arm 97 it is moved laterally by reason of its cam portion 98 riding upon the cam portion of the part 99 and being in contact with the sprocket-wheel 94 moves the same against the tension of the spring 96 and engages the clutch by moving the lugs 101 out of the path of the projecting ends of the pin 100. The arm 97 is connected to a weighted arm 102 by means of a rod 103, and said weighted arm 102 is attached to a rock-shaft 104, mounted in bearings attached to the cross-timber 45 and provided with a trip 105, to be engaged by means of an arm 106, attached to or forming a part of one of the arms 43 and 46. The rock-shaft 104 is actuated at the instant the bale reaches the predetermined size, and the pivoted arms 31 and 32 are forced apart by means of the weighted arms 55 in the manner stated. As the arms 31 and 32 close and the arm 106 moves away from the trip 105, the weight applied to the arm 102 serves to rock the shaft 104 and move the arm 97, so as to permit the sprocket-wheel 94 to become clutched to the shaft 95, whereby the feeding mechanism is thrown into gear.

The means for feeding the binding-twine to the bale comprises an arm 107, which is attached to a rock-shaft 108 and is adapted to be engaged by a projection 110, extended from the pivoted arm 31 at the delivery side of the machine. The arm 107 is provided with a guide 111 for the binding-twine, and its upper end is curved and made concave in cross-section. The roller 112 is journaled to the upper portion of the arm 107 and operates, through the opening formed therein, so as to come in contact with the outermost indenting-disk 75, so as to be rotated thereby and automatically feed the twine to the bale. Normally the arm 107 stands away from the bale-forming mechanism; but when the bale has reached the required size and the arms 31 and 32 are forced apart by the weighted arms 55 the projection 110, striking the trip 109, rocks the shaft 108 and throws the arm 107 toward the rollers 24 and brings the roller 112 in engagement with the outermost indenting-disk 75, and the twine 77 being confined between the roller 112 and the indenting-disk automatically and positively advances the twine to the bale.

The spindle 58 is initially rotated by means of a disk 113, attached to or forming a part thereof, said disk being in contact with the series of rollers 23, 24, 25, and 26. This is indicated most clearly in Figs. 3 and 11. After the spindle has received a number of winds of the mat or web the roll is thereafter rotated, by means of the tension-belts 27 and 28, in the manner hereinbefore stated.

The compression-rolls are geared together in any determinate way so as to rotate at uniform speed and in opposite direction. The sprocket-wheel 94 is connected, by means of a sprocket-chain 114, to a companion sprocket-wheel 115, mounted upon an extension of the shaft of the lower compression-roll 7. A twin sprocket-wheel 116 is attached to the shaft of the upper compression-roll 6, and sprocket-chains 117 and 118 pass around the respective members thereof and around sprocket-wheels 119, applied to the journals of the series of bale-forming rollers 23, 24, 25, and 26, so as to drive the tension-belts 27 and 28 in opposite directions. An idler 120 supports the opposite ends of the sprocket-chains 117 and 118 and is journaled to a pivoted support 121, to which a movable bar 122 is connected and acted upon by means of a spring 123 to maintain the sprocket-chains 117 and 118 under a given tension and by means of which any variation due to the relative movement of the pairs of rollers 23 and 24 and 25 and 26 results. A sprocket-chain 124 connects a sprocket-wheel 125 with the sprocket-wheel 63.

In the operation of the machine the material to be baled is supplied to the carrier 11 and advanced thereby to the compression-rolls 6 and 7, by means of which it is formed into a mat or web. This mat or web passes along the pan to the bale-forming mechanism and is wrapped about the spindle 58. After the bale has reached the predetermined size the feeding mechanism is thrown out of gear in the manner stated, and the spindle 58 is thrown into gear with actuating mechanism, by means of which it is rotated at a higher rate of speed than the tension-belts 27 and 28, and as a consequence has imparted thereto an endwise movement which forces it from between the tension-belts. During the operation of discharging the bale the tension-belts cleared are successively straightened between the respective rollers 23 25 and 24 26. The indenting-disks form a spiral groove or indentation in the outermost layer of the bale as the same is discharged, and the binding-twine 77 is correspondingly wrapped about the bale in a spiral direction. The finishing end of the binding-twine after being cut is tucked under the last wind of the twine by hand. The starting end of the binding-twine is automatically caught under the first wind. Hence the only operation to be performed by hand is the tucking of the finishing end of the binding-twine under the last wrap. The binding-twine is automatically cut by means

of a knife 126, applied to the upper end of the arm 107. The disk 113 is located at the inner end of the spindle at the beginning of the spiral 61 and acts as a head to prevent the material working toward the bearings and gearing coöperating with the spindle.

