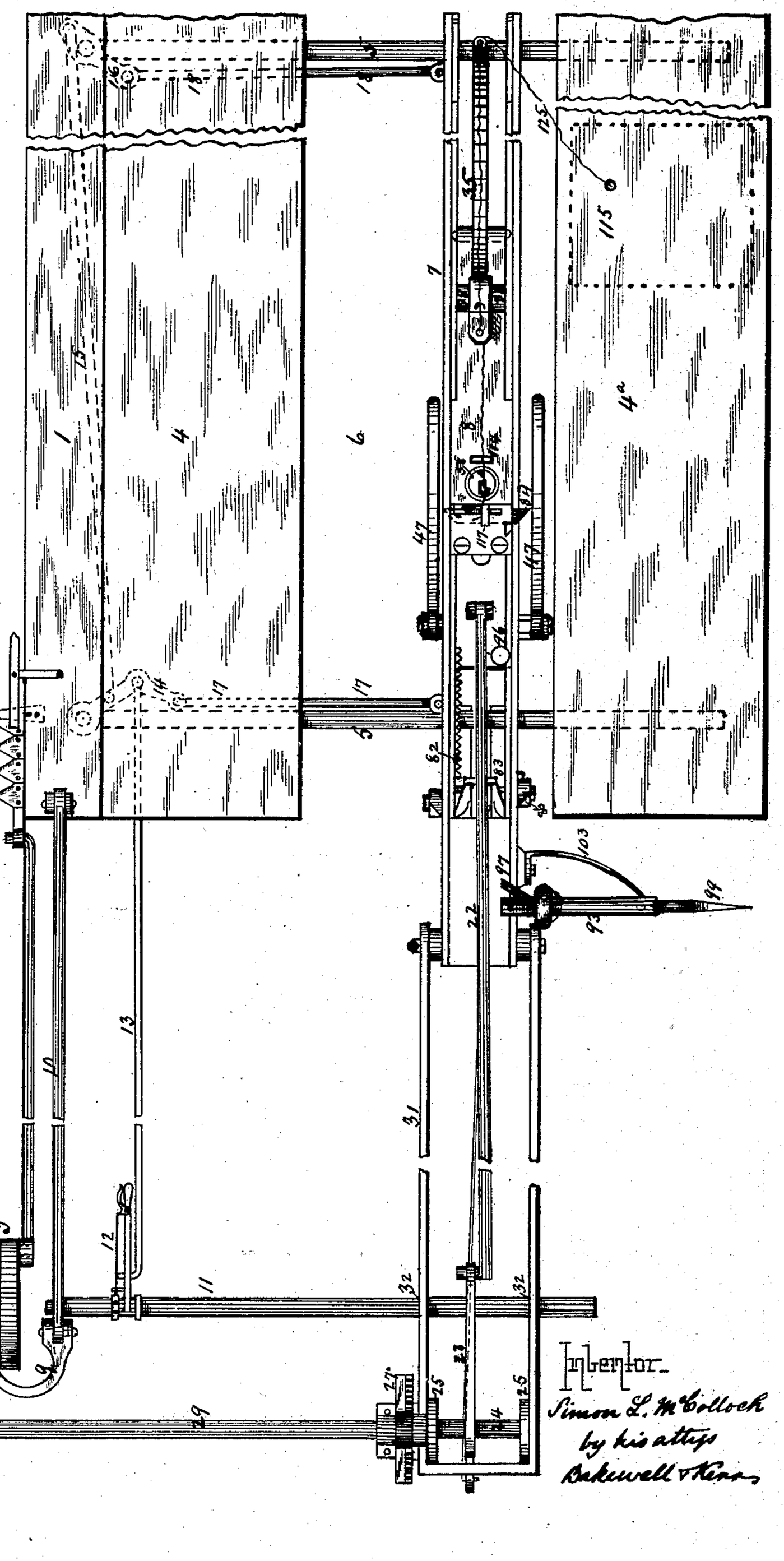
(Model.) 7 Sheets—Sheet 1.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 315,528. Patented Apr. 14, 1885.

Fig. 1.



Witnesses—
W. B. Corwin
Robt. J. Sample.

Inventor—
Simon L. McColloch
by his attys
Bakewell & Kerr

(Model.)

7 Sheets—Sheet 2.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 315,528. Patented Apr. 14, 1885.

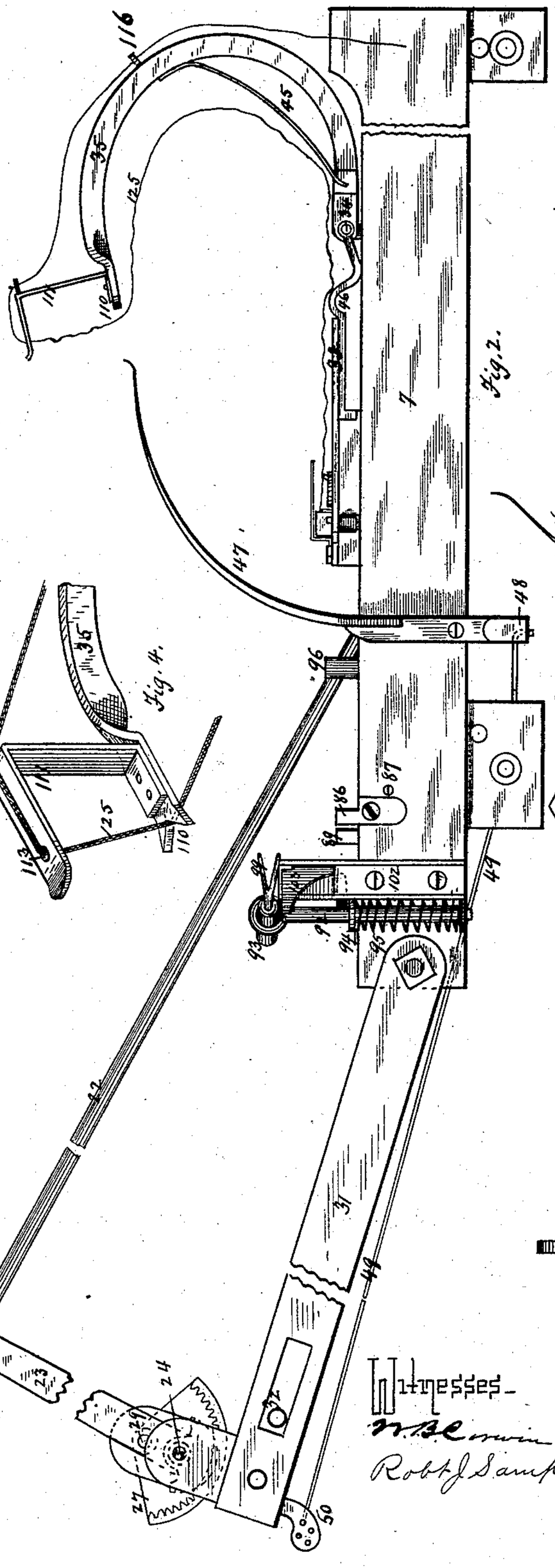


Fig. 2.

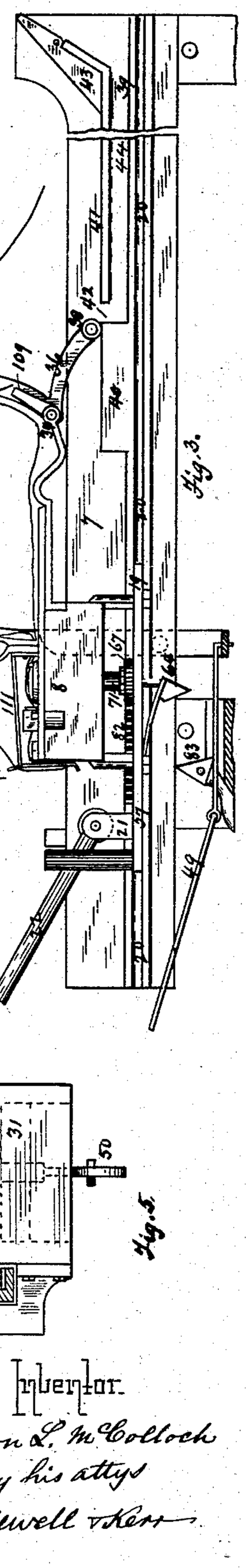


Fig. 3.

Fig. 4.

Fig. 6.

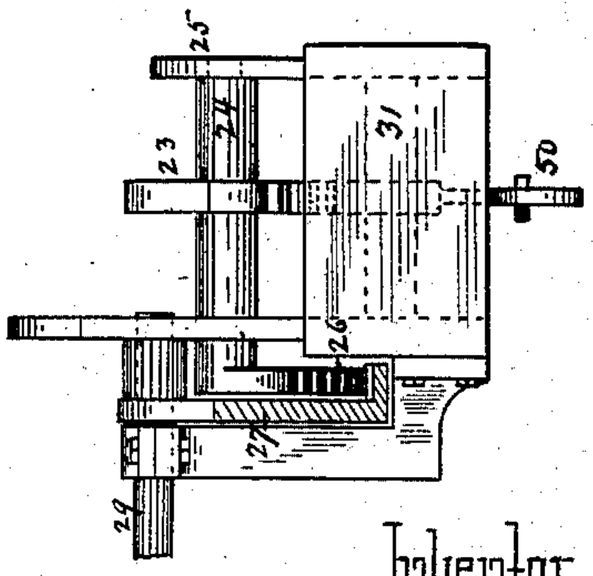


Fig. 5.

Witnesses—

W. B. Corwin

Robt J. Samples.

Inventor.

Simon L. McColloch

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Bakewell & Kerr.

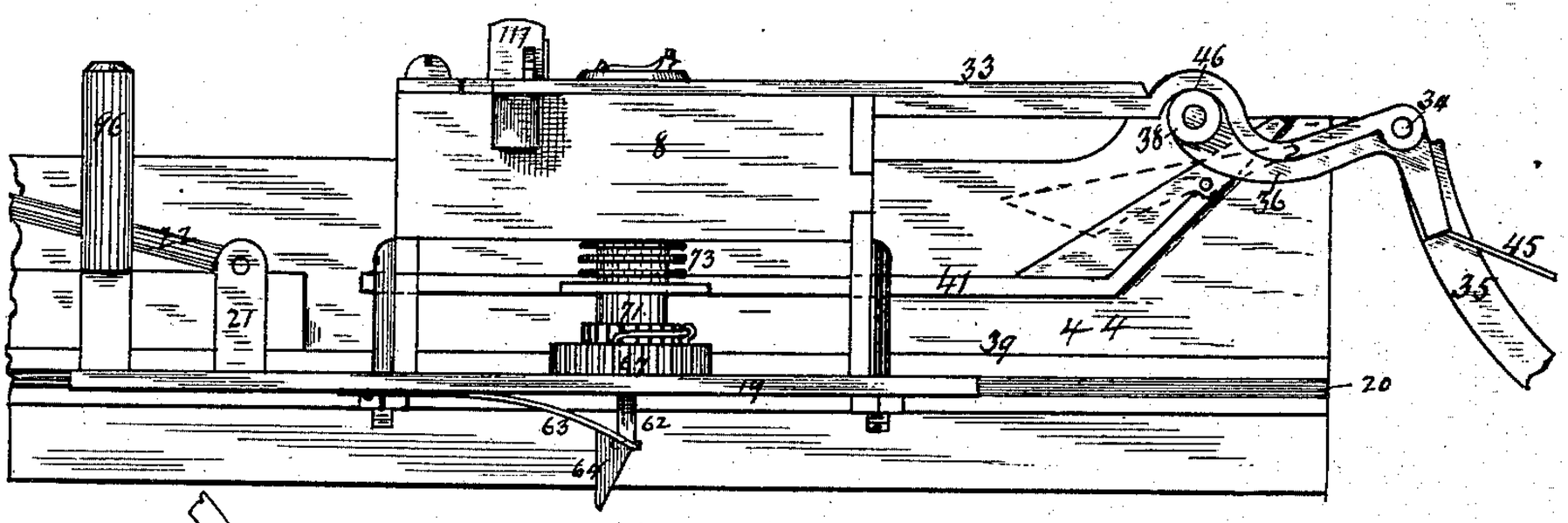
(Model.)

