(Model.)

5 Sheets—Sheet 1.

C. W. LEVALLEY.

GRAIN BINDER.

No. 245,924. Patented Aug. 16, 1881.

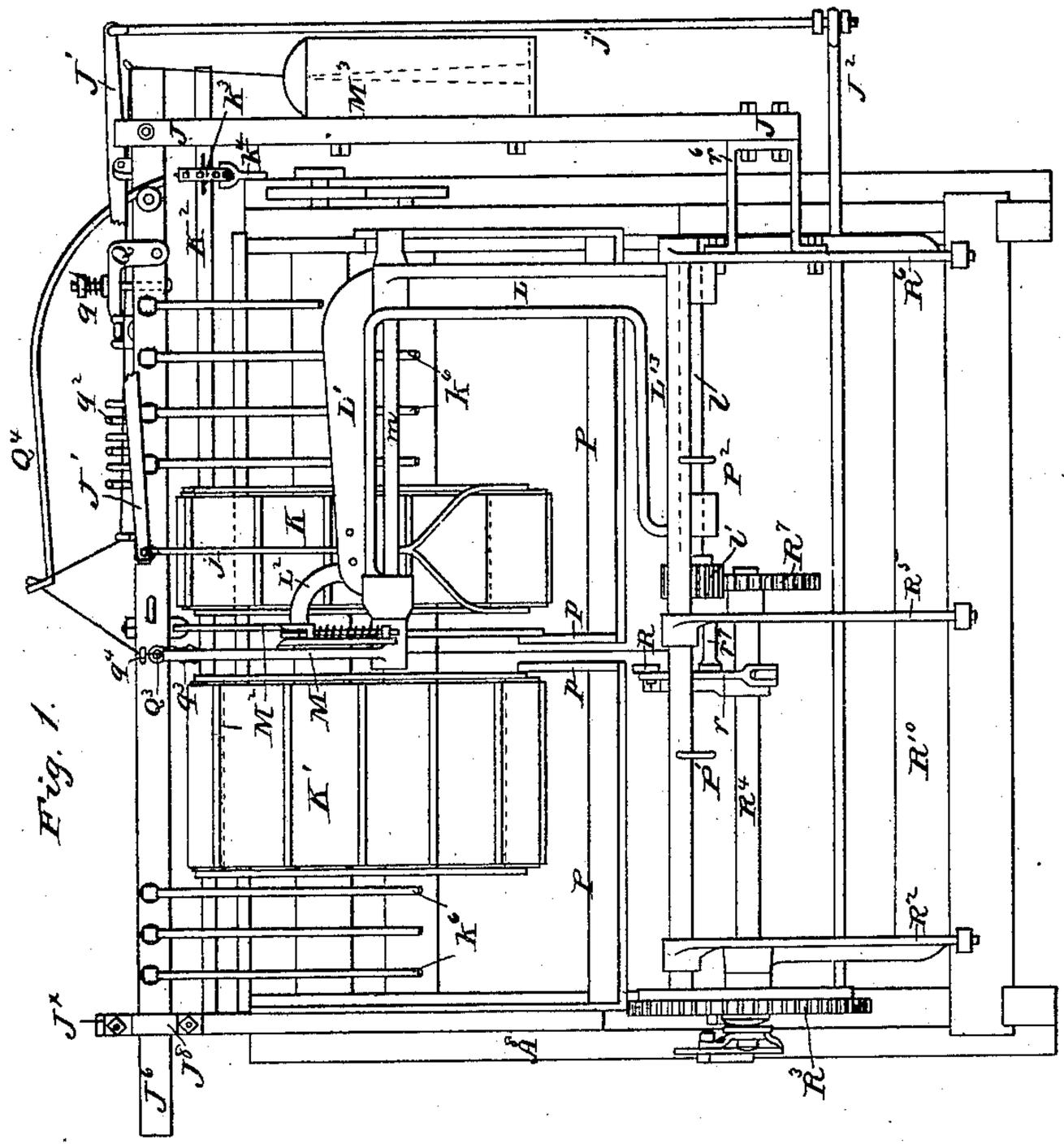

Fig. 1.

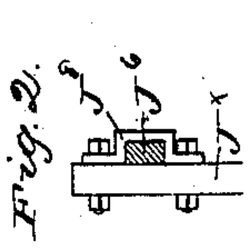

Fig. 2.

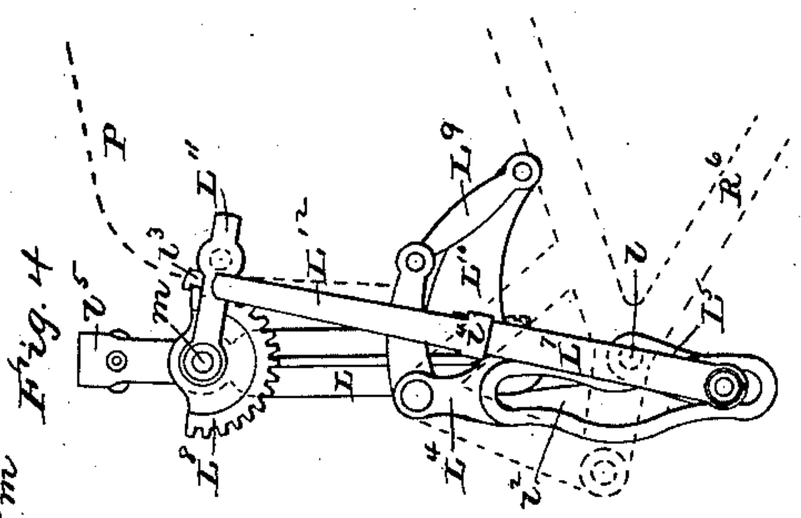

Fig. 4.

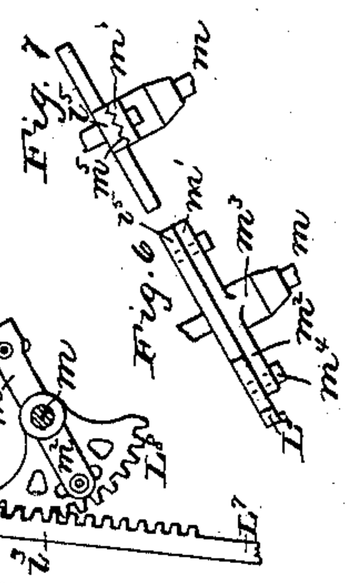

Fig. 5.

Fig. 6.

Fig. 7.

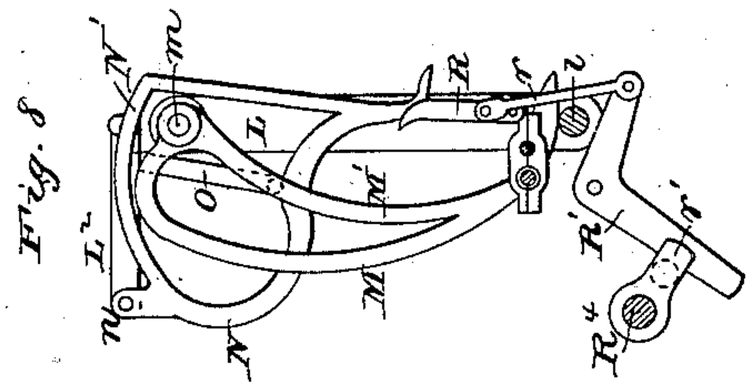

Fig. 8.

Witnesses:
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(Model.)

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C. W. LEVALLEY.

GRAIN BINDER.

No. 245,924. Patented Aug. 16, 1881.

Fig. 10.

