(Model.) 6 Sheets—Sheet 1.

C. M. RICHARDSON & J. S. GIBBS.

KNOT TYING MECHANISM FOR GRAIN BINDERS.

No. 300,009. Patented June 10, 1884.

Fig 1

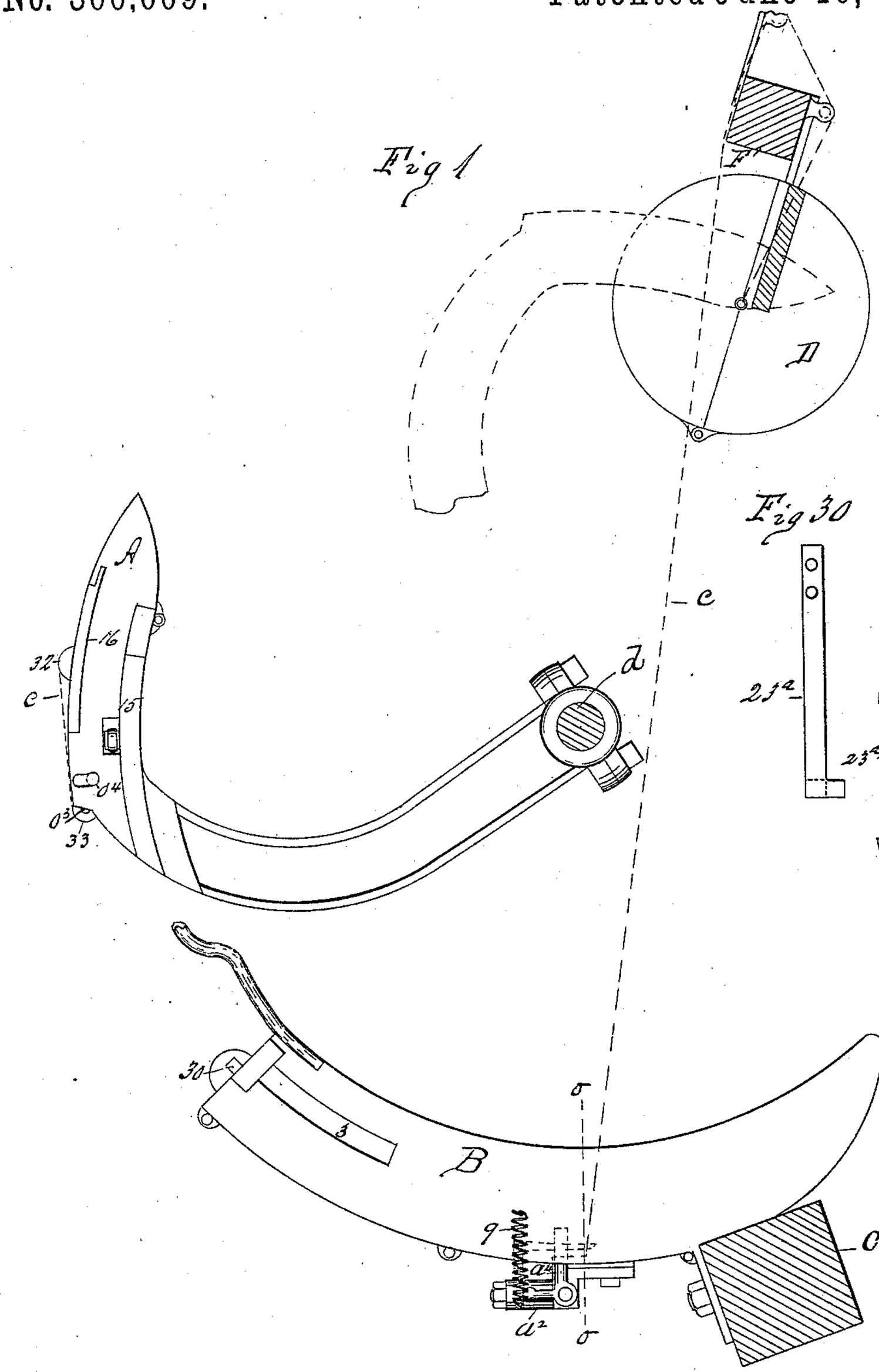


Fig 29