7 Sheets—Sheet 3.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 315,528. Patented Apr. 14, 1885.



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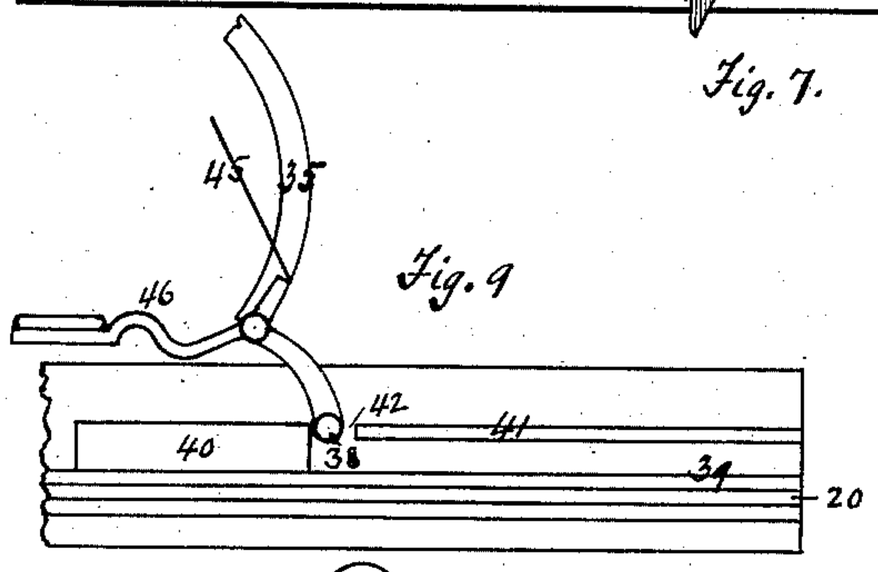
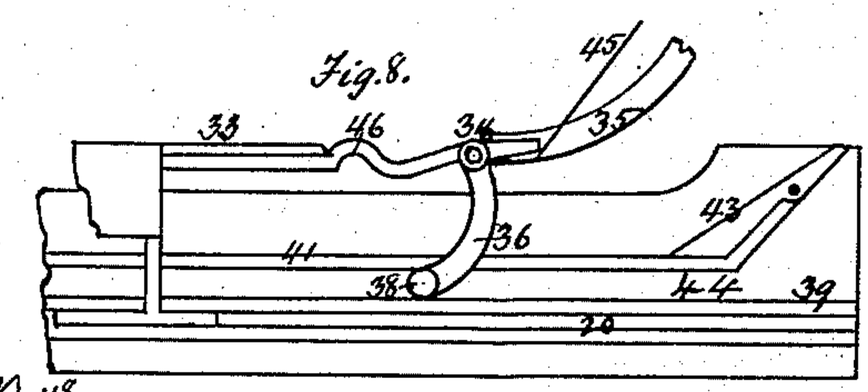


Fig. 9



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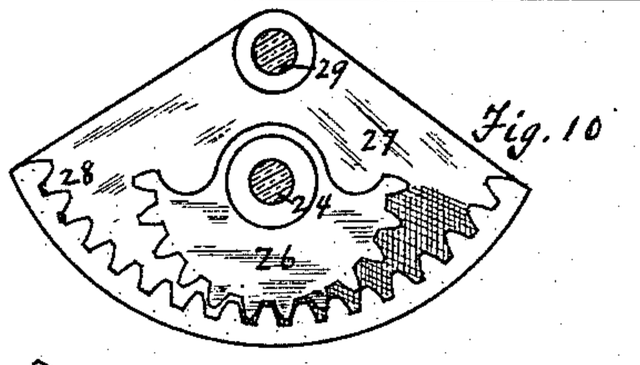


Fig. 10

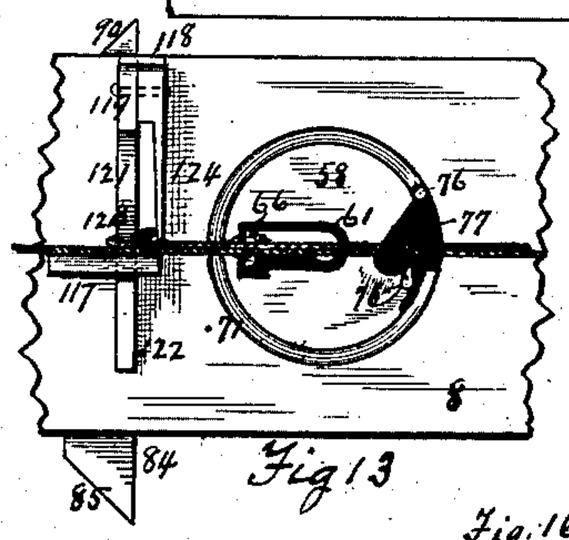


Fig 13

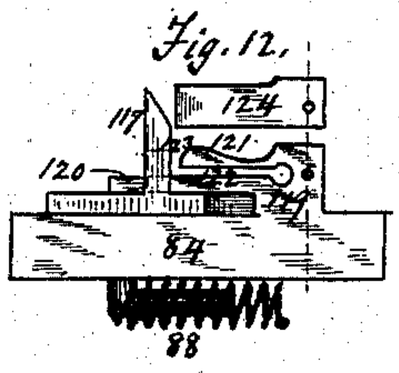


Fig. 12.

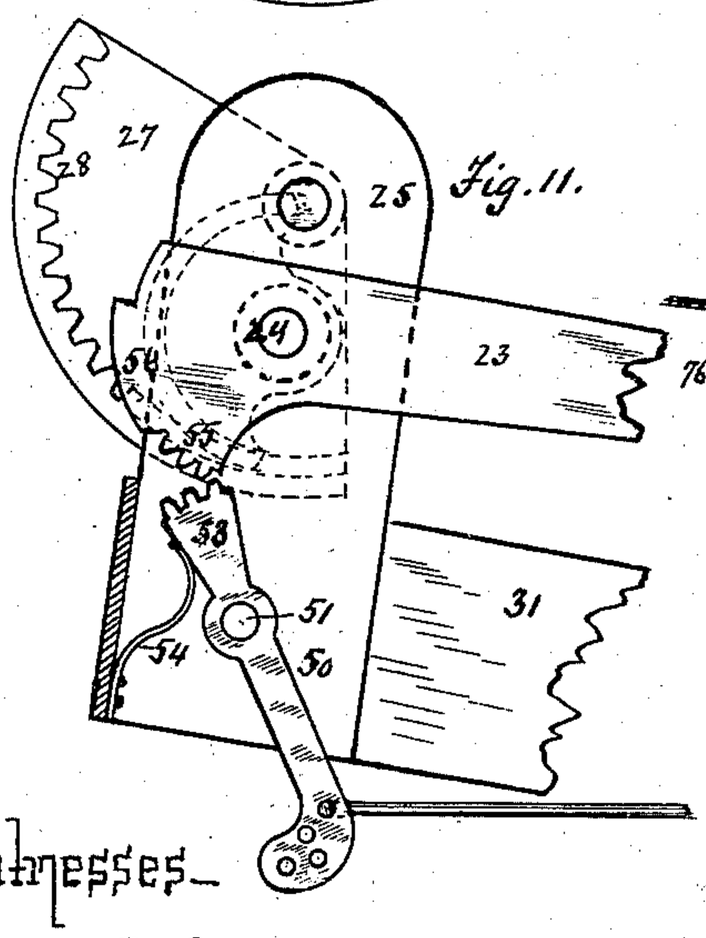
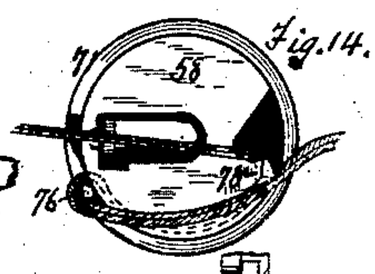


Fig. 11.



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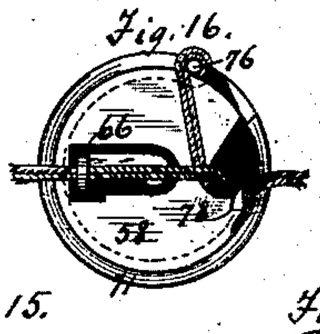

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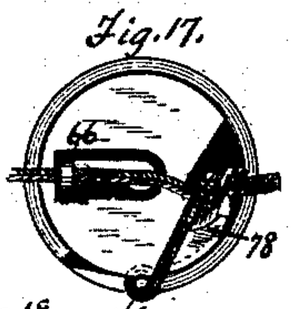

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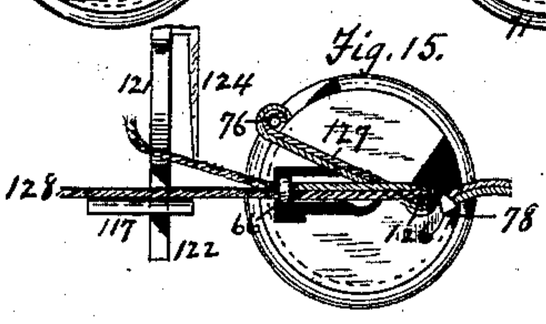

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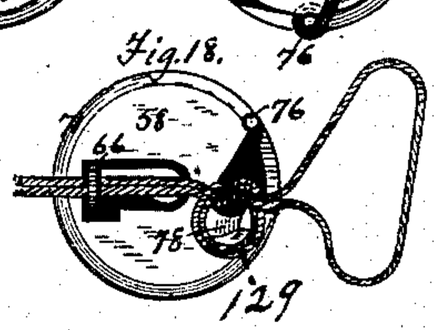

Fig. 18.

Witnesses—

W. B. Corwin

Robt. J. Sample.

Inventor—

Simon L. McColloch

by his attys

Bakewell & Kerr

(Model.)

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S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 315,528. Patented Apr. 14, 1885.

Fig. 19.