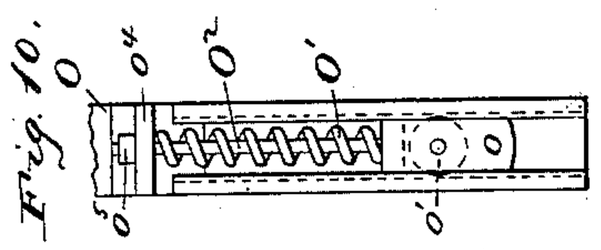

Fig. 11

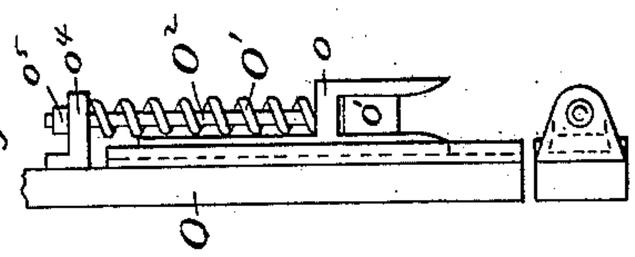

Fig. 12

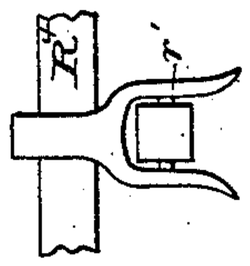

Fig. 3

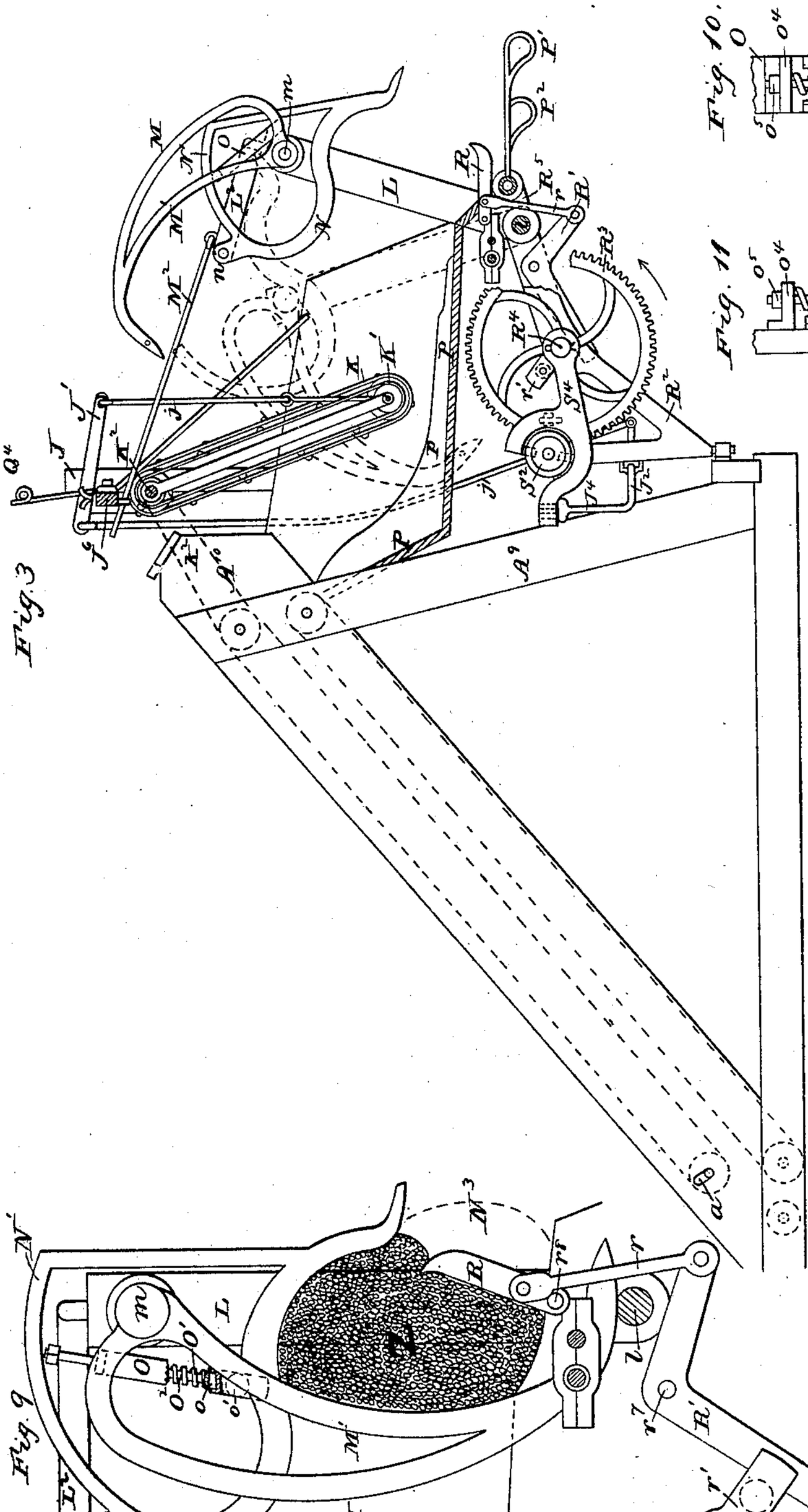

Fig. 9

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GRAIN BINDER.

No. 245,924. Patented Aug. 16, 1881.

