(No Model.) 6 Sheets—Sheet 1.

H. E. PRIDMORE.

GRAIN BINDER.

No. 442,545. Patented Dec. 9, 1890.

Fig. 1.

(No Model.)

6 Sheets—Sheet 2.

H. E. PRIDMORE.

GRAIN BINDER.

No. 442,545. Patented Dec. 9, 1890.

Fig. 2.

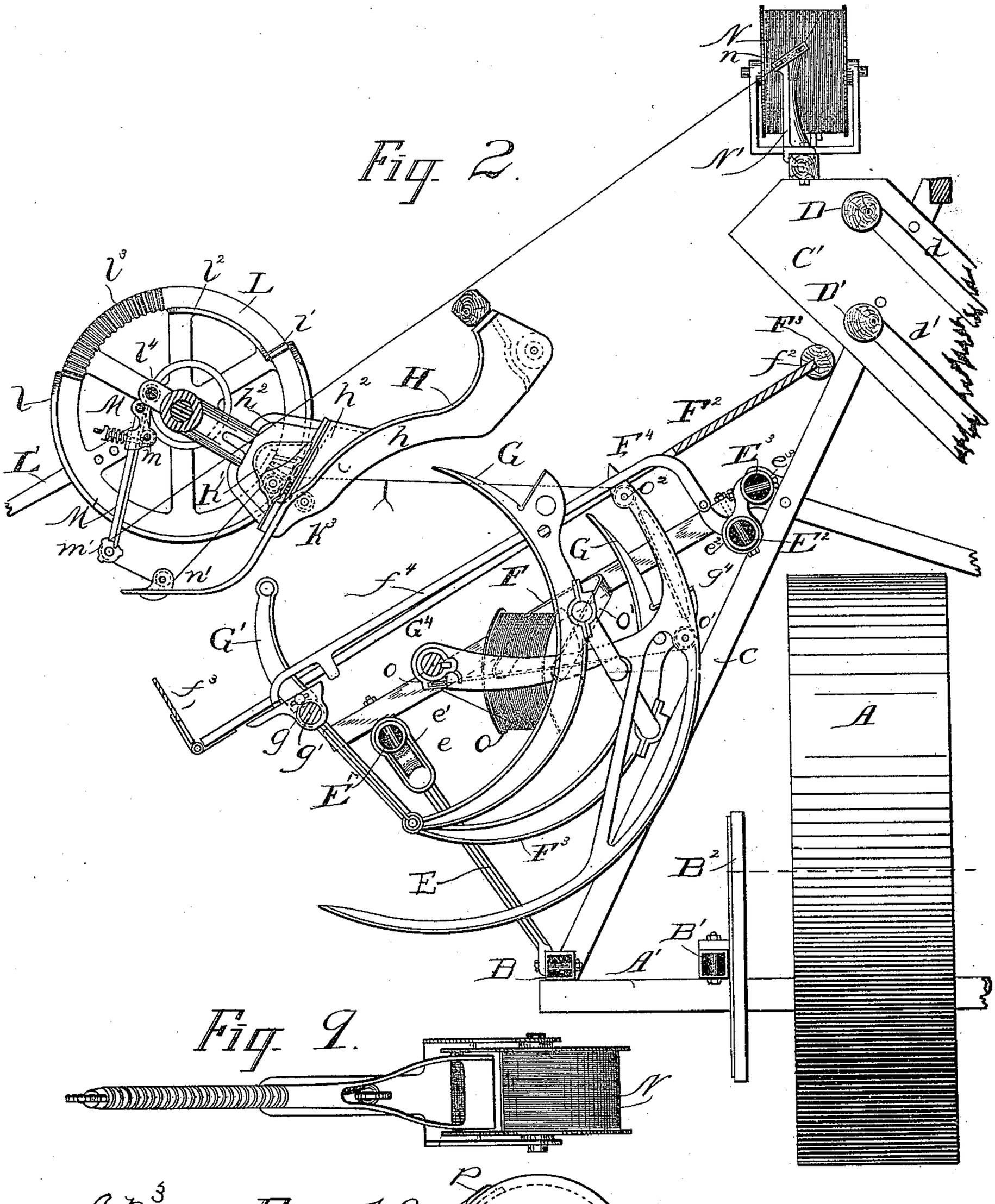
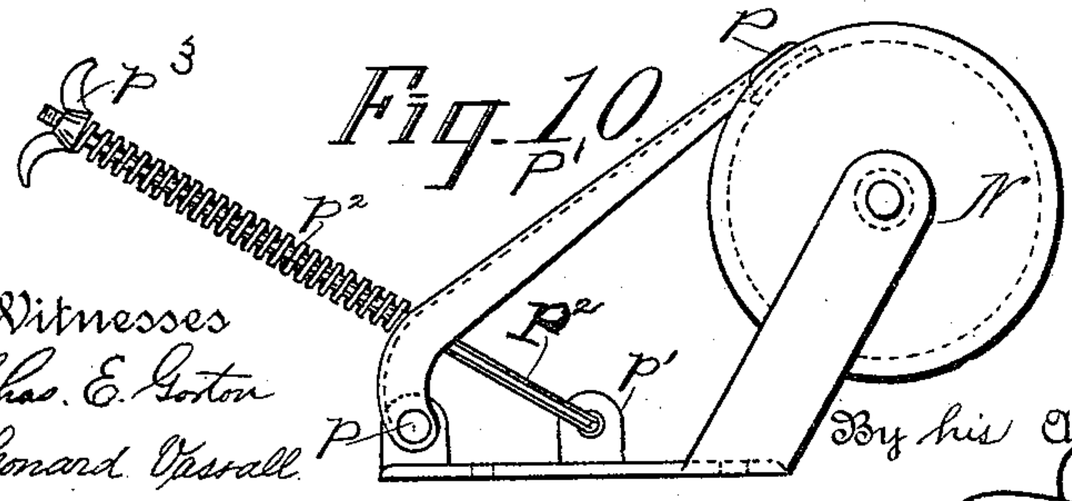


Fig. 9.

Fig. 10.



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By his Attorney
Joseph G. Pennington

(No Model.) 6 Sheets—Sheet 3.

H. E. PRIDMORE.

GRAIN BINDER.