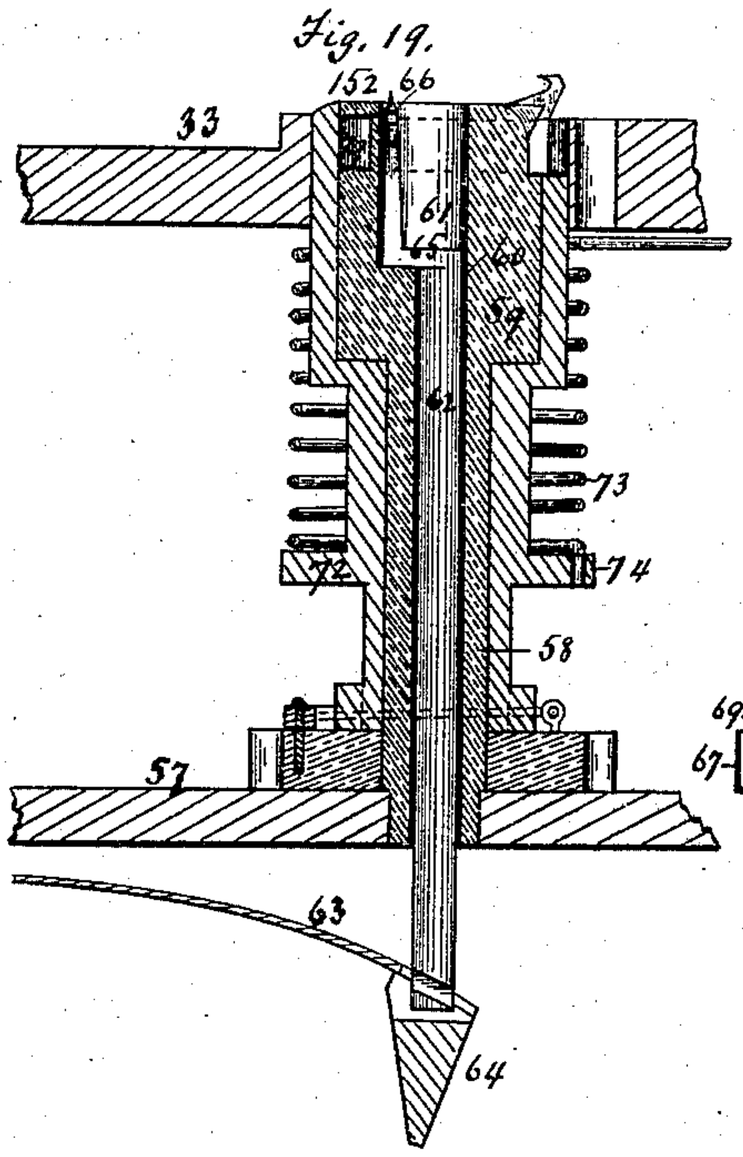
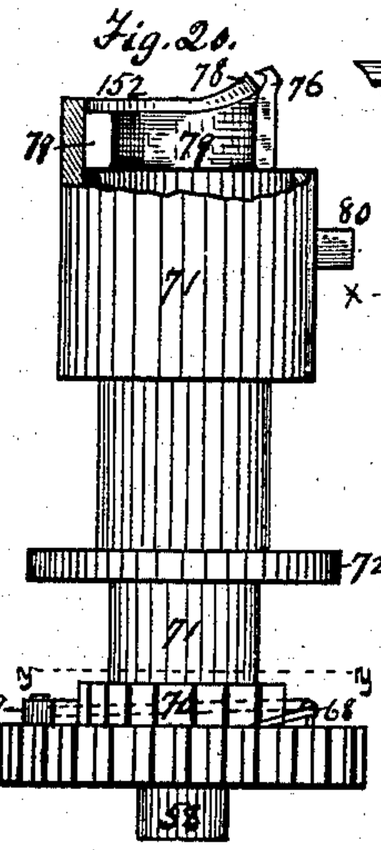


Fig. 20.



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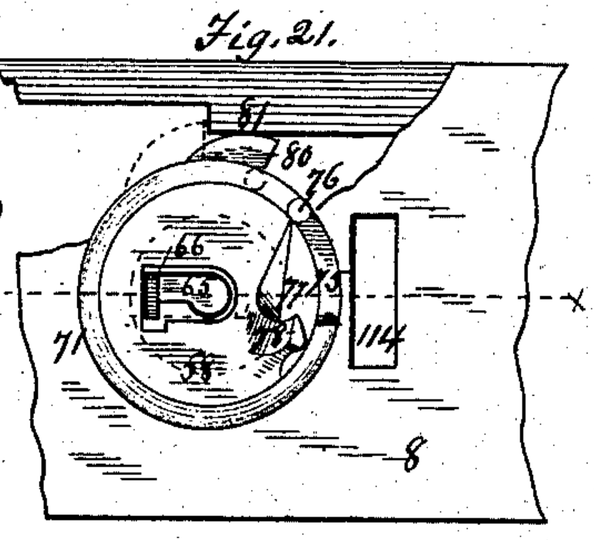


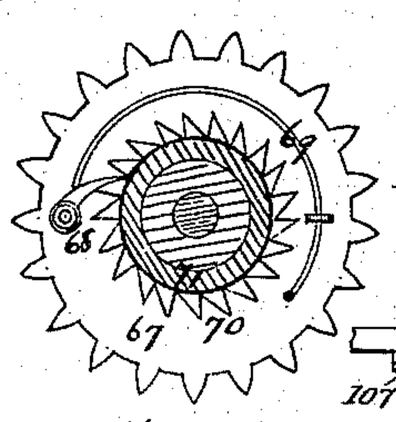
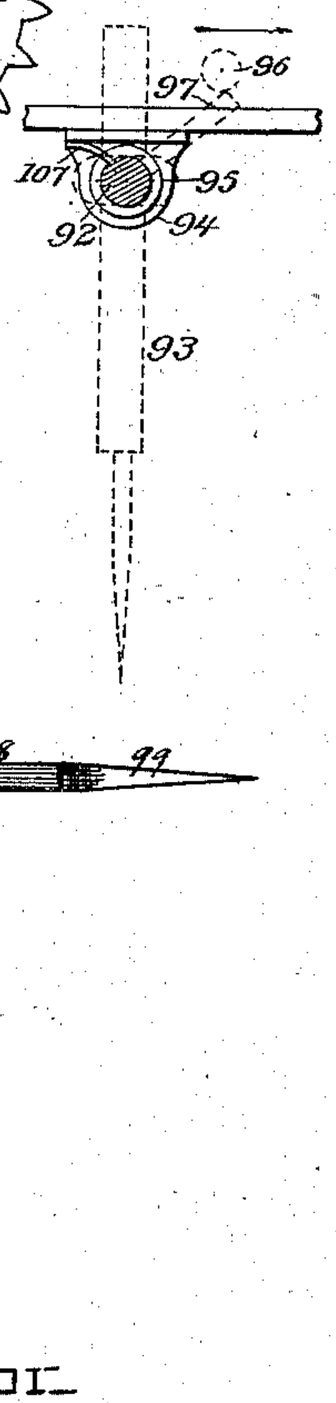


Fig. 22.

Fig. 30.



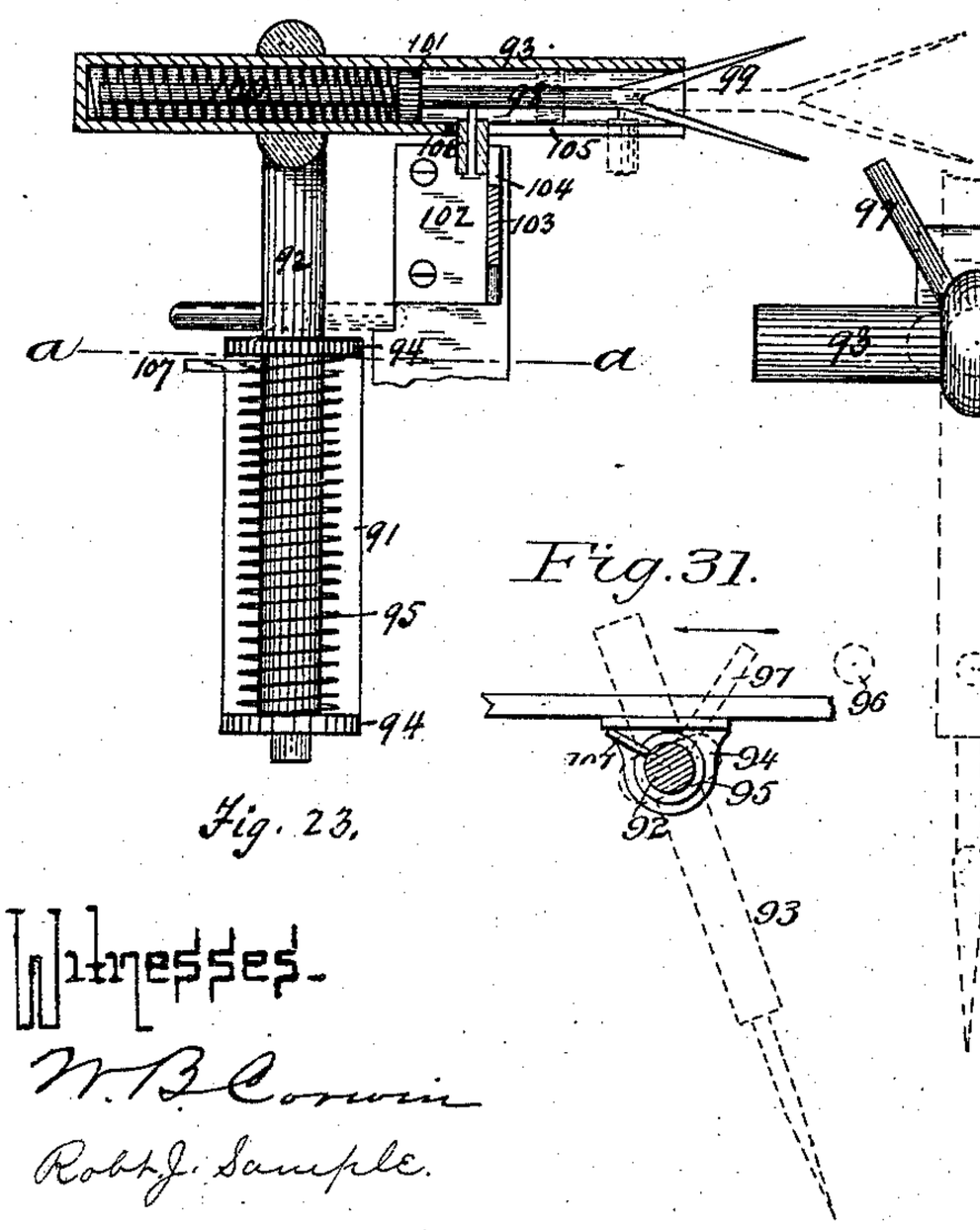


Fig. 23.

Fig. 31.

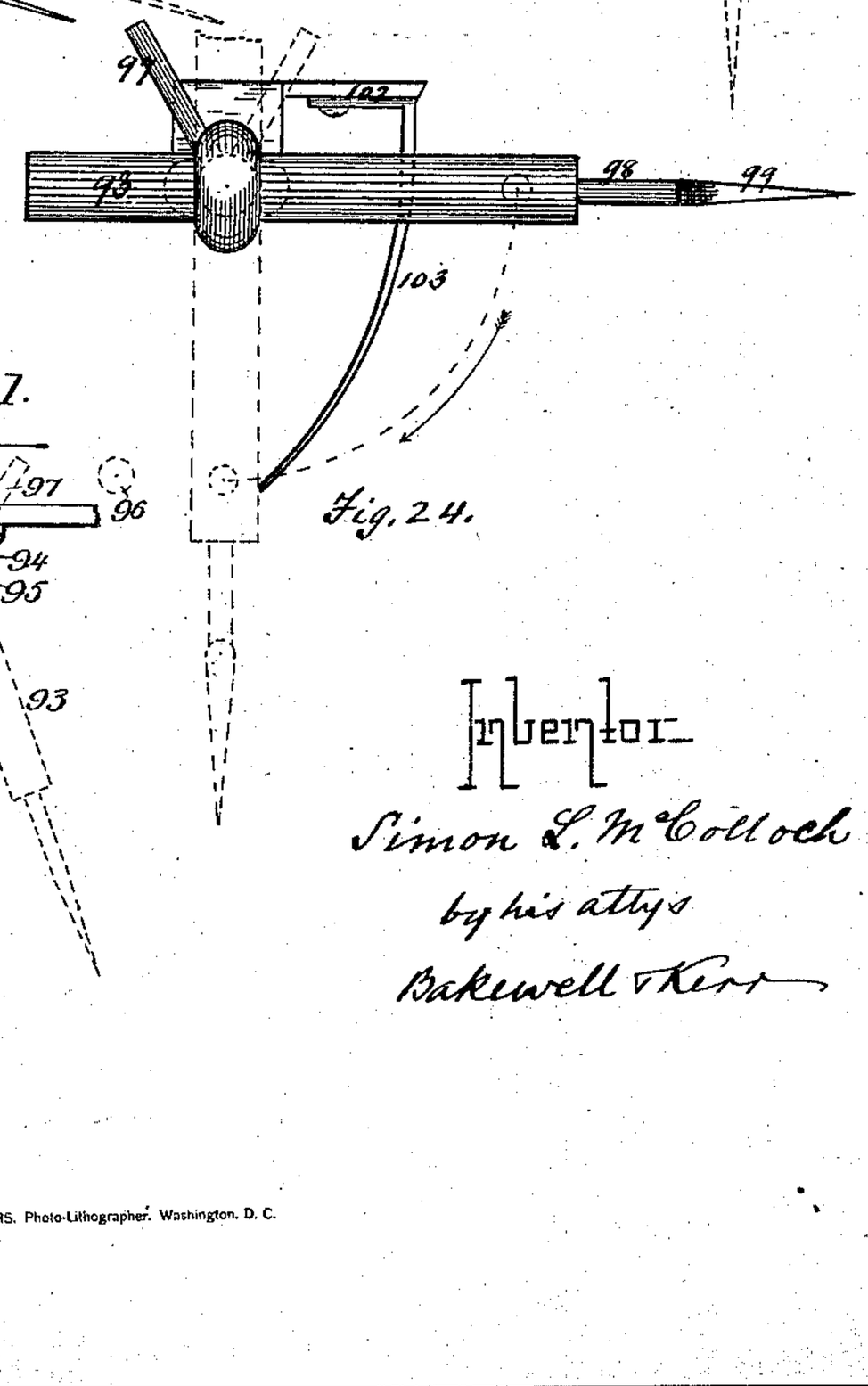


Fig. 24.

