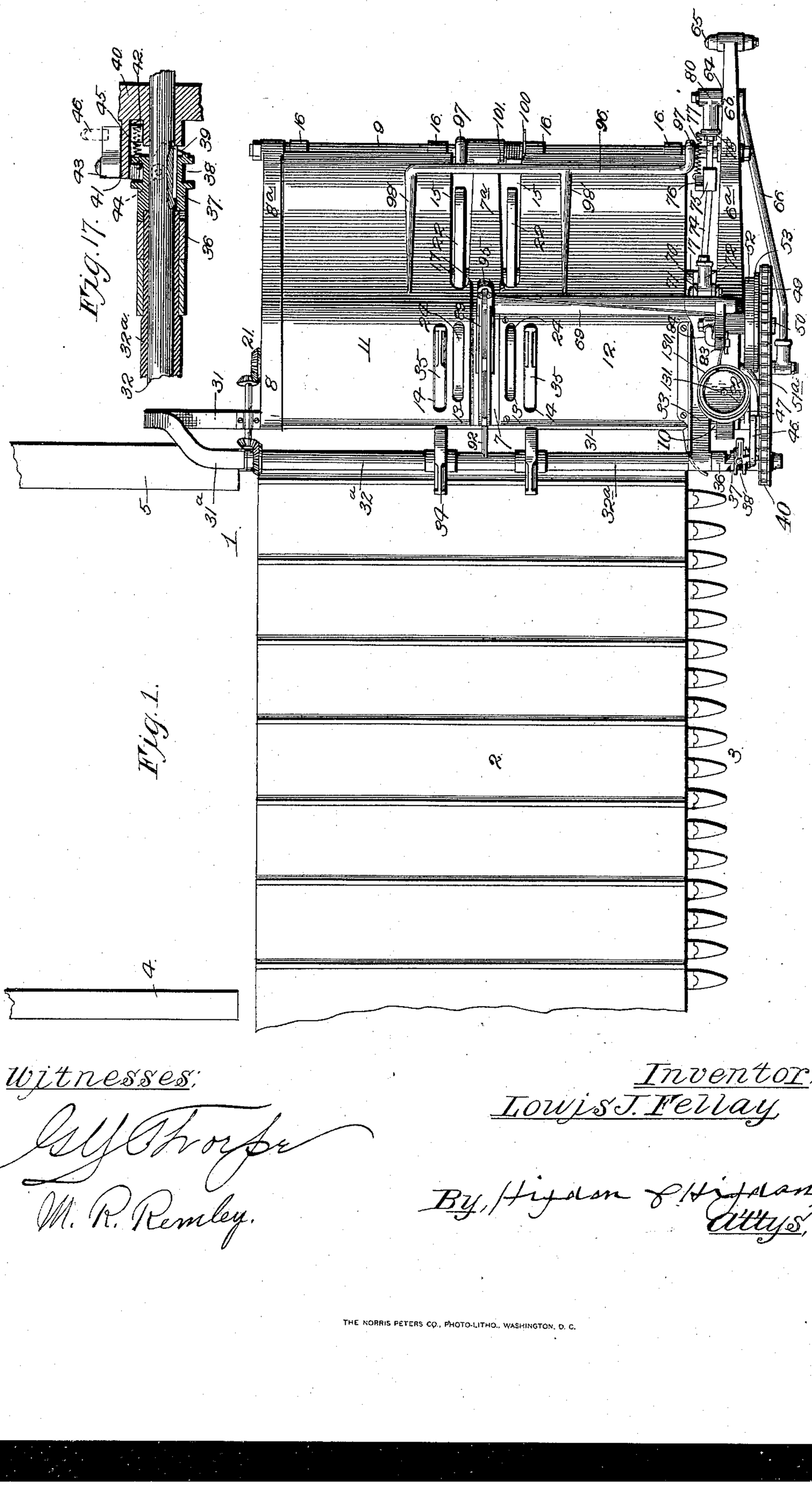
(No Model.) 7 Sheets—Sheet 1.

L. J. FELLAY.

GRAIN BINDER.

No. 567,826. Patented Sept. 15, 1896.

Fig. 1.



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M. R. Remley.

Inventor:
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Fig. 2.

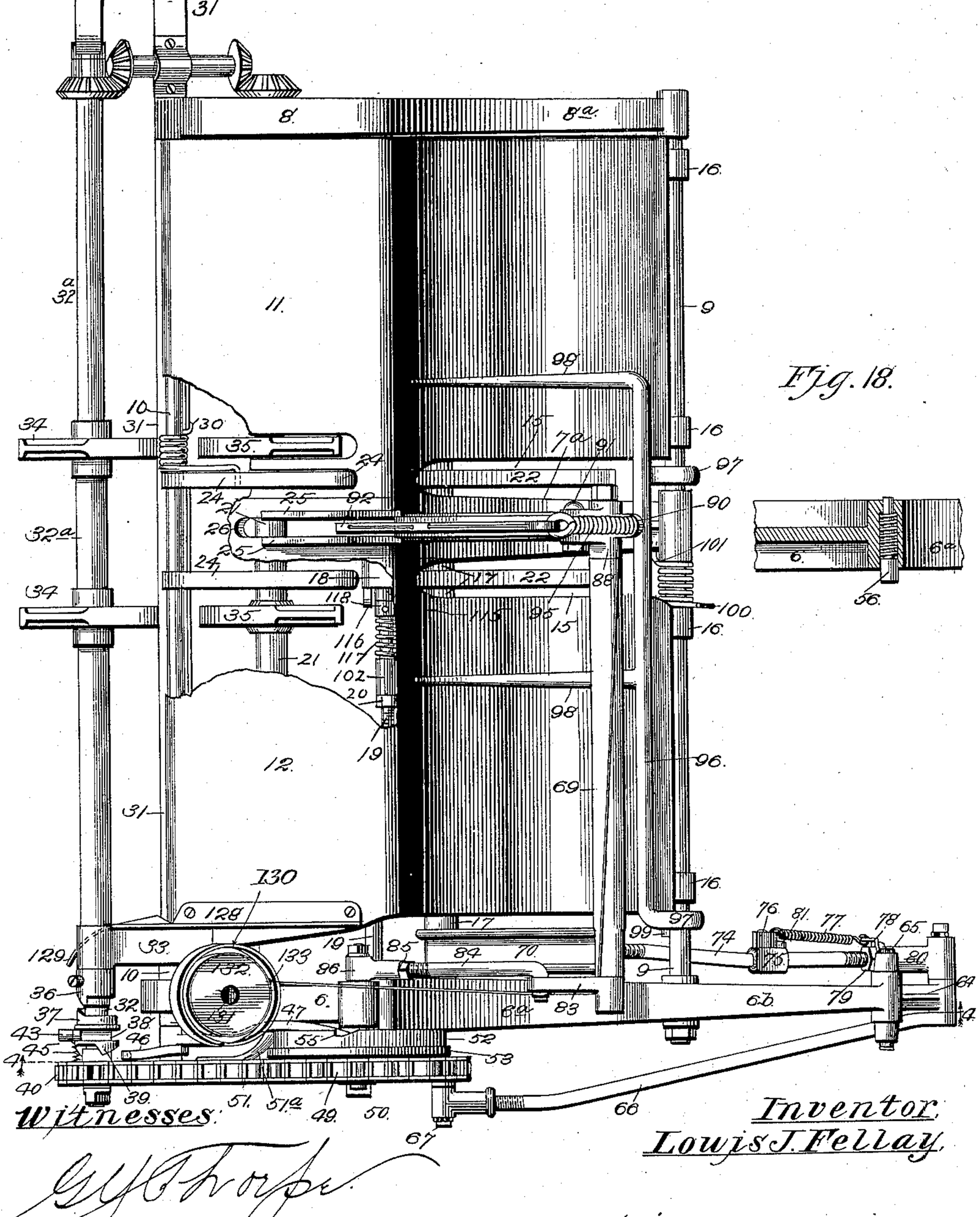

Fig. 1a.

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L. J. FELLAY.

GRAIN BINDER.