Fig. 27

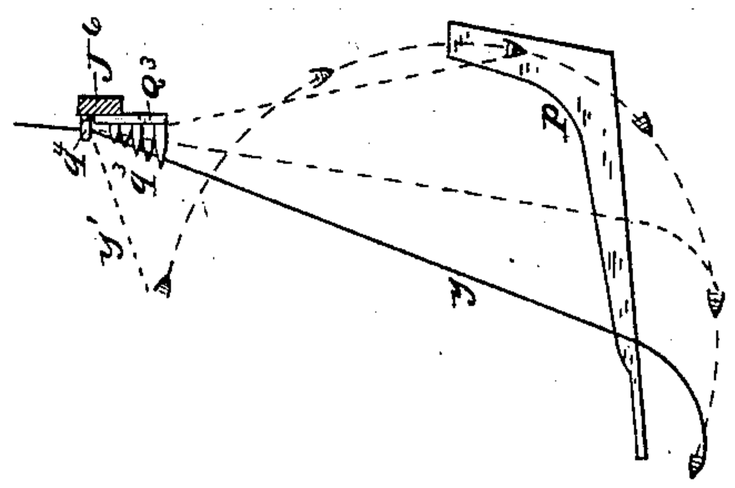


Fig. 16

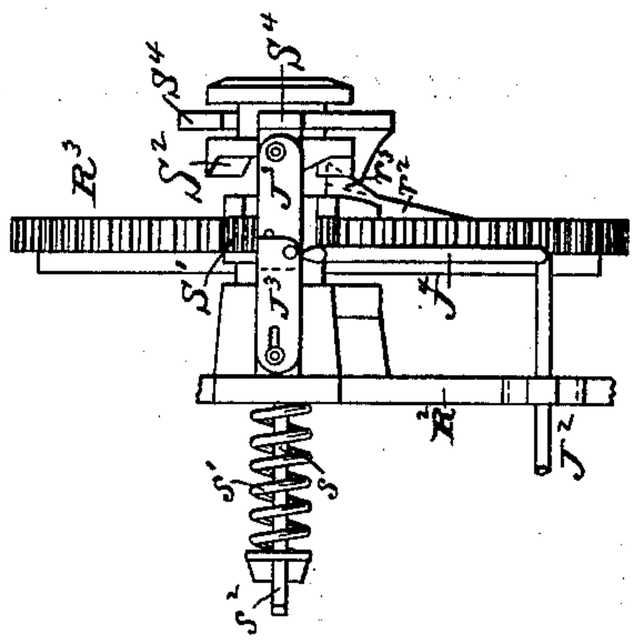


Fig. 13

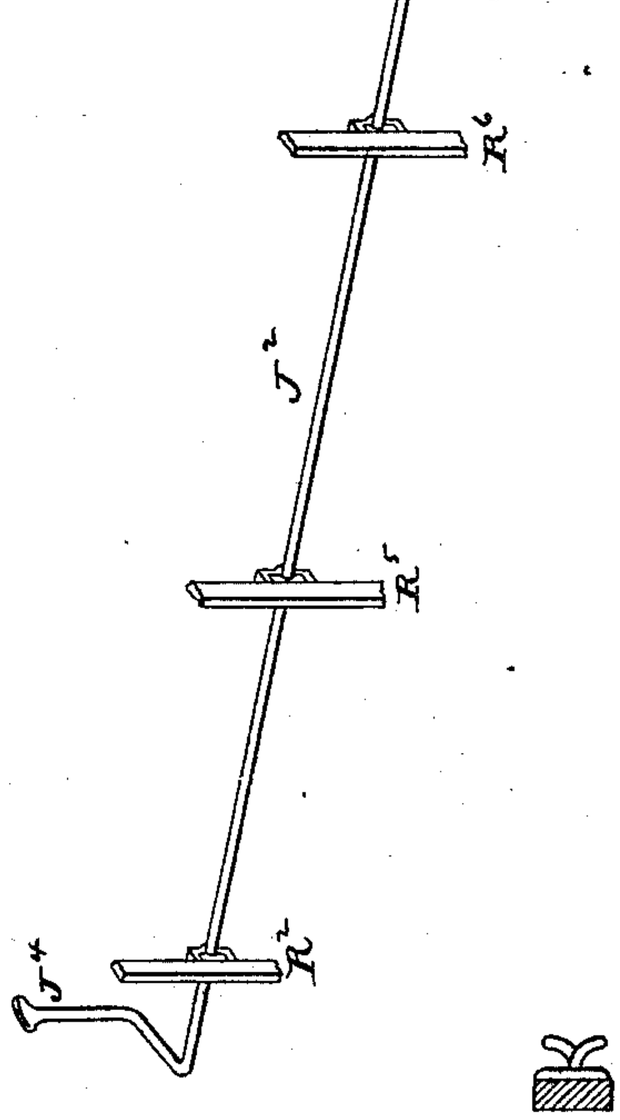


Fig. 15

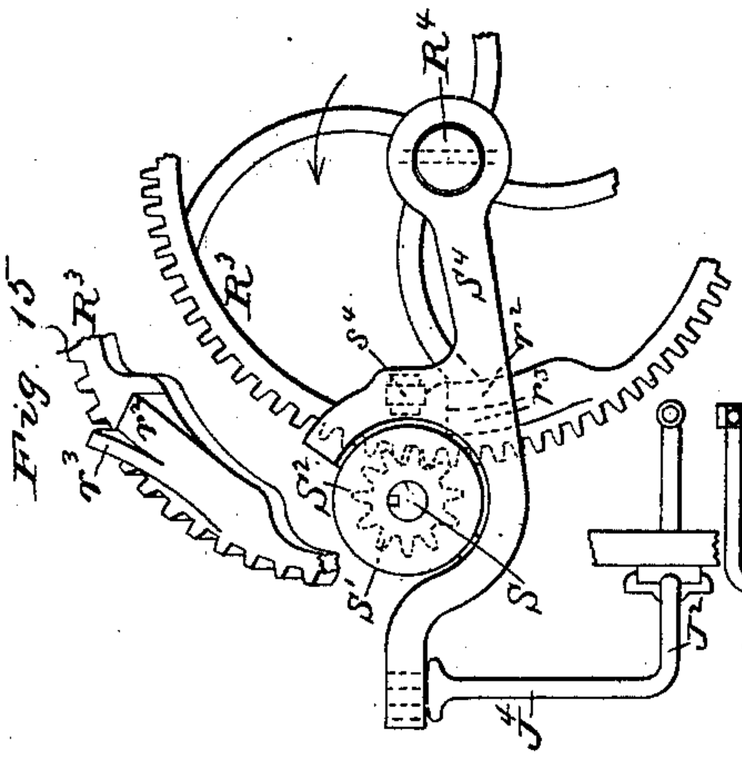


Fig. 14

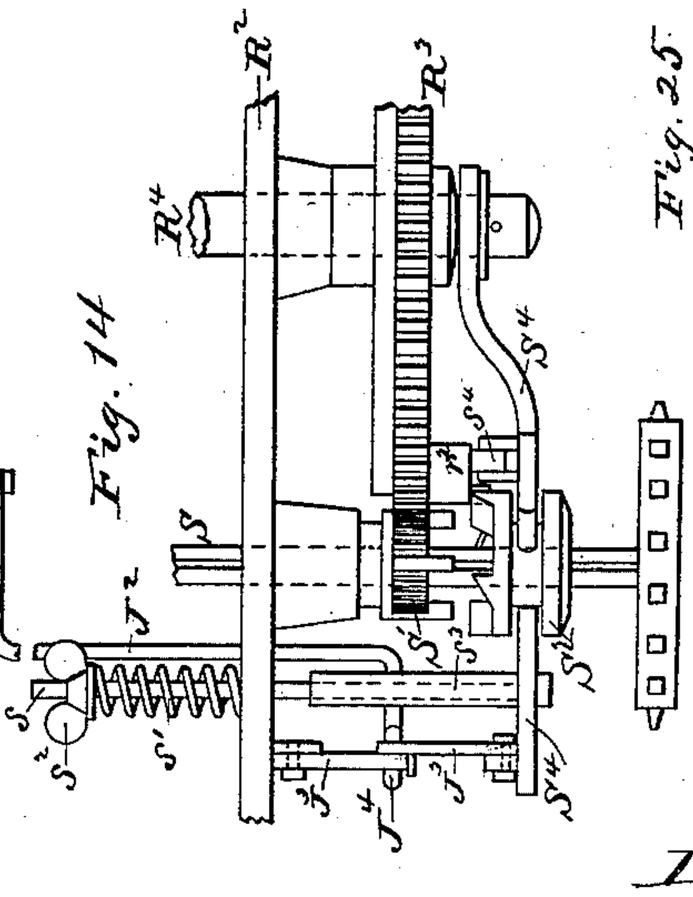


Fig. 25

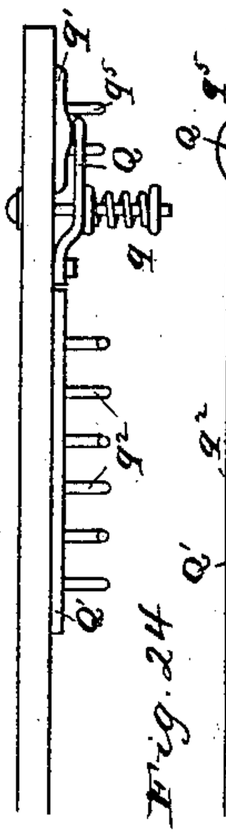
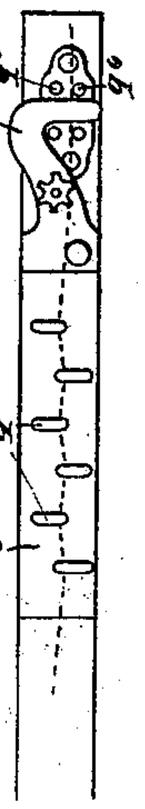


Fig. 24



Witnesses:

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(Model.) 5 Sheets—Sheet 4.

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GRAIN BINDER.

No. 245,924. Patented Aug. 16, 1881.

