4 Sheets—Sheet 1.

I. KAREL.
Grain-Binder.

No. 208,741. **Patented Oct. 8, 1878.**

Fig. 1

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I. Karel

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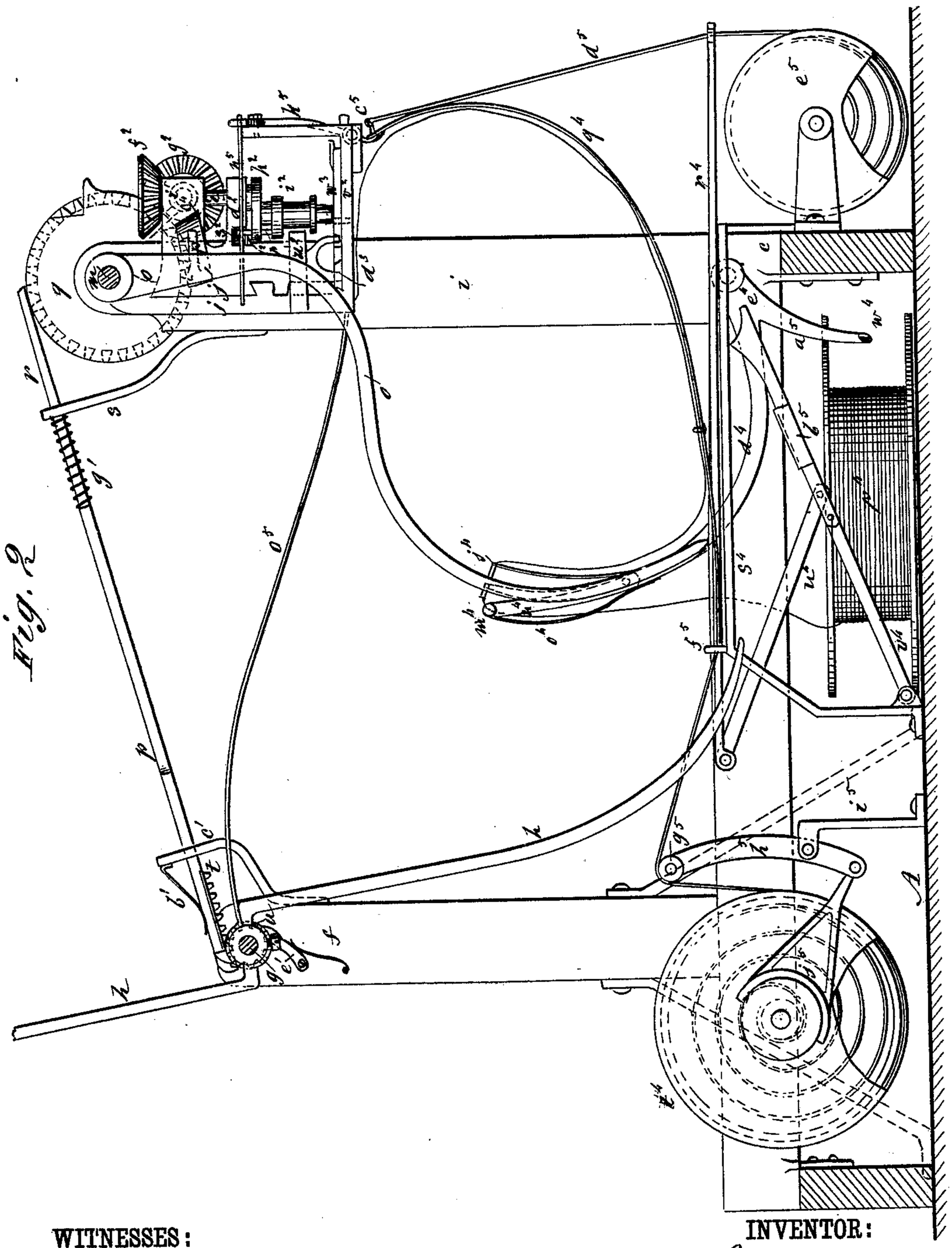

Fig. 2.