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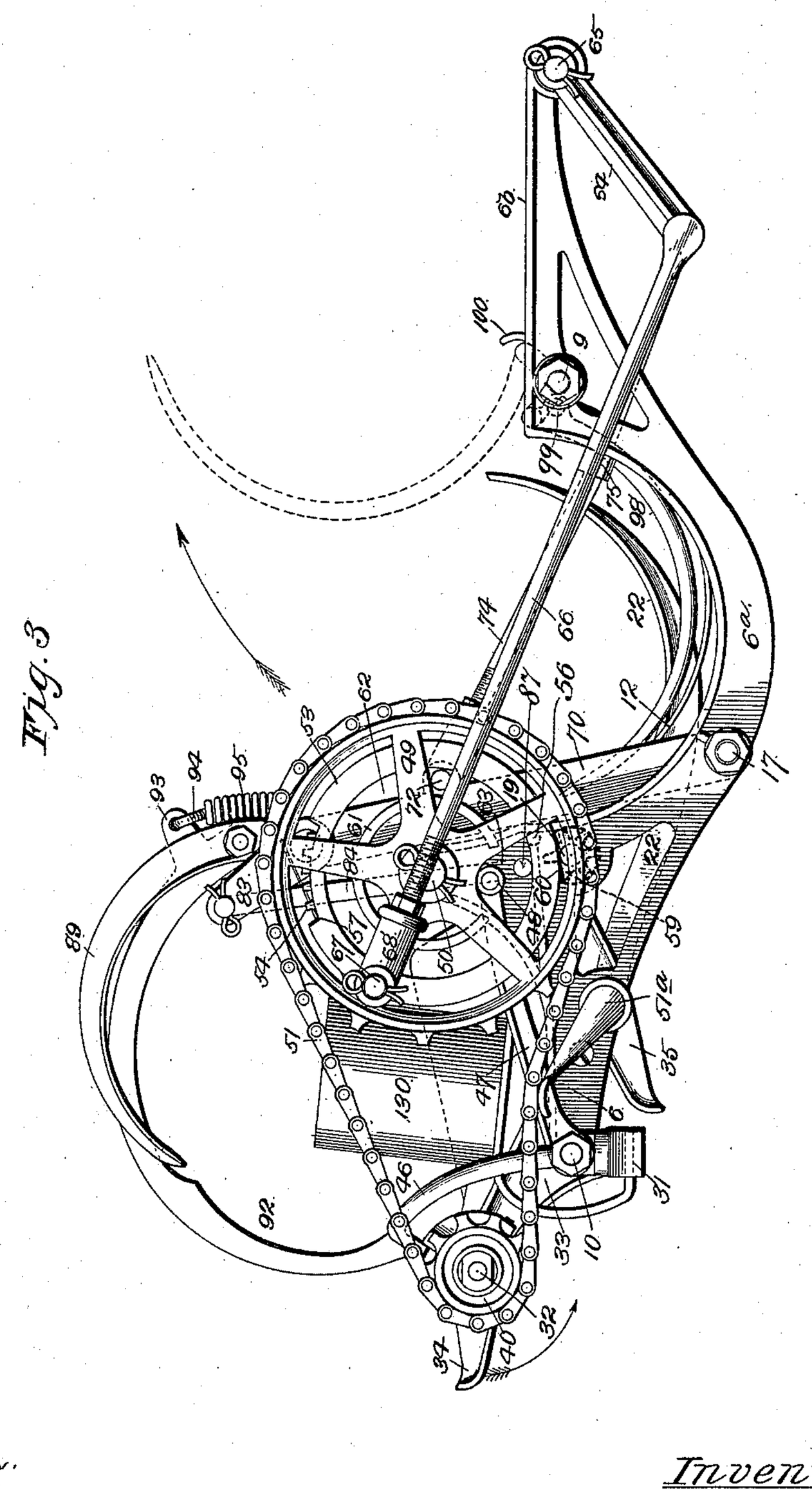

Fig. 3

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L. J. FELLAY.

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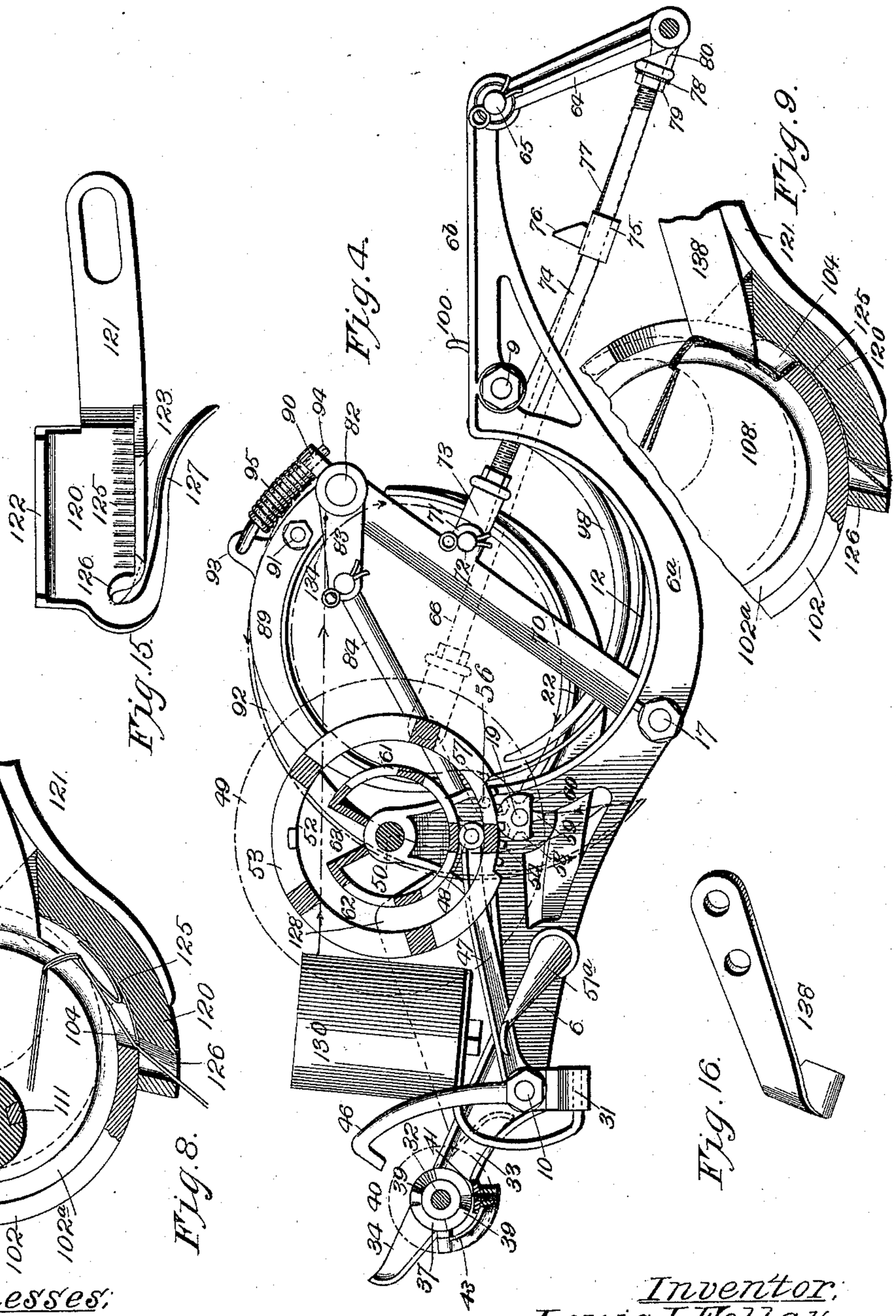

Fig. 4.

Fig. 15.

Fig. 8.

Fig. 16.

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L. J. FELLAY.

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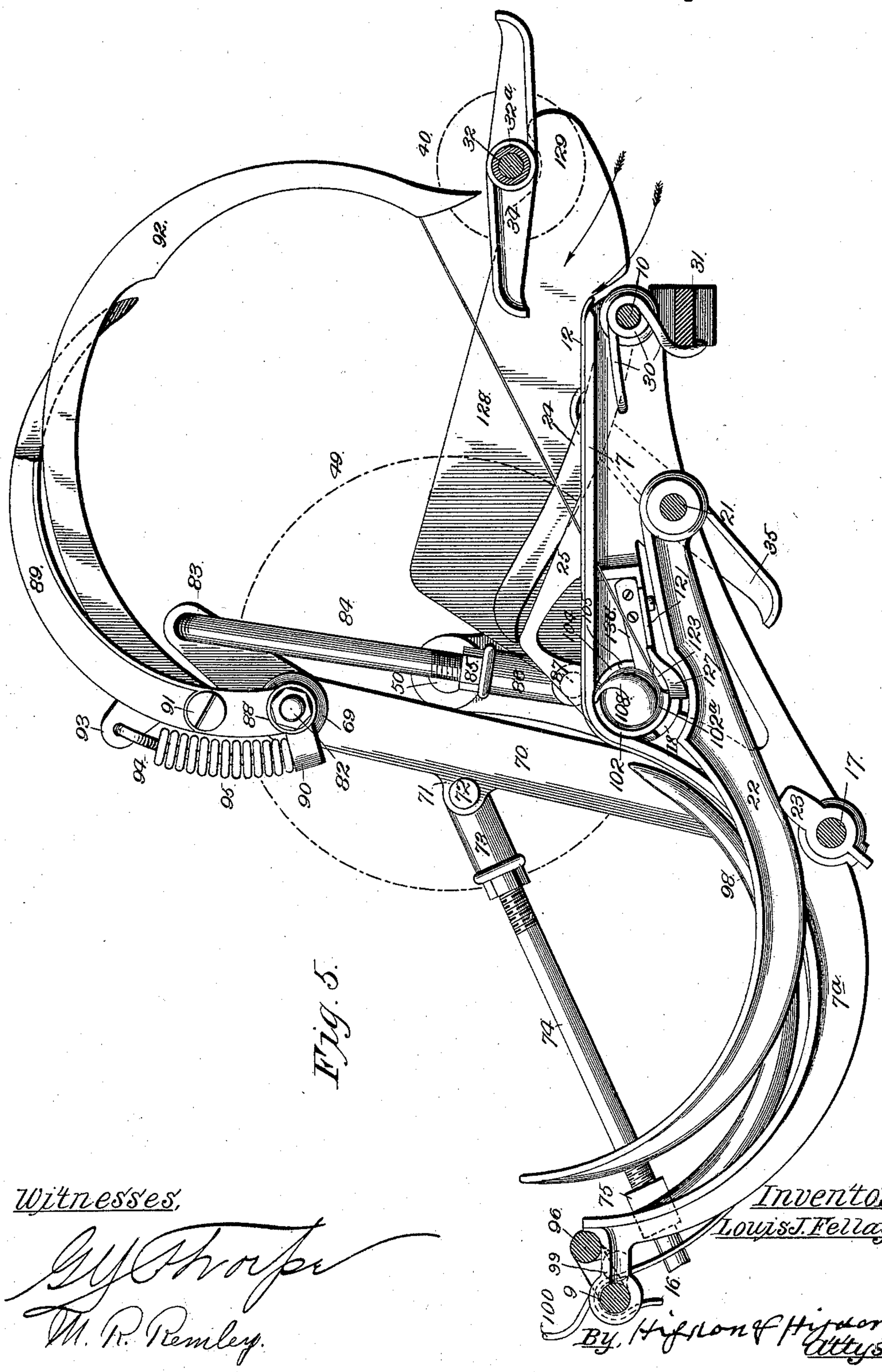

Fig. 5.