Witnesses.

W. B. Corwin

Robt J. Sample.

Inventor

Simon L. McCulloch

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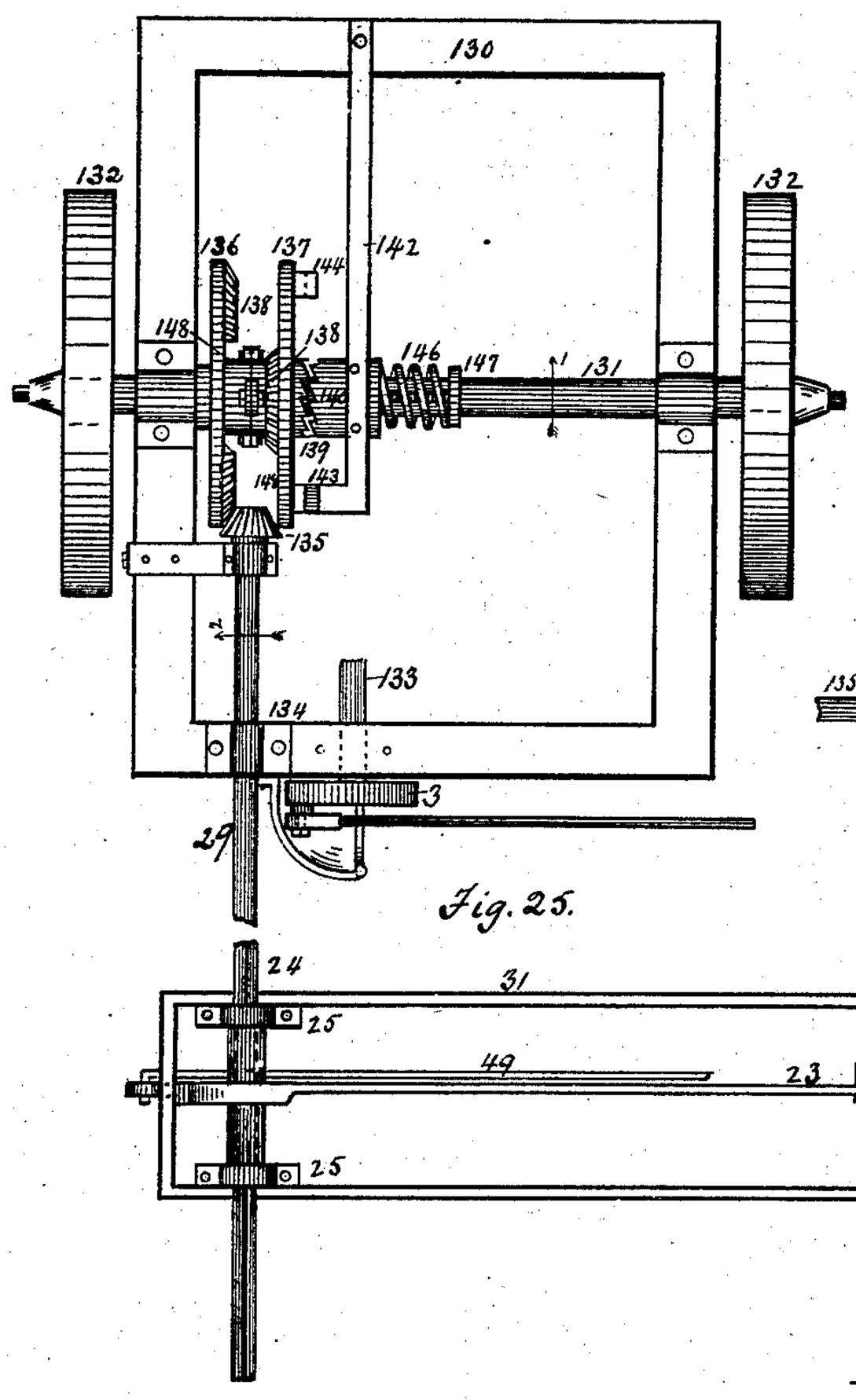
Bakewell & Kerr

(Model.) 7 Sheets—Sheet 5.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 315,528. Patented Apr. 14, 1885.



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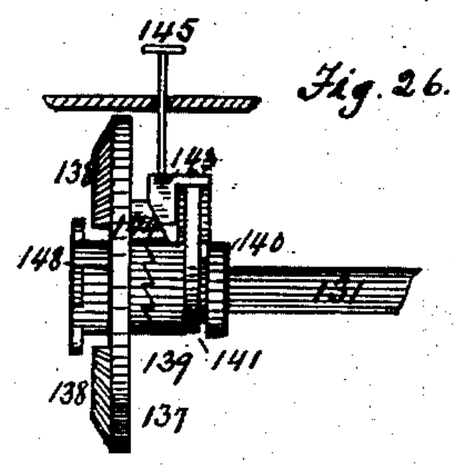

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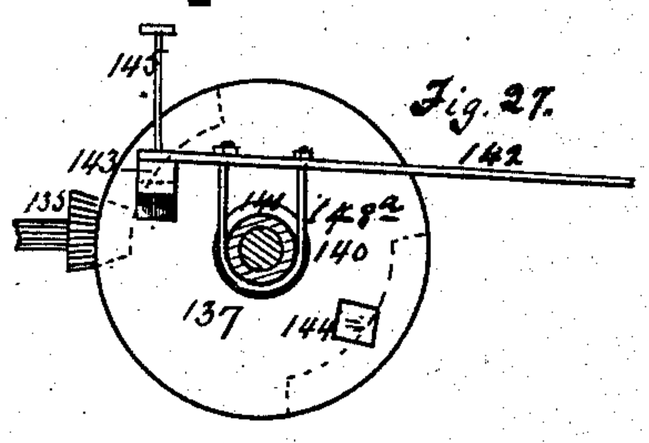

Fig. 27.

Witnesses

W. B. Corwin

Robt J. Sample.

Inventor

Simon L. McColloch

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Bakewell & Kerr

(Model.)

7 Sheets—Sheet 6.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 315,528. Patented Apr. 14, 1885.

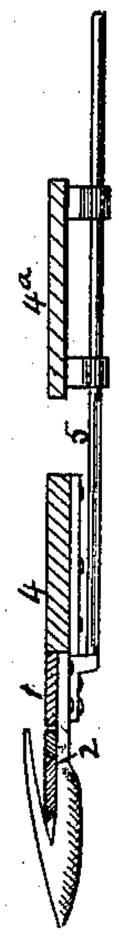

Fig. 29.

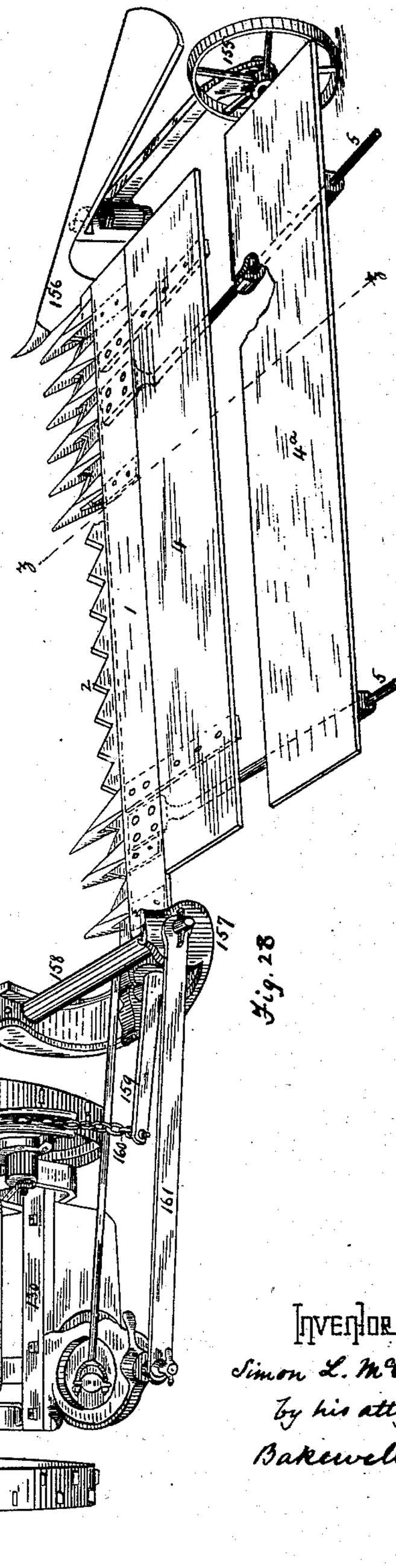

Fig. 28

Witnesses.
W. B. Corwin
Jno. K. Smith

Inventor
Simon L. McCulloch
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Bakewell & Kerr

(Model.)

7 Sheets—Sheet 7.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 315,528. Patented Apr. 14, 1885.

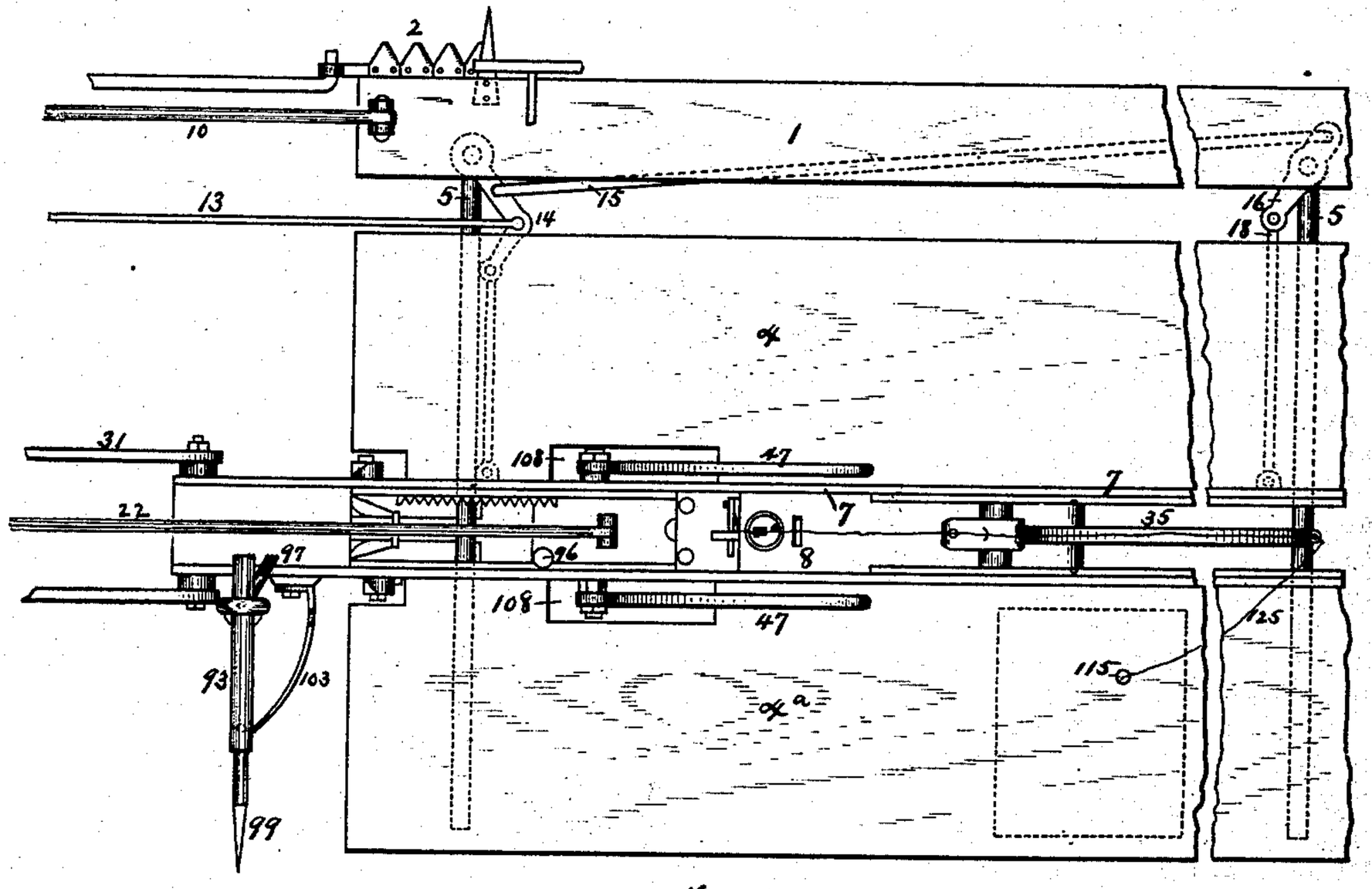

Fig. 32.