It is noted that the belts 27 and 28 may be more cheaply produced, are more durable, and operate more effectively than a single wide belt, because the strain is uniformly distributed thereon, and any element may be replaced at a comparatively slight expense. Moreover, the belts admit of a shifting of the traveling beds or carriers upon the rollers 23, 24, 25, and 26 as the bale is ejected by means of the spiral 61. The rollers 23 and 26 are longer than the rollers 24 and 25 to admit of the tension-belts shifting thereon when the bale is discharging.

Having thus described the invention, what is claimed as new is—

1. In a cylindrical baling-machine, the combination of oppositely-disposed bale-forming belts, pairs of supporting-rollers therefor, the rollers of each pair sustaining opposite belts, a movable support for each pair of said rollers, idlers for tensioning the belts, and movable supports for the idlers to admit of maintaining the belts under tension during all stages of the bale, substantially as set forth.

2. In a cylindrical baling-machine, the combination of two sets of endless bale-forming belts, pairs of positively-driven rollers supporting the same, movable supports for the pairs of rollers, idlers coöperating with said belts, and means coöperating with the idlers to compensate for any slack in said belts and to maintain the same under proper tension, substantially as specified.

3. In a cylindrical baling-machine, the combination of independent movable supports, a pair of rollers carried by each of the supports, oppositely-disposed bale-forming belts passed around the rollers of each pair, idlers for the respective belts, and independent counterbalanced supports for said idlers to maintain the bale-forming belts under tension under all conditions, substantially as set forth.

4. In a cylindrical baling-machine, the combination of oppositely-disposed bale-forming belts, corresponding pairs of rollers for supporting portions of said belts in position to form a baling-space, arms extended in opposite directions and pivoted at their outer ends, each arm supporting a pair of said rollers at its inner end, counterbalanced idlers for maintaining said belts under tension, and means for positively rotating the belts so that their opposing portions travel in opposite direction, substantially as set forth.

5. In a cylindrical baling-machine, the combination of oppositely-disposed pivoted arms, a pair of rollers carried by each pivoted arm, bale-forming belts passed around corresponding rollers of the pairs so as to maintain a predetermined distance apart, means for yieldingly pressing the pivoted arms together to insure compactness in the formation of the bale, idlers for the respective belts, and counterbalanced supports for the idlers, substantially as set forth.

6. In combination, oppositely-disposed pivoted arms, a pair of rollers journaled to each of said arms, means for positively rotating said rollers, upper and lower counterbalanced arms, idlers for each of the counterbalanced arms, and tension-belts supported by corresponding idlers and the pairs of rollers applied to the pivoted arms, substantially as set forth.

7. In a cylindrical baling-machine, the combination of supports mounted to move in opposite directions and provided with the bale-forming mechanism, said supports being gradually separated as the bale increases, and means coöperating with said supports to resist their separation to a given point and to facilitate their separation after said point has been passed, substantially as set forth.

8. In a cylindrical baling-machine, the combination of oppositely-disposed supports provided with the bale-forming mechanism, a lever pivoted between its ends and having the latter connected to corresponding supports, a counterbalance, and means for connecting said counterbalance to the lever to resist separation of the supports until a point is reached in their outward movement beyond which said counterbalance forces the supports apart, substantially as specified.

9. In combination, oppositely-disposed arms provided with bale-forming mechanism, a lever pivotally supported between its ends, means connecting opposite ends of said lever with corresponding pivoted arms, a counterbalanced arm, and a link connecting the counterbalanced arm with said pivoted lever to resist spreading of the pivoted arms during the first part of their movement and to facilitate their separation during the latter part of their pivotal movement, substantially as set forth.

10. In cylindrical bale-forming mechanism, the combination of the spindle, means for rolling the material about the spindle, and actuating means for driving said spindle at a higher rate of speed after the compression of the bale to effect its automatic ejectment from said spindle, substantially as set forth.

11. In combination, a spindle provided with a spiral rib, means for wrapping the material about the spindle and rotating the latter in the formation of the bale, and actuating means for imparting a relative higher speed to the spindle after the bale has been completed to effect automatic discharge thereof, substantially as set forth.

12. In combination, a spindle provided with a spiral rib, means for wrapping the material

to be baled about the spindle, actuating mechanism, a clutch between said actuating mechanism and the spindle, and means operated by the bale-forming mechanism to automatically throw said actuating mechanism into gear to effect rotation of the spindle independent of the bale-forming mechanism to cause automatic discharge of the bale, substantially as set forth.