Witnesses,

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(No Model.) 7 Sheets—Sheet 6.

L. J. FELLAY.

GRAIN BINDER.

No. 567,826. Patented Sept. 15, 1896.

Fig. 19.

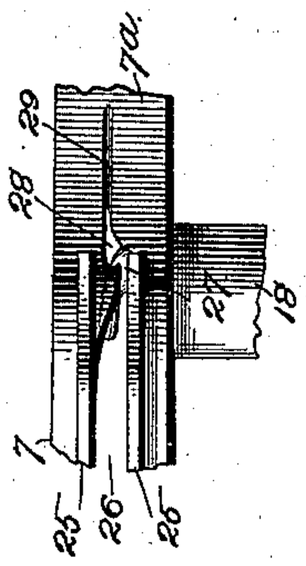

Fig. 6.

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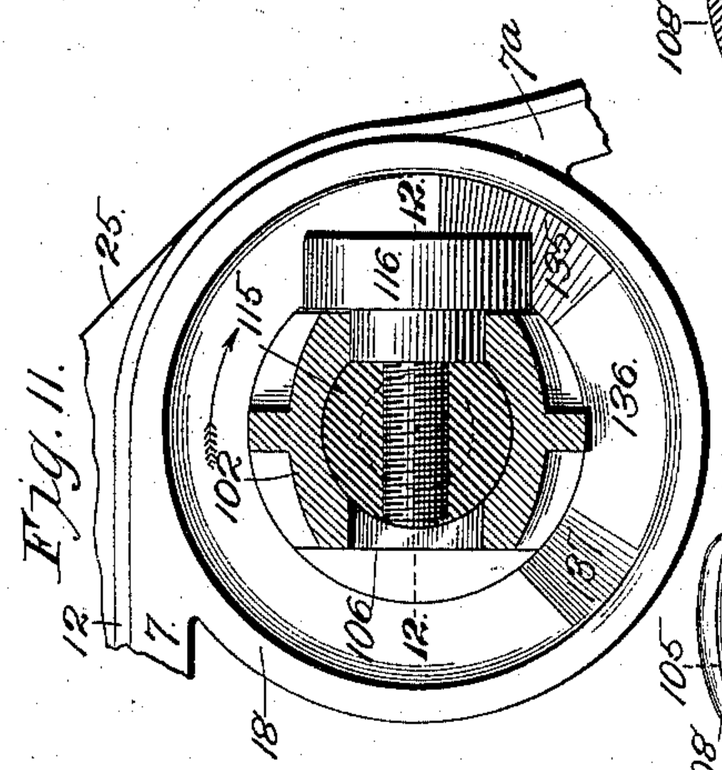
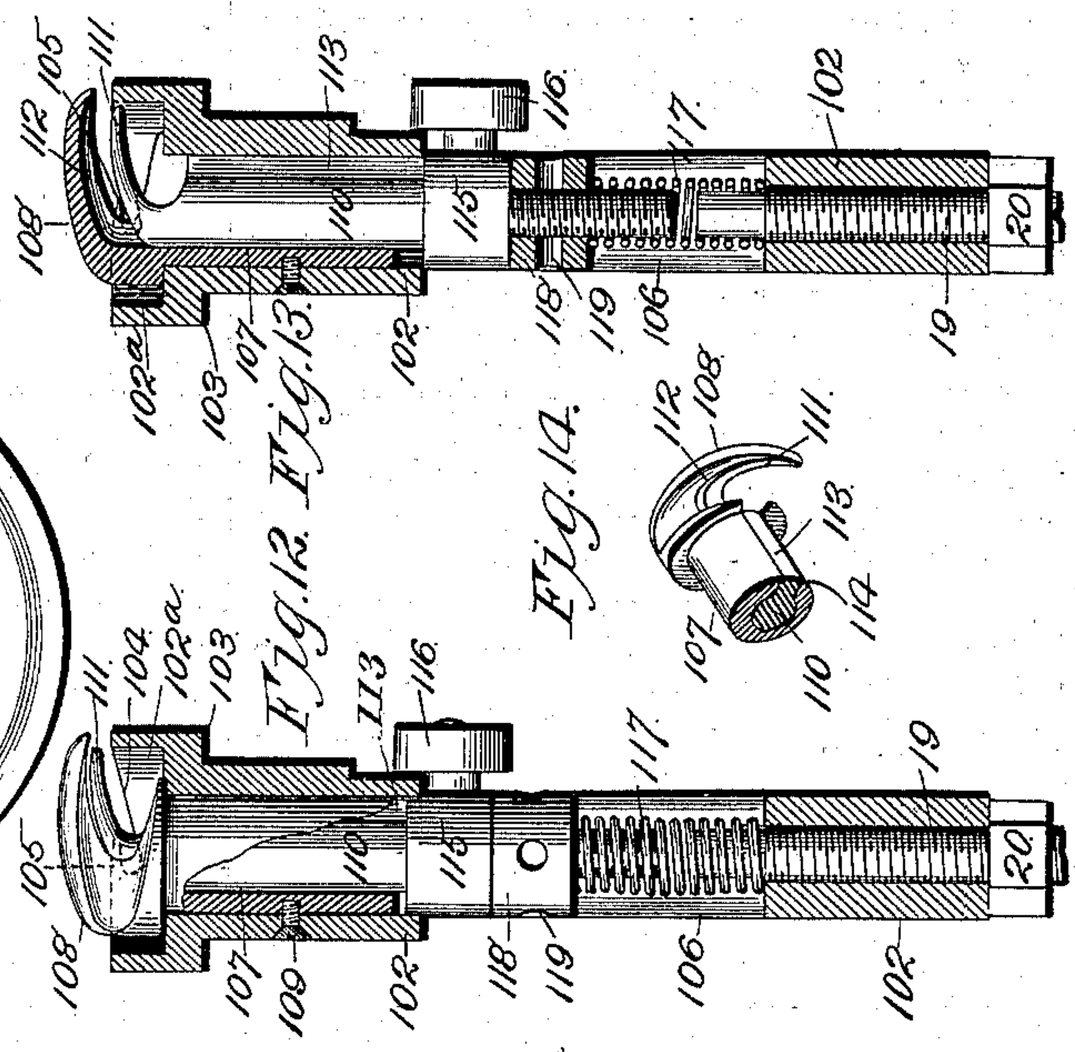
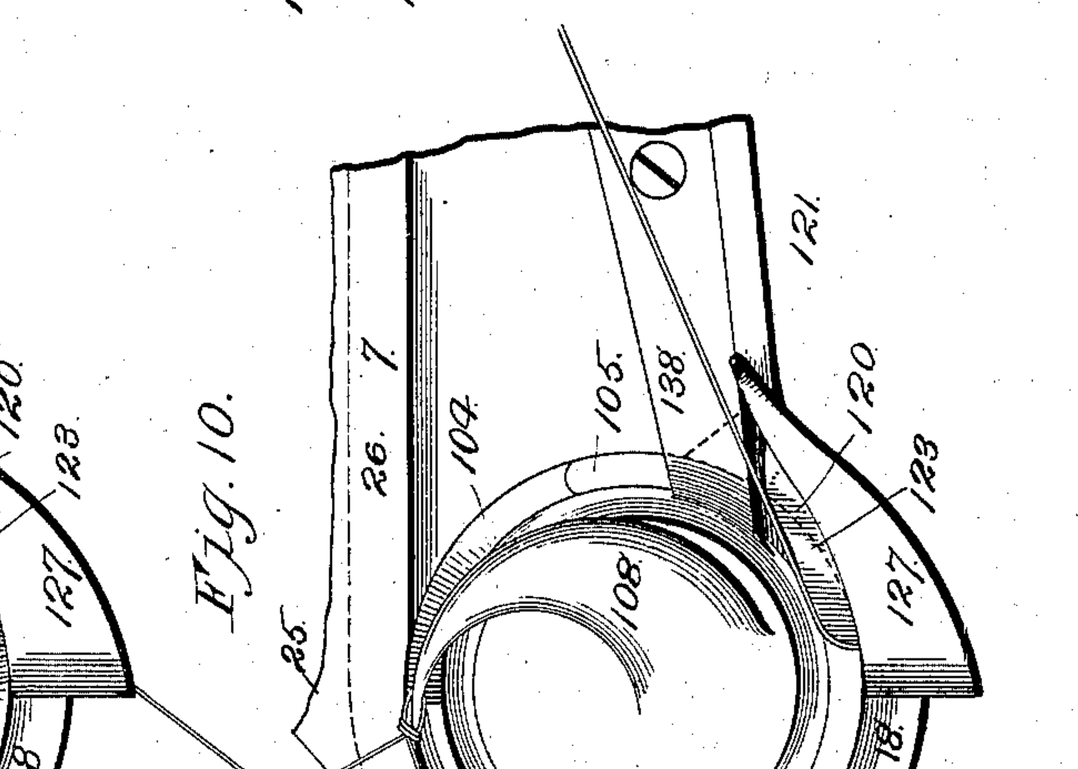
L. J. FELLAY.