Fig. 26

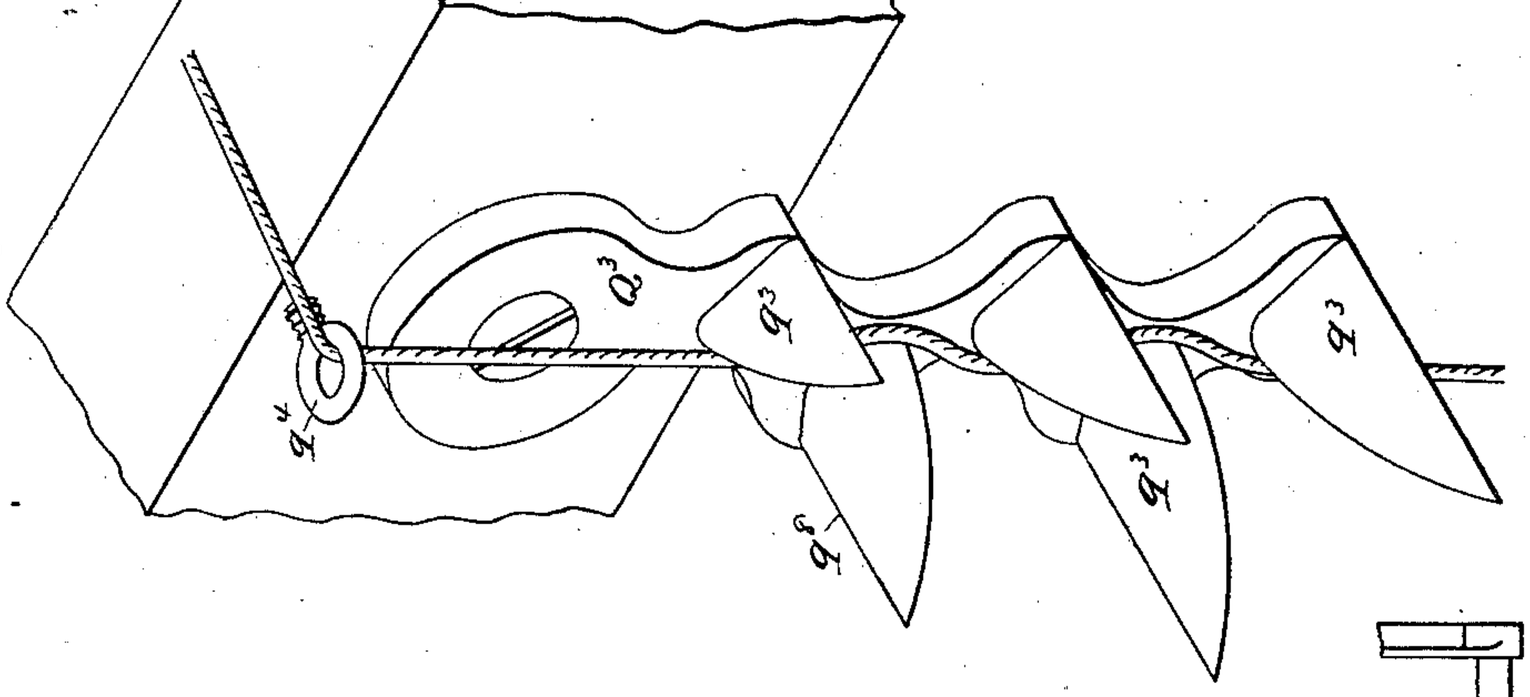


Fig. 19

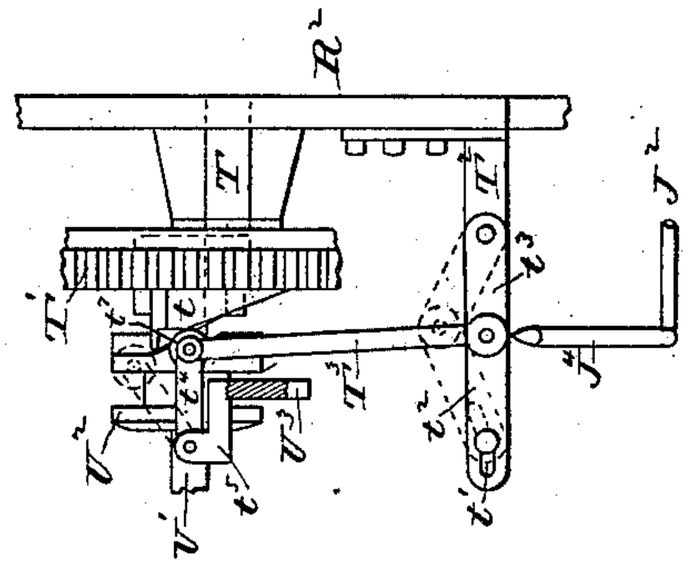


Fig. 20

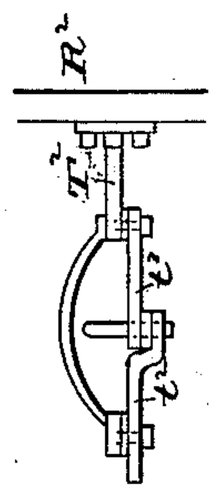


Fig. 25.

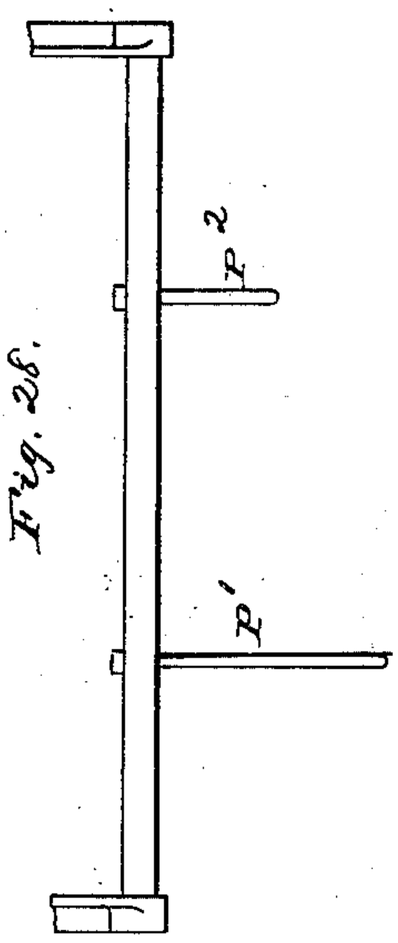


Fig. 18

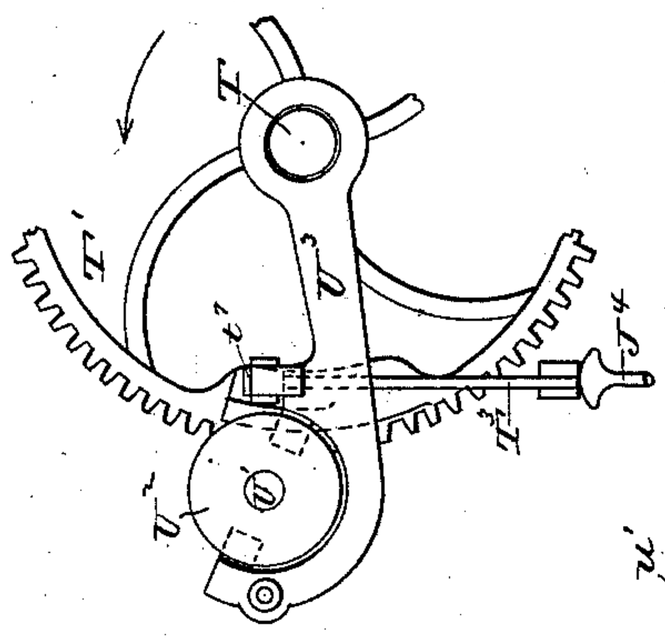
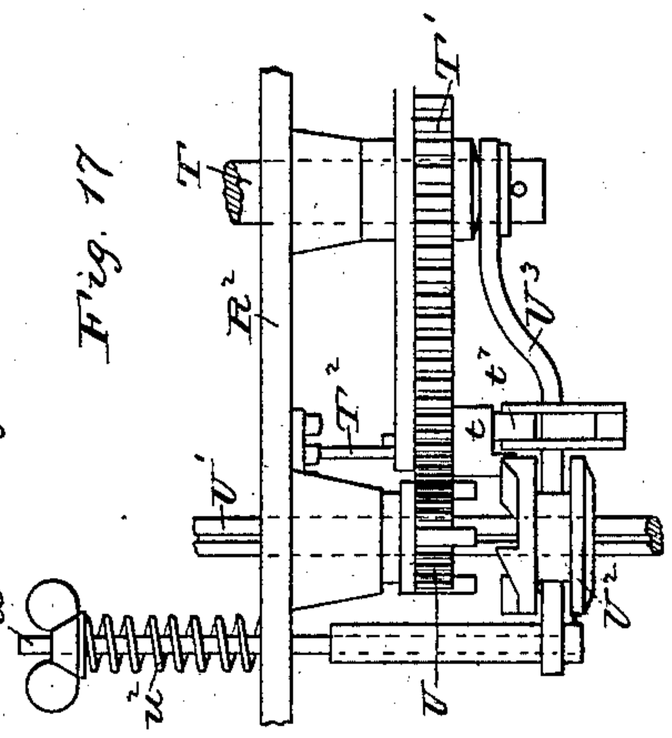


Fig. 17



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(Model.) 5 Sheets—Sheet 5.

C. W. LEVALLEY.

GRAIN BINDER.

No. 245,924. Patented Aug. 16, 1881.

