(No Model.)

3 Sheets—Sheet 1.

R. H. DIXON & J. F. STEWARD.

SELF BINDING GRAIN HARVESTER.

No. 452,836. Patented May 26, 1891.

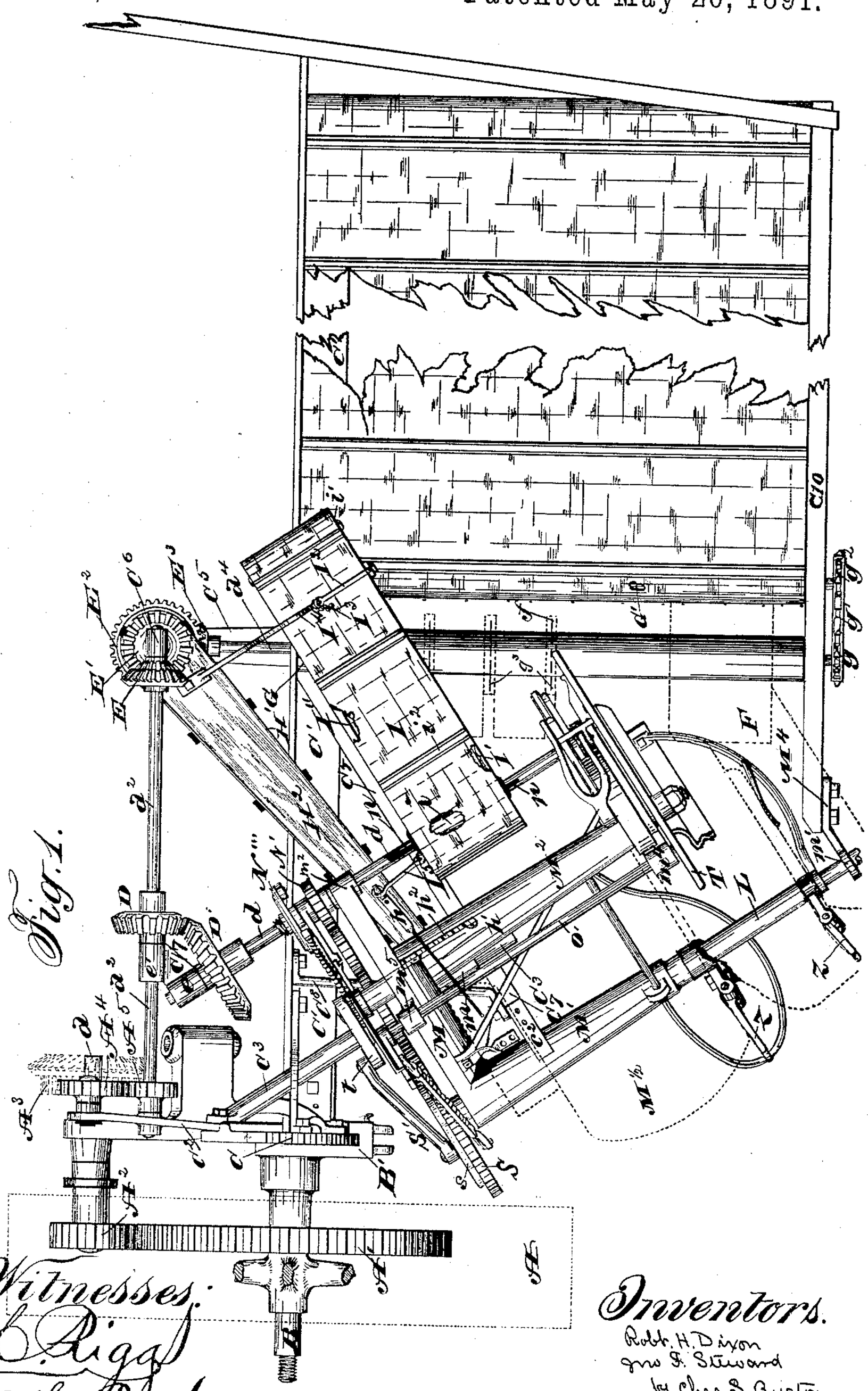

Fig. 1.

Witnesses:
L. C. Rigg
W. L. Parker

Inventors.
Robt. H. Dixon
and J. F. Steward
by Chas. S. Burton
their Atty.

(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

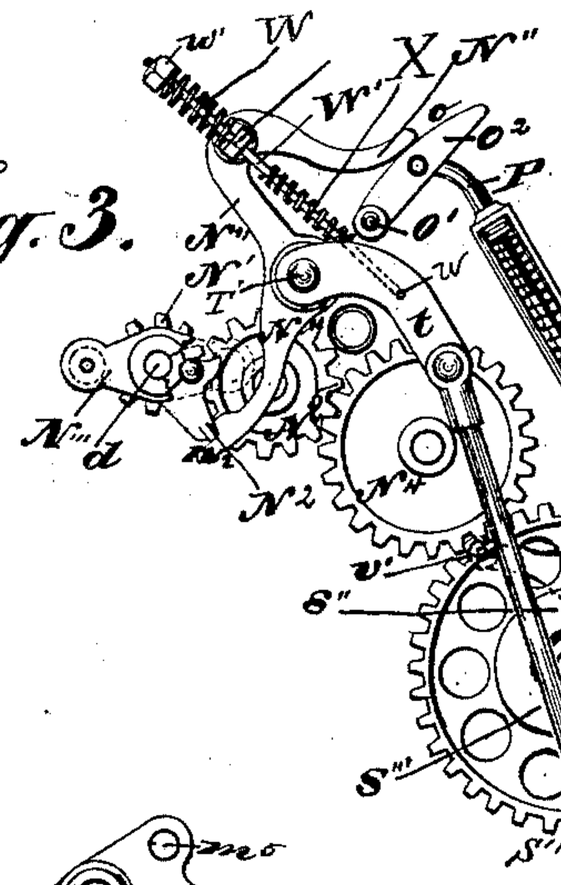

Fig. 9.