No. 442,545. Patented Dec. 9, 1890.

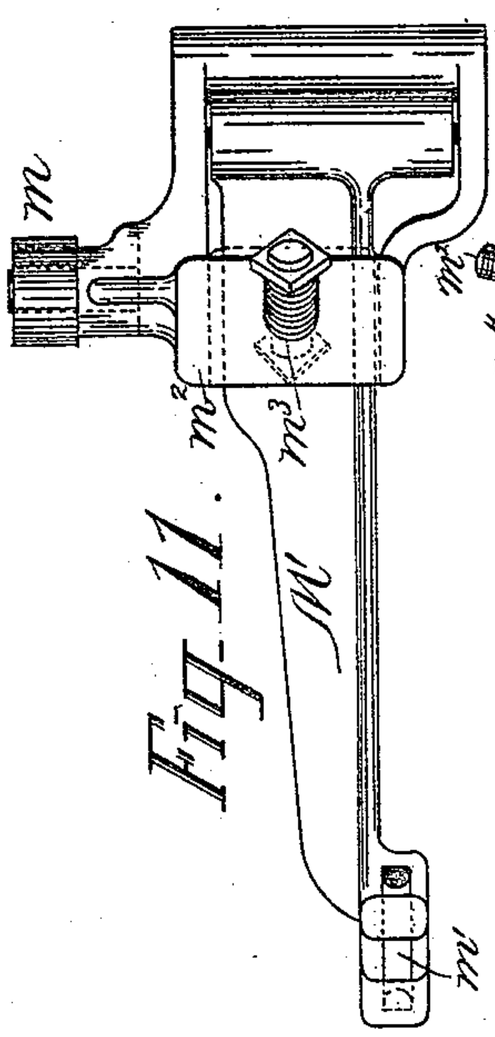

Fig. 11.

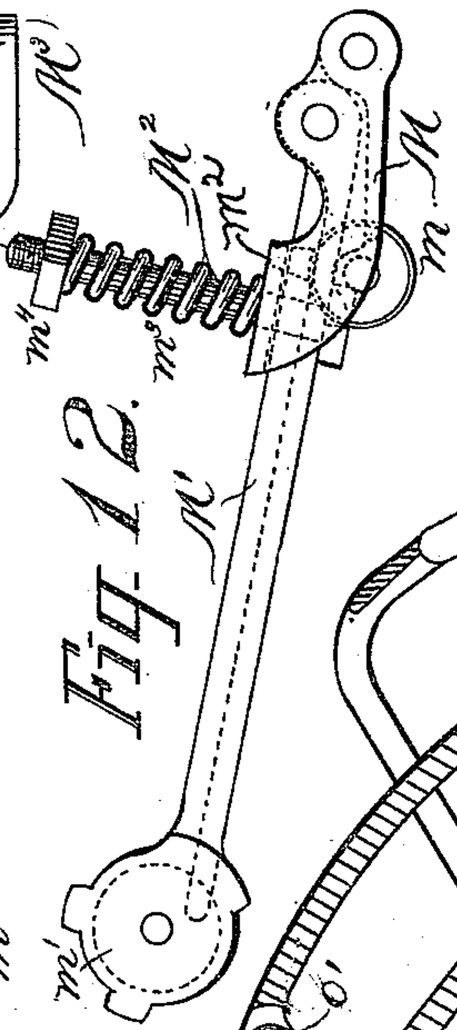

Fig. 12.

Fig. 3.

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(No Model.) 6 Sheets—Sheet 4.

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GRAIN BINDER.

No. 442,545. Patented Dec. 9, 1890.

Fig. 5.

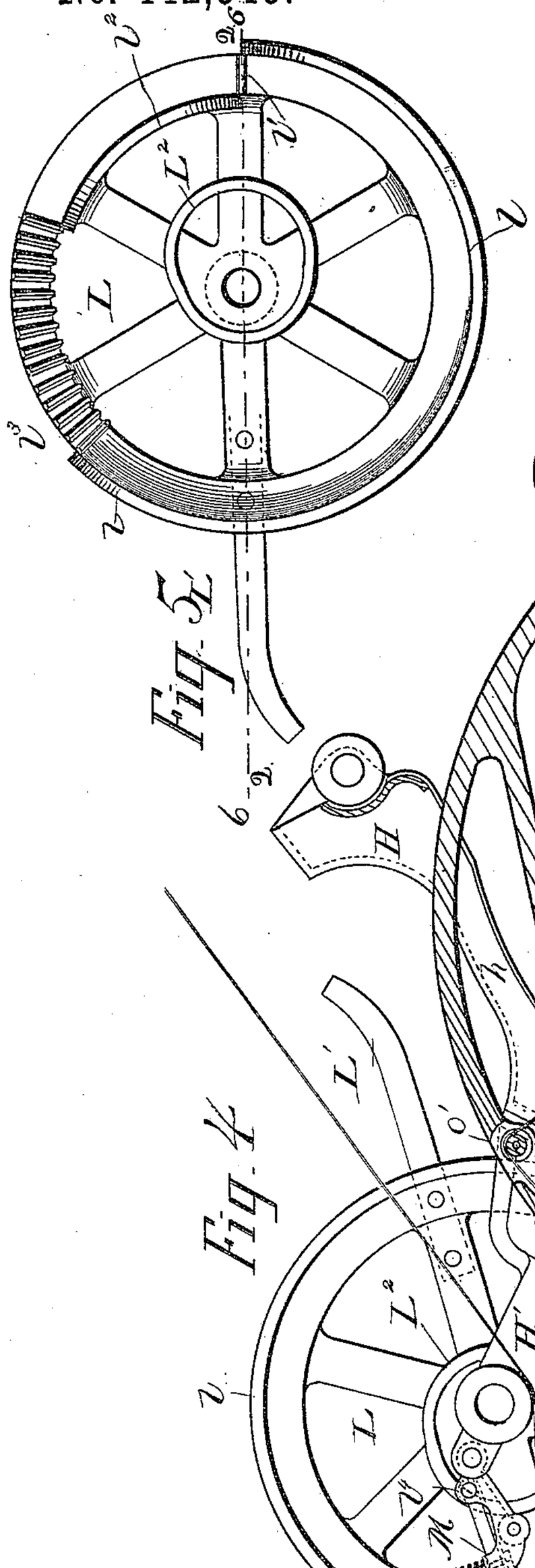

Fig. 6.