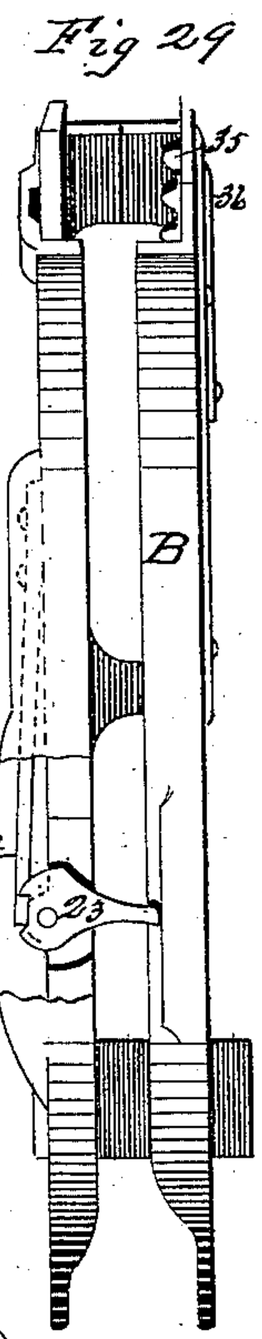


Fig 30

Witnesses:
R. F. Hyde
Wm H Chapin

Inventors,
Charles M Richardson
and Jacob S Gibbes.
by Henry A Chapin Atty

(Model.) 6 Sheets—Sheet 2.