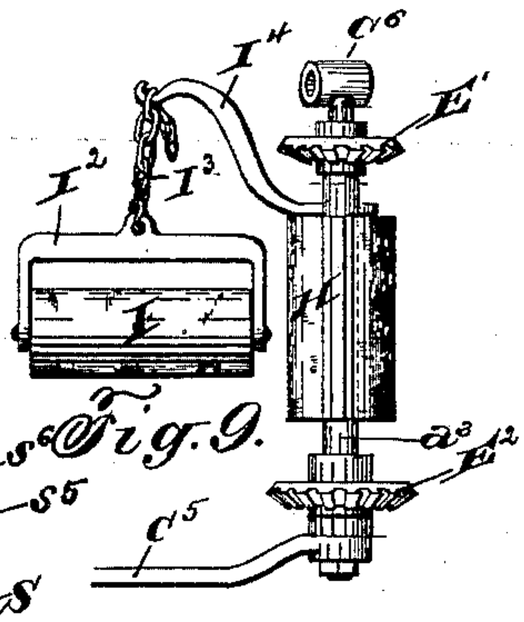

Fig. 2.

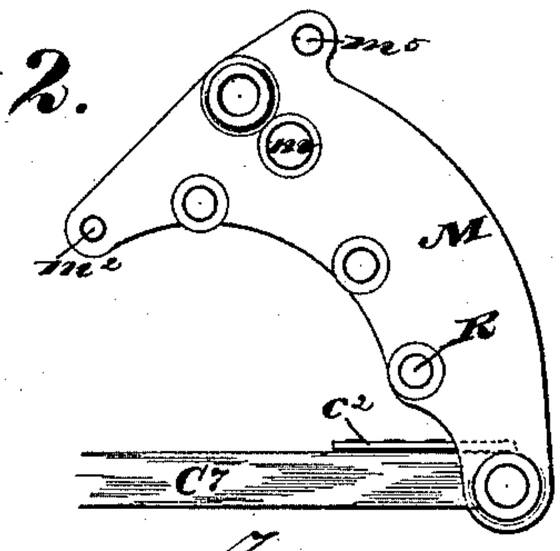

Fig. 5.

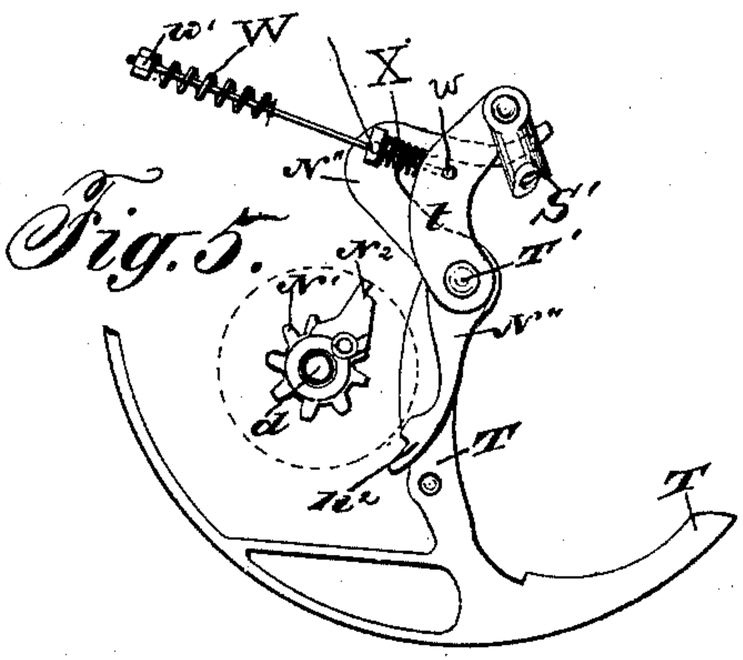

Fig. 4.