Fig. 21

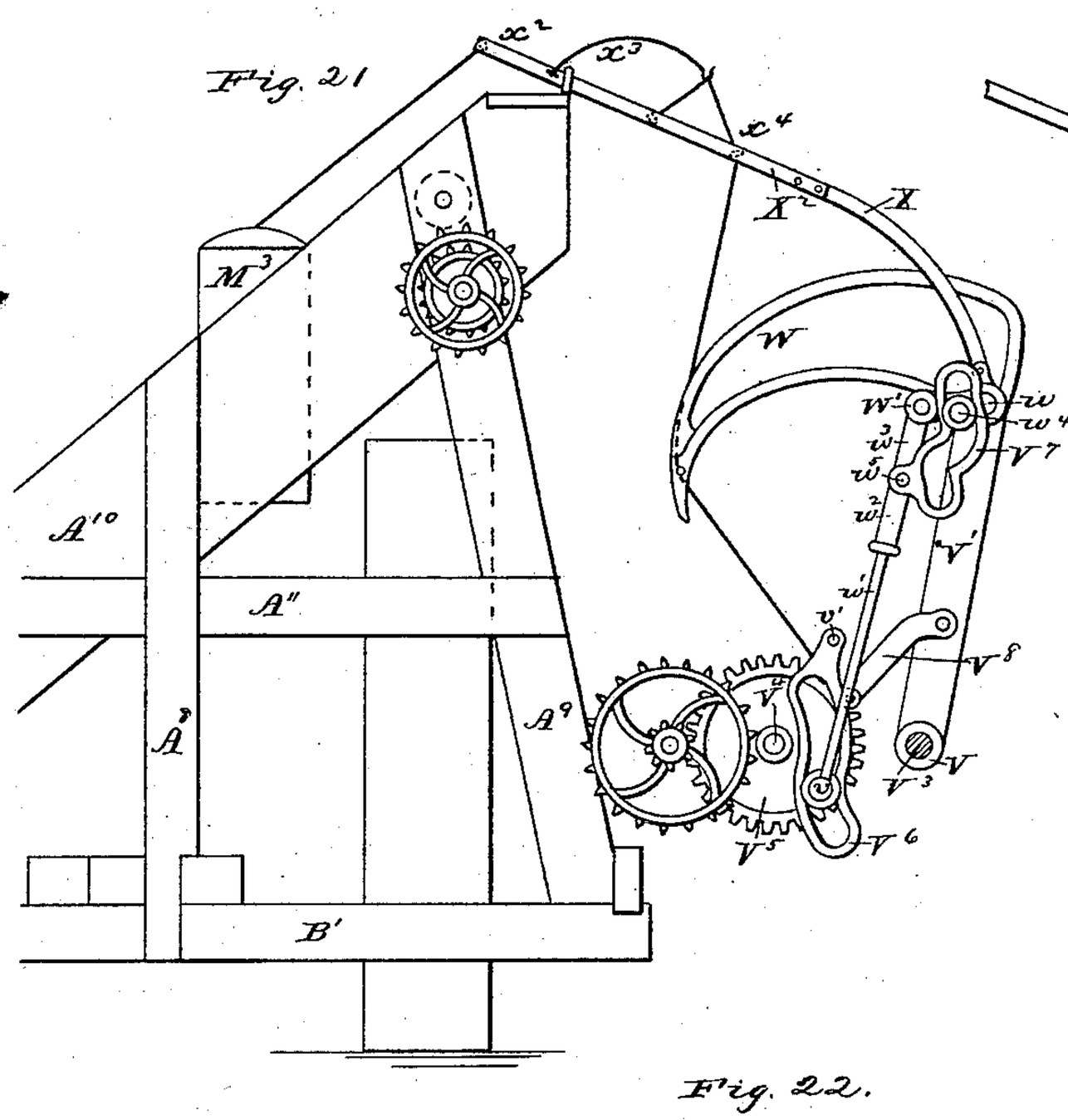


Fig. 23

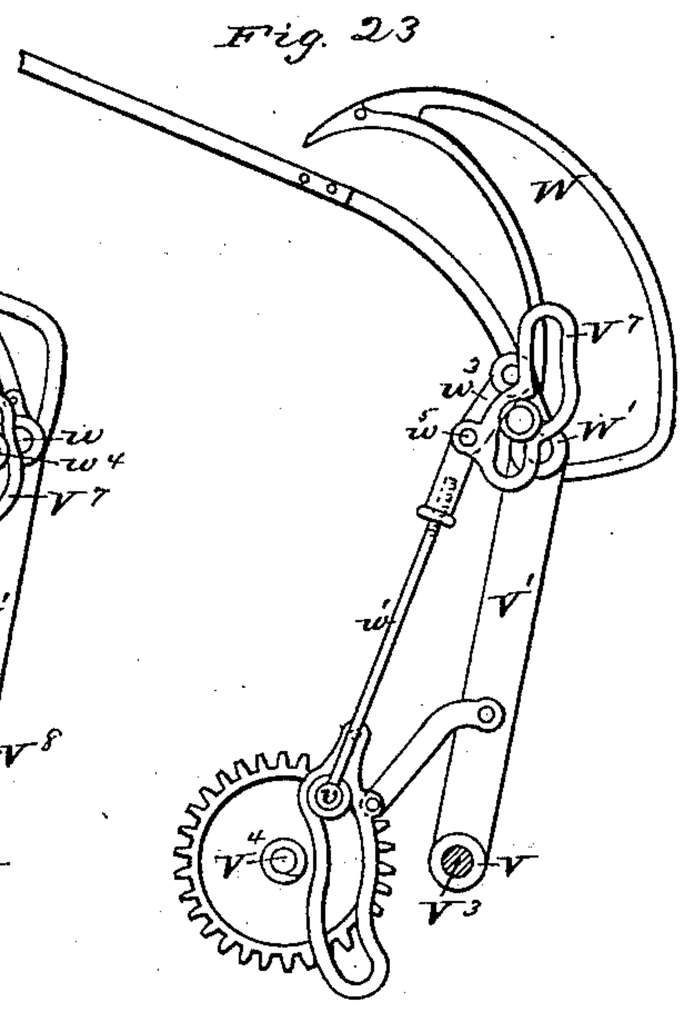
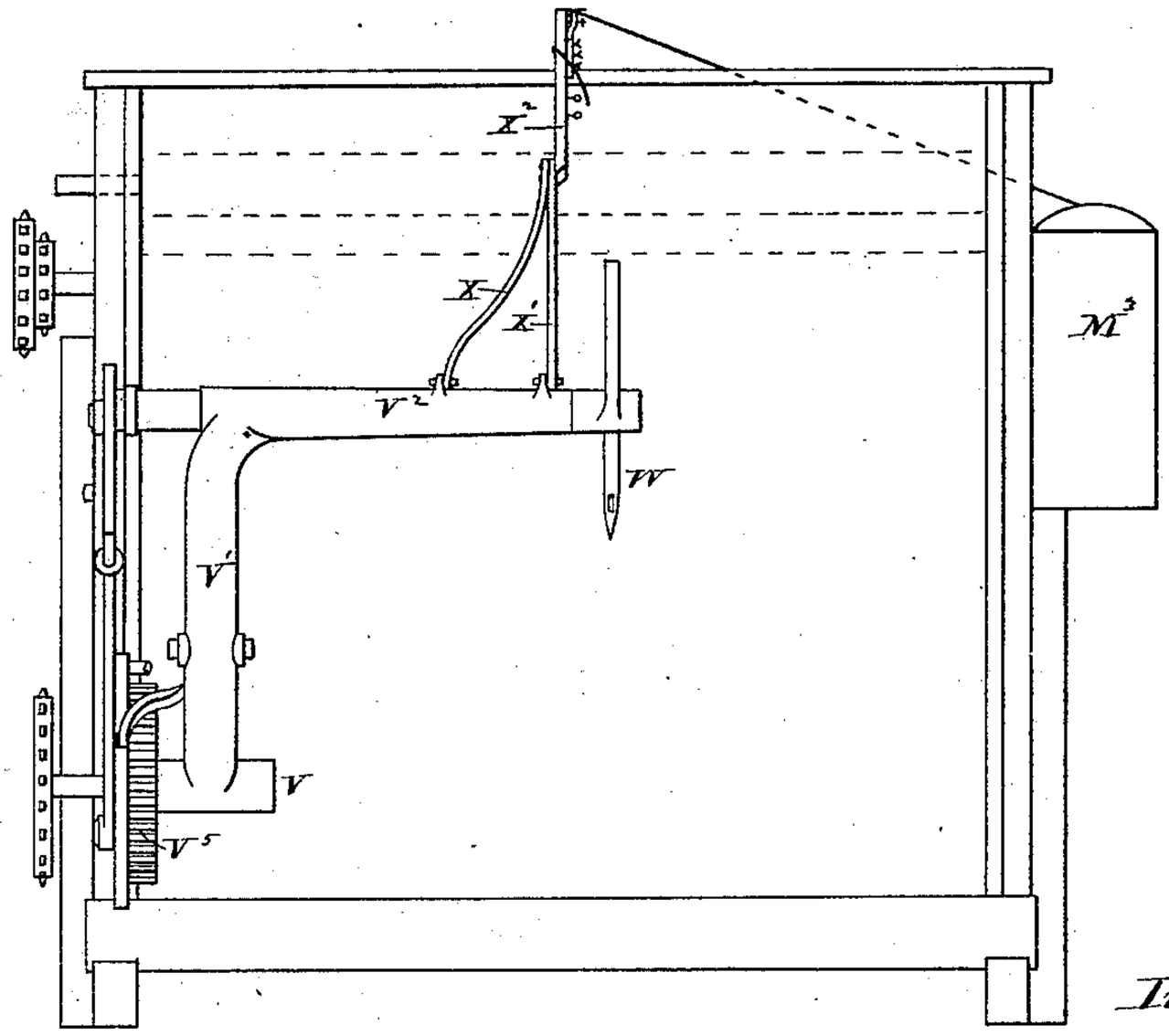