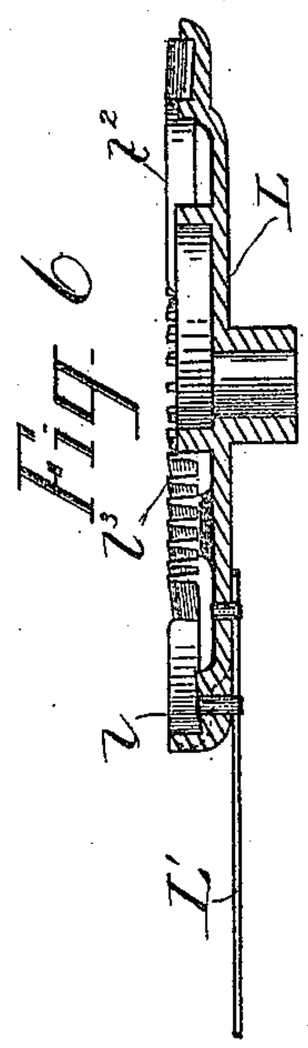

Fig. 4.

Witnesses
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(No Model.) 6 Sheets—Sheet 5.

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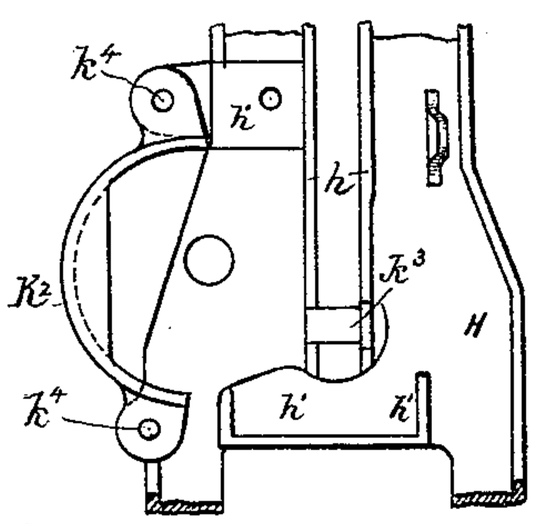
GRAIN BINDER.

No. 442,545. Patented Dec. 9, 1890.

Fig. 8b



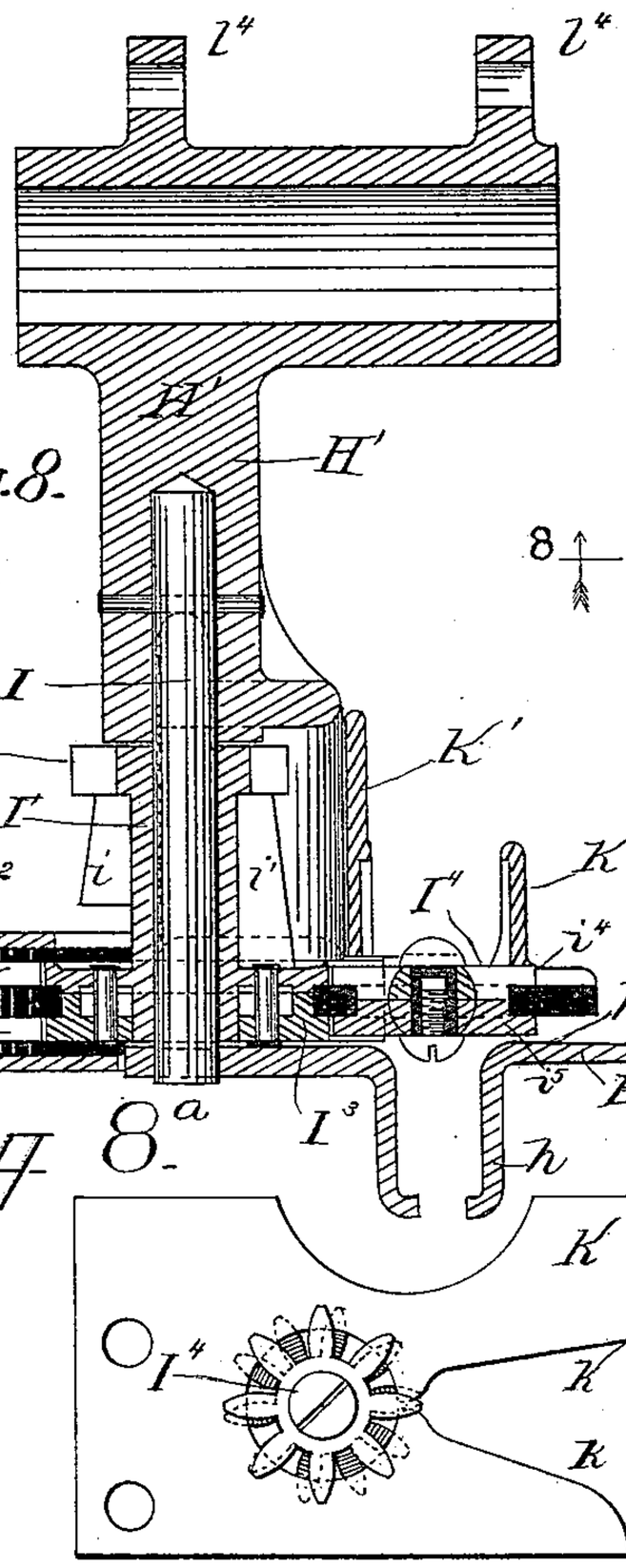
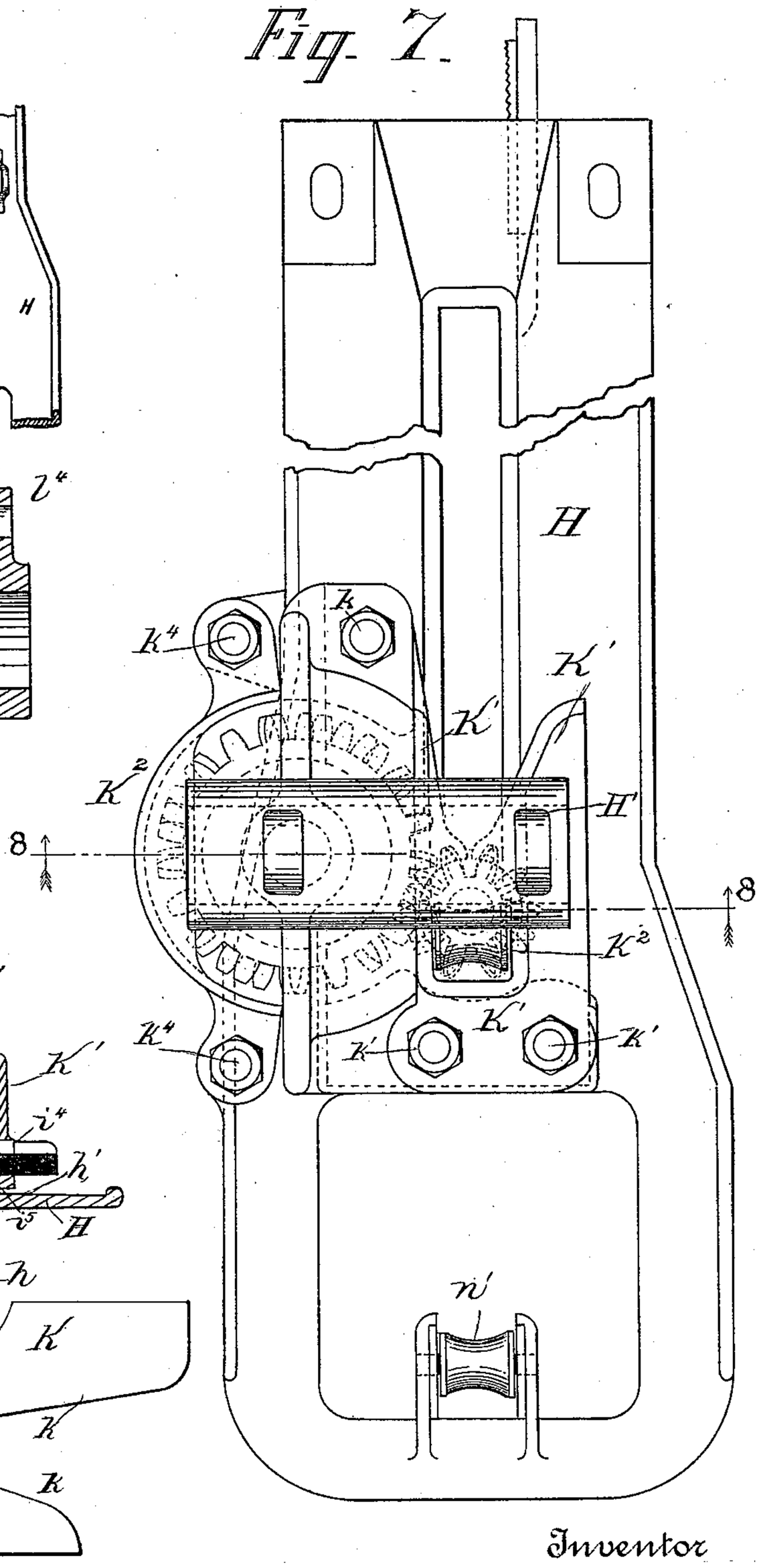