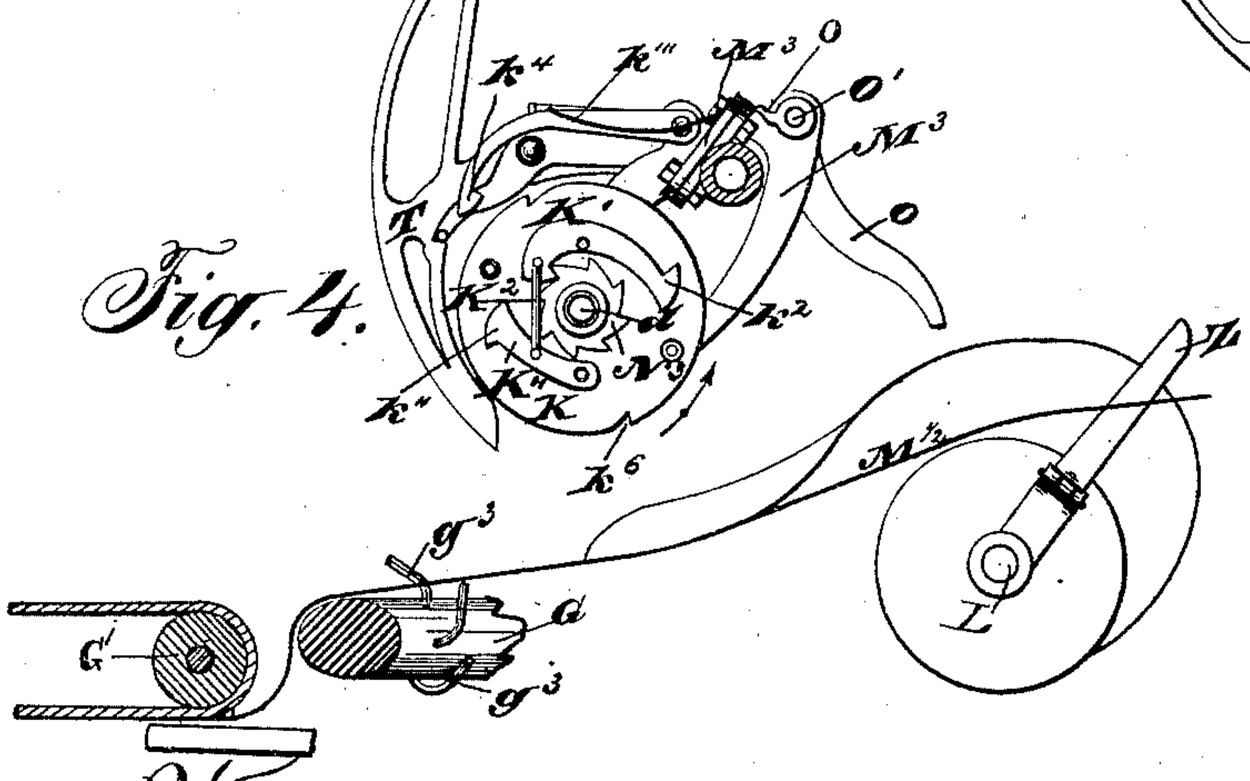

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Fig. 6.

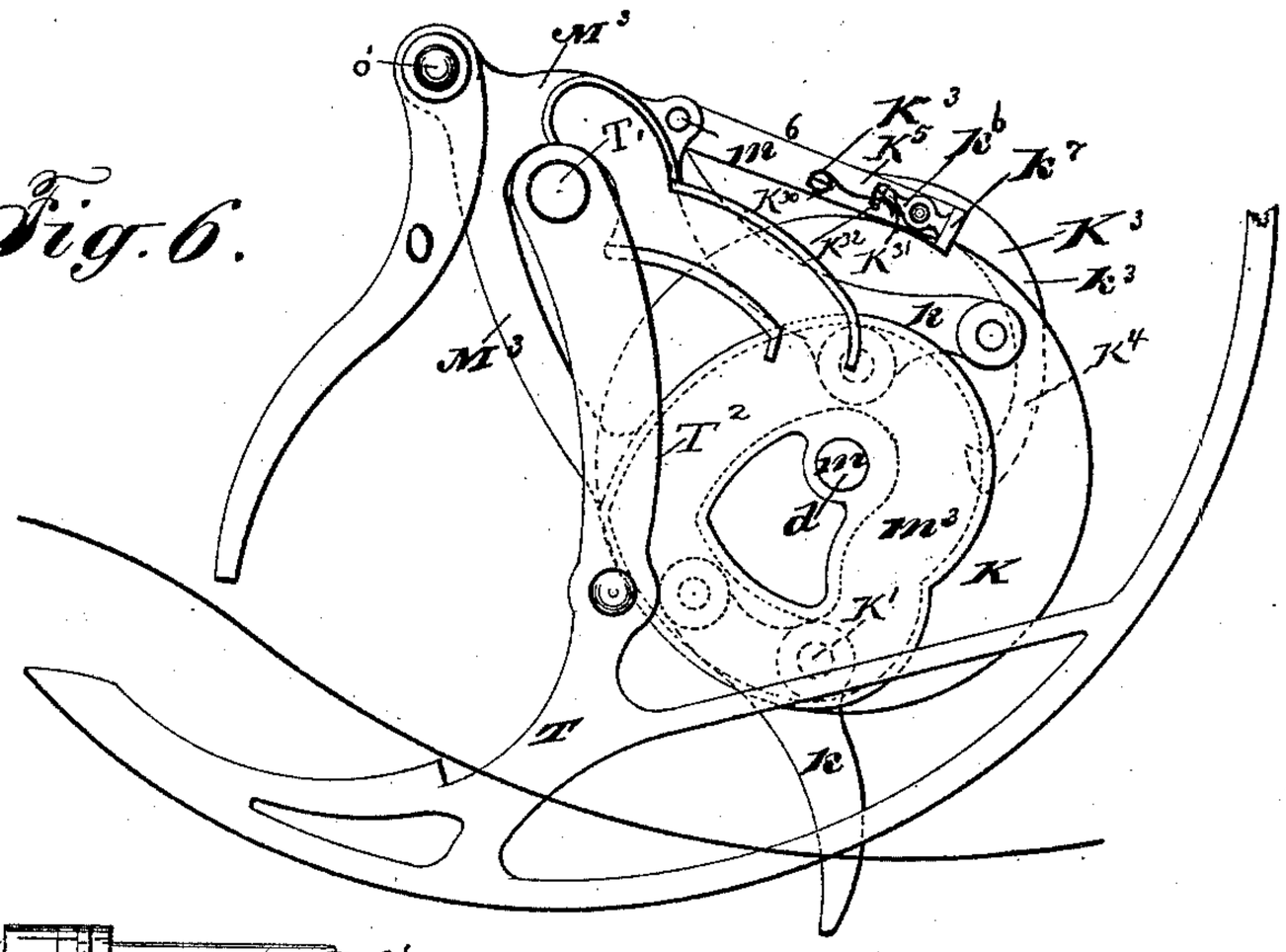
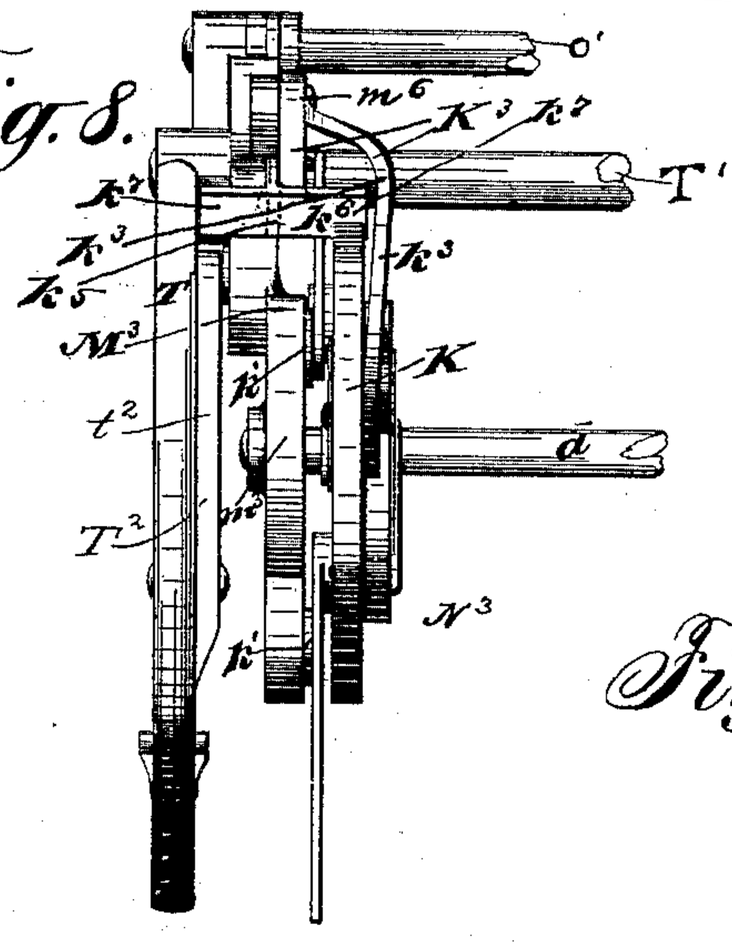