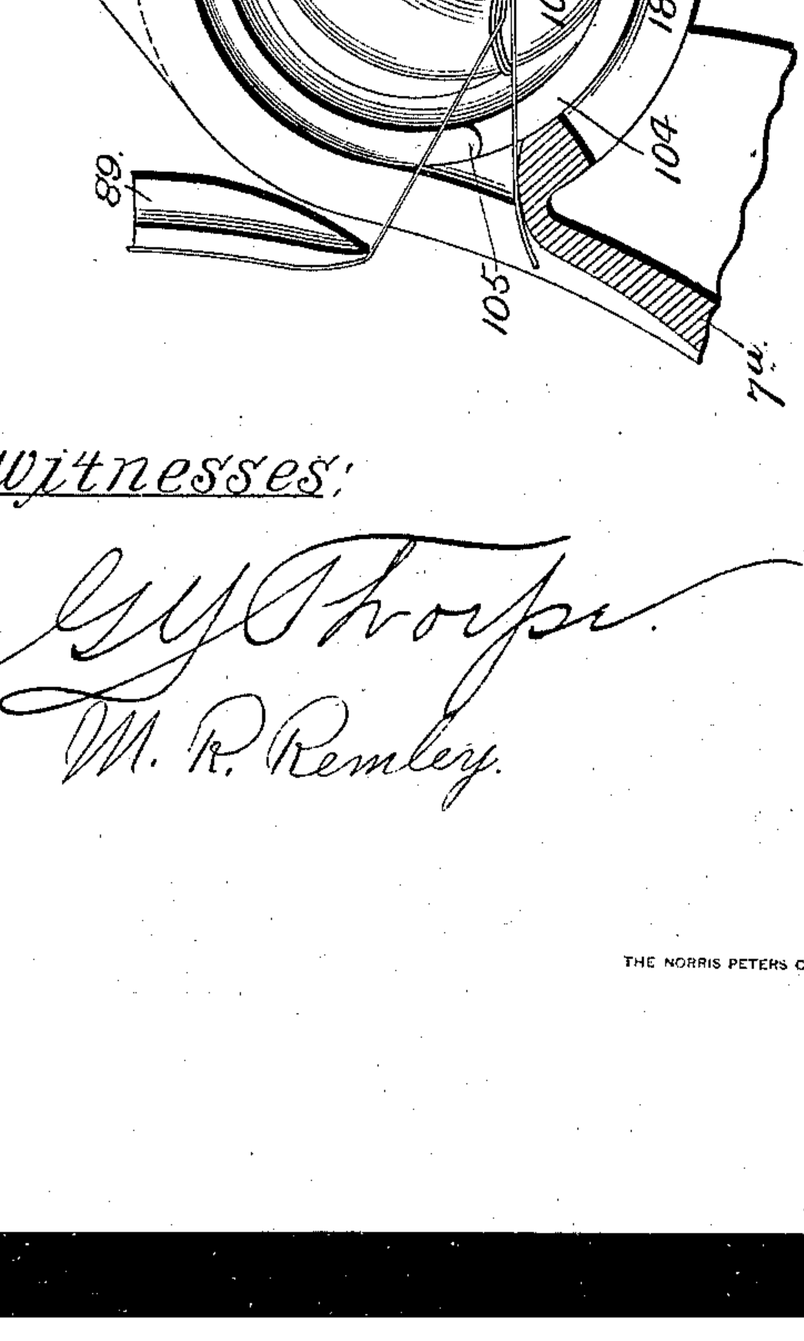
GRAIN BINDER.

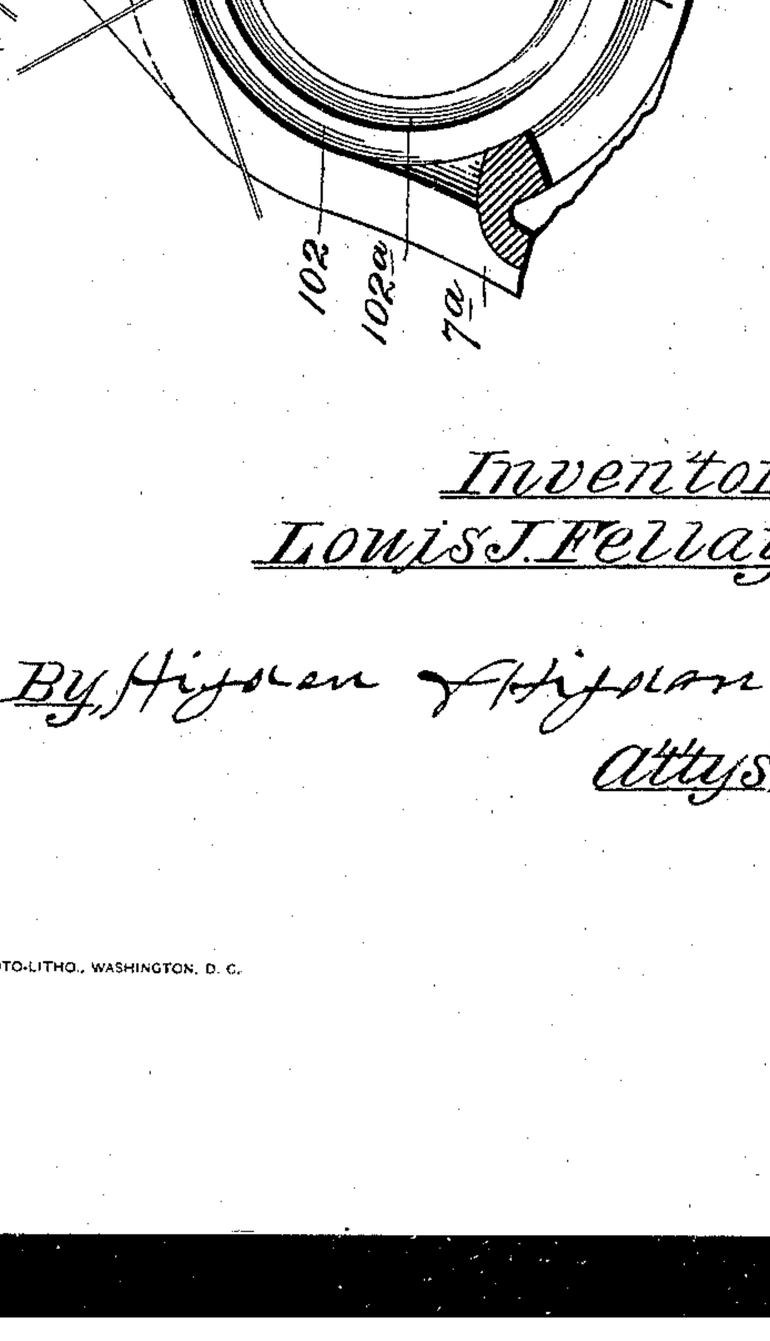
No. 567,826. Patented Sept. 15, 1896.











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UNITED STATES PATENT OFFICE.

LOUIS J. FELLAY, OF MADISON, KANSAS, ASSIGNOR OF ONE-HALF TO E. D. MARTINDALE, OF SAME PLACE.

GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 567,826, dated September 15, 1896.

Application filed July 20, 1895. Serial No. 556,580. (No model.)

To all whom it may concern:

Be it known that I, LOUIS J. FELLAY, of Madison, Greenwood county, Kansas, have invented certain new and useful Improvements in Grain-Binders, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to grain-binders, and more particularly to that class known as "low-down" binding-machines, wherein the elevating-apron is dispensed with and the draft thereby lightened to a considerable degree.

The object of my invention is to produce a binding-machine which is positive and reliable in operation and strong and durable of construction.

The invention consists in certain novel and peculiar features of construction and combinations of parts, as will be hereinafter described and claimed.