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Fig. 3

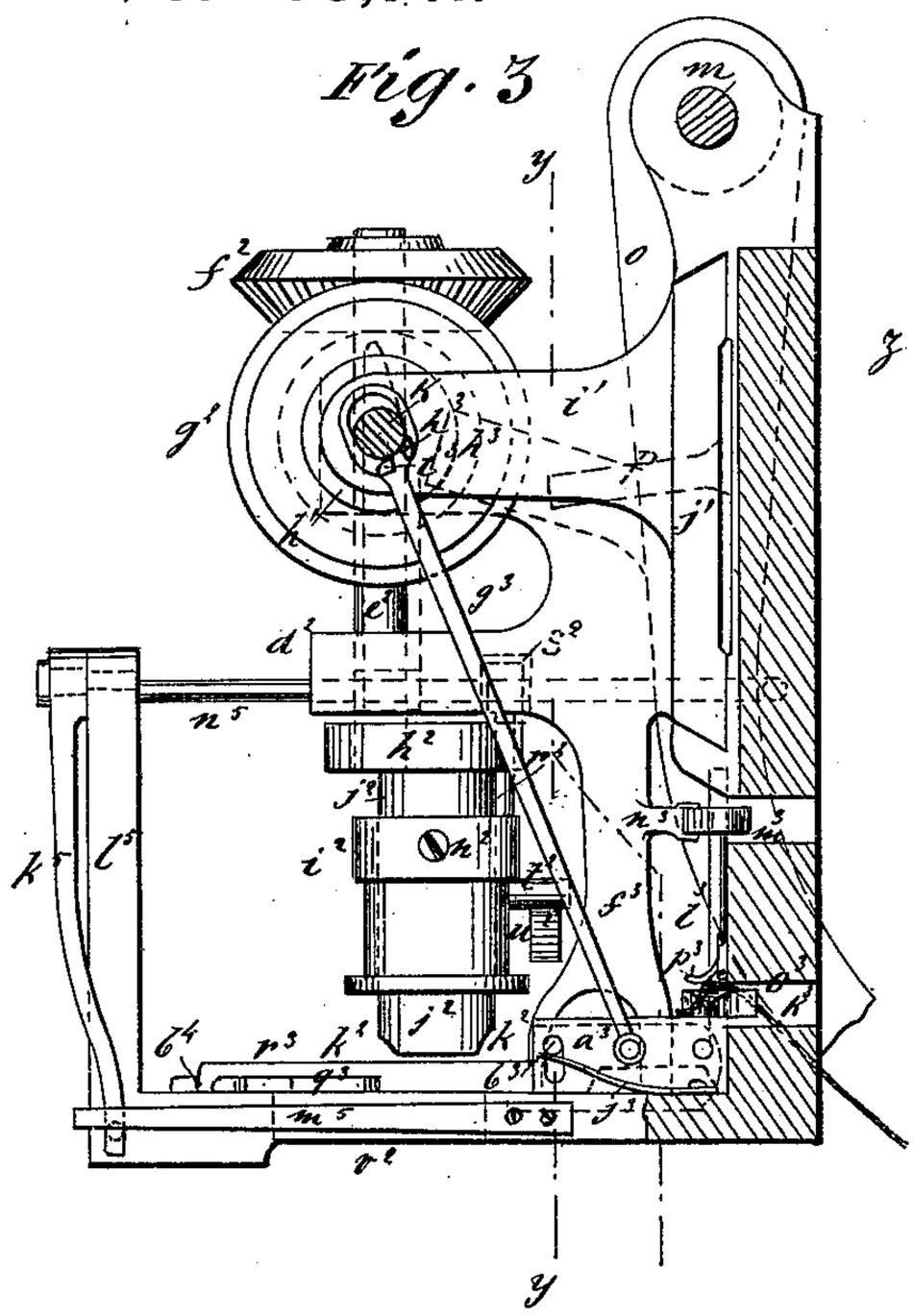

Fig. 4

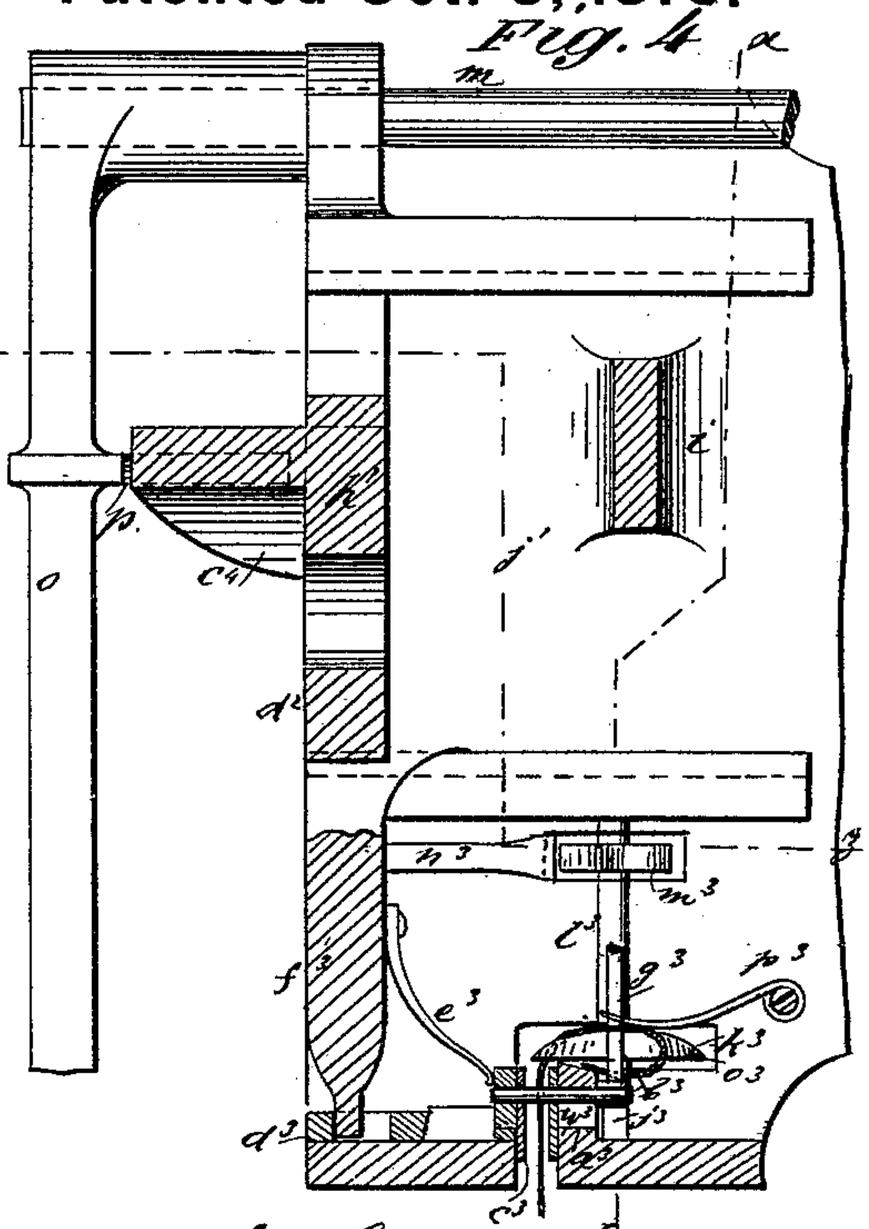

Fig. 5

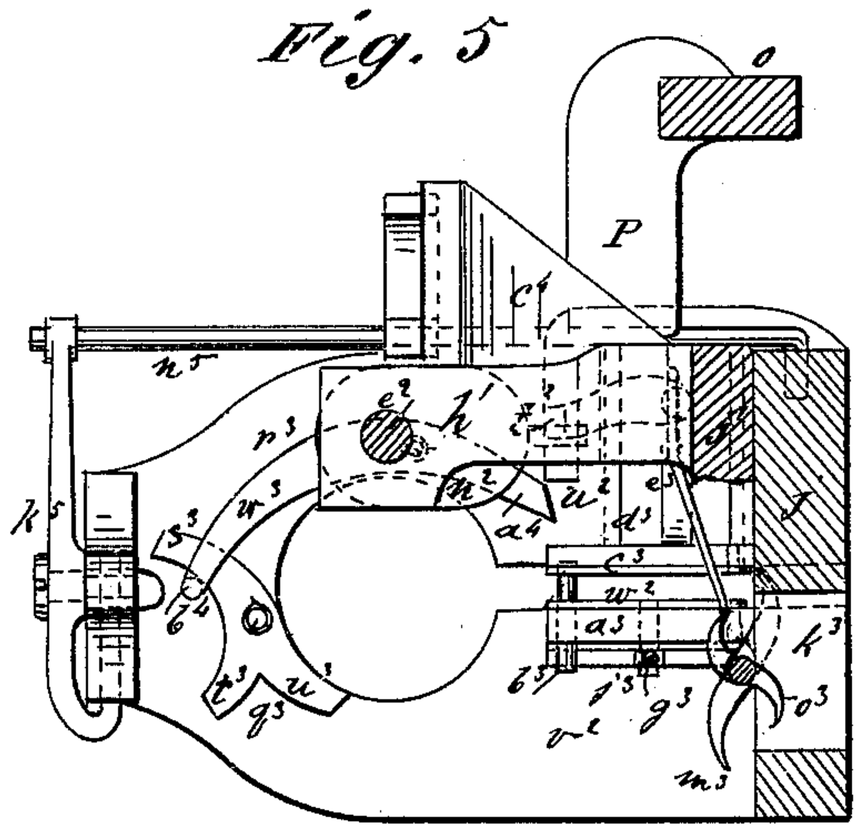

Fig. 6

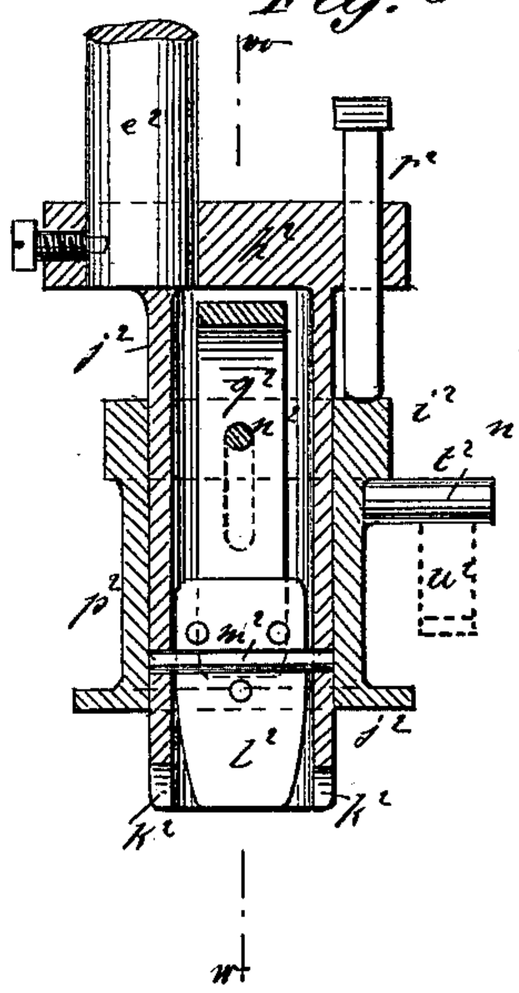

Fig. 7

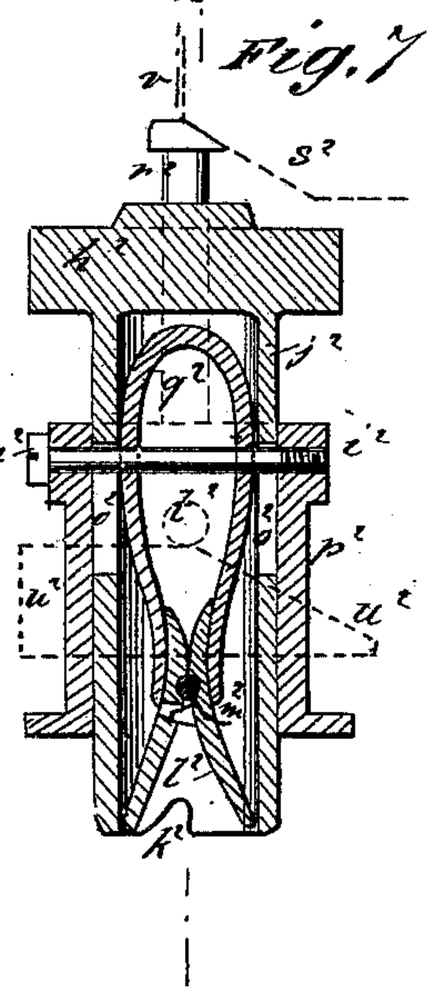

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Fig. 11

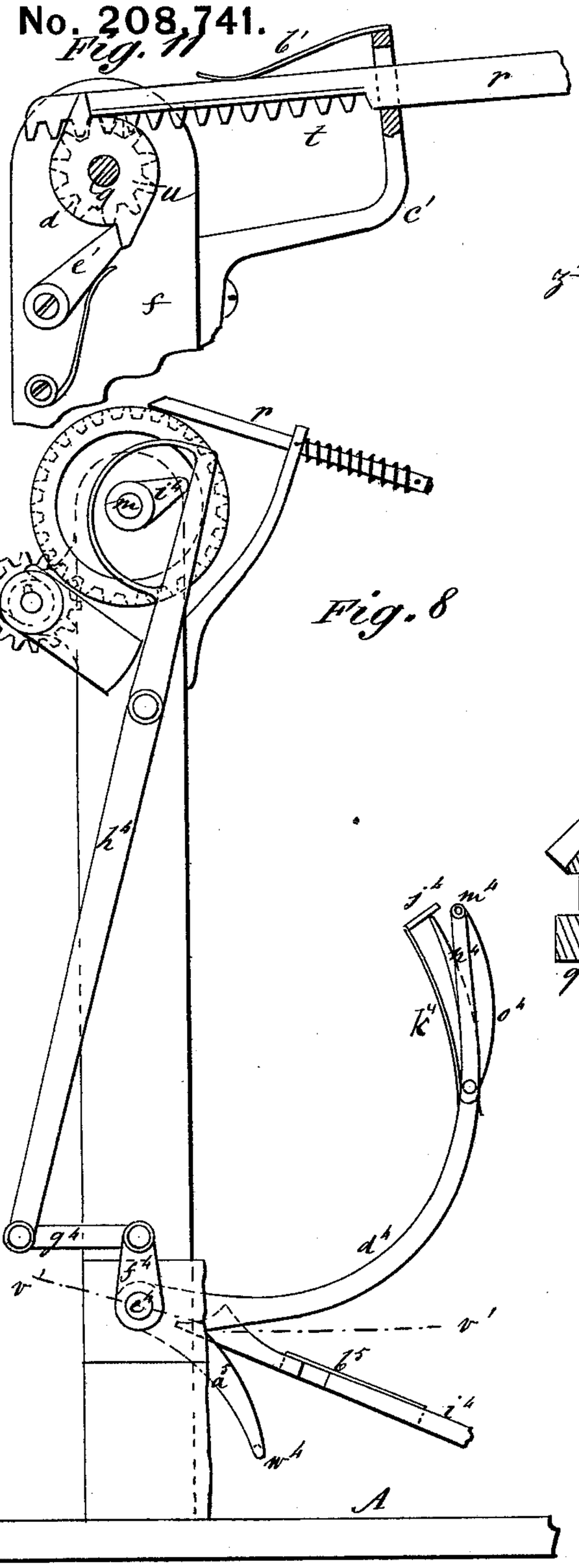


Fig. 8

Fig. 9

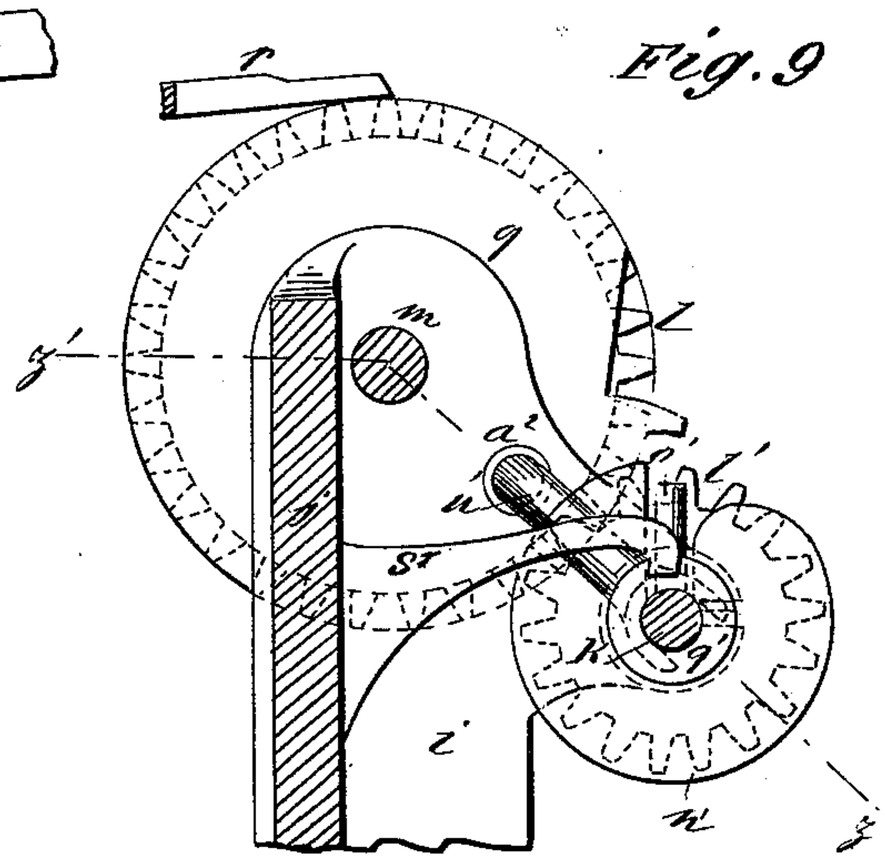


Fig. 10

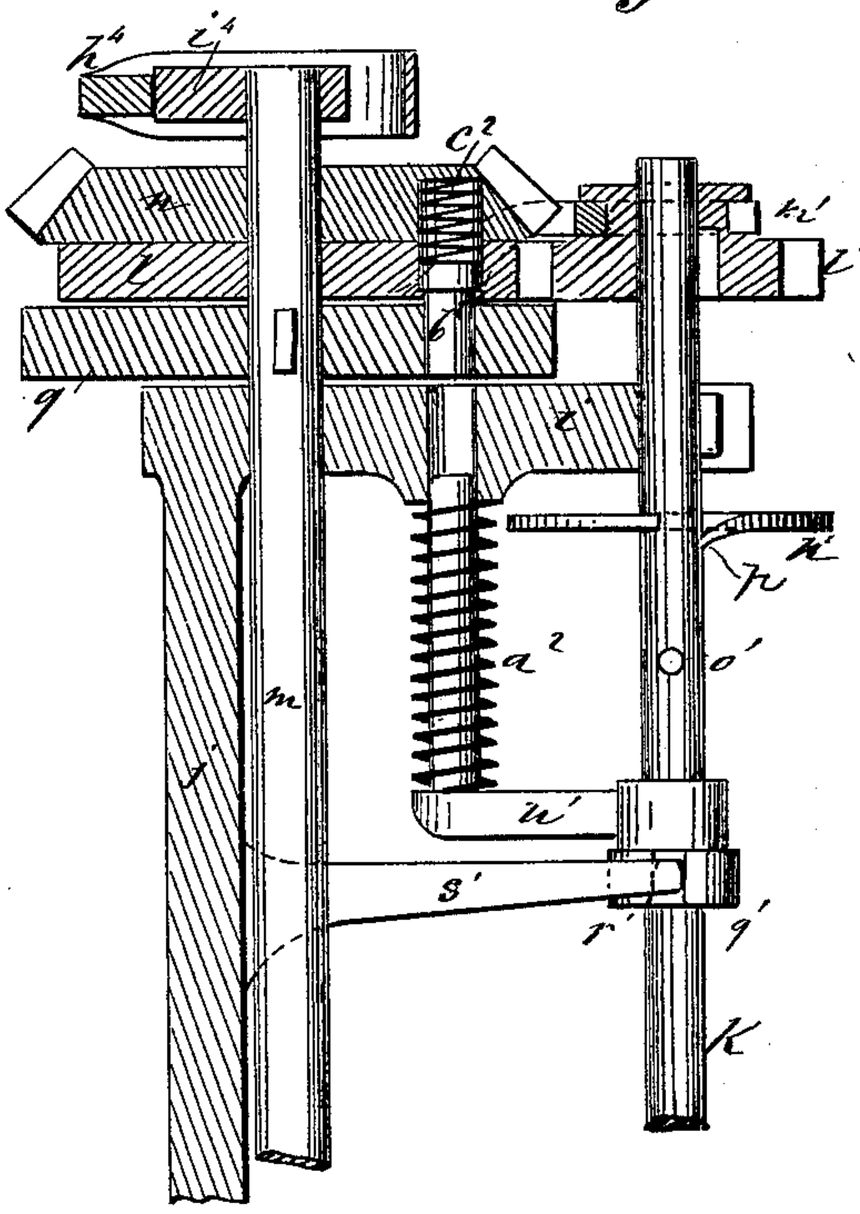
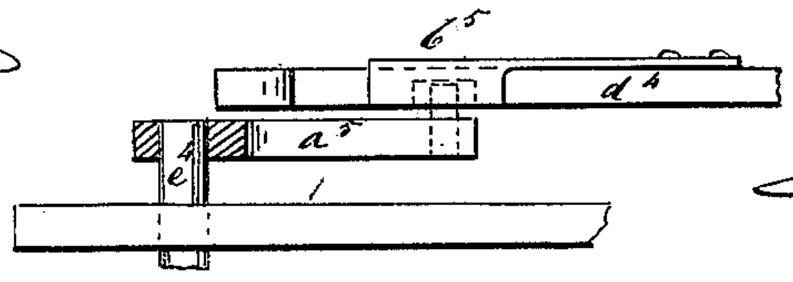


Fig. 12



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INVENTOR:

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UNITED STATES PATENT OFFICE.