Fig. 8.



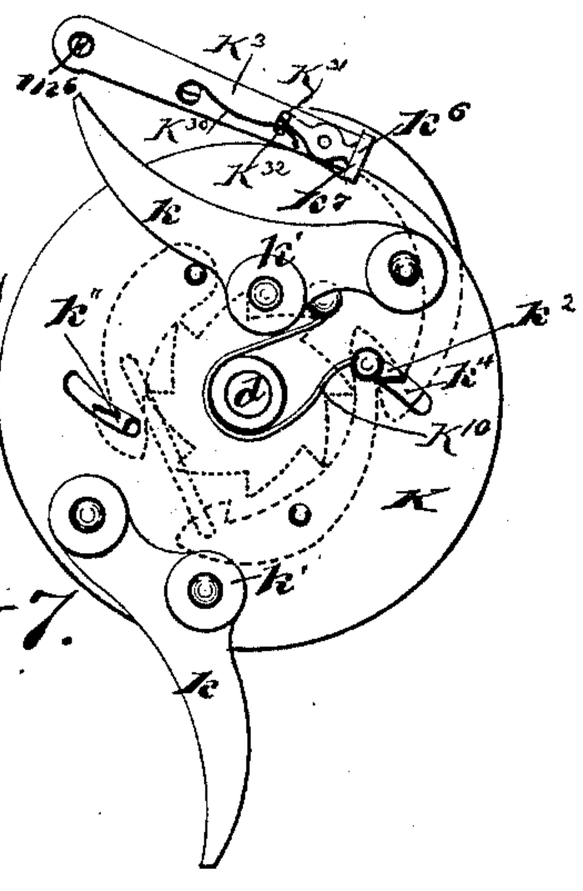


Fig. 7.

Witnesses:
L. C. Riggs
W. L. Parker.

Inventors
Robt. H. Dixon
and J. F. Steward
by Chas. S. Burton
their Atty.

UNITED STATES PATENT OFFICE.

ROBERT H. DIXON AND JOHN F. STEWARD, OF CHICAGO, ILLINOIS.

SELF-BINDING GRAIN-HARVESTER.

SPECIFICATION forming part of Letters Patent No. 452,836, dated May 26, 1891.

Application filed March 21, 1885. Serial No. 159,709. (No model.)

To all whom it may concern:

Be it known that we, ROBERT H. DIXON and JOHN F. STEWARD, citizens of the United States, and residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Self-Binding Grain-Harvesters, which are set forth fully in the following specification.

This invention relates to devices pertaining to the automatic adjustment and binding of grain in a self-binding harvester, particularly of that class which make the bundle without elevating the grain over the drive-wheel.

Figure 1 is a plan of harvester and binder containing my invention. Fig. 2 is a front elevation of the binder-frame. Fig. 3 is a front elevation of the binder-driving train having its several bearings in the said binder-frame or gear-standard. Fig. 4 is a front elevation of the needle or binding arm, packer-wheel, and rear compressor, shown in their relation to the binder-deck and discharger. Fig. 5 is a front detail elevation of the needle and the crank-arm on its rock-shaft and certain mechanism for locking it out of gear. Fig. 6 is a rear elevation of the needle, compressor, packer-wheel, and guiding-cam. Fig. 7 is a detail elevation of the packer-wheel. Fig. 8 is an inner side elevation of the same parts shown in Fig. 6. Fig. 9 is a detail inner side elevation of the butting-belt and the forwarding-belt.

A is the main wheel. A′ is the driving-gear thereon.

B is the main axle, terminating interiorly in the segment guide-block B′.

C is the segment guided in the segment guide-block B′ and having rigidly projected from it the platform-bar C′, the gearing-bracket C^2, and the binder-beam C^3.