Fig. 8.

Fig. 8a

Fig. 7.



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(No Model.) 6 Sheets—Sheet 6.

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GRAIN BINDER.

No. 442,545. Patented Dec. 9, 1890.

Fig. 13.

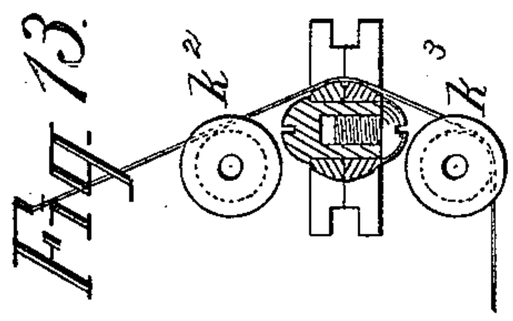


Fig. 13a

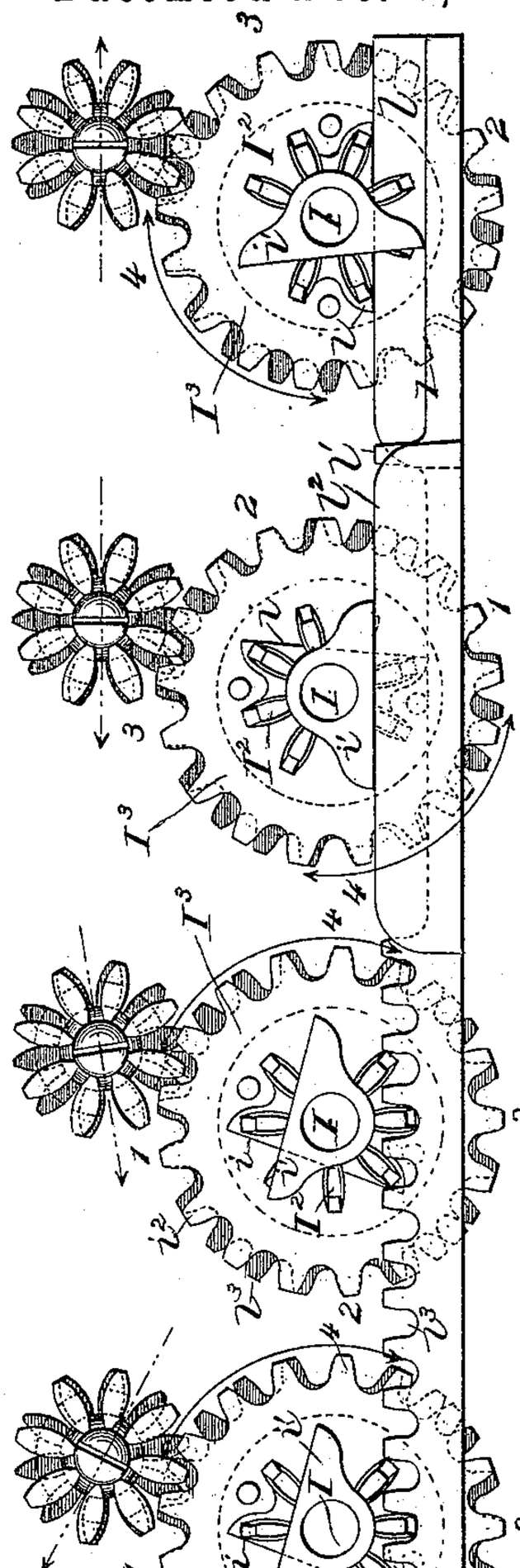


Fig. 14.