IGNATZ KAREL, OF BLUE EARTH CITY, MINNESOTA.

IMPROVEMENT IN GRAIN-BINDERS.

Specification forming part of Letters Patent No. **208,741**, dated October 8, 1878; application filed May 18, 1878.

To all whom it may concern:

Be it known that I, IGNATZ KAREL, of Blue Earth City, in the county of Faribault and State of Minnesota, have invented a new and Improved Grain-Binder, of which the following is a specification:

Figure 1 is a front elevation of my improved grain-binder. Fig. 2 is a side elevation. Fig. 3 is an enlarged detail sectional view of the knot-tying apparatus, taken on line *x x* in Fig. 4. Fig. 4 is an enlarged vertical section taken on lines *y y* in Fig. 3. Fig. 5 is an enlarged horizontal section taken on line *z z* in Fig. 4. Fig. 6 is an enlarged detail sectional view taken on line *v v* in Fig. 7. Fig. 7 is a vertical section taken on line *w w* in Fig. 6. Fig. 8 is a partial end view, showing the bundle-compressing and thread-carrying mechanism. Fig. 9 is an enlarged sectional view taken on line *x' x'* in Fig. 1. Fig. 10 is a sectional view taken on line *z' z'* in Fig. 9. Fig. 11 is a detail view of the fork-rotating mechanism. Fig. 12 is a detail sectional view on line v^1 v^1 in Fig. 8.

Similar letters of reference indicate corresponding parts.

My invention relates to grain-binders for binding grain by means of twine; and it consists in a device for bundling, which also carries the twine to the knot-forming and twine-cutting mechanism.

It also consists in a novel arrangement of parts for forming the knot; also, in a combination of levers and gearing for operating the different parts of the apparatus.

The object of my invention is to provide a light, simple, and easily-operated attachment for reapers for binding the bundles of grain as they are discharged from the reaper-table.

Referring to the drawing, A is the bed of the machine, which may be an extension of the reaper-platform, or it may be made separately and attached to the reaper-platform. Upon the bed A there are four cross-pieces, *a b c d*, which support a table, B. (Shown in dotted lines.)