Power is communicated from the main driving-gear A′ through the main driving-pinion A^2, shaft a, gear A^3, intermediate gear A^4, and gear A^5, all having their bearings in the gear-bracket C^2 to the horizontal shaft a^2, which has one bearing on the gear-bracket C^2 and the other on the upright support C^6, which is rigidly secured to and projected up from the bar C^5, which is bolted fast to the under side of the platform-bar C′, crossing the same at right angles and forming the inner end of the platform-frame. From the horizontal shaft a^2 power is communicated through the intermeshing bevel-gears D and D′ to the binder driving-shaft d, whose bearings are obtained one at e in the yoke C^{17}, which has also a bearing e' for the shaft a^2, and thereby serves to retain the two gears D and D′ permanently and accurately in mesh, and the other at m^2 on the binder-frame or gear-standard M, as hereinafter explained in detail. From the same shaft a^2 power is communicated through the intermediate bevel-gears E and E′ to the vertical shaft a^3, which is a tubular shaft surrounding the upright support C^6, having the said gear E′ fixed on the upper end and the bevel-gear E^2 fixed on the lower end and meshing with and driving the bevel-gear E^3, which is fixed on the front end of and so drives the horizontal shaft a^4, which is the shaft of the clearing-roller G, and which communicates motion by means of the sprocket-wheel g on its rear end and chain g' to the sprocket-wheel g^2 on the rear end of and driving the platform-carrier roller G′, whose shaft is journaled in the rear sill C^{10} and in suitable bearing upon the platform-bar C′. The clearing-roller has the retrocurved teeth or fingers g^3 at intervals of its length from the front to or somewhat beyond the middle, said teeth being adapted to revolve up through the slots f in the lower or inner end of the binder-deck F, sometimes regarded and named the "receiving-platform." The structure here described is the familiar one for the purpose of clearing the grain from the carrying-platform, except that the clearing-roller has no teeth or fingers toward the rear end, the omission being for a purpose hereinafter stated. The shaft a^3 carries the drum H, which drives the endless belt H′, called the butting or butt adjusting and forwarding belt, whose frame H^2 is swiveled upon the shaft a^3, and has at its rear end the bearings for the idle-roller about which the canvas belt H′ is driven. The rear end of the frame H^2 has secured to its upper head-board the spring-rod h, whose projecting end h' is adapted to rest in the notches of the notched bar h^2, secured to the binder-gear standard arm M^2, the rod springing sufficiently to allow it to be lifted clear of the notches and placed in any one of them at will, whereby the said rear end of the butting-belt

is adapted to be set back and forward, and so adjusted to correspond with the length of grain being bound.

I is also an endless belt, which will be referred to as the "forwarding-belt." Its driving and carrying drums *i* and *i'* are horizontal, the former being carried by the binder-driving shaft *d*, which carries also the packing mechanism, as hereinafter described, and the latter, which overhangs the delivery end of the conveying-platform, bearing in the headboards or frame I' I'', which in turn is sustained by the forked link I^2, connected by the chain I^3 to the overhanging hooked bracket I^4, which is secured upon the upper headboard H^2 of the butting belt-frame. Thus the forwarding-belt is adapted to be raised and lowered at the lower or inner end by taking up one or more links of the chain I^3; or it may be allowed in some cases to float upon the grain as it is delivered against and under its lower end, meanwhile revolving to advance the grain under it, as hereinafter more fully described. At the outer upper end of the forwarding-belt its frame is connected by the link I^5 to the frame H^2 of the butting-belt.

The shaft *d* has a key-seat *n*, and the flange-collars of the driving-drum *i* are adapted to slide on said shaft and be revolved by it by suitable key or set-bolt fitting said seat, so that as the butting-belt is adjusted forward and back for long and short grain the forwarding-belt receives similar adjustment, except that, whereas the angle of direction of the butting-belt is changed by adjusting it at one end only, the forwarding-belt preserves always its direction at right angles to the packer-driving shaft *d* and changes its distance from the butting-belt at the receiving end. The action of this forwarding-belt is to engage the grain by means especially of its slats i^2 as soon as the clearing-roller has delivered it off the platform-carrier and advance it to within reach of the packers.

In the form of structure shown, the binder being located obliquely to the direction of the platform-carrier, in order to deliver the bundle behind the wheel without locating the sickle in the rear of the main axle, it becomes necessary to turn the grain after it falls upon the platform-carrier into an oblique position corresponding to that of the binder-arm and packers, so that they may receive it at right angles or approximately at right angles to their planes of motion. The clearing-roller deprived of its teeth or fingers at the rear portion, the butting-belt traveling in an oblique direction from the heel of the sickle toward the binder, and the forwarding-belt also traveling in the said oblique direction, but particularly traveling in a direction at right angles to the packer-shaft, and so in the precise direction of the planes of motion of the packer and binder-arms and teeth, and having its slats crossing it in the precise direction which it desired to cause the grain to assume, are each and all, or any two combined, adapted to accomplish the said desired result of giving a new oblique direction and position to the grain. The teeth at the forward end of the clearing-roller seize the butts of the grain at the delivery end of the canvas, and the heads being more or less retarded by reaching the limit of the canvas and resting against the stationary binder-deck the grain is turned so that it lies obliquely, the butts being forward of the heads. One advantage of this is that the grain cannot so easily become lodged in the throat or dead-space at the end of the canvas as if its whole length were at that point exposed to the same action of the clearing-roller fingers, for by being slightly turned it lies across instead of falling into the throat and causing the canvas to become choked. At the same time the butting-belt acts upon the butts, its slats engaging and advancing them, and by its oblique direction forcing the grain somewhat endwise to the rear simultaneously with the turning which it effects. If the grain is short and the butting-belt has been on that account set back at the outer end, its effect in turning the grain will be correspondingly increased, and since in short grain the effect of the absence of teeth from the rear end of the clearing-roller will have less effect in turning the grain than in long grain, the greater turning effect of the more obliquely placed butting-belt is not objectionable. The grain delivered by the clearing-roller under the forwarding-belt I is thereupon subjected to the grasp of the said belt and of its cross slats or ribs i^2. The action of this belt, by reason of its breadth, is to turn the grain to a position at right angles to its motion, as will be understood from considering that the grain moved by the friction of a belt upon it while lying on a stationary surface will be moved chiefly by being rolled over and over, either the separate stalks or small or large aggregations of stalks or straws rolling thus under the friction of the moving surface above and the stationary surface below, and that if a stalk or straw or bundle of stalks or straws should be placed lengthwise of the motion of the moving belt it would with great difficulty be moved at all by it, and if placed directly across the direction of motion it will be most easily rolled and so advanced, and that intermediate directions would yield intermediate results as to ease and speed of advance. When, therefore, the grain comes under such moving belt lying in various directions, that which is most nearly at right angles to the direction of motion of the belt will move fastest and will overtake and crowd upon the rearward ends of the more obliquely lying grain, and thereby tend to force it into similar cross-position—*i. e.*, position across the direction of motion—from which will arise the result stated that the tendency of such moving belt will be to force all the grain advanced under it into position at