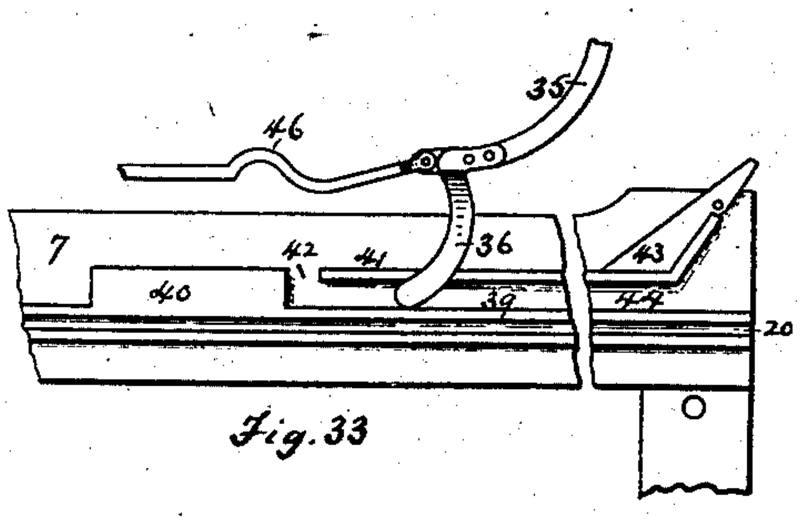

Fig. 33

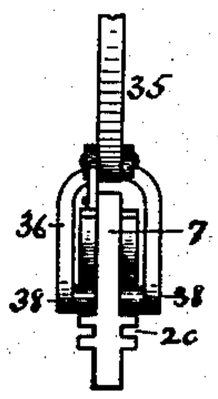

Fig. 34.

Witnesses.

J. A. Burns.

W. T. Cornwell

Inventor.

Simon L. McColloch

by his attys

Bakewell & Kerr

UNITED STATES PATENT OFFICE.

SIMON L. McCOLLOCH, OF WHEELING, WEST VIRGINIA.

GRAIN-BINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 315,528, dated April 14, 1885.

App'ication filed April 26, 1883. (Model.)

To all whom it may concern:

Be it known that I, SIMON L. McCOLLOCH, of Wheeling, in the county of Ohio and State of West Virginia, have invented a new and useful Improvement in Grain-Binding Machines; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to a grain-binding machine to be used as an attachment for mowing and reaping machines.

To enable others skilled in the art to make and use my invention, I will now describe it by reference to the accompanying drawings, in which—

Figure 1 is a plan view of my improved binder. Fig. 2 is a rear elevation of the binding mechanism with the binder-arm in a half-open position. Fig. 3 is a like view, partly in section, showing the binder-arm closed. Fig. 4 is an enlarged view of the end of the binder-arm. Fig. 5 is an end view of the frame which supports the actuating mechanism. Fig. 6 is a perspective view of the shield which covers the tying mechanism. Fig. 7 is an enlarged side elevation of the traveling carrier which carries the tying mechanism and binder-arm. Figs. 8 and 9 are views illustrating the positions and operation of the binder-arm at different stages of its inward or gathering movement. Figs. 10 and 11 are views of the devices for reciprocating the binding mechanism. Fig. 12 is an elevation of the devices for holding and cutting the cord. Figs. 13 to 18 are plan views of the tying or knotting devices, showing the successive positions assumed in tying a knot. Fig. 19 is a vertical section of the tying mechanism on the line *x x* of Fig. 21. Fig. 20 is a side elevation of the rotating barrel. Fig. 21 is a plan view of the tying mechanism. Fig. 22 is a cross-section on the line *y y* of Fig. 20. Fig. 23 is a vertical section of the discharging mechanism. Fig. 24 is a plan view of the same. Fig. 25 is a plan view of power devices for automatically operating the binding mechanism. Figs. 26 and 27 are respectively edge and side elevations of a portion of the mechanism of Fig. 25. Fig. 28 is a rear elevation of a reaper, showing my improved platform and the manner of supporting the inner and outer ends of the finger-bar. Fig. 29 is a section of the finger-bar and platform on the line *z z*, Fig. 28. Figs. 30 and 31 are views of the parts below the line *a a* in Fig. 23, illustrating the operation of the spring 107, which restores the arm 97 to position in the path of the pin 96, the upper parts being shown in dotted lines to indicate their position with relation to the parts which are shown in full lines. Fig. 32 is a plan view illustrating a modification of the construction of the platform, in which the two parts 4 and 4ª are shown to be attached to the side of the guide-trough 7 and adjustable therewith with relation to the finger-bar. Figs. 33 and 34 are respectively side and end views showing a modification in the construction of the guide-trough, in which the guide-flanges are made in the outer sides of a plate instead of the inner sides of the trough, as will be hereinafter described.

Like figures of reference indicate like parts in each.

As it is unnecessary to illustrate my invention, I do not show the entire reaping-machine, but only the finger-bar 1, knives 2, crank 3 for operating the knives, and platform 4, the latter, however, being modified to adapt it for the attachment of my improved binding devices. I will now describe it. Extending back from the finger-bar 1 are two or more strong rods or bars, 5. The platform is divided into two parts, 4 and 4ª, there being a rectangular opening, 6, between them. The front part, 4, is fastened to the back edge of the finger-bar, and the rear part, 4ª, is supported on the rods 5. The outer end of the finger-bar is supported by a wheel or caster, 155, Fig. 28, of the usual construction. The grain-divider 156 is attached to the outer end of the finger-bar. The inner end of the finger-bar is fastened to a shoe, 157, mounted on the drag-bar 158, which is attached to an extension of the front sill of the main frame of the machine. The shoe 157 is further supported by a bar, 159, which is sustained by the well-known chain or link, 160, commonly employed for that purpose, and is braced from the rear end of the main frame by a bar, 161, of the usual construction. The rods 5, which sustain the platform, are rigid, and extend backward the distance necessary for the proper adjustment and support of the platform. In the opening 6 is a trough or guideway, 7,

open on top, which is designed to receive the traveling carrier 8, which carries the binder-arm and the tying mechanism. This guide-trough is supported by, and is capable of a lateral movement on, the rods 5. The opening 6 is considerably wider than the guide-trough 7, so as to permit of its lateral adjustment therein, the purpose of which is as follows, viz: It is desirable to apply the band at or about the middle of the sheaf. The combined traveler 8 and binder-arm in the outward movement carries the cord across the position in opening 6 where the grain will fall. In the return or inward movement the binder-arm throws the cord over the loose grain and carries the cord inward, both over and under the gavel, in a similar manner to what would be done by the two arms of a person. If the grain is short, the guide-trough 7 is adjusted toward, and if long away from, the front platform, 4, so as to cause the band to be applied at the desired point. The devices for effecting this adjustment are the following: Extending between the bracket 9 and finger-bar 1 is a bar, 10, from which a bar, 11, extends backward at right angles. Pivoted on the bar 11, or at any other point on the machine within easy reach of the driver, is a lever, 12, pivoted to which is a rod, 13, that extends to an elbow-lever, 14, under the platform 4. The elbow-lever 14 is pivoted at one end to the under side of the finger-bar 1, and at the other to a link, 17, which is connected to the guide-trough 7. The rod 13 is pivoted at or near the angle of the lever 14. Pivoted to the under side of the finger-bar 1, near the grain end, is another lever, 16, which is connected to the lever 14 by a rod, 15, in turn pivoted to the lever 14 between the rod 13 and the finger-bar, and to the lever 16 at its forward end. The rear end of the lever 16 is connected to the guide or trough 7 by a link, 18. With these devices the guide-trough 7 is moved away from the platform 4 by throwing the lever 12 away from the finger-bar 1, and is moved away from the platform 4ª by throwing it back toward the finger-bar.

I will now proceed to describe the construction of and devices for operating the carrier 8. It is a rectangular-shaped box, and has a flange, 19, projecting laterally from its bottom on both sides into grooves, guides, or ways 20, formed in the inner sides of the trough or guide-way 7. At its inner end are lugs 21, pivoted to which is one end of a rod or pitman, 22, the other end of which is pivoted to an oscillating lever, 23. The lever 23 is mounted rigidly on a shaft, 24, which is journaled in bearings 25. Also mounted rigidly on the shaft is a geared segment, 26, having an arc of one hundred and eighty degrees, which meshes into a large segmental wheel, 27, having inwardly-projecting teeth 28. The segmental wheel 27 is mounted rigidly on a shaft, 29, journaled at the rear end in one of the bearings 25, and extends forward toward the driver's seat, where it is provided with a lever, 30, within his reach. The bearings 25 are supported on a frame, 31, which is sustained at one end by the trough or guideway 7 and at the other end by the bar 11, the latter extending through holes 32, which are large enough to permit the frame 31 to slide easily laterally therein when the trough 7 is adjusted in the opening 6. By means of these devices the carrier 8 is reciprocated in the trough or guide-way 7. When the lever 30 is thrown over toward the finger-bar 1, the large segment 27 causes the segment 26 to turn to the position shown in Fig. 11, and that causes the lever 23 to assume a nearly horizontal position, as also shown in Fig. 11, and to force the carrier 8 out to the extreme end of the trough 7. When the lever 30 is drawn away from the finger-bar, it will cause the segments to work in the opposite direction to that just described, and to throw the lever 23 over and draw the carrier 8 inward to the position shown in Fig. 3.