To the two outer cross-pieces, *a d*, are attached standards *e f*, in the upper ends of which a horizontal shaft, *g*, is journaled. To this shaft are secured four curved tines or arms, *h*, arranged in two pairs, the tines in each pair projecting from diametrically opposite sides of the shaft. The pairs of tines are separated, so as to straddle the two cross-pieces *b c* during the lower part of their revolution. These tines receive the grain from the table of the reaper and deliver it to the binding apparatus.

A standard, *i*, is secured to the cross-piece *d*, and carries at its upper end an arm, *j*, that supports at its free end the knot-forming apparatus, which is driven by a horizontal shaft, *k*, that receives its motion from a spur-wheel, *l*, on the standard end of the shaft *m*, which is journaled in boxes supported by the standard *i* and arm *j*.

The wheel *l* turns loosely on the shaft *m*, and is secured to a bevel-wheel, *n*, which is also loose on the shaft. Motion is communicated to the bevel-wheel *n* from some rotating part of the reaper to which the binder is attached.

The shaft *m* projects beyond the free end of the arm *j*, to receive a curved arm, *o*, the end of which projects downward between the two middle cross-pieces *b c*. This arm also carries a cam, *p*, for operating parts of the knot-forming apparatus.

A notched disk, *q*, is secured to the shaft *m* between the spur-wheel *l* and the standard *i*, and upon it rests one end of a rod, *r*, which is guided by an apertured arm, *s*, secured to the standard *i*. The other end of this rod is provided with a rack, *t*, which engages a pinion, *u*, on the shaft *g*, and is guided by a slotted arm, c^1, secured to the standard *f*, and is pressed into engagement with the pinion *u* by a spring, *b'*, secured to the slotted arm c^1.

The shaft *g* is provided with a ratchet, d^1, having two teeth, which correspond in position with the tines *h*. The said ratchet is engaged by a spring-acted pawl, e^1, which is pivoted to the standard *f*.

A flange projects from the side of the rack *t*, and is engaged by one of the teeth of the ratchet d^1 at every half-revolution of the tines *h*, so as to throw the rack out of engagement with the pinion *u*.

As the rod *r* is moved forward by engagement with the notched disk *q*, it turns the shaft *g* through a half-revolution, and as this movement of the shaft is completed the rack

t is lifted out of engagement with the pinion u by the ratchet-teeth, as before described, when the spring g^1 returns the rod r to its normal position, where it remains until it is again moved by the notched disk q.

The shaft k is journaled in arms h^1 i^1, that project from a plate, j^1, that slides in ways k^1, formed on the arm j, and is also journaled in an arm that projects from the standard i. The pinion l^1 on the shaft k, by which the said shaft takes motion from the wheel l, is placed loosely on the shaft, but is prevented from turning thereon by a slot in the pinion and a feather in the shaft, and the said pinion has a grooved hub, which receives a forked arm, m^1, that is secured to the standard i, and prevents the pinion from moving laterally while the shaft t is moved longitudinally.

A disk, n^1, which is perforated centrally to receive the shaft k, and is slotted from the central aperture to its periphery to admit of passing the pin o^1, is secured to the standard e by means of an ear projecting from its edge, and a portion of the disk at one side of the slot is curved toward the free end of the arm j, forming the lip p^1.

A collar, q^1, having in one side a slot, is secured to the shaft k, and is engaged by a projection on the under side of the arm s^1 when the shaft is at rest.

Between the collar q^1 and the pin o^1 upon the shaft k is placed an arm, u^1, which is bent at right angles and extends through the standard i, and is forced against the collar q^1 by a spring, a^2. A pin, b^2, is placed in a hole drilled in the wheels n l, and is thrown forward into a hole drilled in the notched disk q by a spring, c^2.

The position of the arm u^1, that projects through the standard i, is such that once during every revolution of the notched disk q the arm u^1 and the pin b^2 fall into the same axial line, when a movement of the arm u^1 in the direction of the wheels n l will force the pin b^2 from the disk q, permitting the wheels n l to revolve independently of the disk, at the same time locking the said disk, so that it remains stationary.

Below the arm h^1 there is an arm, d^2, which projects from the sliding plate j parallel with the said arm. In the outer ends of the arms h^1 d^2 a short vertical shaft, e^2, is journaled. A miter-wheel, f^2, is secured to the upper end of this shaft, which meshes with a similar miter-wheel, q^2, placed between the arms h^1 i^1, and on the shaft k. To the lower end of the shaft is secured the plate h^2, which carries the knot-forming device i^2.

The knot-former i^2 consists of a tube, j^2, the upper end of which is secured to the plate h^2, and in the lower end thereof there are notches k^2, on diametrically opposite sides, for receiving the binding-twine after it has been carried around the bundle of grain by the mechanism presently to be described.

The notches k^2 have one straight and one inclined side, and are oppositely disposed in respect to each other, so that the twine is engaged by the two notches as the tube j^2 is turned. The axis of the tube j^2 is eccentric to the axis of the shaft e^2, so that the motion of the tube is the same as that of a crank or eccentric.

The tube j^2 contains a pair of nipper-jaws, l^2, which are pivoted on a pin, m^2, that passes through the tube. The outer sides of the nipper-jaws l^2 are slightly concave in the direction of their length, and their upper ends are extended a short distance above their pivot.

The outer sides of the jaws are pressed by the curved ends of a horseshoe-shaped spring, q^2, which is retained in position by a bolt, n^2, which passes through slots o^2 in opposite sides of the tube j^2, and also through the sides of a sleeve, p^2, that is fitted to the outer surface of the tube j^2. This sleeve is capable of sliding upon the tube j^2, and when moved carries with it the spring q^2, which, when moved so that its ends press the upper ends of the jaws l^2, throws the said jaws open, but when it is moved downward, so as to press the sides of the jaws l^2 below their pivot, closes the jaws, and thus causes them to clamp the twine, which extends across the lower end of the tube and is received by the notches k^2. A pin, r^2, passes through a hole in the plate h^2, and rests upon the upper end of the sleeve p^2. This pin is moved downward at the proper instant by engagement with an inclined surface, s^2, formed on the under side of the arm d^2. The sleeve p^2 is lifted by the engagement of a pin, t^2, that projects from one of its sides, with an inclined plane, u^2, supported by an arm projecting from the end of the arm t^2.