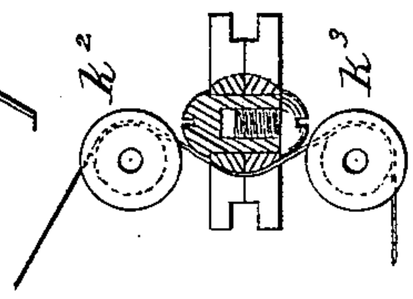


Fig. 14a

Fig. 15.

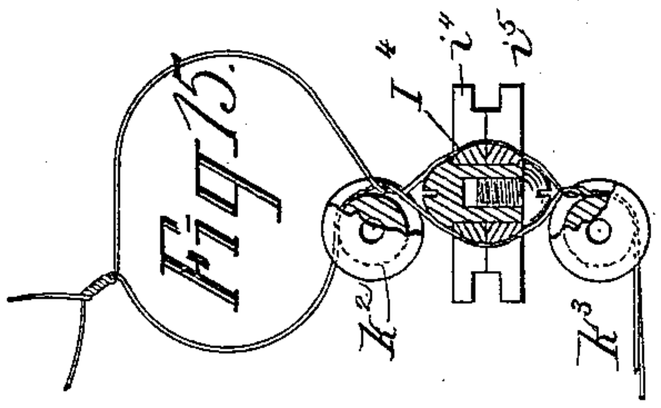


Fig. 15a

Fig. 16.

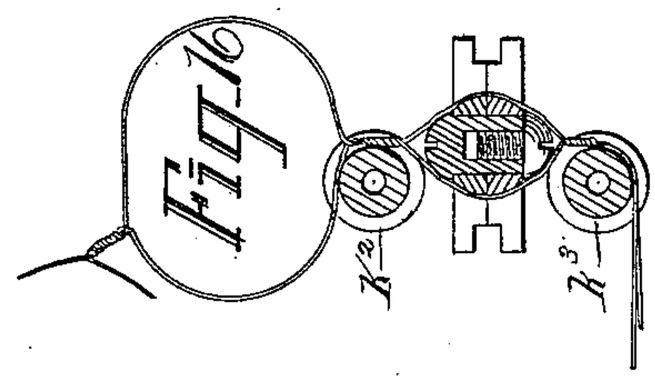


Fig. 16a

Fig. 17.

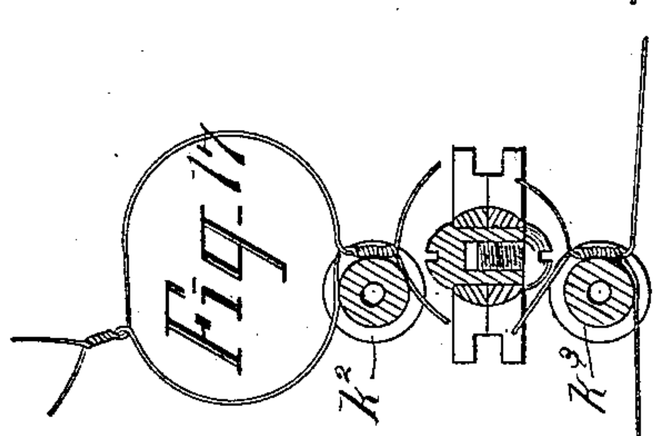
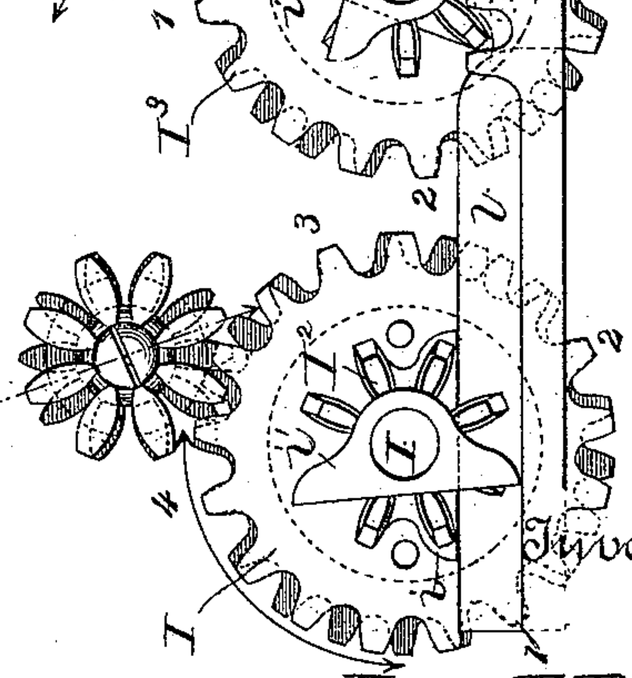


Fig. 17a



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Leonard Vassall.

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By his Attorney Henry E. Pridmore.
Joseph G. Robinson

UNITED STATES PATENT OFFICE.

HENRY E. PRIDMORE, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE McCORMICK HARVESTING MACHINE COMPANY, OF SAME PLACE.

GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 442,545, dated December 9, 1890.

Application filed October 5, 1889. Serial No. 326,126. (No model.)

To all whom it may concern:

Be it known that I, HENRY E. PRIDMORE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Grain-Binders, of which the following is a specification.

This invention relates particularly to the binding of grain with wire, and has for its object the adaptation of wire supplying, twisting, and severing devices to the modern grain-binder—that is, to a binder having the general characteristics of the so-called "Appleby" type.