Referring to the drawings, Figure 1 represents a p'an view of a low-down binder embodying my invention and shows the working parts in the positions they occupy during the formation of the bundle. Fig. 2 represents, on a larger scale, a plan view of my improved part of the machine in the position it occupies during the knot-forming operation. Fig. 3 represents, on a still greater scale, a side view of the improved mechanism in the position shown in Fig. 1. Fig. 4 is a sectional view on the same scale as Fig. 3, taken on the line 4 4 of Fig. 2 and showing the parts in the same operative position as in the said Fig. 2. Fig. 5 is a sectional view on a still greater scale, to illustrate more clearly the relation between the knotter mechanism, the needle, the trip-arms, the compressors, and the bundle discharging or dropping device, said figure being viewed in the opposite direction to Figs. 3 and 4. Fig. 6 is a similar view, but showing the parts in the position they occupy after the bundle is formed and while the knot is being formed. Fig. 7 is a view on a still greater scale which shows the parts in the position they occupy just before the knot is completed. Fig. 8 is a view on the same scale, but partly in section, to show the position of the parts after the knotter has made about three-fourths of its revolution and showing also the cut end of the twine when free to be moved. Fig. 9 is a similar view which shows the twine about to be severed and the knotter after it has nearly completed its revolution. Fig. 10 represents a view similar to Fig. 7, except that the knotter has completed its revolution and the twine is being disengaged therefrom by the action of the bundle discharger or dropper. Fig. 11 is a sectional view through the knotter mechanism as viewed toward the opposite side of the breastplate from Figs. 7 and 10. Fig. 12 is a view on a small scale, partly in elevation and partly in section, on the line 12 12 of Fig. 11, the parts occupying in this figure the same relative positions that they occupy in Fig. 11. Fig. 13 is also a sectional view of the knotter mechanism, but shows the inner jaw or finger at its full distance from the outer jaw or bill. Fig. 14 is a sectional perspective view of the outer jaw or bill and the inner jaw or finger. Fig. 15 is a plan view of the twine cutting and holding device and of the spring for actuating the same. Fig. 16 is a perspective view of the knife for cutting the twine. Fig. 17 is a longitudinal section of the mechanism for throwing the upper packer-shaft and the bundle-forming and knot-tying mechanism alternately in and out of gear. Fig. 18 is a sectional view to illustrate the spring-actuated pin which prevents the back rotation of the mechanism. Fig. 19 is a plan view of a part of the breastplate, which illustrates clearly its guide-slot configuration and its relation to the bill or knotter.

In the said drawings, 1 designates a low-down binder, which is provided with the usual traveling platform or apron 2, the usual cutting mechanism 3, the grain-wheel 4, and the main wheel 5, which in this construction are preferably arranged rearward of the platform or apron, as shown in Fig. 1. The supporting-framework (not shown) may be of the customary arrangement or configuration, and the tongue (not shown) will project to the rear, that the draft-animals may, in effect, push instead of pull the machine. This arrangement may be carried out in any suitable or preferred manner. The binder will also be provided with a reel (not shown) located, as usual,

above the sickle-bar, and with the other features of construction common and necessary in this class of machines.

The part of the machine above described and referred to does not embody any portion of my invention, except in its combination with and mode of application to the bundle-feeding and knot-tying mechanism. This mechanism I will now proceed to describe, prefacing the description, however, with the statement that I do not confine myself to any particular supporting-framework for maintaining it in proper position relative to the platform 2, at the discharge end of which it is located, as shown clearly in Fig. 1.

The framework proper of the improvement comprises three castings 6, 7, and 8, the casting 7 being located about midway between the castings 6 and 8 and forming the breast-plate of the machine. The casting 6 is in line with the sickle mechanism, while the casting 8 is in line with the rear edge of the platform 2. Said castings 6 and 8 and the breastplate 7, for a part of their length, are approximately horizontal and for the remainder of their length are approximately semicircular, being depressed, as shown at 6^a, 7^a, and 8^a, respectively. The casting 6 is furthermore provided with the rearwardly-projecting arm 6^b, and connecting the rear ends of the casting 8 and the breastplate 7 with the casting 6, near its junction with the parts 6^a and 6^b, is the shaft 9. Extending parallel to the shaft 9, and in a plane below the upper side of the horizontal portions of said castings, is a rock-shaft 10, which connects the front ends of said castings, said rock-bar 10 being rotatably mounted, for a purpose which will hereinafter appear.

Occupying the space between the breastplate 7 and the casting 8, and conforming to the configuration of the same, is a platform 11. A similar platform 12 connects the casting 6 with the breastplate. Said platforms are provided at opposite sides of and near the breastplate with longitudinal slots 13 and 14, the slots 14 being the farthest from the breastplate. The curved portions of said platforms in longitudinal alinement with the slots 13 are slotted, as shown at 15. Said platforms are preferably provided at their rear edges with downwardly-disposed hooks 16, which detachably engage the shaft 9, while the front ends may be secured in position by screw-bolts or equivalent devices. The particular method of securing said platforms in position, of course, is not essential and may be varied accordingly as circumstances may direct. Journaled in said castings a suitable distance below and outward of the junction-points of the horizontal and curved parts of the same is a rock-shaft 17. The breastplate 7 is formed with a circular sleeve or tube 18 at the junction of its curved and straight portions, and the connecting-surface of said curved and straight portions, like the connecting-surfaces of the curved and straight portions of the platforms 11 and 12, extends concentrically to the axis of said sleeve or tube. A shaft 19 is journaled in the casting 6 concentrically to the axis of said tube and terminates at some distance forward of the same, and mounted upon the threaded portion of said shaft is an adjusting-nut 20. The knotter mechanism, which connects said shaft and said sleeve, will be hereinafter described.

Extending parallel with the shaft 19, and a suitable distance below and about midway between the same and the shaft 10, is the shaft 21. Said shaft preferably is journaled only in the breastplate-casting and the casting 8, and mounted loosely upon the same, and projecting forwardly through the slots 15 of the platforms are the lower compressors 22, said compressors being raised at the proper height by the cams or shoulders 23 of sleeves secured in any suitable manner to the rock-shaft 17. Superimposed relative to said compressors 22 are the trip-arms 24. Said trip-arms are mounted rigidly at their lower ends upon the shaft 10 and project upwardly through the slots 13 at opposite sides of and parallel with the guard-flanges 25, rising vertically at opposite sides of the slot 26 in the breastplate. Said slot is of peculiar formation, it tapering stubbleward to form a very narrow passage 27 in the vertical plane of the axis and slightly rearward (with respect to the machine) of the sleeve 18, and then curves forward and stubbleward, as shown at 28, and terminating in the groove 29 for the reception of the twine while the knot is being tied. By this formation of the slot I provide the rearwardly-projecting finger 26^a, which binds the strands of the binding-cord upon the transfer of the loose bundle and the descent of the needle between the knotter-jaws, to be hereinafter referred to.

The trip-arms are held normally in their elevated position by means of the spring 30, which spirally encircles the shaft 10 and bears at its opposite ends against the under side of one of said trip-arms and the bar 31, forming a part of the framework and directly supporting the inner ends of the castings 6, 7, and 8. The bar 31 at its rear end is bent upward and extended forward a suitable distance, as at 31^a, to form a journal for the rear end of the shaft 32, and mounted upon said shaft and extending from its rear end nearly to its front end is a hollow shaft 32^a, which is journaled in an arm 33, projecting also from the front end of the bar 31. Said hollow shaft is provided with a pair of intermittently-operating packers 34, hereinafter termed the "upper" packers, in contradistinction to the lower packers 35, which are mounted rigidly upon the shaft 21 and operate through the slots 14 of the platforms 11 and 12.

Mounted rigidly upon the front end of the hollow shaft 32 is a clutch-section 36, and keyed to slide upon but not to rotate independently of the shaft 32 is the companion clutch-section 37. Said clutch-section 37 is

formed with an annular groove 38, and at its front side with the approximately V-shaped cams 39. A small sprocket-wheel 40 is mounted loosely upon said shaft 32. Said sprocket-wheel is provided with the rearwardly-projecting arm 41, which overhangs the groove of said clutch-section, and at its inner side carries the antifriction-roller 42, against which the abrupt faces of the cams 39 are adapted to operate.

The bell-crank lever 43 is pivotally mounted upon the arm 41, and has one arm carrying the antifriction-roller 44, (see dotted lines, Fig. 17,) and has its other arm projecting and normally held by the retraction-spring 45, which connects said arm with the sprocket-wheel, into the path of the hook-arm 46, (see Fig. 1,) mounted rigidly upon the rock-shaft 10. Projecting rigidly upon the same shaft, or cast integral with the hook-arm 46, and extending rearwardly at about right angles to said hook-arm, is the arm 47, which carries at its free end the antifriction-roller 48, the object of which will be hereinafter explained.

49 designates a large sprocket-wheel, which is rotatably mounted upon the shaft 50, projecting forwardly from the casting 6, and said sprocket-wheel is connected to the sprocket-wheel 40 by means of the chain 51. Said chain is tensioned by the adjustable arm 51^a. The relative diameters of said sprocket-wheels are such that the large wheel 49 makes one complete revolution with every three revolutions of the small sprocket-wheel 40. Cast integral with said large sprocket-wheel or secured thereto in any suitable manner is the inwardly-projecting concentric flange 52, and said flange at its forward margin is provided with the outwardly-projecting shoulder 53 and at diametrically opposite points with a series of cog-teeth 54 and a notch to form an abrupt shoulder 55, which shoulder is adapted to come in contact with a spring-actuated pin 56, projecting forwardly from the casing 6, and prevent back rotation of the sprocket-wheel. The shoulder 53 along the line of the teeth 54 is cut away, as shown at 57, wherein the flange 58 of a cog-pinion 59 may roll during the operation of the machine. This cog-pinion is mounted rigidly on the shaft 19, and is adapted to intermittently operate the knotter. The said flange is cut away at one side to form the flat shoulder or face 60, which, during the greater part of the revolution of the sprocket-wheel, fits snugly against the periphery of the shoulder 53, and thereby prevents the accidental rotation of the knotter mechanism. A second flange 61, arranged concentrically within the flange 53, projects rearwardly from the sprocket-wheel, so as to form an annular passage or groove 62 between said flanges, wherein the antifriction-roller of the arm 47 operates. At the point diametrically opposite the cog-teeth 54 the passage or groove 62 is formed with an inwardly-projecting offset or chamber 63, wherein said antifriction-roller is forced each time the trip-arms are depressed, as will be hereinafter more particularly referred to.