I will now describe the construction and operation of the bundling devices. Projecting horizontally backward from the top of the carrier 8 is an arm or plate, 33, on the end of which are lugs supporting a pin or axle, 34, on which is pivoted a curved binder-arm, 35. Projecting downward from the pivot 34 is a short arm or heel extension, 36, on the binder-arm. This short arm 36 has a cross-piece at its outer end provided with small friction-rollers 38, which travel on top of the upper flanges, 39, of the grooves 20, the distance of such travel being limited by the stops 40, placed near the middle of the length of the trough or guide-way 7. Above the flanges 39 are other flanges or ways, 41, which extend inward nearly to the stops 40, but not quite, there being an opening or gap, 42, between them. The top of the stops 40 are on a level with the top of the flanges 41. At the outer end of each flange 41 is a pivoted pawl or switch, 43, placed in an upwardly-inclined position, its lower end resting upon the flange 41, and, while capable of turning over into an oppositely-inclined position, it is weighted at its lower end, so that it shall always return to its first or normal position. The purpose of this construction of the short arm 36 and its cross-piece, having the rollers 38, flanges 39 and 41, stops 40, openings 42, and switches 43, is to give a forward-sweep motion to the binder-arm 35 as the carrier 8 travels inward. In Fig. 7 I show the position of the parts named just before the carrier reaches the limit of its outward movement. In this position the rollers 38 ride over the upper ends of the pawls or switches 43 and cause them to tip, as shown by broken lines, Fig. 7. The further outward movement causes the rollers to pass over the ends of the pawls, when the latter, by reason of their weighted lower ends, drop back into their normal position, as shown by the full lines in Fig. 7. Then, when the carrier begins to advance, the rollers 38 strike the under side of the pawls 43, and are caused to travel down under them into the grooves 44, formed by the

flanges 39 and 41. The effect of this movement is to cause the binder-arm 35 to be thrown upward into the position shown in Fig. 8. The further advance of the carrier brings the rollers against the stops 40, which causes the arm 35 to be thrown over into the position shown in Fig. 9. The further advance of the carrier causes the rollers to ascend out of the grooves 44 through the openings 42 and to roll along the upper edges of the stops 40. When the carrier reaches the limit of its inward movement, the rollers have passed entirely beyond the stops 40, and the gathering-arm 35 is, by means of the spring 45—the operation of which will be described—thrown backward into the position shown in Fig. 7, being held in that position by the arm 36 coming in contact with the under side of the plate 33, said arm being made, preferably, with a bend forming a concavity, 46, for the reception of the cross-piece which carries rollers 38. Then the backward movement of the carrier causes the rollers 38 to encounter the pawls 43 and pass over them, as has been described, into position for the next inward movement. Opposite to the binder-arm 35, and constituting part of the bunching or gaveling devices, is a pair of oscillating fingers, 47, which are pivoted to the trough 7, and united below the same by a cross-strap, 48. The cross-strap 48 is connected by a rod, 49, to the lower end of a lever, 50, pivoted on a shaft, 51, at the inner end of the frame 31 below the shaft 24. The other end of the lever 50 is provided with a segmental gear, 53, having three or more teeth, as may be desired. Fastened to the frame 31, and bearing against the segmental gear 53, is a spring, 54. The end of the lever 23 is provided with a segment, 55, having a corresponding number of teeth at its lower end, and a plain segment, 56, of a height equal to that of the teeth, and of any desired length. The geared segment 53 meshes into the teeth of the segment 55, so that the lever 50 is operated by the lever 23, and causes the vibration of the fingers 47 by means of the rod 49. This is done in the following manner: When the lever 23 is raised to draw the carrier inward, which movement of the carrier causes the raising of the binder-arm 35, as has been described, the segment 55, coming into gear with the segment 53, causes the lower end of the lever 50 to be turned inward away from the trough 7. This movement draws the lower ends of the fingers 47 in the same direction and causes the fingers to move toward the outer ends of the trough 7, thereby operating in opposition to the movement of the binder-arm 35, and in conjunction therewith to effect the bunching or gaveling and compressing of the grain preparatory to binding, as hereinafter described. This position is shown in Fig. 2. After the teeth of the segments 53 and 55 have passed each other the movement of the lever 50 is stopped, and it is held in the position shown in Fig. 2 by the passage of the solid segment 56 over its last tooth. During this stoppage the binder-arm 35 is brought to the position shown in Fig. 3, and the bunch or gavel of grain will have been formed, as hereinafter described, by the binder-arm and the fingers, and is now encircled by the binder-arm. The teeth of the segment 53 having passed the solid segment 56, there is nothing to prevent the lever 50 being restored to its normal position, and this is effected by the further advance of the carrier 8, which causes the bunch or gavel of grain to come in contact with the fingers 47 and throw them back into their normal position, which movement, operating on the lever 50 by means of the connecting-strap 48 and rod 49, will throw it into the position shown in Fig. 11. This position it will maintain during the outward movement of the carrier 8, and until the segment 55 is brought by such outward movement into the position shown in Fig. 11. The function of the spring 54 is to cause the first tooth of the segment 53 to drop into gear with the first tooth of the segment 55 after the solid arc 56 has passed it upon the outward movement of the lever 23. The spring 54 is not of sufficient strength to retract the lever 50 and restore the fingers 47 to their normal position, but is strong enough to cause the slight movement of the lever 50 necessary to throw the teeth into mesh.

I will now describe the mechanism by which the knot of the binding-cord is tied. Secured firmly to the base-plate 57 of the carrier 8 is a hollow standard, 58, having an enlargement, 59, at its upper end. The bore 60 of the standard is also enlarged, to form a chamber, 61, in the enlarged portion 59. In the bore 60 is a vertical sliding rod, 62, fastened at its lower end to a spring, 63, which spring is also fastened to the base-plate 57, and at its free end this spring is provided with a wedge-shaped block or incline, 64, the purpose of which will be described. At the upper end of the rod 62 is a short arm, 65, which stands at right angles to the rod, and at its outer end is provided with a vertical hook, 66, the upper end of which is preferably pointed or tapered so as to insure its easy insertion and passage through the loop of the tying cord. Mounted loosely on the standard 58 next to the base-plate 57 is a gear-wheel, 67, provided with a pawl, 68, and a spring, 69, which bears against the pawl and holds it in gear with the ratchet 70, formed on the lower end of a rotating barrel, 71, which surrounds the standard 58. The upper end of the barrel 71 projects slightly above the top plate, 33, of the carrier 8, encircling closely the standard 58 throughout its length, but capable of turning thereon. It is provided with a flange, 72, or other suitable device for sustaining and fastening a coiled or spiral spring, 73. In the construction shown I make use of a spiral spring, one end of which is fastened to the flange 72 in the hole 74, and the other to the frame of the carrier 8 at any convenient point. The purpose of this spring is to retract or give a reverse motion to the barrel after it has been

turned in a forward direction in the operation of tying the knot. The upper end of the barrel is recessed or slotted, as at 75, and is provided with a pin or projection, 76, at one end of the slot. The upper end of the standard 58 has a recess, 77, which, when the parts are in their normal position, coincides with the recess or slot 75 in the barrel. It is also provided with an upwardly-projecting hook or pin, 78, which stands opposite to the pin or projection 76 on the barrel. It also has a circular groove, 79, around its upper end, which groove is entered through the slot or recess 77, its open side being closed by the plain inner face of the barrel which surrounds it. On the periphery of the barrel 71 is a projection, 80, which is designed to operate in connection with a suitable stop, 81, formed on the side of the carrier-frame to stop the backward movement of the rotating barrel at the proper point. On one of the flanges 39 of the trough or guideway 7 is a rack, 82, which is designed to operate in conjunction with the gear-wheel 67 to give the forward rotation to the barrel 71. Pivoted in the trough 7 below the grooves 20 is a pawl, 83, designed to operate in conjunction with the inclined surface or block 64 to give a vertical movement to the sliding stem 62. This pawl is held rigid by stops as the block 64 passes over it in an inward direction, so as to force the latter upward, and thereby give the vertical motion to the stem. When the block 64 passes over the end of the pawl 83, the stem 62 is retracted by means of the spring 63, to which it is fastened. When the carrier 8 is moved outward and the block 64 strikes the pawl 83 on the opposite side, the latter turns over on its pivots and permits the passage of the block without raising the stem 62, acting in this respect like the pawl of an ordinary ratchet. Extending laterally across the upper portion of the carrier 8, as near as possible to the barrel 71, is a slide, 84, having an inclined end, 85, which is designed to operate in connection with an inclined lug or tripping-pawl, 86, pivoted to the side of the trough 7, and which is provided with a stop, 87, so as to be incapable of turning in the direction of the inward movement of the carrier, and capable of turning in the direction of the outward movement of the carrier, so that when the carrier moves inward the lug 86, encountering the inclined end 85 of the slide 84, will cause the latter to be pushed in its bearing laterally through the box 8, and when the carrier is pushed outward and the rear side of the slide 84 strikes the pivoted lug 86 the latter will swing over and permit the free passage of the carrier. The slide 84 is thrown outward again, either by means of a spring, 88, or of an inclined lug, 89, placed on the opposite side of the trough 7 and operating in conjunction with an inclined surface, 90, on the opposite end of the slide, or by means of both spring and lug, as may be desired. Fastened to one side of the trough 7 at the inner end is a bracket, 91, journaled in the arms of which is a vertical shaft, 92. At the upper end of this shaft is a tubular case, 93, standing at right angles to the shaft. On the shaft between the bearings 94 of the bracket 91 is a spiral spring, 95, one end of which is fastened to the bracket and the other end to the shaft, so that when the shaft is turned in one direction a tension will be put upon the spring, which, when the shaft is released, will cause it to return to its normal position, which position is such that the tubular case 93 stands at an angle, preferably a right angle, to the side of the trough 7. On the forward end of the base-plate 57 of the carrier 8 is an upwardly-projecting post, 96, and extending out laterally from the side of the shaft 92, above its upper bearing, is an arm, 97. The purpose of the post 96 is to strike the arm 97, and to cause the shaft 92 to turn in its bearings so as to bring the tubular case 93 into a line parallel with the side of the trough 7. Inside of the tubular case 93 is a stem, 98, having a pointed and preferably a forked end, 99, extending beyond the open end of the sheath 93. Inside of the sheath, and encircling the stem 98, is a spiral spring, 100, which bears against a collar, 101, formed on the stem, and is for the purpose of projecting the end of the stem from the sheath. Fastened to the side of the trough, at the outer side of the bracket 91, is a plate or bracket, 102, to which is secured a curved guide, 103, the end of which projects back under the sheath 93, and which is also provided with a notch or slot, 104, in its upper edge, near the bracket 102. The under side of the sheath is slotted, as at 105, and the stem 98 is provided with an outwardly-projecting pin, 106, which projects through the slot 105. When the carrier 8 advances, after the bundle has been formed and while the binding-cord is being tied, the post 96 strikes against the arm 97 and causes the tubular sheath 93 to spring around. This brings the pin 106 into contact with the concave side of the guide 103 and causes the stem 98 to be forced back into the sheath until the pin 106 comes to the slot 105, when the spring 100 causes the stem 98 to spring out and embed its point into the sheaf of grain, which by this time has been bound and released from the binding-arm. At this moment the post 96 has passed the end of the arm 97 and released the shaft 92, permitting the spring 95 to recoil and throw the tubular case 93 around to its normal position, which movement causes the sheaf of grain to be jerked off of the platform and thrown out back of the machine. Projecting radially from the side of the shaft 92 is a small spring, 107, which bears against the side of the bracket 91, as shown in Figs. 30 and 31. The purpose of this spring is to restore the arm 97 to the path of the post 96 after the latter, in the outward movement of the carrier 8, has passed the former. When the post 96 pushes the arm 97 out of its way as it goes out, some provision is necessary to bring the arm 97 again into the path of the post

96, so that when the latter comes in again it will catch it and turn the shaft in the manner described. This office is performed by the spring 107, which is of sufficient power to give the shaft 92 the slight movement necessary for this purpose. The binder-arm 35 is provided with a flat or leaf spring, 45, which is so fastened thereto and arranged therein as to constitute the chord of an arc formed by the curved arm, the free end being held in position by a projection or stop, 109. The purpose of this spring is to cause the binder-arm to be thrown back when released after the binding cord has been tied on the sheaf. The loose grain which is gathered into a bundle by the arm 35 and the fingers 47 is pressed between them, and this compression puts a tension on the spring 45, so that when the arm is released after the tying operation has been completed this tension causes the spring to act against the side of the sheaf and to throw the arm 35 back and free the sheaf. The forward end of the arm 35 is forked or notched, as at 110, the purpose of which construction will be described, and fastened to it back of the forked end is a bent or angled finger, 111, having an eye, 112, at the corner and a hole, 113, at or near the outer end. In the top plate, 33, of the carrier 8 is a slot, 114, for receiving the forked end 110 of the arm 35. The end of the finger 111 passes over the front end of the carrier 8, so as to bring the hole 113 below its upper surface. Secured in any convenient position under the platform is a twine box or spool, 115. The twine is led from the box or spool up through one or more eyes, 116, (see Fig. 3,) on the arm 35, thence through the eye 112 and hole 113, and thence back to the holding and cutting mechanism, which I will now describe. On that portion of the top plate, 33, which stands over the slide 84 is a slotted post, 117, and a lateral slot, 118, which extends from the base of the slotted post to the edge of the top plate, 33. Projecting up from the slide 84 through the slot 118 is a plate, 119, having two laterally-projecting arms, 120 and 121, the lower one, 120, being long enough to always project through the opening in the post 117 during the movements of the slide 84. The arms 120 and 121 are separated from each other by an open slot, 122. The arm 121 is short, so that when the slide 84 is pushed back by the lug 86 it will pass out of the opening through the post 117. Its forward end is beveled or wedge-shaped, and its upper edge higher than the opening in the post, so that when the slide 84 is restored to its normal position by the spring 88 and lug 89 the inclined surface 123 shall encounter the top of the opening through the post and the arm 121 be forced down to close the slot 122. The end of the binding-cord, after being drawn through the hole 113, is carried back and inserted in the slot 122, and is there held by the arm 121 pressing down upon the arm 120. Secured to the side of the plate 119 is a shear or knife, 124, the end of which passes the square vertical side of the post 117, such square side constituting the stationary part of the cutting apparatus necessary to sever the cord in the tying operation. This knife, being fastened to the slide 84, moves back and forth with it across the square edge of the post in making the cut.