Fig. 22.



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UNITED STATES PATENT OFFICE.

CHRISTOPHER W. LEVALLEY, OF ST. PAUL, MINNESOTA.

GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 245,924, dated August 16, 1881.

Application filed September 13, 1880. (Model.)

To all whom it may concern:

Be it known that I, CHRISTOPHER W. LEVALLEY, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Grain-Binders; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Figure 1 is an elevation of my improved binder, taken from the stubble side. Fig. 2 shows the support for one end of the upper sliding bar. Fig. 3 is a view, partly in section and partly in elevation, taken from the rear. Fig. 4 is a front elevation of the devices for actuating the needle and the needle-frame when the latter are mounted at the front end of the machine, as shown in Figs. 1 and 3. Fig. 5 is a view of the rack and cogged plate which actuate the needle. Fig. 6 is a top view of the cogged plate and its adjusting devices. Fig. 7 is a view of the last said devices taken from the outer end of the sector-plate. Fig. 8 is a view of the needle and the gavel-compressors detached. Fig. 9 is a side view of the last said devices in the positions occupied during the operation of tying. Fig. 10 is a front view of the spring and friction-roller for forcing the compressor against the gavel. Fig. 11 is a side view of the same parts. Fig. 12 is a view of a crank-arm detached, shown in Figs. 8 and 9. Fig. 13 is a perspective view of the tripping rock-shaft detached. Figs. 14, 15, and 16 illustrate one form of mechanism for throwing the binder into and out of operation, Fig. 14 being a top-plan view thereof, Fig. 15 an end elevation, taken from the rear end of the binder, and Fig. 16 a side elevation, taken from the grain side of the machine. Figs. 17, 18, 19, and 20 illustrate a modified form of mechanism for the last said purpose, Fig. 17 being a top plan thereof, Fig. 18 an end elevation, Fig. 19 a side elevation from the stubble side of the machine, and Fig. 20 a top view of the toggle-levers shown in Fig. 19 detached. Figs. 21, 22, and 23 illustrate a modified form of mechanism for actuating the needle and needle-frame, Fig. 22 being an elevation from the stubble side of the machine, Fig. 21 an end view from the rear end of the binder, and Fig. 23 a view of the needle-operating devices detached, in the position occupied when the needle is at the end of its upward throw. Fig. 24 is a top view of the tension devices. Fig. 25 is a side elevation of the same. Fig. 26 is a perspective view of the intermittent tension detached and on a larger scale. Fig. 27 illustrates the various positions of the cord. Fig. 28 is a view of the gavel-receiver detached.

In the drawings, A^8 A^9 represent standards; A^{11} B′, girts, and A^{10} the elevator-frame.

$J^\times$ is an upright secured to the elevator-frame, and having a bracket, J^8, attached to it.

The binder-frame has a top bar, J^6, and lower bar, R^{10}, brackets R^2 R^5 R^6, and an upright, J, the latter attached to bar J^6 and to bracket R^6 by a supplemental bracket, r^6. The binder-frame slides on the elevator-frame, substantially as described in my Patent No. 226,865.

P represents the table which receives the grain from the elevator.

p p are needle-guides, there being between them a transverse slot in the table P.

The needle-frame may be mounted on the binder-frame, either at the front end, as shown in Figs. 1, 3, 4, 5, 6, 7, 8, and 9, or at the rear end, as shown in Figs. 21, 22, and 23.

In Figs. 1, 3, 4, 5, 6, 7, 8, and 9 the needle M M′ is attached to a shaft, *m*, which is mounted in the needle-frame L L′ L^{13}. The frame vibrates on shaft *l*, supported in brackets R^5 R^6, and extending to the front of the latter.

L^5, Fig. 4, is a crank-arm on shaft *l*, engaging with a bell-crank, L^4, which has a curvilinear slot, l^2.

L^9 is a link pivoted to bell-crank L^4, and to an arm, L^{10}, of the needle-frame.

L^7 is a bar pivoted to crank-arm L^5, having a rack, l^3, Fig. 5, at its upper end, which engages with a spur-segment, L^8.

L^{11} is a guide for rack l^3, the guide being supported by an arm, L^{12}.

l^4 is an eye or sleeve on arm L^{12}, and through it bar L^7 passes.

By means of these devices the needle-frame is swung toward and from the elevator, and at the proper time the needle is oscillated with its shaft *m*.

The spur-segment L^8 is secured to shaft m by a clutch-plate, m' m^2, which permits it to be adjusted thereon. The clutch has a hub, m^3, and the needle-shaft passes through said hub and through the segment L^8. The segment has a rearwardly-extending arm, l^5, which is notched, as indicated at m^5, to engage with the adjacent face of the part m' of the clutch-plate.

m^4 m^4 are bolts, which fasten the clutch-plate to the segment, passing through slots. The segment L^8 is loose on the needle-shaft, and the clutch-plate keyed to said shaft. After loosening bolts m^4 the needle and its shaft can be oscillated in either direction relatively to the segment L^8 and secured in a new position. Thus the needle can be properly timed; but I do not in this case claim the segment, the slotted clutch-plates, the bolts, or any of the devices shown in Figs. 4, 5, 6, and 7 for thus adjusting or timing the needle upon the needle-shaft, as I prefer to make these parts the subject-matter of another application which I have filed as a division of this case.

The devices for operating the needle and needle-frame are constructed as follows, referring still to Figs. 1, 3, and 4, and also to Fig. 14: The shaft l (which, through crank-arm L^5, arm L^7, and bell-crank L^4, conveys the necessary motions to the needle and its frame) carries a spur-wheel at l', which is rotated by a wheel, R^7. The latter is keyed to the main shaft R^4, which is mounted in the brackets R^2 and R^5. This shaft R^4 is rotated by a wheel, R^3, which, in turn, is actuated by a pinion, S', the latter shown in Fig. 14. Said pinion is mounted loosely upon a shaft, S, but can be engaged therewith by a feathered clutch, S^2. The shaft S is rotated by a chain receiving power from the harvester, or by other preferred means. The clutch S^2 may be engaged with and disengaged from the pinion S', either by an ordinary shipping-lever extending within reach of the driver, or by an automatic mechanism.

The mechanism which actuates the needle and its frame also operates the compressor, which latter I will now describe. It is represented by N N', and is pivoted at n to an arm, L^2, projecting inwardly from the needle-frame. The lower part, N, is somewhat **S**-shaped. The inner edge of the upper part, N', describes substantially the arc of a circle. O is a plate on the side of the needle M M', having a dove-tailed groove in one face. o is a block which slides in said groove and carries a friction-roller, o'. o^4 is an angle-iron secured to plate O, and O^2 is a stem passing through said angle-iron and attached to block o. O' is a spiral spring which presses against the block o and the angle-iron o^4, the downward movement of the block o being limited by a nut, o^5. These parts are shown detached in Figs. 10 and 11. As the needle rises and falls the roller o' is held in contact with the inner edge of the compressor N N', and when the parts are in the position shown in Fig. 9 the compressor N is forced downwardly upon the gavel Z by the spiral spring O'.