13. In combination, a spindle free at one end and mounted in supports at its opposite end and provided with a spiral rib, means for initially rotating said spindle and wrapping the material therearound, a driver in coaxial alinement with said spindle, a clutch between said driver and spindle, and means operated by the bale-forming mechanism for throwing the said driver into gear to operate the spindle at a relatively higher speed to effect automatic discharge of the completed bale, substantially as set forth.

14. In a baling-machine and in combination with mechanism for forming material into a mat or web, feeding mechanism comprising a carrier, and rotating disks for uniformly distributing the material upon said carrier, substantially as set forth.

15. In a baling-machine and in combination with mechanism for forming the material into a mat or web, feeding mechanism comprising a carrier, spreading mechanism the same comprising coöperating disks, and means for rotating the same in opposite directions, substantially as set forth.

16. In a baling-machine and in combination with mechanism for forming material into a mat or web, feeding mechanism comprising a carrier, spreading mechanism the same comprising oppositely-rotating disks having their opposing portions overlapped, substantially as set forth.

17. In a baling-machine and in combination with mechanism for forming material into a mat or web, feeding mechanism comprising a carrier, spreading mechanism the same comprising positively-rotating disks having their peripheral portions sharpened and their opposing edge portions overlapped, substantially as specified.

18. In cylindrical bale-forming mechanism, the combination of a series of oppositely-disposed bale-forming rollers, counterbalancing means for each of said rollers, and a friction device coöperating with the bale-forming rollers and their counterbalancing means to prevent their too rapid movement and to admit of their having a limited play, substantially as set forth.

19. In bale-forming mechanism, the combination of a series of oppositely-disposed bale-forming rollers, counterbalancing means normally pressing each of said rollers together, and a friction device coöperating with the bale-forming rollers and their counterbalancing means to prevent their too rapid movement and to admit of their having a limited play, the same consisting of plates provided with openings, and a rod supported in the openings of the plates, substantially as set forth.

20. In cylindrical bale-forming mechanism, the combination of rollers, bale-forming belts, idlers for each of the bale-forming belts, counterbalanced arms supporting said idlers, plates interposed between the counterbalanced arms and held in frictional contact therewith, and means for limiting the play of said plates, whereby the idlers are adapted to have a limited independent movement to permit automatic take-up of the belts, substantially as set forth.

21. In combination, oppositely-disposed pivoted arms, a pair of rollers journaled to each of said arms, tension-belts supported upon corresponding rollers of the respective pairs, idlers for the tension-belts, pivotally-supported counterbalanced arms carrying said idlers, plates mounted coaxially with the arms carrying said rollers and counterbalances and having openings, means for causing the plates to engage frictionally with the hub or pivotal portions of said arms, and a rod for each of said plates passed through openings therein, substantially as set forth.

22. In combination, a cylindrical bale-forming mechanism comprising movable supports, a counterbalance coöperating with the supports to resist their spreading during the initial part of their movement and to facilitate their separation during the remainder of their movement, means for returning the parts to a normal position after ejectment of the bale, and a friction device coöperating with the retarding means for preventing a too rapid return of the parts to a normal position, substantially as set forth.

23. In cylindrical bale-forming mechanism, the combination of oppositely-disposed supports, a pivoted lever connected thereto, a counterbalance connected with said lever to resist separation of the supports during their initial movement and to facilitate their separation during the latter part of their movement, and a friction device connected with the lever and adapted to resist its movement in both directions, substantially as set forth.

24. In combination, an expansible bale-forming mechanism, a pivoted lever connected with opposite parts of the bale-forming mechanism, a shaft supporting said lever and movable therewith, an arm having frictional engagement with the shaft to retard its movement, a counterbalance for resisting the initial expansion of the bale-forming mechanism and to press same apart during the latter part of its movement, and a second friction device coöperating with said arm in each direction, substantially as set forth.

25. In combination, a bale-forming mechanism comprising a series of belts, idlers forming a support for said belts, counterbalanced

arms supporting said idlers, plates connected with the counterbalanced supports for movement therewith, a counterbalanced lever having its end portions connected with opposite parts of the bale-forming mechanism, an arm having frictional engagement with the support of said lever, and a rod carried by the aforementioned plates and having a limited movement and adapted to engage with the friction-arm to retard its movement in each direction, substantially as set forth.

26. In combination, a bale-forming mechanism, means for ejecting the bale, a pivoted support for sustaining the bale during its discharge, and a sectional brace for normally holding the support in proper position and adapted to be tripped to permit quick discharge of the bale, substantially as set forth.

27. In combination, an expansible bale-forming mechanism controlled by means of the bale, a pivoted support for sustaining the bale during its discharge, means for ejecting the bale when completed, a sectional brace for holding said support in proper position, and means actuated by the bale-forming mechanism for tripping the support after the bale has cleared the bale-forming mechanism to permit said support to drop and effect quick delivery of the bale, substantially as set forth.