right angles to its line of motion. This effect is increased by the breadth of the belt, the said breadth being to an extent the length of lever which the straight grain uses to drive the oblique grain into its position; but the effect is most fully attained by use of the slats i^2, fixed at intervals across the belt I, the almost irresistible tendency of such slats being to bring the grain into position parallel with them as they advance against and upon it. This effect is constantly assisted by the action of the butting-belt, particularly on account of its tendency to push the grain endwise rearward, the grain so pushed alongside the slats on the forwarding-belt tending to fall into line parallel with said slats. A further result of the same sort is accomplished as the grain is delivered from under the forwarding-belt at the upper outer end of its length. The slight upward slope of the platform giving the grain a tendency to roll back will obviously cause it, whatever its position when first discharged, to fall back into position parallel with the end of the belt, against which it must rest when it rolls back. This effect occurs only in the slight interval between the strokes of the packer-teeth; but that stroke itself will have a similar effect, for the reason that, as hereinafter described, the binder-deck, sloping upward and forming a resistance against which the grain is packed, tends to give its own direction to the gavel packed upon it, and such gavel, as it begins to be formed, constitutes the fulcrum upon which that end of the grain which is too far forward will rest, while the packer turning the said grain upon such fulcrum brings the other end into line with the forming gavel. During the interval when the packers are at rest they form a fulcrum against and about which the grain actuated by the forwarding-belt in front of the packers is turned by advancing the butts, since the movement of the forwarding-belt is continuous.

The binder-frame comprises the binder-gear standard M and the rigidly-extended arms (preferably integral therewith) M′ and M^2, both horizontal, the former below and the latter above the binder-deck $M^{\frac{1}{2}}$. The entire frame is sustained upon the binder-beam C^3, rigidly projected rearward from the segment C in direction parallel with the horizontal arms of the binder-frame and piercing the binder-gear standard at *m*, where a bearing for said beam is provided, and may be such that the binder-frame may slide on said beam and be thereby rendered adjustable back and forward to accommodate different lengths of grain. The binder-frame is rendered stable on said outreaching binder-beam by the brace C^7, bolted to the platform-bar C′ and extended outward and rearward at right angles to the direction of the horizontal arms M′ M^2 of the binder-frame, and itself rendered rigid by the brace C^8, bolted to it and to the platform-bar C′. The brace C^7 abuts endwise against the binder-frame arm M′, and is provided with the overhanging lip c^2, of heavy metal plate, bolted to it, which projects above the said binder-frame arm. The only motion the binder-frame could have would be a rotary or rocking motion over the binder-beam C^3. That beam being several inches above the arm M′ and the vertical end of the brace C^7 and the horizontal surface of the lip c^2 forming an angle about said arm, they prevent any such rotary or rocking movement, and, with the said binder-beam C^3, render the binder-frame stable and rigid in relation to the main frame.

From the rear end of the binder-frame arm M^2 depends the rigid hanger M^3, which contains the rear bearing m^3 for the binder and packer driving shaft *d*. From the rear sill of the platform is extended the bracket M^4, which has the bearing *m′* for the rear end of the knotter-shaft L. The binder-driving shaft *d* beside the bearing m^3, located in the hanger M^3, has its front bearing at m^2 in the binder-gear standard and is driven continuously by the bevel-gears D D′, as above described, and communicates motion alternately to the packers and the binding and knotting mechanism. The mechanism by which such alternation is produced is the same in general as that heretofore known and used, but contains certain details and modifications which are part of the present invention, and I will now describe the entire movement, both those features which are known and those which are new, in order that the operation and importance of the latter may be understood.