Below the lower end of the tube j^2 a plate, v^2, projects horizontally from the arm j, and is apertured below the said tube, and slotted from the aperture backward throughout, and the arm j is also slotted to admit the twine-carrier. Upon one side of the slot in the plate v^2 there is a jaw, w^2, one end of which is pivoted to a flange, a^3, that projects upward from the plate v^2. The other end is movable, and is connected, by means of a pin, b^3, with a jaw, c^3, which is pivoted to a flange on a plate, d^3, that slides in ways on the plate v^2. The flange of the plate d^3 is pressed by a spring, e^3, which is secured to an arm, f^3, that projects downward from the arm d^2, and enters a short slot in the plate d^3. By means of the spring e^3 the jaws w^2 and c^3 are forced together with a yielding pressure when the plate j^1 and parts attached are moved from the outer end of the arm j, and when the arm f^3 reaches the end of the slot in the plate d^3 the pressure is positive. The twine used in tying is clamped between the jaws w^2 c^3 during the operation of tying, and the jaws are raised by a spring, j^3, which engages the pin b^3, and are depressed (turning on their pivots) by a rod, g^3, which is pivoted to the jaw w^2, and has at its upper end a short slot for receiving the shaft k. A cam, h^3, projects from the shaft k, and a beveled pin, i^3, projects from rod g^3 below the shaft

The engagement of the cam h^3 with the pin i^3 effects a momentary downward movement of the rod g^3 and jaws w^2 c^3.

Above the flange a^2 there is a horizontal slot, k^3, in which is placed an **S**-shaped rotating twine-cutter, o^3, which is mounted on a short shaft, l^3, that turns in boxes secured to the arm j. To the upper end of the shaft l^3 is secured a cross-arm, m^3, which is engaged by a pawl, n^3, carried by the arm f^3, at each movement of the plate j^1 from the end of the arm j, so as to cause the knife o^3 to make a half-revolution. The cutter o^3 turns in contact with the edge of the flange a^2 and cuts the twine, and carries the free end thereof under a spring, p^3, which is secured to the arm j and rests upon the knife o^3. To the plate v^2 are pivoted two levers, q^3 r^3. The lever q^3 has three arms, s^3 t^3 w^3. The edge of the lever between the arms s^3 t^3 is concave, and the arm w^3 is curved to conform to the aperture in the plate v^2.

The lever r^3 has two arms, w^3 a^4, and is curved so that its arm w^3 overlaps the lever q^3. This arm is provided with a stud, b^4, which engages the curved edge of the lever q^3.

The sliding of the plate j^1 is effected at the proper instant by the engagement of the cam p on the arm o with the inclined plane e^4, that projects from the plate j^1, and its return is effected by the spring a^2 on the arm u^1.

A curved arm, d^4, is supported between the cross-pieces b c upon the end of a rock-shaft, e^4, which is journaled in the said cross-pieces, and is provided at its outer end with an arm, f^4, which is connected by a short connecting rod or link, g^4, with a lever, h^4, that is fulcrumed on a stud that projects from the standard i. The upper and shorter arm of the lever h^4 is engaged during half of the revolution of the shaft m by an arm, i^4, secured to the end of the said shaft, so as to turn the shaft e^4, and thus raise the arm d^4. The free end of the curved arm d^4 carries a twine-guide, j^4, which consists of a short half-tube, that is secured to the end of a spring, k^4, attached to the concave side of the arm. The twine-guide j^4 projects in a radial direction from the shaft e^4, and receives its twine from a short tube, m^4, carried by a forked arm, n^4, that is pivoted to the arm d^4, and is pressed toward the said arm by a spring, o^4. The twine is carried by a spool, p^4, placed under the platform B, and passes through the twine-guide j^4, thence to the spring p^3 above the cutter o^3.

The bundle, when delivered by the tines h to the curved arm o, and carried forward by the latter under the knot-forming apparatus, is received and confined by a leather strap, q^4, which is manipulated by a lever, r^4, that is fulcrumed on a support, s^4, placed between the cross-bars b c, and by a spring-acted drum, t^4, that is journaled between the said cross-bars. The short end of the lever r^4 is connected by a rod, w^4, with a lever, v^4, that is pivoted at the bottom of the support s^4, and is engaged by a pin, w^4, that projects from the side of an arm, a^5, that is attached to the curved arm d^4. When the arm a^5 rises, the pin w^4 slips by a spring-latch, b^5, on the lever v^4, and when the arm a^5 descends it carries with it the lever v^4, and, by virtue of the connection of the lever v^4 with the lever r^4, moves the longer end of the latter upward. The leather strap q^4 has at its free end a double eye, c^5, one eye of which is attached to a strap, d^5, that passes through an oblong aperture in the end of the lever r^4, and is wound upon a spring-acted drum, e^5, that is journaled in supports placed below the level of the table B, and draws the eye c^5 into contact with the end of the lever r^4. The strap q^4 is provided with a stop, which strikes a loop, f^6, on the lever r^4, near its fulcrum, and prevents the entire length of the strap from being drawn backward by the turning of the drum t^4. The strap, after leaving the loop f^5, passes over a roller, g^5, journaled in the end of a lever, h^5, before it is wound upon the drum. The lever h^5 is fulcrumed in a standard, i^5, that is supported by the frame of the binder, and two brakes, j^5, are pivoted to its shorter end and bear against the bosses of the drum t^4. These brakes check the paying out of the strap, while they permit of the free rotation of the drum by the spring when the strap is wound up.