R represents a supplemental compressor, pivoted at r^8.

R' is a bell-lever, pivoted to a stud, r^7, projecting from bracket R^5.

r is a link connecting said bell-crank and compressor R.

r' is a crank-arm or cam-arm carried by main shaft R^4. Preferably it is forked and provided with an anti-friction roller. It bears against the bell-crank R' and actuates compressor R. The parts are timed so that the compressor R shall begin to act at the instant the knotting mechanism begins to operate, in order to relieve the band from tension and permit it to be somewhat slack, as shown in dotted lines at N^3, Fig. 9.

I have shown, and will now describe, the mechanism for automatically engaging clutch S^2 with the wheel S' to drive the mechanism for compressing, tying, &c. This automatic engagement is caused by devices which are actuated by the loose straw as it comes from the elevator. When sufficient straw has accumulated to form a gavel it actuates said devices which cause the engagement.

K K' represent endless feeding-belts mounted on rollers at the upper and at the lower ends. The upper rollers are rotated by a shaft, K^2, which is mounted in uprights J and $J^\times$.

k^3 is a sprocket-wheel on shaft K^2, driven, preferably, by the upper roller of the elevator-belt, as shown by dotted lines at k^2, Fig. 3. The sprocket-wheel k^3 is feathered on shaft K^2, so that the latter can slide through it. k^4 is a forked arm secured to the elevator-frame, and it holds the wheel k^3 in permanent position relative to its driving-wheel.

J' is a lever pivoted upon bar J^6. j is a forked rod hinged to the inner end of lever J', and having the lower roller of belt K journaled in its forked ends. If the lower roller of belt K be elevated it will elevate the inner end of lever J'.

J^2 J^4 represent a rock-shaft, the part J^2 lying substantially horizontally beneath the inner side of the binder, and extending from the vertical plane of the outer end of lever J' to that of the wheels S' and R^3, and the clutching mechanism j' is a link connecting the outer end of lever J' with a crank, j^5, on the forward end of rock-shaft J^2. When the roller of belt K raises the inner end of lever J' the outer end falls and shaft J^2 rocks, so as to lift the short upwardly-projecting arm J^4.

Immediately above the arm J^4 are toggle-levers J^3 J^3, pivoted, one to the frame-bracket R^2 and the other to a shifting-lever, S^4, which at the front end is supported loosely on shaft R^4. The wheels S' R^3 are mounted on their shafts between the parts R^2 S^4. When the toggle-levers J^3 lie both in the same plane they hold lever S^4 and and clutch S^2 away from wheel S'. Lever S^4 engages loosely with clutch S^2

and shifts the clutch out and in, and it (said lever) is moved outward by a cam, r^2, on wheel R^3, arranged to bear against the lever, or preferably against a roller, s^4, thereon. This cam r^2 is of sufficient depth to push the clutch S^2 out of engagement with wheel S', and this occurs once in every revolution of the main wheel R^3. The forcing outward of lever S^4 by cam r^2 brings toggle-levers J^3 J^3 into the same plane, and while there they lock the clutch out of engagement. If the arm J^4 of rock-shaft J^2 J^4 be raised by the devices described above, it will unlock the toggle-levers J^3 J^3, and then clutch S^2 can be moved inward again. This inward moving is effected by a spring, s', connected to lever S^4 by a stem, s, the spring bearing against a nut, s^2.

If the parts be in the position shown in Figs. 1, 3, 14, 15, and 16, and if the straw between the table P and belt K forces the lower roller of said belt upward, the following results will occur successively, namely: The outer end of lever J' will descend, the shaft J^2 will be rocked, the arm J^4 of said shaft will be raised, the toggle-levers J^3 J^3 will be unlocked, spring s' will draw clutch S^2 into engagement with pinion S', and wheel R^3 and main shaft R^4 will be rotated. Shaft R^4 imparts motion to the needle M M', to the needle-frame L L', to the compressors N and R, and to the tying mechanism. (Not shown.) During one revolution of wheel R^3 the needle descends, the gavel is compressed, the knot is tied, and the needle is raised; and at the end of these operations cam r^2 pushes clutch S^2 to its outer position, and the toggle-levers J^3 J^3 lock it there till sufficient straw has accumulated to again raise belt K.

To carry cam r^2 below the roller s^4 a spur, r^3, is formed, projecting from cam r^2. It is arranged to lie in the path of the teeth of clutch S^2, immediately after the clutch has been forced out by cam r^2, and hence the clutch engages for a moment with said spur and turns wheel R^3 a short distance to carry cam r^2 below the roller s^4.

s^3 is a sleeve around stem s, arranged to act as a stop to prevent spring s' from drawing clutch S^2 too forcibly or too tightly against wheel S'.

I have shown a modification of the clutch-moving mechanism, and also a modification of the needle-operating devices.

The modified form of clutch mechanism is shown in Figs. 17, 18, 19, and 20, wherein R^2 represents the frame-bracket; T, the main shaft; T', the wheel thereon; t, a cam on wheel T'; U', the power-shaft; U, a loose pinion on said shaft; U^2, a sliding clutch; U^3, a shipping-lever; u', the stem attached to said lever; u^2, a spring around the stem, each corresponding, respectively, to the parts R^2 R^4 R^3 r^2 S S' S^2 S^4 s s', already described. In this construction crank-arm J^4 is nearly beneath the stubble side of the clutch. When it rises it unlocks the toggle-levers t^2 t^3 pivoted to bar T^2, secured to frame-bracket R^2. One of the toggle-levers is pivoted in a slot, t'. T^3 is a link pivoted at its lower end to the toggle-levers, and at its upper end to a link, t^4. Link t^4 is pivoted to an arm, t^5, projecting from lever U^3. t^7 is a roller mounted on the pivot which connects links T^3 and t^4. These links are raised with toggle-levers t^2 t^3, by crank-arm J^4, into the position shown in dotted lines, Fig. 19. When these parts are in this elevated position the clutch is free to be moved inward by spring u^2. At the instant wheel T' is completing its revolution cam t engages with roller t^7 and the parts are returned into the position shown in full lines, Figs. 17 and 19.

In Figs. 21, 22, and 23 I have shown devices for actuating the needle-frame and needle, which possess some advantages over those shown in the other figures; but I do not in this case claim either the mechanism shown in said Figs. 21, 22, and 23, nor those in the other figures which are adapted for operating the needle and needle-frame.

The needle-frame consists of an upper sleeve, V^2, for shaft w, a lower sleeve, V, and the connecting-standard V', the whole mounted and oscillating on shaft V^3 at the rear end of the binder.

V^4 is the main driving-shaft, and V^5 a wheel thereon, corresponding respectively to the parts R^4 and R^3 in the construction above described. The needle W and shaft w are oscillated in the frame by means of a crank-arm, W', attached to shaft w, a crank-pin, v, connected to wheel V^5, and a pitman-connection between them. The pitman-connection consists of an upper part, w^3, pivoted to crank W', and a lower part, w' w^2, pivoted to the crank-pin v. The upper and lower parts of the pitman are pivoted together at w^5.

V^7 is an arm rigidly attached to the part w' w^2 of the pitman, and provided with a curvilinear slot. w^4 is a wrist-pin projecting from crank W' and arranged to traverse the slot in arm V^7. These parts control properly the movements of the pitman-sections relatively to the needle-shaft and needle-frame.

The needle-frame is oscillated by a slotted lever, V^6, and a link, V^8. The crank-pin v engages with the slotted lever V^6 and operates to swing it forward and backward, and with it the needle-frame. The slotted lever V^6 is pivoted at v' to the frame of the binder, or to a suitable bracket or hanger.

With the needle-frame last described, and shown in Figs. 21, 22, and 23, may be combined the compressors and driving mechanism hereinbefore described, and also an automatic clutch-shifting mechanism, such as the one shown in Figs. 14, 15, and 16, or shown in Figs. 17, 18, and 19.