In carrying out said invention two spools of wire are employed, as in the Withington machines, widely used but a few years ago, and two twists are formed in the wire at each binding operation—one above and the other below the twisting device—so that when severed one of said twists shall serve to unite the ends of the bands and the other to reunite the ends of the supply-wire. The twister is located above the breast-plate in the position or about the position occupied by the tying-bill in the Appleby machines and driven by a stop-motion wheel mounted upon the usual tyer-shaft and practically occupying the place of the tyer-cam in said machines. A slack take-up for the upper wire is also automatically operated by a cam on said stop-motion wheel, and a brake of novel construction is applied to each spool of wire, the brake-shoe resting upon the surface of the wound wire, and pressure being imparted to the brake-lever by a rod and spring arranged in such manner that the effective lever-arm is shortest when the spool is full and increases constantly in length as the wire is drawn off, so that although the spring expands and decreases in pressure or force the leverage compensates for such decrease.

Various other details and features of construction will appear from the ensuing description.

In the drawings, Figure 1 is a top plan view of a grain-binder embodying my invention. Fig. 2 is a vertical section therethrough on the correspondingly-numbered line in the preceding figure. Fig. 3 is another vertical section taken parallel with the preceding, but through the center of the binder-arm or needle and twister, showing the binder-arm rising to encircle a gavel and the slack take-up depressed. Fig. 4 is a similar section to the foregoing, but with the parts farther advanced in action, the sheaf bound and wire severed, the spool ends reunited, and the binder-arm just upon the point of withdrawing, while the slack take-up is elevated to store up slack for the next binding operation. Fig. 5 represents the stop-motion gear with its slack-take-up cam, and which may as a whole be termed the "twister-cam," in side elevation; and Fig. 6 is a section therethrough on the correspondingly-numbered line in the preceding figure. Fig. 7 is a top plan view of the breast-plate and twister-stock; and Fig. 8 a section therethrough on the line 8 8 of the preceding figure, looking in the direction indicated by arrows. Fig. 8^a is a plan view of the twister and twister-plate detached. Fig. 8^b is a detail in top plan view of the breast-plate with the twister-stock and twister-plate removed, showing the seat for the foot of said stock and for said plate and the cap for the outside edge of the twister-gear. Fig. 9 is a top plan view of the tension-brake for the wire-spool, and Fig. 10 an elevation thereof. Fig. 11 is a top plan view of the slack take-up for the upper wire, and Fig. 12 a side elevation thereof. Figs. 13 and 13^a to Figs. 17 and 17^a are a diagrammatic series showing the action of the twister at successive stages of operation.

A represents the main or carrying wheel of the harvester.

A′ is one of the sills of the elevator-frame, which may be the front or the rear sill, depending upon whether the harvester is a right or left hand.

B is an outside girt at the stubble end of the harvester, and B′ a parallel girt constituting one of the lateral members of the wheel-frame and supporting the bridle-piece or segment-standard B^2, in which the main wheel is adjusted up and down.

C is an outside strut of the elevator-frame, and C′ one of the side-boards of the elevator, the drums or rollers D and D′ for the heads

of the upper and lower elevator-belts being mounted in bearings in said boards at the upper ends of the apron-guides $d\,d'$. Standards E rise obliquely from the outside girt and are provided with yokes e and anti-friction rollers e' for the support of the outer tubular bar E′ of the binder-frame, while the inner tubular bar E^2 is carried in annular guides e^2, depending from a parallel bar E^3, secured to the brackets e^3 from the elevator-struts on the harvester, and constituting a fixed part of the harvester-frame.

F is one of the transverse bars of the binder-frame, bolted at its outer end to the outer longitudinal tubular frame-bar and at its inner end to the corresponding longitudinal bar.

F′ is the post-frame having upper tubular arm f for the reception of the tyer or twister shaft and lower tubular arm f' for the reception of the binder-arm shaft, and F^2 represents the grain-deck or binder-table sliding at its inner or upper end in the longitudinal groove f^2 in the rod F^3, immediately beneath the head of the elevator, and at its outer or lower end suitably supported from the binder-frame at some height above the tubular frame-bars. At its extreme outer end it has or may have the usual tail-board f^3, and it is slotted transversely from receiving to discharge side for the play of the table-trip f^4, between the arms of which the needle F^4 passes as it rises in the binding operation. Packers G also play through the slot (or independent slots) in the decking, one on each side of the table-trip, and the outer end of the slot permits the vibrations of the compressing and tripping finger G′, adjustably mounted upon a block g, upon an offset from which the end of the table-trip presses, the tripping-finger and its supporting-block being carried by a rock-shaft g', which will be connected with the tripping mechanism of the binder in any suitable way.

G^2 is the main gear and cam wheel of the binder, mounted upon and driving the tyer or twister shaft G^3, journaled in the upper tubular overhanging arm of the post-frame, driving said shaft, tripped by the binder, and itself driven by any suitable train, and G^4 is the needle-shaft journaled in the subtending arm of the post-frame, which shaft at its outer end has a crank g^2, connected by a link G^{41} to a wrist-pin g^4 on the main gear, so that the binder-arm will be vibrated once in each revolution of said gear.

Above the deck is the breast-plate H, having on its under surface the usual ribs or flanges h, which serve to keep down the waist of the gavel, and between which the needle passes, and above said flanges being formed with a seat h' for the reception of the twister-plate, hereinafter described, and of the foot of the twister-stock H′, which is sleeved upon the tyer-shaft in the same way as customary with the tyer-stock in the modern twine-binders. The foot of this twister-stock bridges the space for the twister-gear, and centrally through this bridge depends a spindle I, the lower end of which is stepped in the breast-plate, as shown in Fig. 8, that it may serve as a journal for the sleeve I′, carrying at its upper end the stop-motion pinion I^2 with its delay-shoes i and i', and at its lower end the double twister-gear I^3, the latter of which has two unbroken or non-mutilated series of teeth i^2 and i^3, set apart from each other somewhat in the manner shown and described in Letters Patent granted Lambert Erpelding on the 18th day of June, 1878, No. 205,067, but differing from the gear described in said patent, in not having the same number of teeth on each series—that is to say, in the present gear one series (represented in white in the diagrammatic view) numbers seventeen, while the other series numbers twenty-one in the specific instance shown; but it will be obvious from the ensuing description that there may be a difference of any number of cogs that will give the space of one-half of one cog advanced or retarded in one revolution of the binder or for one bundle to cause the twister-pinion to sever the wire at the termination of the twisting operation. This twister-pinion I^4 consists of two separate cogged disks i^4 and i^5, the first having in the present instance but eight teeth meshing into the series of seventeen cogs on the gear-wheel and the second with ten teeth meshing into the series of twenty-one cogs on the gear-wheel. In this respect the twister differs from that shown in patent granted William R. Baker on the 11th day of January, 1876, No. 171,972; but as in the Baker patent it is supported by a stationary twister-plate or guide K, which is fitted upon and into the before-mentioned seat in the breast-plate and has flaring sides k to receive and direct the wire to the interdental spaces of the twister-pinions and a circular recess for the reception of said pinions, into which said sides open, the edges of the plate entering into an annular groove or channel cut into the adjacent faces of the pinions, so as to partly close the spaces afforded by the teeth and serving to support the pinions when united together by their pivotal bolt. In the present construction this twister-plate is also extended to enter an annular groove in the twister-gear between the two series of teeth on the latter and formed by said series, so as to support the gear adjacent to the pinions and prevent any possible disarrangement, as in the Erpelding patent.