At the rear end of the shaft *d*, rigid with it, is the ratchet-disk N^3, and close alongside said ratchet-disk is the packer-disk K, carrying the usual packer trip-teeth *k*, and close alongside the said packer-disk K the hanger M^3 has the cam m^3 to guide the packer trip-teeth by the engagement in its groove of the cam-rolls *k′* in the manner and for the purpose which is familiar. Pivoted on the disk K are the levers K′ and K″, connected by the link K^2. The lever K′ is a pawl to engage the ratchet-disk N^3, and is provided with the spring K^{10}, which is looped around the shaft *d*, one end bearing against the stop-pin k^{10}, fixed on the disk K, and the other end bearing against the pin k^{12} on the lever K′ and protruding through a slot in the disk K, thus tending to hold said lever in engagement with the ratchet-disk N^3. Both the levers K′ K″ have their outer ends provided with the hooks K^2 and K″, to be engaged as hereinafter described. When the pawl K′ is in engagement with the ratchet-disk N^3, the shaft *d* drives the packer-disk K, the packer-teeth *k* being guided by the cam m^3 in the familiar manner. The compressor-arm O is rigid with the rock-shaft O′, which has its bearings one in the lug m^4 of the hanger M^3 and the other at m^5 in the gear-standard M, through which it extends forward, and has the rigid crank-arm O^2, provided with the cam-surface *o*, for a purpose hereinafter

stated. To the crank-arm O^2 is connected the compound extensible link P, whose telescoping sections P′ and P^2 are provided within the one and encircling the other, with the "compressor-spring" Q, so named because by tending to resist the extension of the compound-link it becomes the means of pressure which the compressor exerts against the bundle. At the lower end this link P is connected to the lever R, which is pivoted at v' to the binder-gear standard, and is provided at its remaining corner with the stud and roll r' to engage in the cam s on the gear-wheel S, for a purpose hereinafter stated.

Loose on the binder-driving shaft d is the gear N′, adapted to be engaged with and driven by said shaft by the dog N‴ when the latch N^2 is disengaged from the detent-lever N″, the construction being substantially that of the so-called "Appleby clutch." The gear N′, by means of the two intermediate gears N^4 and N^5, drives the gear S, all said gear-wheels being journaled on the binder-gear standard M. From the gear S the pitman S′ is connected to the crank-arm t of the rock-shaft T′, which is journaled in and extends through the overhanging arm M^2 of the binder-frame and carries at its rear end the needle or binding arm T. When the compressor-arm O is moved rearward by the pressure of the packers against the intervening accumulating bundle, the crank-arm O^2, acting by its cam-surface o against the end of the lever N″, rocks it over its pivot (which is the rock-shaft T′) and disengages the detent-shoulder n^2 from the latch N^2, and thereby causes the gear N′ to come into engagement with and be driven by the shaft d. The revolution thus communicated to the gear S causes the pitman S′ to actuate the crank t and rock the shaft T′ and swing the needle T down toward the bundle.

At m^6 on the hanger M^3 is pivoted the forked lever K^3, provided with a spring k''', tending to force it to swing downward. The branch k^3 overhangs the shaft d in front of the disk K and has the hook k^4, adapted when in proper position to engage the hook k^2 or k'' of the lever K′ or K^2. The main arm of the lever K^3 overhangs the shaft d behind the disk K and has pivoted at the end of it the T-shaped latch k^6, one end of whose cross-arm k^7 is in position to rest upon the back of the radial arm T^2 of the needle T when the latter is at rest, the said arm T^2 being laterally flanged or deflected at t^2 for that purpose, and the other overhangs and is adapted at proper time to rest upon the edge of the disk and provided with a spring k^{30}, tending to throw it down as far as the stop-pin k^{31}, playing in the slot k^{32}, will permit. When the needle receives its initial motion, as above described, its descent allows the lever K^3 to descend and the hook k^4 of the branch k^3 to pass below the track of the hooks k^2 and k'' of the levers K′ and K″ and to collide with the back eccentric edge of one or the other of said levers, and, as the disk revolves, force the pawl-lever K′ out of engagement with the ratchet-disk N^3, and so out of connection with the driving power, and by the engagement of the hook k^4 with the hook k^2 or k'' of either the lever K′ or K″ positively to stop and detain the said disk K and the packers from further motion. The needle, meanwhile continuing to descend, lets the latch k^6 down onto the edge of the disk, where it falls into the notch k^7 or k^8, located at such point on the edge of the disk K that the said latch may engage one or the other at the instant the hooks of the levers K^3 and K′ or K″ have engaged, as above described, whereby the said disk is securely locked against reverse movement. Meanwhile the action of the binding mechanism continues, the cam-roller r' on the lever R standing in inner concentric portion s'' of the cam-groove s on the gear-wheel S, and the spring Q in the extensible link P being held compressed by the pressure of the needle or binding arm T, which is encircling the bundle with the cord. By the time the revolution of the gear-wheel S has brought the eccentric portion s''' of the cam-groove s to the cam-roll r' the needle has fully encircled the bundle. At this point the further revolution of the gear-wheel S will cause the eccentric part s''' of the cam-groove s to rock the lever R over its pivot at v' and draw the inner member P^2 of the extensible link P downward, compressing the spring Q and communicating such pressure, through the lever or crank-arm O^2 and the rock-shaft O′, to the compressor-arm O, so additionally compressing the bundle and allowing slack cord, at that instant needed for the purpose of making the knot. The lever N″ is provided with the spring W, coiled under the stop-nut w' about the rod W′, which is connected at w to the crank-arm t, tending to force and retain said lever N″ in position to engage the latch N^2. When the action last described occurs, the bundle yielding to the pressure allows the crank O^2 to withdraw from the end of the lever N″. The immediate effect of this action, if not counteracted, would be to allow the lever N″ to yield to the pressure of the spring W if the upward motion of the crank, thrusting the rod W′ and stop-nut w' upward, had not removed the spring too far to exert its pressure, and in that case the weight of the lever itself or the jarring of the machine might produce the same effect, which would be to swing the lever back into range of the revolving dog N^2 and engaging it to disconnect the gear N′ from the driving-shaft d and arrest the action of the binder, leaving its work uncompleted. To prevent this result there is provided the spring X under the lever N″ and bearing below against the crank-arm t, so that the crank as it rises compresses the spring X and exerts a pressure against the lever N″ to retain it in the position to which it has been forced by the compressor rock-shaft and crank O^2. This spring serves