I will now describe the operation of the machine. The guideway or trough 7 is adjusted in the opening 6 with relation to the length of the grain so that the binding-cord shall be applied at or near the middle of its length. The advance and operation of the reaper causes the standing grain to be cut by the knives 2 and to fall on the platform 4 in the usual way. When a sufficient quantity of cut grain to form a sheaf has fallen upon the platform, the operator or driver seizes the lever 30 and draws it toward him. This turns the shaft 29, and thereby operates the shaft 24 by means of the segments 27 and 26. The lever 23, being rigidly attached to the shaft 24, is raised thereby, and by means of the rod or pitman 22 draws the carrier 8 inward in the guideway or trough 7. This movement of the carrier 8 causes the binder-arm 35 to rise from the position shown in Fig. 7 to that shown in Fig. 2, and to advance along the trough 7, gathering and bunching the grain as it proceeds. The inward movement of the lever 23 causes its geared segment 55 to engage the teeth of the segment 53 on the lever 50 and to turn the latter on its pivot, causing it, by means of the rod 49, to throw the fingers 47 upward into the position shown in Fig. 2, which position they maintain, standing rigidly, until the gavel of loose grain is formed against them by the inwardly-moving binder-arm 35, and then they are freed by the solid segment 56 passing the end of the lever 50, and so permitted to retire before the bundle of grain, which is pressed against them by the advancing arm 35 as it carries the bundle along during the tying operation. The arm 35 by this time is thrown inward by the stops 40 into the position shown in Fig. 3, where it is supposed to encircle the gavel of grain. To prevent the end of the arm 35 from catching on the side of the gavel as it sweeps around it, the curve of the fingers 47 is shorter than that of the arm, so that they compress and hold the grain down below the line described by the end of the arm, and so that they hold the grain back of the slot 114, in order that the forked end 110 of the arm may enter the slot. These fingers I prefer to make with elastic or flexible ends, to give the bundle a rounded form when pressed against them by the inward movement of the carrier 8; but they may be made rigid, because after the end of the arm 35 has entered the slot 114 they are released and will swing back and permit the bundle of grain to expand against the curved arm 35, and thus assume a rounded form preparatory to binding.

As before described, the end of the binding-twine 125 is held between the jaws 120 and 121, and the twine extends back therefrom through the hole 113, eyes 112 and 116, to the

box or spool 115. As the carrier 8 travels outward the twine is drawn across the position the loose grain will occupy on the platform, (see Figs. 7 and 2,) and on the inward movement, when the arm 35 passes up over and encircles the grain, it carries a loop up over the top of the gavel, as shown in Figs. 2 and 3, and lays it alongside of the end held by the jaws 120 and 121, as shown in Fig. 13, the spool portion or length being held down alongside of the other by the forked end 110 and finger 111. When in this position, Fig. 13, the two strands lie alongside of the post 117, across the top of the knife 124 and the top of the standard 58, lengthwise of the slot or chamber 61, across the recess 77, and between the pin 76 and hook 78. This is the position necessary to give the strands in order that they may be operated upon by tying or knotting mechanism. At this instant the advance of the carrier brings the gear-wheel 67 into gear with the rack 82 on the flange 39, and this causes the gear-wheel to turn. The pawl 68, being held into the ratchet 70 on the barrel 71 by the spring 69, causes the barrel to turn with the gear-wheel. The turning of the barrel 71 causes the pin 76 to catch on the two strands of twine and carry them around under the hook 78 into the groove 79, forming a loop around the pin 76, one member of which loop lies in the groove 79 and the other lies across the top of the standard 58, as shown in Fig. 14. This loop is formed from the slack of the loop encircling the bundle of grain. The further movement of the barrel carries the loop around under the straight strands which lie across the top of the standard, causing the upper member, 127, of the loop to twist around the straight strands, as at 126 in Fig. 15. Immediately as the upper member, 127, of the loop passes beyond the straight strands the wedge-shaped block 64 passes over the pawl 83 and raises the stem 62, the upper end of which passes between the straight strands and the upper member, 127, of the loop. The stem being immediately drawn down by the spring 63, the hook 66 descends upon and grasps the straight strands, as shown in Fig. 15. At the same time the inclined end 85 of the slide 84 encounters the lug 86, and the slide which carries the knife 124 and the holding-jaws 120 and 121 is forced backward, as also shown in Figs. 12 and 15. This releases the spring-jaw 121 from the slotted post 117, so that the end of the twine may escape from the slot 118 preparatory to the grasping of the twine in a new place by the holding-jaws. The withdrawal of the jaw 121 permits the strand 128, which runs through the eye in the finger 111, to drop down alongside of the post 117 and in front of the open end of the slot 122, so that when the slide 84 returns to its normal position the strand 128 shall enter the slot 122 and be grasped by the jaws 120 and 121. As soon as the incline 85 passes the lug 86 the slide 84 is restored to its normal position by the spring 88 and lug 89. The return movement is sudden and strong, and it causes the knife 124, coacting with the straight edge of the post 117, to cut the strand 128, and thus sever the band which encircles the sheaf from the ball of twine. The new end of the latter is, by the same movement of the slide 84, grasped by the jaws 120 and 121, and is so held until the tying operation is performed on the next sheaf. During the movement of the slide 84 just described the barrel 71 continues to rotate, and passes to the position shown in Fig. 16, at which instant the movement of the carrier 8 carries it past the rack 82, when, the gear-wheel 67 being released, the movement of the barrel 71 is reversed, and it is thrown back to normal position by the recoil of the spring 73, which was wound up by its forward rotation. The barrel is stopped at the proper point by the projection 80 encountering the stop 81, as shown by the dotted lines in Fig. 21, the full lines indicating the position of the projection at the limit of the forward rotation of the barrel. The reverse movement of the barrel carries the upper member, 127, of the loop which encircles the pin 76 over the top of the straight strands, (which are now both separated from the ball of twine, and are both held down in the opening 61 by the hook 66,) and gives it a second coil or twist around the same, as shown in Fig. 17, which shows the barrel moving back to its normal position. When the barrel comes to rest against the stop 81, as shown in Fig. 21, the pin 76 is either withdrawn from the loop 129, Fig. 18, or the loop rests so loosely around it that it is easily removed therefrom by the discharging device 99. When the tying mechanism comes thus to rest, the sheaf is relieved from the pressure of the arm 35, and the natural expansion of the straw coming against the loop which encircles the sheaf, pressing outwardly against the twine, draws it in opposite directions and tightens the loop 129, Fig. 18, into a tight knot. All this time the carrier 8 is moving inward, and this movement brings the post 96 into contact with the arm 97 and causes the shaft 92 to be turned in its bearings until the sheath 93 comes parallel with the trough 7. This occurs at or immediately after the completion of the tying operation, and then the pin 106 comes opposite to the slot 104, and the spring 100 projects the stem 98 outward and causes its pointed end 99 to be embedded in the sheaf. At this instant the post 96 passes the arm 97, releasing it, and permits the spring 95 to act on the shaft 92 and restore it to its normal position. The action of the spring 95 is quick and powerful and causes the stem 98 to pull the sheaf off of the platform 4^a and throw it out behind.

It will be apparent to the skilled mechanic that many of the mechanical constructions and devices of this machine can be varied in particulars by the substitution therefor of mechanical devices and constructions which are the equivalents, mechanically speaking, of those

described. I do not therefore limit myself to the precise form, construction, and arrangement of the devices described, except when such precise form, construction, or arrangement is necessary to the operation of my machine.

As I have hereinbefore described my improvement, it is operated by means of a hand-lever, 30. I will now describe how it may be operated automatically by the power of the reaping-machine. This construction is illustrated in Figs. 25, 26, and 27 on Sheet 5. The frame of the reaping-machine is shown at 130, the axle at 131, and the wheels at 132. The shaft 133, which operates the crank 3, is broken off, and the power attachments by which it is driven are not shown, as they form no part of my invention, and are not necessary to its illustration. They are, moreover, constructed in the usual way. On the end of the shaft 29, which has its bearings on the frame 130 at 134, is a beveled pinion, 135. Mounted loosely on the axle 131 is a driving-wheel composed of two beveled gear-wheels, 136 and 137, the collars of which are bolted together so as to form practically one wheel. On each of these wheels are two segmental gears, 138. The pinion 135 is arranged between the geared portions of the wheels 136 and 137 so that it shall mesh into the segmental gears 138, mounted thereon. The outer side of the wheel 137 is provided with a ratchet-shaped clutch, 139; and on the axle 131 outside of the wheel 137 is a sliding clutch, 140, having teeth of corresponding shape, which clutch is splined to the axle, and is capable of being thrown into and out of gear with the clutch 139. It is provided with a peripheral groove, 141. Pivoted to the frame 130 is a spring-arm, 142, which is capable of a slight lateral spring on its pivot. Attached to the arm 142 is a strap or yoke, 148ª, which extends around the clutch 140 in the groove 141. On the outer end of the arm 142, and projecting laterally therefrom toward the wheel 137, is a wedge-shaped block, 143, and on the side of the wheel 137 are two wedge-shaped projections, 144, which are so placed upon the wheel as to come in contact with and act upon the wedge 143 as the wheel revolves. The arm 142 is also provided with a standard, 145, which projects up through the floor of the reaper in a position convenient to the foot of the driver. Back of the clutch 140 is a spring, 146, which bears against the clutch and against a collar, 147, rigidly attached to the axle, so that its tension is constantly against the side of the clutch for the purpose of throwing it forward toward the wheel 137. In this modification of my machine the devices just described are designed to take the place of the segmental gear-wheels 26 and 27 in operating the oscillating lever 23. The axle is supposed to be turning in the direction of the arrow 1, Fig. 25, and the devices for operating the bevel-wheel are at rest, having just completed the retraction of the binding-arm. The outward motion is given to the carrier 8 by means of the wheel 136, and the inward motion is given to it by means of the wheel 137. These two wheels, as stated, are fastened together; but the reverse motions are obtained from them because they are arranged on the opposite sides of the pinion 135. When the parts are in the position shown in Fig. 25, the binding mechanism is at rest, for the reason that the clutch 140 is out of gear with the wheel 137, and the latter, being loose on the shaft, will consequently remain at rest. When a sufficient quantity of cut grain has fallen on the platform 4, the driver places his foot on the top of the standard 145 and forces the spring-arm 142 down. This causes the wedge 143 to pass down upon and spring under the wedge 144. The sliding clutch 140, being then released, is thrown forward by the spring 146 into gear with the clutch 139. This causes the wheels 136 and 137 to be turned by the axle, and brings one of the segmental racks 138 on the wheel 137 into gear with the beveled pinion 135, causing the latter to make a half-revolution in the direction of the arrow 2. The half-revolution of the pinion is what is necessary to cause the oscillating lever 23 to be thrown up and to give the inward motion to the carrier 8, as hereinbefore described. While the segmental rack 138 on the wheel 137 is working on the pinion 135, the latter is out of gear with the wheel 136 there being a plain or stripped portion, 148, on each wheel 136 and 137 opposite the toothed portion of the other wheel. When, however, the rack 138 on one wheel runs out of the beveled pinion, a similar rack on the other wheel starts into mesh with it and causes it to rotate in the opposite direction.