C. M. RICHARDSON & J. S. GIBBS.

KNOT TYING MECHANISM FOR GRAIN BINDERS.

No. 300,009. Patented June 10, 1884.

Fig 2ª

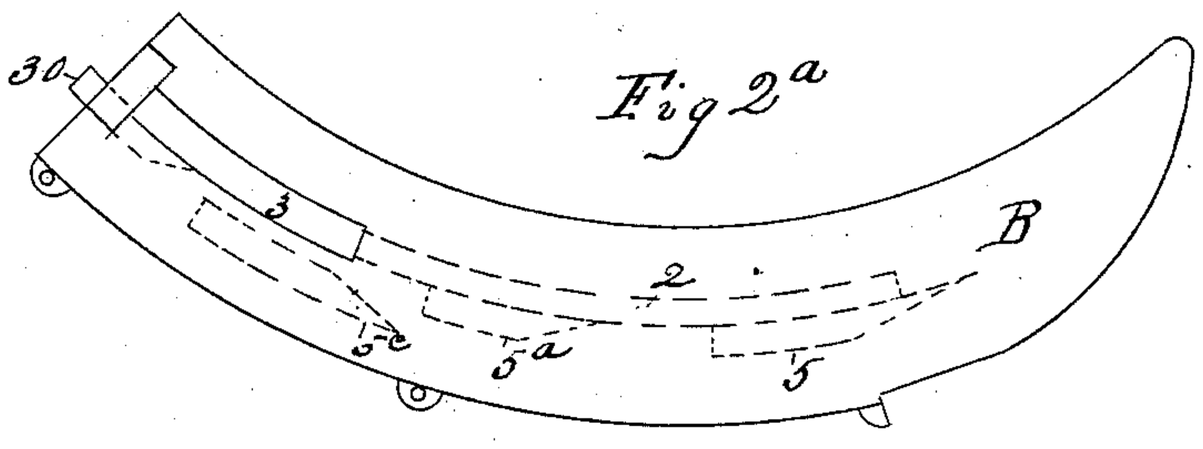
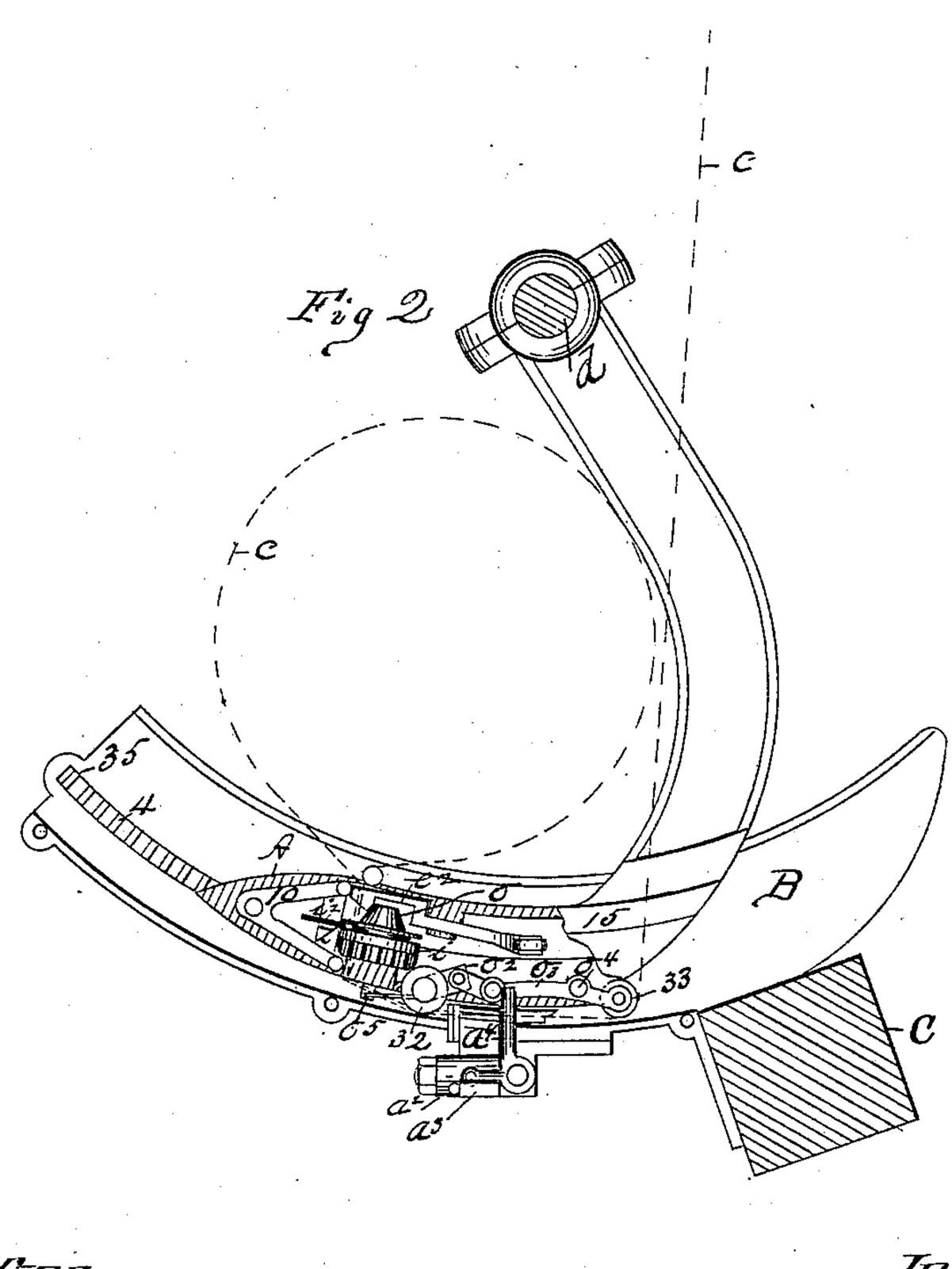