The cord is supplied to the needle from a holder, M^3, the tension being regulated by devices supported upon bar J^6. It (the cord) passes between pins q^5 q^6, then under an adjustable tension-arm, Q, thence in a zigzag path

around pins q^2, thence through the eye of a spring take-up, Q^4, thence through a stationary eye, q^4, and then to the eye of the needle. The pins q^5 q^6 project upwardly from a plate, Q′, on the top of bar J^6. At q a spring and thumb-nut are arranged to adjust the tension of arm Q, said arm having a part arranged across the plate Q′. The pins q^2 project upwardly from a plate, Q′, also on the top of bar J^6. The desired tension is produced by the pressure of arm Q and the pins q^2, which may be varied in number. The spring-arm Q^4 takes up the slack cord, in whatever position the needle may be. While the needle is carrying the cord around the gavel the cord immediately below eye q^4 runs between rows of peculiarly-constructed tension-studs q^3. These studs project laterally from a plate, Q^3, which is bolted to bar J^6 in a pendent position. Each stud is substantially oval at its base in cross-section, and pointed at its upper end. They are arranged in a zigzag line, with their bases overlapping each other somewhat. The outer edges, q^8 q^8, (see Fig. 26,) are substantially straight, but the inner edges are rounded both in cross and longitudinal section. The slope of the inner edges of the studs is such as to gradually decrease the degree to which they overlap each other, (coming from the base outward toward the point,) and they gradually increase in length from the top to the bottom of the series. As the needle is beginning to enter the grain it forces the cord down between these studs until it lies close to the plate Q^3 in a zigzag path from the eye q^4 to the eye of the needle. The cord follows this zigzag path while the needle is performing the first part of its operation, and it is therefore subjected to a tension supplemental to that caused by the above-described tension devices. This supplemental tension continues till the needle nearly reaches the limit of its downward movement. Just before it reaches this limit, and just before the tying devices begin to operate, the cord escapes from the studs q^3, as shown by line y, Fig. 27, and therefore cord is supplied free from this tension during the tying. When the needle is in its uppermost position the cord takes the path y', Fig. 27.

P' P^2 are fingers projecting from the stubble side of the binder to receive the bound gavel. The forward finger, P^2, is shorter than the rear one, and as the butt-end of the gavel before falling rests upon the forward finger, said end will fall first when the gavel is pushed laterally outward. This insures that the bundle shall strike the ground in a substantially upright position, and avoids the scattering of grain incident to the ordinary mode of dropping the gavel. The plane of these fingers P' P^2 is some distance below that of table P. The gavel is thrust from the latter to the former by the toe or point of compressor N, which, as the compressor comes downward to compress a new gavel, descends behind the last gavel and moves it outward as the compressor and needle swing outward.

A stripping device is combined with the needle of such character that when the needle is rising it shall remove from the needle any loose straw which may be clinging to it. This stripper consists of a bar pivoted at one end to the needle-frame, and at the other arranged to rest upon the top bar of the binder or the elevator-frame, there being an eye upon the supporting-bar arranged to guide the stripper as it slides to and fro upon said bar. The needle rises in close proximity to the stripping-bar. It is represented in Figs. 1 and 3 by M^2, and in Figs. 21, 22, and 23 by X^2 X X′, the part X X′ being forked and pivoted to the needle-frame. This device may, if preferred, be so arranged as to support some or all of the tension devices. The plate Q′, with pins q^5 q^6 and tension-arm Q, and the pins q^2, (already hereinbefore described,) may be supported upon the stripper at the point indicated by x^2, Fig. 21. The take-up Q^4 may be supported thereon as indicated at x^3, and the eye q^4 may be also attached thereto at the point indicated by x^4.

k^6 k^6 are guide-wires depending from sliding bar J^6, and serving to properly direct the grain after it leaves the elevator.

In Fig. 3 is shown that part of the harvester which elevates the grain to the binder. There are two elevator-belts, the journals of the lower roller of the upper belt being mounted in slots a, which permits the lower end of said belt to rise and fall relative to the lower belt. This arrangement insures that the grain shall be uniformly delivered to the binding-table, and prevents the large tangled masses of straw from lifting the belt K too suddenly, and thus starting the binding mechanism before sufficient grain has accumulated for a gavel. When the mountings of the lower elevator-belt rollers are of the ordinary character—that is, unyielding—the tangled masses of grain often clog the elevator to such an extent that large masses of straw are suddenly delivered to the binder-table, which force up belt K and start the binding mechanism too soon. This is avoided by combining with the automatic clutch-shifting mechanism above described the elevator-belt mounted at the lower end in the manner set forth.

The belts K and K′ are preferably arranged on rollers of different diameters, and are moved with different speeds, so that the straw shall be delivered uniformly, notwithstanding the difference in size between the butt-ends of the straw and the head ends. The belt K operates not only to trip the mechanism which operates the binder, but also to pack the grain compactly and advantageously after it has been delivered by the elevator-belts, the weight of the belts K K′ pressing upon the grain as it passes over the table P, and insuring that the grain shall be packed against the binding-cord with sufficient density to insure the making of a bundle of satisfactory size.

What I claim is—

1. The combination, with the needle M M′,

of the compressor N N′, and the friction-roller *o′*, forced downward by a spring, substantially as set forth.

2. The combination, with the needle M M′, the elevator-frame, and the frame which swings the needle toward and from the elevator-frame, of the needle-stripper pivoted at one end to the needle-frame in a vertical plane adjacent to that of the needle, and arranged to reciprocate longitudinally on the elevator-frame, as set forth.

3. The combination, with the needle-frame arranged to swing toward and from the elevator, the needle pivoted on said frame to swing vertically thereon, and the compressor N N′, pivoted to the needle-frame independently of the needle, of the supplemental compressor R, and mechanism arranged to force said compressor against the gavel after the needle and the compressor N N′ have come to rest, substantially as set forth.

4. In a grain-binder, the combination, substantially as hereinbefore set forth, of the following elements, namely: the vertically-swinging cord-carrying needle, the compressor N N′, arranged to force the straw against said needle, the supplemental compressor R, the bell-crank R′, link *r*, the main shaft R^4, mechanism for imparting motion from said shaft to said needle and said compressor N N′, and the crank-arm *r′*, situated relatively to said mechanism to move compressor R while the needle and compressor N N′ are at rest and the knot is being tied.

5. The grain-receiver P′ P^2, having the finger P^2 shorter than the finger P′, substantially as set forth.

6. In a grain-binder, the combination, with the grain-elevator, of a lower surface adapted to support the grain during its descent from the elevator to the table over which grain is moved to the binding mechanism, and a feeding-belt having its lower end mounted on a movable roller, substantially as set forth.

7. In a grain-binder, the combination, with a grain-table over which the grain is moved to the binding mechanism, of a feeding-belt mounted at its upper end upon and driven by a roller which is capable of being moved longitudinally relative to the upper end of the grain-elevator, substantially as set forth.

8. In a grain-binder, the combination, with a surface adapted to support the grain during its descent from the elevator to the grain-table over which grain is moved to the binding mechanism, of a feeding-belt having its lower end mounted upon a movable roller, and arranged substantially as set forth, whereby the weight of said belt and roller is caused to press the grain upon the grain-support and binding-table, as set forth.

9. In a grain-binder, the combination, with a grain-table over which grain is moved to the binding mechanism, of a feeding-belt having its lower end movable, and mechanism connecting said belt with the devices which throw the binding mechanism into action, substantially as set forth.

10. The combination, with the binding mechanism, the devices which throw said mechanism into and out of operation, and the endless belt K, suspended above the binding-table and arranged to carry the grain downward, of the lever J′, pivoted above the binder-frame, the link *j′*, pivoted to said lever, the rock-shaft J^2 J^4, beneath the binding-table, and the toggle-levers J^3 J^3, as and for the purposes set forth.

11. The combination of the gear-wheel R^3, pinion S′, having clutch-teeth, the shipping-lever S^4, clutch S^2, cam r^2, spur r^3, toggle-levers J^3 J^3, spring *s′*, and rod *s*, substantially as set forth.

12. The combination, with the elevator-frame, the sliding binder-frame, the tension devices, and the lever J′, of the upright $J^\times$, secured to the elevator-frame, the upright J, attached to the binder-frame, and the bar J^6, secured to the upright J at one end and arranged to slide at the other end on upright $J^\times$ and to support the tension devices and tripping-lever J′, as set forth.

13. In a grain-binder, the combination, with the binder-arm and the cord-supplying devices, of the herein-described intermittent tension device constructed with the series of studs q^3 of different lengths, substantially as shown and set forth.

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

CHRISTOPHER W. LEVALLEY.

Witnesses:
J. S. BARKER,
M. P. CALLAN.