The motion of the lever r^4 is sufficient to carry the eye c^5 upward to a slot in the plate v^2, where it is engaged by the end of a catch-lever, k^5, that is pivoted to a standard, l^5, supported by the plate v^2.

The catch-lever k^5 is thrown into engagement with the eye c^5 by the spring m^5, and the eye is released from the catch-lever by the engagement of a lever, n^5, (which is pivoted to the arm j and connected with the lever k^5) with the cam p, carried by the arm o.

To prevent the grain from rising as it is moved forward toward the tying apparatus, two rods, o^5, are stretched from the shaft g to the arm j.

The operation of my improved machine is as follows: The grain is delivered in gavels to the tines, which are made to rotate at the proper instant by the disk q and rod r, as already described, so as to move the gavel forward within reach of the curved arms o d^4. These arms now move forward, carrying the bundle into the strap q^4, which, being held fast at its upper end by the catch-lever k^5, confines the bundle, so that it is compressed by the forward movement of its two curved levers. The strap yields to the forward motion of the bundle, but is kept under considerable tension by the spring in the drum t^4, and by the action of the brakes j^5 on bosses of the said drum. When the free end of the arm d^4 reaches the arm j, and the curved arm o is in a vertical position, the shaft k is moved longitudinally by the engagement of the cam p with the inclined plane c^4, thus disengaging disk q from the wheels l n, permitting the wheels to revolve, while the disk is locked by the arm u^1, so as to prevent the rotation of the shaft m, and consequently stop the curved arm o. The shaft

k, being moved so as to bring the feather into engagement with the pinion l^1, begins to revolve at the same time the twine-carrier j^4 moves forward between the jaws w^2 c^3. The sliding of the plate j^1 clamps the twine after the twine-carrier has passed to the center of the aperture in the plate r^3, and immediately the twine is clamped the cutter o^3 is rotated, so as to sever the twine.

The first result of the movement of the shaft k is to rotate the tube j^2 once around the upper end of the twine-carrier j^4, thereby wrapping the two parallel ends of the binding-twine once around the lower end of the tube. Just before this revolution is entirely completed, the jaws w^2 c^3 drop and rise again, so as to bring the two ends of the twine into the notches k^2 in the lower end of the tube. The pin r^2 then engages the incline s^2, and forces the sleeve p^2 downward on the tube j^2. This results, first, in causing the jaws r^2 to clamp the twine that extends across the lower end of the tube in the notches k^2, and, second, in discharging from the outside of the tube the coil by which it is surrounded. In this manner a loose knot is formed, which is tightened by the levers w^3 g^3. As the plate j^1 is moved back into its normal position, the arm f^3 engages the lever w^3, which is moved toward the aperture in the plate r^2. Motion is communicated by the lever w^3 to the lever g^3, and both combine in tightening the knot. A further movement of the tube j^2 brings the pin t^2, that projects from the sleeve p^2, into engagement with the incline u^2, thus raising the sleeve and opening the jaws l^2, releasing the knot.

The return movement of the sliding plate j^1 is instantaneous, and results, first, in tightening the knot, and, second, in opening the jaws w^2 c^3.

After the shaft k has made one complete revolution the pin o^1 escapes through the notch in the plate n^1, and permits the spring a^2 to withdraw the arm u^1 from the disk q, and move the shaft so as to disengage the feather from pinion l^1. When the hole in the wheel l which contains the pin b^2 coincides with the hole in the disk q, the pin springs into the disk and causes the disk and the shaft m to revolve with the wheels l n. The forward movement of the arm o releases the eye c^5, that is attached to the leather straps q^4 d^5, and permits the straps to wind on their respective drums, while the bundle is discharged and the operation is repeated.

The table B is provided with a gage for evening the butt of the bundle, and for regulating the distance of the band from the butt. This gage may be moved by a lever extending to the driver's seat.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. The knot-former consisting of the slotted and notched tube j^2, secured eccentrically to the shaft e^2, the jaws l^2, spring q^2, and sleeve p^2, in combination, substantially as herein shown and described.

2. The pivoted jaws w^2 c^3, the arm f^3, carrying the spring e^3, spring j^3, the cam h^3, and the rod g^3, having the beveled pin i^3, in combination, substantially as and for the purpose specified.

3. The levers g^3 w^3 and the arm f^3, in combination, for tightening the knot, as herein specified.

4. The combination of the arm o, carrying the cam p, with the plate j^1, having the inclined plane c^4, for moving the knot-forming apparatus and throwing it into gear, as herein shown and described.

5. The combination, in a grain-binder, of curved arms c d^4 and the strap q^4, having a tension device, for forming and compressing the bundle, substantially as herein shown and described.

6. The lever r^4, lever v^4, and arm a^5, in combination with the strap q, for carrying the free end of the strap upward to the knot-former, as herein shown and described.

7. The combination of the strap d^5 and spring-acted drum e^5, with the strap q^4, as and for the purpose specified.

8. The combination of the brakes j^5 and lever h^5, carrying the roller g^5, with the drum t^4 and strap q^4, substantially as herein shown and described.

9. The combination of the levers k^5 n^5 with the eye c^5, attached to the straps q^4 d^5, for holding the straps while the bundle is formed and tied, substantially as herein shown and described.

10. The arm o, carrying the cam p and the lever n^5, in combination with the strap-retaining lever k^5, for releasing the straps, as herein shown and described.

11. The combination of the slotted disk n with the shaft k, carrying the pin o^1, and the spring-acted arm u^1, for holding the shaft and arm in a working position during one revolution of the shaft, as herein shown and described.

12. The slotted collar q^1, spring-pressed arm u^1, and arm s^1, in combination with the shaft k, as and for the purpose specified.

13. The combination of the sliding spring-acted pin b^2 and the arm u^1 with the disk q and wheels l n, as herein shown and described.

IGNATZ KAREL.

Witnesses:

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