a further purpose, which will be understood by considering that if the bundle should at any time be removed, the pressure upon the compressor being thus removed, it would return toward the packers precisely as in the action above described. It is forced in that direction by the cam s'''. The situation is the same whenever for any reason it becomes necessary to make a revolution of the binder without forming a bundle, commonly done by forcing the compressor back by the hand, so tripping the binding mechanism into action. In this case, in the absence of the spring X, it would be necessary to hold the compressor back through the entire revolution of the binder, or else the action would be interrupted at an incomplete stage and the binder be thereby thrown out of time with the other movements. After the eccentric portion s''' of the cam s has passed, the radial portion s^4 arrives at the cam-roller r' and carries it outward, rocking the lever R, so as to throw the link P upward, relaxing the spring Q until the inner member P^2 of the link strikes the upper end of the telescope cavity of the outer member, and the link, being thus at its shortest, moves upward bodily, rocking the shaft O′ by means of the crank-arm O^2 and throwing the compressor O upward entirely out of the way of the bundle, while simultaneously the dischargers Z Z on the rear end of the shaft L, carried by the gear S, rise through the deck $M\frac{1}{2}$ behind the bundle, and while the roller r' stands in the outer concentric portion s^5 of the cam-groove s move forward against and discharge the bundle. The radial portion s^6 of the cam-groove s, having now reached the roller r' forces it inward, rocking the lever R, so as to draw down the link P, rocking the shaft O′, and throwing the compressor toward its initial position. The crank-arm t, having simultaneously been drawn down, has relaxed the spring X and brought the stop-nut w' down upon the spring W, which, acting upon the lever N″, no longer restrained by the crank O^2, rocks it over its pivot and throws its detent-shoulder n^2 into range of the revolving latch N^2, with which it presently collides, and thereby unlocks the gear N′ from its driving-shaft and positively detains it by the said engagement between the latch N^2 and the lever N″. Simultaneously with the latter part of this action the needle-arm T has risen to its initial position above the deck, and in rising has lifted the forked lever K^3 and disengaged the hook k^4 from the pawl-lever K′ or K″ and permitted the latter to yield to the pressure of its spring K^{10} and fall into engagement with the ratchet-disk, by which engagement the packing mechanism is brought again into action.

We claim—

1. In a self-binding harvester, the forwarding-belt on parallel horizontal rollers overhanging the binder-deck, adjustable bodily in the direction of its roller-axes.

2. In a self-binding harvester, the forwarding-belt on parallel horizontal rollers overhanging the binder-deck, adjustable bodily in the direction of the roller-axes and vertically adjustable at its receiving end.

3. In a self-binding harvester, the frame of the forwarding-belt, the binder-frame, the shaft of the forwarding-belt-driving roller journaled on the binder-frame, overhanging the deck, and serving as the pivotal support for the belt-frame, the overhanging bracket-hook supported at the front end by the harvester-frame, the forked link striding the forwarding-belt-frame at the receiving end, and the flexible and adjustable connecting chain or cable from the bracket-hook to the forked link, all combined and co-operating as set forth, whereby the forwarding belt is adapted to be adjusted as described.

4. In a self-binding harvester, in combination with the platform and the binder-deck and the means for delivering the grain from the former onto the latter, the vertical butting-belt moving obliquely to the lines of motion of the platform-conveyer, and delivering mechanism pivoted near its forward roller and adjustable back and forward at its rear roller, a forwarding-belt carried on horizontal rollers overhanging the deck and moving obliquely to the motion of the platform-conveyer and adjustable back and forward in the direction of its roller-axes.

5. In a self-binding harvester, the oblique forwarding-belt adjustable bodily in the direction of its roller-axes and preserving its direction of motion unchanged by such adjustment, in combination with the oblique butting-belt adjustable horizontally at one end and changing its direction of motion by such adjustment.

6. In a self-binding harvester, the butting-belt adjustable horizontally at the rear or binder end and the forwarding-belt adjustable bodily in the direction of its horizontal axes, in combination with the connecting-link from the movable end of the butting-belt frame to the forwarding-belt frame, whereby the adjustment of either frame is automatically communicated to the other.

7. In combination with the platform-conveyer delivering the grain sidewise, the clearing-roller located at the delivery side of the conveyer, the binder-deck extending obliquely rearward and stubbleward beyond the clearing-roller, and the butting-belt located over the forward part of the binder-deck and operating obliquely rearward and stubbleward, the clearing-roller being provided with grain-feeding teeth over its forward part only, substantially as set forth.

8. In combination with the platform-conveyer delivering the grain sidewise, the clearing-roller located at the delivery side of the conveyer, the binder-deck extending obliquely rearward and stubbleward beyond the clearing-roller, the overhanging forwarding-belt and the butting-belt, and the packers, all operating beyond the clearing-roller in lines

obliquely rearward and stubbleward, the clearing-roller having grain-forwarding teeth over its forward part only, substantially as set forth.

9. In combination with the binder-frame overhanging the deck, the continuously-driven binder-driving shaft journaled therein and extending across the deck, the packers intermittingly connected to and revolved by said shaft, and the forwarding-belt having its driving-roller fixed on said shaft and continuously driven by it.

10. In a self-binding harvester, in combination with the lever N″, the compressor-shaft crank O^2, located and adapted to actuate said lever, the needle-shaft crank *t*, and the spring X, suitably retained between said crank and lever on the same side of the lever and on the same side of its pivot as the compressor-shaft crank, whereby the said needle-shaft crank is caused to communicate to the lever a yielding pressure in the same direction as the positive pressure communicated by the compressor-shaft crank.

ROBERT H. DIXON.
JOHN F. STEWARD.

Witnesses:
D. W. C. GATES,
C. M. HUNT.