Fig 2



Witnesses,
R. F. Hyde
Wm. H. Chaffin

Inventors,
Charles M. Richardson
and Jacob S. Gibbs.
by Henry A. Chaffin Atty

(Model.) 6 Sheets—Sheet 3.

C. M. RICHARDSON & J. S. GIBBS.

KNOT TYING MECHANISM FOR GRAIN BINDERS.

No. 300,009. Patented June 10, 1884.

Fig 3

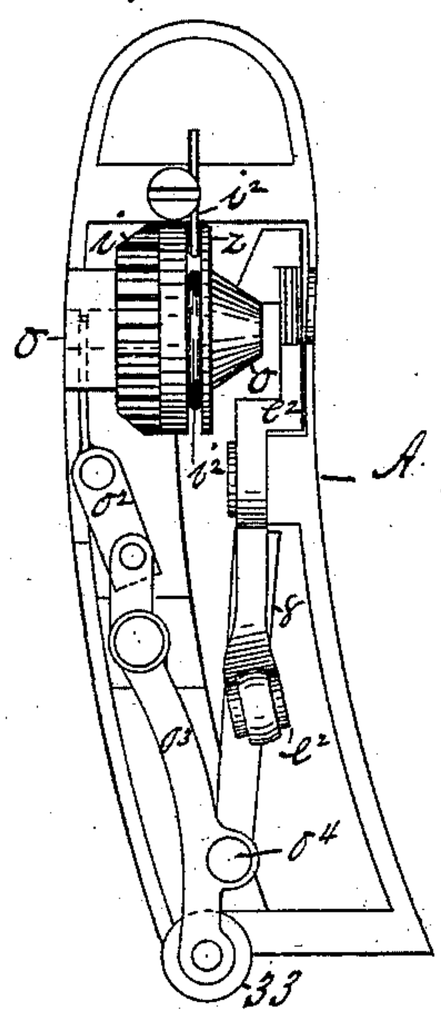


Fig 4

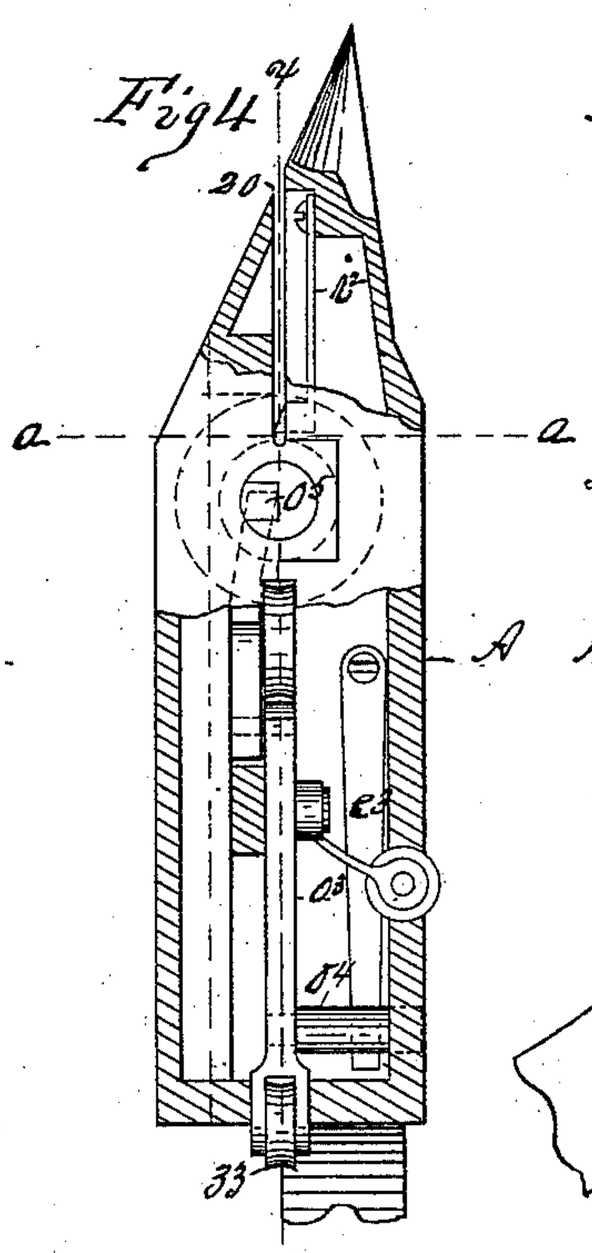


Fig 5

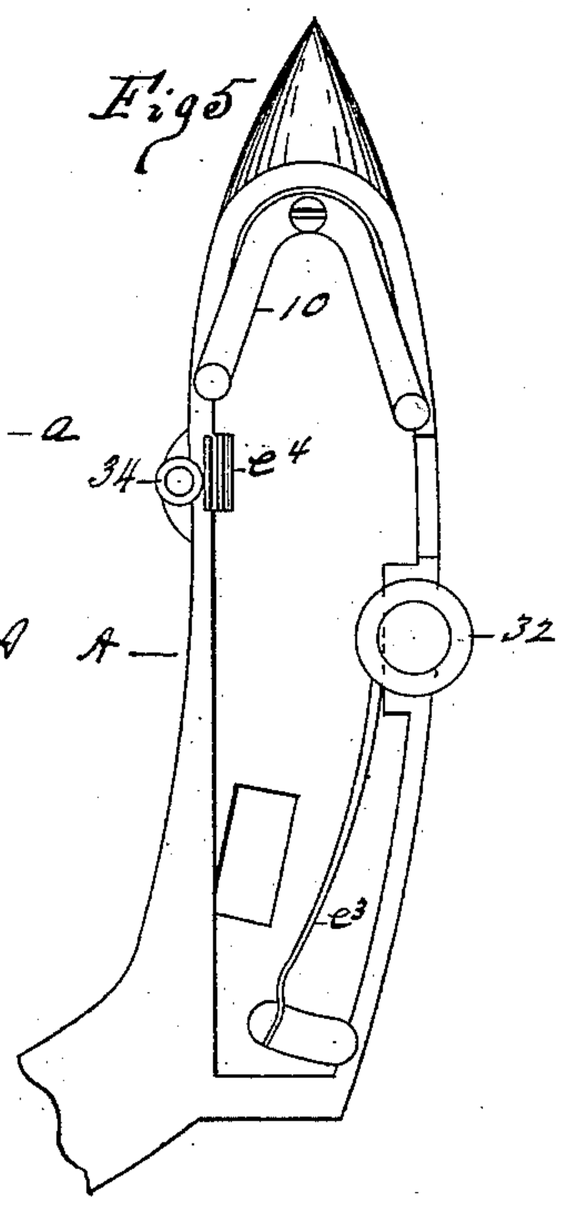


Fig 6

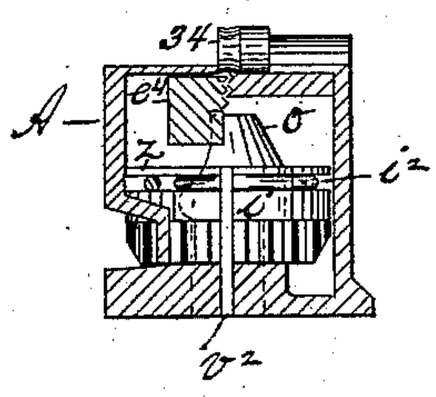


Fig 7

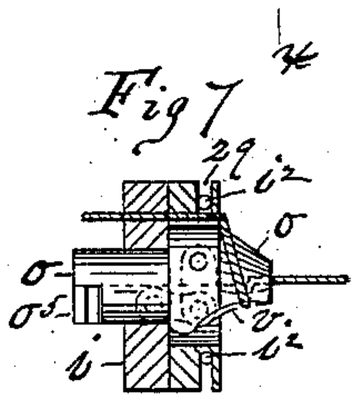


Fig 8