64 designates a swinging link, which is mounted at its upper end upon a shaft or pivot-bolt 65, secured in the outer end of the portion 6^b of the casting 6. At its lower end said link is pivotally connected by the pitman 66 with the wrist-pin 67, projecting from the sprocket-wheel 49 through the usual T-coupling 68. Therefore it will be apparent that with each complete revolution of the sprocket-wheel the link 64 will swing outwardly and then return to its original position. A swinging frame comprises the tubular horizontal portion 69, which extends parallel with the shaft 17, and a depending portion 70, which is rigidly mounted at its lower end upon the said shaft 17, adjacent to the casting 6. The tubular arm or portion is of such length that it nearly overhangs the slot in the breast-plate. Projecting from the pendent portion of said frame are the parallel ears or lugs 71, and pivoted between the same, upon the bolt 72, is the T-coupling 73, and said T-coupling is adjustably connected, like the pitman 66, to the lower end of the swinging link 64 by the pitman 74. Mounted rigidly upon said pitman at a suitable point is a collar 75, and pivotally mounted upon the rear side of the same is a beveled dog 76, which is held normally in its upright position by the retraction-spring 77, secured to said dog at one end and to a plate 78, mounted upon the pitman 74, between the clamping-nut 79 and the T-coupling 80, at its outer end, said T-coupling being employed to pivotally connect said pitman with the swinging link hereinbefore described. The action of the spring 77 is limited by means of the shoulder 81, which projects from the collar 75 in the path of said dog 76, as shown in Fig. 2.

Rotatably mounted within the tubular portion 69 of the swinging frame is the shaft 82, and mounted rigidly upon the same near one end is an arm 83, and said arm is pivotally connected to the upper end of a link-rod 84. Said link-rod is threaded at its lower end and engages adjustably the nut 85 and the coupling 86, which in turn is pivotally mounted upon the stub-shaft 87, projecting rearwardly from the casting 6. Upon the opposite end of the shaft 82 is rigidly mounted the hub 88 of the upper compressor 89, which is approximately semicircular in form and projects forwardly and downwardly. Said compressor is longitudinally slotted for nearly its entire length and is provided radially of its hub with the perforated heel or lug 90. A suitable distance from said hub a pivot-bolt 91 extends through said compressor, and mounted rigidly upon the same and operating within the slot of said compressor is the needle 92, of approximately semicircular formation. A short distance from its pivotal point the needle is provided with the outwardly-projecting apertured lug 93, and pivotally connected to the same is the guide-rod 94, which

engages at its opposite end and is adapted to play through the perforation of the heel or shoulder 90 of the upper compressor. An expansion-spring 95 spirally encircles said rod, and bears at its opposite ends against the upper end of the same and against the said heel or lug, so as to hold the needle normally in contact with the forward end of the slot of the compressor.

From the above description, taken in connection with Figs. 3, 4, 5, and 6 particularly, it will be apparent that the rotation of the sprocket-wheel and the operation of the pitman 66 causes the swinging frame, with the compressor and needle, to move back and forth, and that the link 84 simultaneously causes down and up movement of the compressor and the needle.

The device for elevating and discharging or dropping the completed bundle consists of the rod 96, which extends parallel with the shaft 9 and is pivotally connected to the same by the arms 97, one of them being located contiguous to the breastplate and the other contiguous to the pitman 74. Projecting in the opposite direction from said rod are the semicircular upwardly-disposed arms or hooks 98, which receive the bundle from the compressors and deposit it upon the ground or upon the customary bundle-carrier. The arm 97, pivotally mounted upon the shaft 9, near the front end of the machine, is provided with an antifriction-roller 99, which, as the frame moves outwardly, comes in contact with and rides over the beveled surface of the dog 76 without operating the arms 98, the spring 77 yielding for that purpose. When the swinging frame returns, however, the abrupt side of the dog engages said antifriction-roller and forces the bundle discharger or dropper to the position shown in dotted lines, Fig. 3, and against the resistance of the arm 100 of a spring coiled around the shaft and bearing at its opposite end against the under side of said breastplate, as shown at 101. Immediately said dog has released said antifriction-roller, said spring throws it back to its original position. The arms 98 are held from contact with the curved portions of the platforms, because the rod 96 finds a rest upon the upper side of the upper end of the breastplate, as shown in Figs. 5 and 6.

Referring now to the knotter mechanism, 102 designates a tubular shell which is rotatably mounted in the sleeve of the breastplate. Said shell, at its rear end, is diametrically enlarged both internally and externally to form, respectively, the socket 102^a and the shoulder 103. The object of said shoulder 103 will be presently explained. The rear edge of the shell is slotted or notched, so as to form an inclined slot 104 and an overhanging guide-finger 105. The sleeve is diametrically diminished toward its rear end, and is secured firmly upon the threaded portion of the shaft 19 and against the nut 20, or may be otherwise rigidly secured thereon, and is also formed at diametrically opposite points with longitudinal slots or openings 106.

107 designates the tubular stem of the bill or outer jaw 108, which bill or jaw is approximately semicircular or horn-shaped. Said tubular stem is fitted within the shell so that the point of the bill will overlap for some distance or entirely the inclined slot 104, and the stem is fixed in this relation to the sleeve by means of the screw-bolt 109. (See Figs. 12 and 13.)

110 designates the cylindrical stem of the inner jaw or finger 111, which jaw or finger is adapted at times to lie snugly in the groove 112, formed in the inner side of the bill 108. The stem 110 is longitudinally adjustable within the stem 107, but to prevent independent rotatable movement of said parts stem 110 is provided with a rib or tongue 113, which engages the corresponding groove or slot 114 in the stem 107. At a suitable point the stem 110 is formed with a circular enlargement 115, which is of diameter to fit within the bore or shell 102, and mounted rotatably upon the screw-bolt projecting radially from said enlargement is an antifriction-roller 116. An expansion-spring 117, coiled around the threaded stem of the inner jaw or finger and around the opposing end of the shaft 19, exerts its pressure to hold the antifriction-roller always forward in the position shown in Fig. 12, and to adjust the tension exerted by this spring a circular nut or collar 118 is interposed between the same and the enlargement 115. In order that said collar may be adjusted upon the threaded stem, it is provided with radial perforations 119, which may be engaged with a suitable pointed instrument through the slots 106 of the sleeve without requiring the removal of the knotter-mechanism from operative position.

120 designates the cord-holder, which is segmental in cross-section, and is held snugly against the under side of the enlarged portion of the shell 102 by the action of the spring 121. At its front edge it is provided with an upwardly-projecting flange 122, which bears against the shoulder 103 of the shell, and at its rear edge is provided with an upwardly-projecting flange 123, which bears against the rear edge of the shell. These flanges, as will be understood, fix the relation between the shoulder and the cord-holder as regards lateral movement of the latter. It is held from longitudinal movement by means of the screw-bolt 124, which engages the depending portion of the central casting or breastplate. The upper surface of the cord-holder 120, contiguous to the flange 123, is corrugated or otherwise suitably roughened, as shown at 125, and at the outer end of said corrugated surface it is formed with an approximately circular opening 126 and with an inwardly and rearwardly curved guard-arm 127, said guard-arm flaring away from the body of the cord-holder, in order to more positively and reliably receive the needle and guide the cord

to its proper position in the aperture 126, as hereinafter more particularly referred to.

In order that the butts of the grain may be arranged approximately even in forming the bundle, the vertical butt-board 128 is secured transversely of the front end of the platform 12, and it is provided at its inner end with the forwardly-curved extension 129, which overlaps the discharge end of the platform or apron contiguous to the cutter-bar. The twine-pan 130 is provided centrally with the pin 131, upon which the twine-spool 132 is loosely mounted, and is also provided with an aperture 133, through which the twine is threaded. It is also threaded through an aperture 134 in the arm 83, thence extends externally of the tubular portion 69 of the swinging frame, thence through the heel or lug 90 of the upper compressor, and through the needle in the ordinary manner. The free end of the twine is then secured by the operation of the machine in the position indicated at Fig. 5, the free end being clamped between the roughened surface 125 of the cord-holder and the external side of the shell 102, with a yielding pressure, by the action of the spring 121, and is depressed inwardly or toward the platform and is bent around and extends directly from the upper side of the flange 123 to the needle. The manner in which the twine is thus secured will hereinafter appear.