The twister-pinions and that part of the twister-gear lying on the same side of the stock are covered by a cap K′, secured above the twister-plate by the same bolts k' which secure said plate and the twister-stock to the breast-plate. The lower part or base of this cap corresponds in outline substantially with the outline of the twister-plate—that is, it has a flaring mouth and a central opening to direct and receive the wire. Arranged above this central opening is an anti-friction roller

k^2, the inner side of which, or that side which meets the advancing wire, is just above the axis of the twister-pinions, while beneath and on the other side of the twister-pinions and similarly located with respect to them is a similar roller or guide-pulley k^3, mounted between the flanges of the breast-plate, these rollers being to receive the wire both above and beneath the pinions and hold it to their action. The exposed face of the twister-gear on the opposite side of the stock is protected by a segmental case K^2, secured by bolts k^4 to the breast-plate at each of its ends.

L is what may be termed the "twister-cam," resembling generally the usual tyer-cam, and carried by the tyer-shaft at its extreme end—that is, beyond the sleeve of the twister-stock and on the opposite side of the plane of movement of the binder-arm from that generally occupied by the tyer-cam—the arrangement and adjustment of the twister cam and stock being such that whenever they are removed a tyer-cam and tyer-stock can be substituted therefor in the same machine. This twister-cam carries one of the ejectors L', the other being secured, as usual, on the shaft, its hub occupying the place of the usual tyer-cam. Thus, whenever the twister-cam and twister-stock and the ejector-finger on the shaft are removed, the tyer-cam carrying the ejector-finger, a tyer-stock and an ejector-finger may be put in their place upon the shaft in the succession named and its full length will still be taken up. The twister-cam has a long delay-ledge l, upon which travels the lower delay-shoe of the twister-spindle. This ledge terminates in a single tooth l', which engages with the stop-motion pinion and gives the twister-gear a sufficient movement to turn the twister-pinions one-half of a revolution, as represented in the first two figures of the diagrammatic series. Following this single tooth comes a short delay-ledge l^2, engaging with the upper delay-shoe on the twister-spindle, and this is succeeded by a segment-rack l^3 of fourteen teeth in the present instance, which, as the intermeshing stop-motion pinion has but eight teeth, gives, in conjunction with the action of the succeeding or first delay-ledge upon the lower delay-shoe, a movement amounting in all to two full revolutions of the twister-gear from the time the pinion is first engaged by the single tooth to the time the first delay-ledge is again reached. Thus the series of twenty-one cogs on the twister-gear meshing into the ten cogs of the lower twister-pinion imparts to this latter four and one-fifth revolutions, while the series of seventeen cogs meshing into the upper twister-pinion with eight cogs imparts to the latter four and one-fourth revolutions, this difference being just one-half of one cog, and, as will be hereinafter explained, being nearly all imparted toward the end of the revolution of the twister-gear by the acceleration or crowding of the teeth of one series or a corresponding dispersing of the teeth of the other series. The tyer-cam also carries a cam-ledge L^2, and pivoted in the upstanding ears l^4, from the sleeve of the twister-stock, is a saddle M, provided with an anti-friction roller m, running upon this cam-track. Pivoted in the saddle is a take-up arm M', having at its outer end a guide-pulley m' for one strand of the wire and connected with the overlying plate m^2 of the saddle-piece by a rod M^2, coiled expansion-spring m^3, and adjusting-nut m^4, said spring being seated at one end upon the saddle-plate and at the other end against the nut, thus permitting the take-up arm to be drawn down away from the saddle-plate to an extent determined by the stress of the wire or by the resistance of the spring.

The twister-cam makes but one revolution to each binding operation, and the outline of the "take-up cam," as it may be termed—that is, the cam-ledge carried by the twister-cam—is such that when the binder arm or needle is down beneath the grain-table the slack take-up is at its lowest point, while shortly after the needle rises the slack take-up also begins to rise, until, when the needle has reached home, carrying the wire strand into the twister, the slack take-up reaches its highest point of movement and continues there by a concentric reach of the cam until the sheaf is bound and the needle has again withdrawn, when it is once more at its lowest point. The wire is led to the binder-arm and twister from two spools, one of which N is located on the ridge-bar or ridge-plank or other suitable overhead support, and from which the wire passes to a guide-pulley n at the top of a suitable standard N' to the guide-pulley m' at the end of the slack-take-up arm, then around another guide-pulley n' to the guide-pulley in the cap-covering of the twister-pinions, and down through these pinions to a connection with the other wire. A second spool O is supported in a bracket O' beneath the framework, and from it the wire passes directly to a guide-pulley o in the heel of the binder-arm, and then to another guide-pulley o' near the junction of the shank of said arm and the guard-extension, and from this to another pulley o^2 at the eye of the needle, and then up to its connection with the other wire.