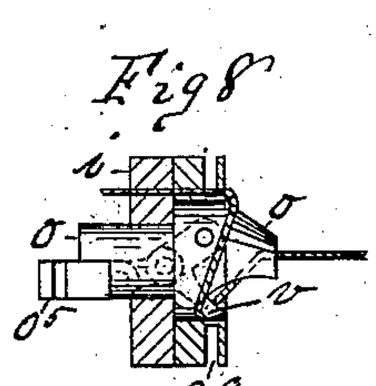


Fig 9

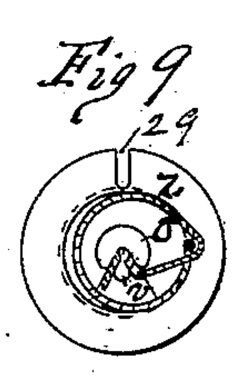


Fig 10

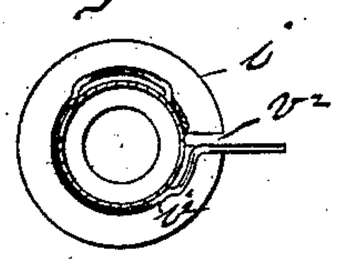


Fig 11

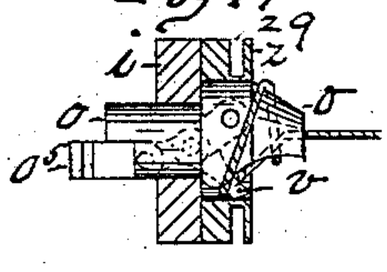


Fig 12

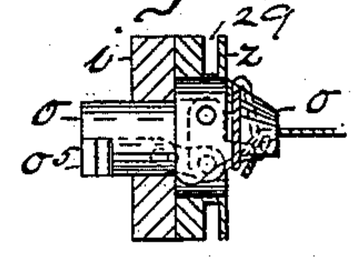


Fig 13

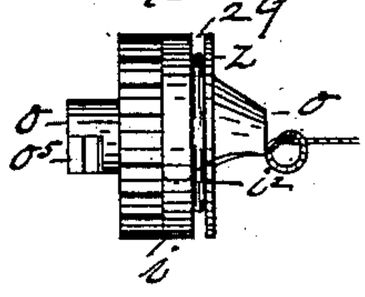


Fig 14

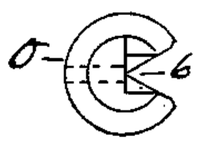


Fig 15

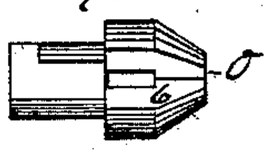


Fig 16

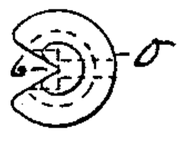


Fig 17

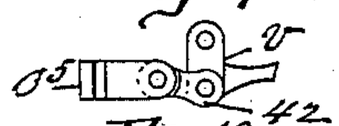
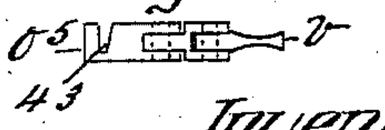