When the machine is first started in operation, the various parts are in the position shown most clearly in Figs. 1, 3, and 5. When in this position, it will be noticed that the trip-arms are elevated, and that the antifriction-roller 48 of the arm 47 and the hook-arm 46 are engaged, respectively, with the offset 63 of the passage or groove 62 and one arm of the bell-crank lever. This engagement of said hook-arm with the bell-crank lever overcoming the resistance of the spring 42 slides the clutch-section 37 out of engagement with the roller 42 and into engagement with the clutch-section 36 upon the hollow shaft 32^a, which carries the upper packers, which are therefore operated in the direction indicated by the arrows, Fig. 5, because the clutch-section 37 is rotated by the constantly-rotating shaft 32, said shaft, as hereinbefore explained, being connected in any suitable manner to the drive-wheel of the machine. The lower packers will also be geared to the upper packers or to the driving mechanism of the machine in any suitable manner, so as to rotate and cease rotating with the upper packers. In the drawings I show a bevel-gear connection between the shafts 21 and 32^a.

In the bundle-forming operation of the machine, as it is pushed across the field, the grain is cut by the cutter mechanism and carried by the platform or apron to the inner end of the platforms 11 and 12, where it is engaged by the upper packers and forced against that portion of the twine which extends from the needle to the cord-holder. The grain is continuously fed in this manner by the upper packers upon said platform, and the lower packers coöperate with the same to compress the bundle of grain to the required degree. The quantity of grain in the bundle and the compactness of the same is determined by the strength of the spring 30, and the breastplate-slot is guarded from the entrance of grain by the flanges 25. Immediately the bundle assumes the required dimensions and compactness the pressure exerted by the packers on the grain causes the trip-arms to yield downwardly, and the hook-arm and the antifriction-roller to be moved simultaneously out of the path of the bell-crank lever and out of the offset 63 of the passage or slot 62. Immediately this takes place the spring 42 retracts and moves the sliding clutch-section 37 out of engagement with the clutch-section 36 and into engagement with the antifriction-roller 42, one of the abrupt shoulders or cams 39 engaging said roller. This engagement causes the immediate rotation of the sprocket-wheel 49 in the direction indicated by the arrow, Fig. 3, and consequently the rotation in the same direction of the sprocket-wheel 49. When the said sprocket-wheel begins to rotate, the swinging frame, through the medium of the pitmen 66 and 74 and the swinging link 64, moves from the position shown in Figs. 3 and 5 to the position shown in Fig. 4. By this time the compressors and the needle have assumed the position shown in Fig. 6, the bundle, of course, being transferred to the same position by the upper compressor and being compressed more tightly by reason of the same moving a slight distance beyond the needle (against the action of the spring 95) and assuming a position snugly against the breastplate over the groove 29 and by the upward or opposing movement of the lower compressors, such movement being due to the operation of the lugs or shoulders 23 upon the shaft 17, as shown in dotted lines, same figure. By assuming this position the lower end of the compressor, which in its descent had engaged the upper strand of that portion of the cord extending around the bundle, holds said strand in a position so depressed that that portion extending from the bundle to the knotter is nearly horizontal and approximately parallel with the adjacent portion of the lower strand leading to the same point that the bundle may be more compactly formed and the knot more positively and reliably tied than would be the case if such portions of the cord diverged widely, because in such case they would be more apt to slip from the knotter-jaws and the strand to get loose and interfere with the operation of the knotting mechanism. The bill of the knotter at this time occupies the position shown in Fig. 5, and the twine from the bundle occupies the position shown in dotted lines, same figure, the cut end of course being secured by the cord-holder, as hereinbefore referred to.

The tendency of the bundle to expand will, of course, hold the lower portion of the twine down into the groove 29 of the breastplate. In Fig. 6 it is shown above said groove for clearness of illustration. The cog-teeth by this time begin to engage the cog-pinion 59, which pinion is provided with teeth which correspond in number with the teeth upon said sprocket-wheel flange, and owing to the fact that the teeth of the flange extend over a comparatively small portion of its periphery the said pinion is rapidly rotated. The movement of the same is limited to one revolution, owing to the fact that the shoulder 60 comes in contact with the periphery of the flange, as hereinbefore explained. The rotation of said pinion of course rotates the shell, which carries the knotter mechanism, as shown in various stages to clearly illustrate the manner of forming the knot. In Fig. 5 it occupies its fixed or inoperative position. Fig. 6 shows it after it has completed about one-fourth of a revolution, and is engaged in forming a loop of the strands of the twine leading direct to the bundle.

When the knotter is in the position shown in Fig. 6, the antifriction-roller 116, by reference to Fig. 11, begins to travel up the inclined shoulder 135 of the front end of the sleeve 18 of the breastplate and to withdraw the inner jaw or finger 111 from engagement with the outer jaw or bill. By the time the bill has completed one-half of a revolution and has assumed the position shown in Fig. 7 the inner jaw or finger is entirely withdrawn from engagement with the outer jaw or bill, as shown in Fig. 13, and the antifriction-roller is in engagement with the surface 136 of the sleeve 18. While said bill and finger are apart they pass on opposite sides of the strands of the twine leading to the needle and to the cord-holder. Immediately thereafter the antifriction-roller rides down the inclined shoulder 137, and the spring 117 expanding forces the inner jaw or finger back to its original position and clamps said strands between the same and the bill or outer jaw. At the same time the continued rotation of the mechanism causes said strands to enter the inclined slot of the shell until the rear end of the same comes in contact with the strand leading directly from the bill to the needle, as shown clearly in Fig. 8. At the same time the cut end of the strand upon the roughened surface of the cord-holder is released by reason of said slot registering with the said roughened surface, as shown in Fig. 8, and as the knotter continuously revolves said cut end is withdrawn entirely from the position shown in said figure and the strand leading directly to the needle takes its place, being clamped firmly upon said surface by the external surface of the shell 102, and at the same time is forced, by the time the knotter has completed three-fourths of its revolution, against and severed (see Fig. 9) by the cutting edge of the knife 138, secured to a part of the breastplate in any suitable manner. The cutting portion of said knife-blade is segmental and lies snugly within the socket or enlarged portion of the bore or the shell. The continuous rotation of the knotter-shaft next presents the bill in the position shown in Fig. 10, and as this position is assumed the swinging frame begins to move forward and the abrupt shoulder of the dog on the swinging frame comes in contact with the antifriction-roller 99 on the pivot-arm and operates the bundle-discharging device by elevating it to the position shown in dotted lines, Fig. 3. As it rises it withdraws the completed knot from the knotter, as shown clearly in Fig. 10. When this takes place, the bundle rolls immediately to the ground or upon the customary bundle-carrier, hereinbefore referred to. At this time the knotter has assumed its original position and the antifriction-roller 48 has again engaged the registering offset of the annular passage or groove 62, and therefore permits the actuating-spring to rock the shaft 10 and thereby raise the trip-arms to their original position and place the hook-arm again in the path of the bell-crank lever, the tendency to rotate of which causes the same to exert pressure against said hook-arm and to slide the clutch-section 37 again into engagement with the clutch-section of the packer-shaft, which immediately begins to rotate and form a new bundle, as will be readily understood. Immediately after the bundle has been discharged or dropped from the machine the spring-arm 100 upon the shaft 9 forces the discharging or dropping device back to its original position. All succeeding operations are repetitions of the one described.

From the above description it will be apparent that I have produced a binder which is positive and reliable in operation, and combines in a high degree simplicity, strength, and durability with inexpensiveness of manufacture.

It is to be understood, of course, that changes in the form, proportion, or arrangement of the parts or in the substitution therefor of mechanical equivalents will not be considered a departure from the spirit and scope or sacrifice any of the advantages of my invention.

Having thus described the invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A grain-binder, comprising a suitable wheeled framework, provided with a traveling platform or apron, a stationary platform at one end thereof, a rock-shaft provided with trip-arms projecting through said platform, a rotating shaft, a grooved clutch-section mounted to slide upon and rotate with said shaft, a packer-carrying shaft mounted loosely upon the rotating shaft, and provided with an opposing clutch-section, a sprocket-wheel mounted loosely on said shaft and pro-

vided with a shoulder and with an arm, a bell-crank lever upon said arm and engaging the grooved clutch-section, a spring connecting one arm of said bell-crank lever and the sprocket-wheel, and holding the former into frictional engagement with the shoulder of the latter, a stub-shaft, a large sprocket-wheel thereon, provided with an annular groove formed with an offset, a chain connecting said sprocket-wheels, a swinging frame operatively connected to said sprocket-wheel and provided with a needle, an arm upon the rock-shaft engaging the groove of said sprocket-wheel, a hook-arm also upon said rock-shaft, and a spring which causes the engagement of the first-named rock-shaft arm with the offset of the groove whenever presented, and the engagement of the hook-arm with the bell-crank lever, substantially as and for the purpose set forth.

2. In a grain-binder, a horizontal platform to receive the cut grain, provided with a slotted breastplate and with a depressed portion, a swinging frame, a horizontal shaft journaled in the upper part of said frame, an arm projecting from its front end, a link pivotally connecting the same with a fixed part of the framework, a downwardly-disposed compressor mounted rigidly upon said shaft, a needle pivotally mounted in a slot in said compressor, a spring connecting and holding them snugly together and means to swing said frame back and forth, substantially as set forth.

3. In a grain-binder, a horizontal platform to receive the cut grain, provided with a slotted breastplate and with a depressed portion, a swinging frame, a horizontal shaft journaled in the upper part of said frame, an arm projecting from its front end, a link pivotally connecting the same with a fixed part of the framework, a downwardly-disposed compressor mounted rigidly upon said shaft, a needle pivotally mounted in a slot in said compressor, an ear projecting from the needle, and a heel from the compressor, a guide-rod connecting the same, an expansion-spring upon said rod exerting its pressure to hold said needle and compressor snugly together, and means to swing said frame back and forth to depress and elevate the compressor and the needle, substantially as set forth.