As soon as the outward motion of the carrier 8 has been completed a reverse motion is given to it by means of one of the racks 138 on the wheel 136 coming into gear with the pinion 135. At the instant the reverse motion of the carrier 8 is completed one of the wedge-shaped projections 144 strikes the wedge 143 and forces the spring-arm 142 back, and the sliding clutch 140, being secured to the arm by means of the strap or yoke 148ª, is carried back also out of gear with the clutch 139, and then the operation of the binding mechanism is stopped until the operator places his foot upon the standard 145 and throws the clutch into gear again. By this arrangement the binding mechanism is automatic in its operation and entirely under the control of the driver, who throws it into action whenever in his judgment there is sufficient grain upon the platform to form a sheaf.

In reaping-machines having a dropping attachment there is a rod for supporting the grain as it is cut until the previously-cut gavel is dropped. I propose to use this rod to support the cut grain and keep it off of the reciprocating carrier 8 while it is forming and binding a sheaf. This being done, the rod is withdrawn, and the grain which it supports

is allowed to fall on the platform to be bound, and then the rod comes into position to receive a new supply. I deem it unnecessary to illustrate and describe this device, because I do not claim it, and because its construction and application to gavel-dropping machines are well and widely known. I prefer to apply my binding attachment to machines having a grain-divider, which is a device attached to the outer end of the cutter-bar to bring a certain swath of standing grain within the reach of the cutters, so that the gathering-arm shall not at its extreme outer range go beyond the effective action of the knives, because otherwise it would encounter the standing grain.

I have described the device in which the carrier 8 moves as a trough or guideway; but I do not limit myself to such construction, for the reason that it may be placed and travel upon a bed-plate having the guides and stops which operate the binder-arm 35 formed on the sides, and the cross-pieces made with projections provided with the friction-rollers 38, extending down under the edges of such bed to operate there in conjunction with the guide grooves and stops, as shown in Figs. 33 and 34.

I have also described the platform 4 4ª as being independent of the trough 7. If desired, the platform 4 4ª may be dispensed with, and large side flanges, 4 4ª, having suitable slots, 108, for the operation of the fingers 47, may be attached to the sides of the trough 7, and constitute the platform on which the cut grain falls, as illustrated in Fig. 32. The adjustment of a platform of such a construction with relation to the cutter-bar to accommodate any given length of grain can be effected by the same means used to adjust the trough in the other construction, as the side flanges constituting the platform are part of the trough and move with it.

It is apparent from the foregoing description that the mower or reaper can be used without using the binder and without detaching the latter. If desired, the binder and its operating mechanism can be removed entirely and the mower be restored to its primitive condition without derangement or injury to its parts or in any way affecting its operation as a mower; also, that the binder can be reattached at any time when needed.

In order to prevent the straw from becoming entangled in and clogging the tying mechanism, I place a shield, 149, Fig. 6, having a longitudinal slot, 150, over the tying mechanism. The binding-cord is carried down into the slot by the presser-foot, the toe 111 of which projects down over the front edge of the carrier 8, and the heel 110 of which enters the slot 114. The binding-cord 125, extending between the parts 110 and 111, Fig. 4, is forced by them down through the slot 114. By the term "presser-foot," I mean the organism composed of the forked end 110 of the binder-arm and the bent finger 111, attached thereto, the functions of which have been described.

To suit different lengths of grain, either the finger-bar must be adjusted relatively to the binding mechanism, or vice versa. In the former case the finger-bar must be supported by the platform, and in the latter case the binding mechanism may be supported by the finger-bar, which, when in use, must be rigid. I can adjust my machine to suit the length of the grain by simply moving a lever, and that while the machine is in motion. The advantage of sustaining the platform from the finger-bar is that it enables me to adapt my improvements to many forms of existing machines, and also to construct a lighter and cheaper but equally good machine as one in which the platform is provided with an independent support.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination, in a self-binding harvester, of the grain-receiving platform provided with a slot or opening parallel with the finger-bar, with a grain gathering, bundling, and binding mechanism, which reciprocates in said opening and is adjustable laterally therein, substantially as and for the purposes set forth.

2. The combination, in a self-binding harvester, of a platform with a grain-binding device which reciprocates across said platform at right angles to the fall of the grain, and a guide-trough supported from the finger-bar of the machine in which said binding device reciprocates, substantially as and for the purposes set forth.

3. A self-binding harvester having its platform and grain-binding mechanism sustained by the finger-bar, substantially as and for the purposes set forth.

4. The combination, in a self-binding harvester, of a finger-bar, with a grain-platform and binder mechanism, sustained by said finger-bar, and devices for adjusting the binder mechanism fore and aft relatively to the finger-bar, substantially as and for the purposes described.

5. The combination, in a self-binding harvester, of a reciprocating binding mechanism carrying an oscillating binder-arm, with independent compressing-fingers which oscillate in a vertical plane at right angles to the fall of the grain and in opposition to the encircling movement of the binder-arm, substantially as and for the purposes described.

6. The combination, in a self-binding harvester, of a reciprocating binding mechanism having an arm for gathering the bundle of grain, with a pair of independent oscillating compressing-fingers adapted to press the bundle of grain inside of the path of the outer end of the gathering-arm, so that the latter will not catch on the bundle, substantially as and for the purposes described.

7. The combination, in a self-binding harvester, of a reciprocating binding mechanism having an arm for gathering the bundle of grain and encircling the same with the band,

with independent pivoted elastic compressing-fingers which oscillate in a vertical plane at right angles to the fall of the grain and in opposition to the inward movement of the gathering-arm, substantially as and for the purposes described.

8. In mechanism for gathering and binding grain, the combination of a traveling carrier provided at one end with a cord holding and knotting mechanism, and on the other end with a reciprocating grain gathering and binding arm having a presser-foot for delivering the spool end of the cord to the holding and knotting mechanism, and compressing-fingers oscillating on an axis on the guide-frame of the carrier, substantially as and for the purposes described.

9. The combination of a traveling carrier which sustains the holding, cutting, and tying devices, with a binder-arm pivoted thereto and provided with a heel-extension having lateral projections, and a trough, box, or guide having ways and stops in the sides thereof, which, operating in conjunction with the lateral projections of the heel-extension, give the necessary movements to the binder-arm to cause it to encircle the grain, substantially as and for the purposes described.

10. The combination of the reciprocating binder-arm and its heel-extension with the trough having guideways for raising the binder-arm into a position for gathering the grain, and stops for throwing it over to encircle the grain, and a spring for throwing it back to release the sheaf, substantially as and for the purposes described.

11. The combination of the reciprocating binder-arm and its heel-extension with the trough having guideways for raising the binder-arm into a position for gathering the grain, and stops for throwing it over to encircle the grain, and weighted pawls at the outer ends of the guideways over which it passes during its backward movement, which pawls depress the heel-extension and cause it to enter the guideways on the forward motion of the binder-arm, substantially as and for the purposes described.

12. The combination of the oscillating lever which actuates the reciprocating carrier and its binder-arm, provided with a segmental gear, with a pivoted lever, also provided with a segmental gear and connected to the vibrating compressor-fingers, which operate in conjunction with the binder-arm to form the gavel for the purpose of communicating a vibration thereto, substantially as and for the purposes described.

13. The combination of the oscillating lever 23, provided with teeth 55, with the lever 50, having geared segment 53 and spring 54, substantially as and for the purposes described.

14. In a tying mechanism, a rotary barrel or casing notched and provided with a pin or hook, as described, in combination with a stationary standard inclosed thereby and having a notch corresponding with the notch in the barrel, a vertically-projecting pin or hook, a groove or recess extending around the standard from the base of the pin, the pin or hook on the barrel being arranged on the side of the notch opposite to the pin on the standard, and devices for laying the cord between the pins or hooks and holding it during the tying of the knot, substantially as and for the purposes described.

15. The combination of a stationary standard, notched as described, having a pin projecting from its end off the center and in line with its axis, and a groove around it for receiving the cord, a notched rotary barrel surrounding said standard and having a coacting hook arranged on the side of the notch opposite to the stationary pin, devices for laying and holding the binder-cord across the top of the standard between the two pins or hooks, a pinion arranged on the barrel and meshing in a rack adapted to give the barrel a rotation, and a spring mounted on the barrel to retract it after the rack ceases to operate, substantially as and for the purposes described.

16. The combination of the slotted post 117 with laterally-reciprocating spring gripping and holding jaws for grasping the leading end of the binding-cord, substantially as and for the purposes described.

17. The combination of the laterally-reciprocating holder having a lower rigid jaw and a shorter upper spring-jaw, with a recessed, perforated, or slotted post, into and out of which the spring-jaw passes, to enable it to grasp and release the cord, and a knife which reciprocates with the holder and severs the cord at the instant the holder grasps the same in a new place, substantially as and for the purposes described.

18. The combination of the trough with the carrier reciprocating therein, the laterally-moving holder and cutter-slide mounted in the carrier and having an inclined end, a tripping-pawl mounted on the trough in the path of the inclined end, for actuating the slide, and devices for restoring the slide to position, substantially as and for the purposes described.

19. The combination of the traveling carrier moving in a guide-trough, the tying mechanism mounted on the carrier and provided with an axially-moving stem carrying a hook for completing the knot, a spring connected with the stem, for holding it in a depressed position, a wedge-shaped block attached to said spring, and a tripping-pawl supported by the guideways in the path of the wedge-shaped block on the spring and coacting therewith so as to raise and project the stem during the inward movement of the carrier, and to permit it to pass freely over it without raising the stem during the outward movement of the carrier, substantially as and for the purposes described.

20. The discharging-spear having an arm projecting into the path of the carrier, in combination with the traveling carrier provided with a tripping-post for striking the arm of

the spear to turn it with its shaft, and a retracting-spring for bringing it back to its normal position, substantially as and for the purposes described.

21. The combination of an oscillating discharging-spear having an arm projecting into the path of the carrier, with the traveling carrier having a projecting arm or tappet which strikes the rear arm or projection of the spear in the passage of the carriage, and thereby causes it to turn on its bearings, substantially as and for the purposes described.

22. The bundle-discharging spear mounted upon a vertical oscillating shaft journaled at the side of the carrier-frame and capable of a longitudinal movement in its sheath and an oscillating movement with its shaft, in combination with a projection spring and a guide for forcing it back into the sheath against the projection spring, substantially as and for the purposes described.

23. The discharging-spear having a projecting arm, in combination with the carrier having a tripping-post, and a spring, 107, for throwing the arm into the path of the carrier, substantially as and for the purposes described.

24. The combination, in a self-binding harvester, of a grain-binding mechanism which reciprocates in a guide or trough across the platform and is capable of adjustment relatively to the finger-bar to suit different lengths of grain, levers pivoted to said finger-bar, links or rods connecting said levers with the guide-trough, a rod connecting said levers, and a lever for adjusting the position of the binding mechanism, substantially as and for the purposes described.

25. The combination, in a self-binding harvester, of the finger-bar with rod or bars supported thereby and extending backward therefrom, and the guide-trough of the binding mechanism mounted on said rods or bars, substantially as and for the purposes described.

26. The combination, in a reaper, of the finger-bar with a divided platform, one part of which is fastened directly to the finger-bar and the other sustained by rods extending back from the finger-bar, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 25th day of April, A. D. 1883.

SIMON L. McCOLLOCH.

Witnesses:
W. B. CORWIN,
T. B. KERR.