28. In combination, a bale-forming mechanism, means for ejecting the bale, a pivoted support for sustaining the bale during its discharge, means for tripping the support to permit of its dropping, a counterbalance elevated by the weight of the bale when the support is tripped and adapted to reset the support after the bale has cleared same, substantially as specified.

29. In combination, a bale-forming mechanism, means for ejecting the bale, a tilting support for the bale, means for tripping said support by means of the bale-forming mechanism, a movable rod actuated by means of said pivoted support, and a counterbalance elevated upon tilting of the support and serving to reset the support when cleared of the bale, substantially as set forth.

30. In combination with mechanism for forming material into a cylindrical bale, indenting-wheels for pressing the succeeding layers into adjacent inner or previous layers, substantially as set forth.

31. In combination, oppositely-disposed bale-forming belts for rolling the material into a bale, and indenting-wheels for pressing the succeeding layers of material into the proceeding adjacent layers during the formation of the bale, substantially as set forth.

32. In combination with bale-forming mechanism comprising a spindle and coöperating traveling parts, means for ejecting the bale and imparting a spiral movement to its outer surface with reference to a given fixed point, and means for applying a binding-twine spirally about the bale simultaneously with its discharge, substantially as specified.

33. In combination, bale-forming mechanism, means for ejecting the bale and simultaneously imparting thereto a rotary movement, and means for applying a binder to the bale, the same being wound spirally about the same simultaneously with its discharge, substantially as specified.

34. In combination, a cylindrical bale-forming mechanism, indenting-wheels for pressing the successive layers into the previous adjacent layers, and means for automatically applying binder by means of one of said indenting-wheels, substantially as specified.

35. In combination, a cylindrical bale-forming mechanism comprising movable parts, a pivoted arm carrying a binder, and means for tripping said arm by means of the bale-forming mechanism to throw the binder into position to be taken up by the bale, substantially as set forth.

36. In combination, expansible bale-forming mechanism, an indenting-wheel, a pivoted arm adapted to be tripped by means of the bale-forming mechanism, a feed-wheel pivoted to said arm and adapted to be thrown into contact with the indenting-wheel to be rotated thereby, and a binder guided by said pivoted arm and adapted to be gripped between the indenting and feeding wheels for positively supplying the binder to the bale, substantially as set forth.

37. In a machine for forming a mat or continuous web of fibrous material into a roll or bale, and in combination with the roll-forming mechanism, a series of disks for indenting or tucking in the material as the same is formed into a roll, substantially as set forth.

38. In a machine for forming a mat or continuous web of fibrous material into a roll or bale, and in combination with the roll-forming mechanism, a series of rollers and disks alternately disposed and adapted to exert a pressure upon the roll during its formation, the disks indenting or tucking in the material to effect a binding of the layers or winds, substantially as described.

39. In a machine for forming a mat or web of fibrous material into a roll or bale, a spindle for winding said mat thereon, and a traveling bed adapted to direct the mat upon the spindle and to insure a compact winding of the mat thereon, said bed yielding to the increasing diameter of the roll, and composed of a series of elements independently movable to allow for inequalities of the roll.

40. In a machine for forming a mat or web of fibrous material into a roll, a spindle for winding the mat thereon, oppositely-disposed pivoted arms, and indenting-disks carried by one of said arms for tucking or binding the winds of the mat in the formation of the roll, substantially as set forth.

41. In a machine for forming a mat or web of fibrous material into a roll, a spindle for winding said mat thereon, pairs of rollers located upon opposite sides of the spindle, endless belts carried by said rollers and arranged to exert a pressure upon the mat in the formation of the roll, movable supports for each pair of said rollers, and independent tension means for each of the belts, substantially as set forth.

42. In a machine for forming a mat or web of fibrous material into a roll, a spindle for winding said mat thereon, a traveling bed for directing the mat to the spindle, said bed being composed of a series of belts, and separate means for normally pressing each belt of said bed toward the spindle to insure compact winding of the mat thereon, substantially as specified.

43. In a machine of the character described, a spindle having a spiral and a disk at the inner end of the spiral to form a guard and drive element, and operating means normally in positive engagement with said disk to impart initial rotation to the spindle, substantially as described.

44. In a machine of the character described, the combination of rollers, tension-belts supported on said rollers, a spindle having a spiral and means for positively rotating the spindle at a higher rate of speed than the bale to discharge the latter, the tension-belts shifting to accommodate the spiral discharge movement of the bale, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

MELCHIOR L. LUEBBEN. [L. S.]
UMMO F. LUEBBEN. [L. S.]

Witnesses:
THEO. MILLER,
CARL SPIREMANN.