4. In a grain-binder, a platform consisting of a straight and a depressed portion and provided with a similarly-formed slotted breastplate, an intermittently-rotating sprocket-wheel, a swinging frame linked to and operated by said sprocket-wheel, a shaft journaled in said swinging frame and provided with an arm pivotally connected to a fixed point of the framework, a downwardly-disposed compressor mounted rigidly upon said shaft, a needle pivotally carried by said compressor, and a spring exerting its pressure to hold them snugly together, substantially as set forth.

5. In a grain-binder, a platform, consisting of a straight and a depressed portion, and provided with a similarly-formed slotted breastplate, an intermittently-operating swinging frame mounted loosely at its lower end upon a shaft, a shaft journaled in the upper end of the same, provided with an arm, a link pivotally connecting said arm with a fixed point of the platform, a downwardly-disposed or upper compressor rigidly mounted on said shaft in the vertical plane of the slot of the breastplate, and a pair of upwardly-disposed or lower compressors mounted loosely below the horizontal portion and projecting up through the depressed portion of the platform, a shaft having lugs, which, each time the swinging frame depresses the upper compressor, causes the upward movement of the lower compressors, substantially as set forth.

6. In a grain-binder, a platform, consisting of a straight and a depressed portion, and provided with a similarly-formed slotted breastplate, an intermittently-operating swinging frame mounted rigidly at its lower end on a shaft, a shaft journaled in the upper end of the same, provided with an arm, a link pivotally connecting said arm with a fixed point of the framework, a downwardly-disposed or upper compressor rigidly mounted on the latter shaft in the vertical plane of the slot of the breastplate, and a pair of upwardly-disposed or lower compressors loosely mounted below the horizontal plane and projecting up through the depressed portion of the platform, lugs upon the first-named shaft, which, each time the swinging frame depresses the upper compressor, cause the upward movement of the lower compressors, a needle pivoted in a slot in the upper compressor, an ear projecting from the same, and a heel on the compressor, and a spring exerting its pressure to hold said ear and heel as far apart as possible, substantially as set forth.

7. In a grain-binder, a stationary platform, consisting of a horizontal and a depressed portion, a shaft at the upper end of the depressed portion, a bundle discharging or dropping device mounted rotatably thereon, provided with an antifriction-roller at one end, a swinging frame, a swinging link, a pitman pivotally connecting the frame and link, a collar upon said pitman provided with a shoulder, and a pivoted dog, a spring holding said dog against said shoulder so that the dog, as the swinging frame moves outward, may pass the antifriction-roller of the bundle discharging or dropping device inoperatively, and may, on its return, reëngage said antifriction-roller and operate the bundle discharger or dropper, substantially as set forth.

8. In a grain-binder, a stationary platform, consisting of a horizontal and a depressed portion, a shaft at the outer end of the depressed portion, a bundle discharging or dropping device mounted rotatably thereon, provided with an antifriction-roller at one end, a swinging frame, a swinging link, a pitman

pivotally connecting the frame and link, a collar upon said pitman provided with a shoulder, and a pivoted dog, a spring holding said dog against said shoulder so that the dog, as the swinging frame moves outward, may pass the antifriction-roller of the bundle discharger or dropper inoperatively, and may, on its return, reëngage said antifriction-roller and operate the bundle discharger or dropper, and a spring upon the shaft to return the bundle discharger or dropper to its original position, substantially as set forth.

9. In a grain-binder, the combination of an intermittently-rotating shell, a bill mounted therein and projecting beyond the rear end of the shell, a cord-clamp bearing with a yielding pressure against the external surface of the shell and coöperating therewith to hold the twine, an inner jaw or finger non-rotatably mounted in said bill, a spring holding the same yieldingly advanced, and a nut mounted upon said jaw or finger and adjustable to regulate the tension of said spring, substantially as described.

10. In a grain-binder, the combination with a breastplate provided with a sleeve, a cylindrical shell rotatably mounted within said sleeve and projecting beyond its rear end, and provided with an inclined slot, a bill provided with a tubular stem rigidly secured within the said shell so that the point of the bill will overlap the inclined slot, an inner jaw or finger non-rotatably mounted within said tubular stem, a spring holding the same advanced with a yielding pressure against the outer jaw or bill, a cord-clamp held snugly against the external surface of said sleeve with a yielding pressure and provided with a roughened surface between which and the sleeve the end of the twine is held, and means to intermittently rotate the sleeve together with the knotter bill and finger whereby once in each revolution the inclined slot of the sleeve will register with the point of the cord-clamp whereon is located the end of the twine that the latter may be released, substantially as described.

11. In a grain-binder, having a breastplate provided with a sleeve, an intermittently-rotating knotter mechanism, consisting of a slotted shell, and an inner and outer jaw which project beyond the rear end of the shell, a cord-holder held with a yielding pressure against said shell, and a knife overhanging said cord-holder and projecting into the rear end of the shell, substantially as set forth.

12. In a grain-binder, having a breastplate provided with a sleeve, an intermittently-rotating knotter mechanism, consisting of a slotted shell, and an inner and an outer jaw which project beyond the rear end of the shell, a cord-holder held with a yielding pressure against said shell, an aperture formed in said cord-holder, and a guide-arm flaring grainward and rearwardly from the same, substantially as set forth.

13. In a grain-binder, having a breastplate provided with a sleeve, an intermittingly-rotating knotter mechanism, consisting of a slotted shell, an inner and an outer jaw which project beyond the rear end of the shell, a cord-holder held with a yielding pressure against said shell, an aperture formed in said cord-holder, a guide-arm flaring grainward and rearwardly from the same, and a knife projecting into the rear end of the shell to sever the twine, substantially as set forth.

14. In a grain-binder, the combination with a suitable supporting-framework, a platform to support the bundle as and after it is formed, a breastplate of similar configuration to said platform and provided with a slot consisting of the parts 26, 27 and 28, guard-flanges at the opposite side of said slot, a sleeve below and forward of the same, a knotter mechanism consisting of a shell journaled in said sleeve, a bill fixed relative to said shell and projecting rearward of the narrow portion 27 of said slot, and an inner jaw or finger operating in conjunction with said bill, of a threaded needle to operate through the part 26 of said slot, and an upper compressor to fit snugly against the breastplate and bridge the part 28 of said slot, substantially as shown and described.

15. In a grain-binder, the combination with a suitable supporting-framework, a platform to support the bundle as and after it is formed, a breastplate of similar configuration to said platform and provided with a slot consisting of the parts 26, 27 and 28, guard-flanges at opposite sides of said slot, and a sleeve below and forward of the same, a knotter mechanism consisting of a shell journaled in said sleeve, a bill fixed relative to said shell and projecting rearwardly of the narrow portion 27 of said slot, and an inner jaw or finger operating in conjunction with said bill, of a threaded needle to operate through the part 26 of said slot, an upper compressor to fit snugly against the breastplate and bridge the part 28 of said slot, a cord-holder holding the cut end of the twine against the bottom of the shell, a guide-arm projecting from said cord-holder to receive that portion of the twine leading to the needle, a knife above said cord-holder, and means to rotate the knotter mechanism, substantially as and for the purpose set forth.

16. In a grain-binder, the combination with a suitable supporting-framework, a platform to support the bundle as and after it is formed, a breastplate of similar configuration to said platform and provided with a slot consisting of the parts 26, 27 and 28, guard-flanges at opposite sides of said slot, and a sleeve below and forward of the same, a knotter mechanism consisting of a shell journaled in said sleeve, a bill fixed relative to said shell and projecting rearward of the narrow portion 27 of said slot, and an inner jaw or finger operating in conjunction with said bill, of a threaded needle to operate through the part 26 of said slot, an upper compressor to fit

snugly against the breastplate and bridge the part 28 of said slot, a cord-holder holding the cut end of the twine against the bottom of the shell, a guide-arm projecting from said cord-holder to receive that portion of the twine leading to the needle, a knife above said cord-holder, means to rotate the knotter mechanism, and means to elevate the bundle and thereby withdraw the completed knot from the knotter mechanism, substantially as set forth.

17. In a grain-binder, the combination of a suitable framework, comprising a slotted breastplate, and a stationary sleeve having cams or inclined surfaces at its front end, an intermittently-rotating wheel provided with an annular flange having a series of peripheral teeth, a shaft journaled in the framework provided with a cog-pinion having one more tooth than the annular flange and adapted for engagement therewith, a cylindrical shell mounted rigidly upon said shaft and enlarged diametrically at its rear end, a bill fixed within said shell, an inner jaw or finger also within the said shell and non-rotatably mounted, a spring holding said inner jaw or finger yieldingly advanced against the bill, a nut to regulate the tension of said spring, an antifriction-roller carried by said inner jaw or finger and held by said spring against the front end of the sleeve, and a cord clamp or holder externally embracing and bearing with yielding pressure against the part of the enlarged portion of the shell, and provided with flanges which fit snugly against the rear end of the shell and the shoulder formed by the diametric enlargement thereof, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

LOUIS J. FELLAY.

Witnesses:
W. D. SMITH,
CHAS. STURDIVANT.