Heretofore when wire-spools have been used some friction or brake device has been employed to prevent the wire from paying off too rapidly; but it has been found that as the amount of wire decreases—that is, in measure with its unwinding—the friction, if applied to the surface of the spool, is apt to decrease, while if applied to the sides of the spool it would remain constant and the wire would pull off harder and harder as the diameter becomes less. To remedy this objection, I propose to employ a friction-brake P, pressing upon the surface of the wire and carried by a bent arm or lever P', pivoted, as at p, to a suitable supporting-ear. To another ear p' is pivoted a link P^2, which passes through the bend or elbow of the lever-arm, as it now be-

comes, and above it receives the coiled expansion-spring p^2, confined by an adjusting-nut p^3, all as shown, the effect of this construction being that when the spool is full the brake and consequently the end of the bent lever are raised to their utmost and the link thrown round into such position that the lever-arm of power becomes very slight; but as the spool empties the lever-arm increases and the link comes into a more effective position for the operation of the spring.

The two differential series of cogs in the twister-gear are arranged so that in the initial movement of the twister-pinions one shall have about an equal progression with the other—that is, the two twister-pinions will be kept in about the same relation to each other by the revolution of the twister-gear, five teeth of one series in the gear corresponding to six teeth of the other series, starting from the cog marked I in the diagrammatic series and counting in both the initial and terminal cog; but in the fourth quarter of the periphery, or, rather, in the fourth division of the periphery, six teeth of one series correspond to seven teeth of the other series, thus advancing one of the twister-pinions beyond the other, so that in the two revolutions of the twister-gear, as already stated, and especially at the close of the second revolution, the cogs on one pinion are caused to positively shear past the cogs of the other pinion to sever the wire held in the interdental spaces, the aggregate differential movement amounting to, say, one-half of one cog for the two revolutions.

In operation the ends of the wires from the two spools are first properly threaded through or over their respective guides—one wire above the breast-plate and the other wire through the needle—and are brought together and twisted sufficiently to unite them, as represented in the second figure of the drawings. Then grain being fed to the binder and massed against the trip-finger and between the table-trip and the breast-plate by the packers, the binding mechanism is finally set in action, the wire having by this time been bent down against the outside trip-finger, as represented in the third figure of the drawings. At this time one strand of the wire is pressed into the twister-pinions and over the guide-pulleys, as in said figure and also in Fig. 13, the position of the twister-pinions, twister-gear, and delay-shoes corresponding to said last figure, being shown in 13^a. Then the needle rises through the deck and breast-plate, meanwhile the twister-pinions being revolved by the single cog in the twister-cam to the position represented in Figs. 14 and 14^a—that is, one-half of a revolution—without relative derangement, carrying the first strand of wire half-way round. The second strand is laid in said pinions by the binder-arm diametrically opposite to the first, and the stop-motion pinion, engaging the face-segment on the twister-cam, again starts the twister-gear and the pinions begin to twist, as represented, respectively, in Figs. 15 and 16, with their exponential plans. Prior, however, to the actual commencement of the twisting operation the slack take-up has been raised by its cam and has assisted the binder-arm in tightening the wire around the bundle. Finally two strands of wire having been firmly twisted together both above and below the twisting-pinions, the latter reach for the second time the fourth division or differential reach of the twister-gear, and their cogs adjacent to the wire strands, having already been brought close, are now caused to shear past each other to a slight extent, sufficient to sever the wire, as shown, leaving both spool-strands reunited, while the gavel-strands are also united, both by the most recent twist and by that twist previously made in the spool-strands in binding the preceding bundle. This severing takes place just before and immediately at the time the lower delay-shoe tumbles over upon the long outer delay-flange of the tyer-cam, upon which it rides for a short distance, while the needle-arm or needle recedes beneath the decking, and the bound sheaf is ejected, when the parts come to rest at their starting-point, as in Fig. 2, with the wire stretched between the binder-arm and twister across the grain-passage to receive the next-accumulating gavel, and fresh interdental spaces of the twister-pinion receiving the new strand laid by the binder-arm in its recession.

I do not limit myself to the use of a revolving differential gear as the means for imparting motion to the pinions, since it is obvious that two differential series of cogs bearing the same relation to each other, as those upon the gear may be otherwise applied to effect the same object; but

What I do claim, and desire to secure by Letters Patent, is—

1. The combination, substantially as hereinbefore set forth, of the twister-pinions having a differential number of cogs with the non-mutilated differential series of driving-cogs.

2. The combination, substantially as hereinbefore set forth, of the binder-arm, the twister-pinions mounted upon the same pivot and differing in their number of teeth, and the twister-gear having non-mutilated differential series of teeth, one engaging with each pinion.

3. The combination, substantially as hereinbefore set forth, of the binder-arm, the two twister-pinions mounted upon the same pivot and differing in their number of teeth, the twister-gear having two unbroken series of teeth differential in number, and the twister-cam having a face-segment engaging with the twister-gear.

4. The combination, substantially as hereinbefore set forth, with the tyer-shaft in a grain-binder, of the twister-cam with its face-segment, the twister-gear with its two unbroken series of differential teeth, and the twister-pinions with their differential teeth, each

pinion engaging with its respective series of teeth upon the gear.

5. The combination, substantially as hereinbefore set forth, of the twister-pinions, their actuating-gear having two unbroken differential series of teeth, one engaging with each pinion, the twister-spindle having bevel-pinion and delay-shoes, and the twister-cam having delay-ledges, a single tooth, and a segment, for the purpose stated.

6. The combination, substantially as hereinbefore set forth, with the twister-pinions and their driving-gear, the binder-arm and the two wire-spools, of the twister-cam having a face-segment to operate said gear, a slack-take-up cam upon said twister-cam, and a slack-take-up lever operated by said cam.

7. The combination, substantially as hereinbefore set forth, to form a slack take-up, of the rotating cam-ledge, the pivoted saddle-piece, the take-up arm pivoted to said saddle-piece, and the spring connected to said saddle-piece and take-up arm.

8. The combination, substantially as hereinbefore set forth, with the wire-spool, of the anti-friction brake-shoe pressing upon the periphery of the wire, the bent lever at the end of which said shoe is secured, and the spring-connection acting at the elbow of said lever, whereby the effective lever-arm increases as the wire unwinds.

9. The combination, substantially as hereinbefore set forth, with the wire-spool, of the brake-shoe resting upon the surface of the wire, the pivoted bent lever at the end of which said shoe is carried, the link passing obliquely through the elbow of said lever, the coiled spring around said link, and the adjusting-screw.

HENRY E. PRIDMORE.

Witnesses:
A. S. WELLS,
L. VASSALL.