Fig 18



Witnesses,
R. F. Hyde
Wm. H. Chapin

Inventors,
Charles M. Richardson
and Jacob S. Gibbs
by Henry A. Chapin Atty

(Model.) 6 Sheets—Sheet 4.

C. M. RICHARDSON & J. S. GIBBS.

KNOT TYING MECHANISM FOR GRAIN BINDERS.

No. 300,009. Patented June 10, 1884.

Fig 19

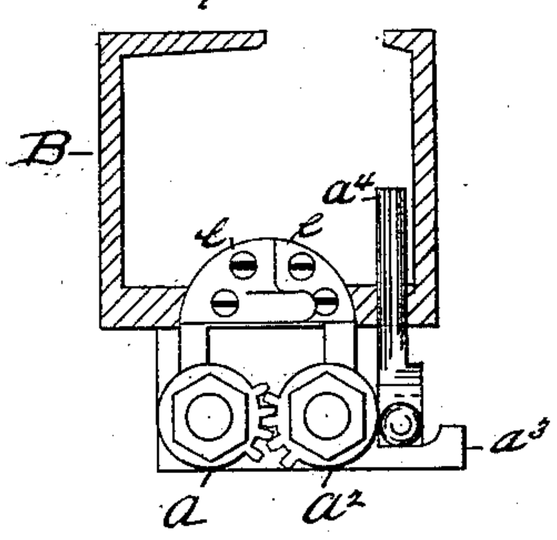


Fig 20

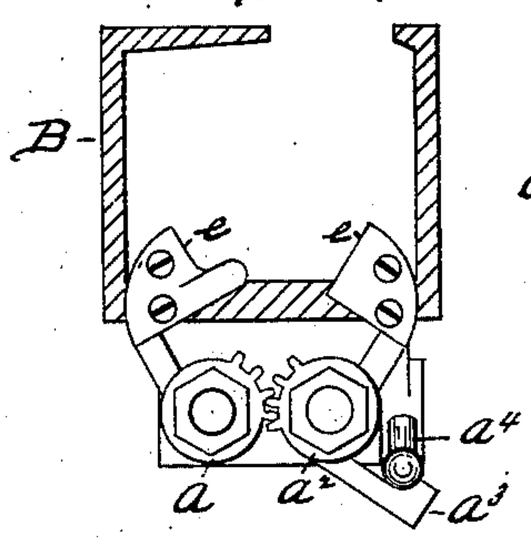


Fig 21

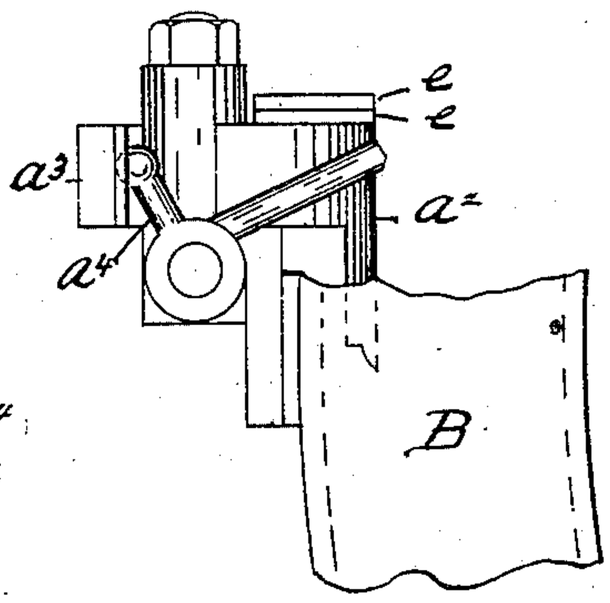


Fig 22

Fig 23

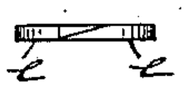


Fig 24

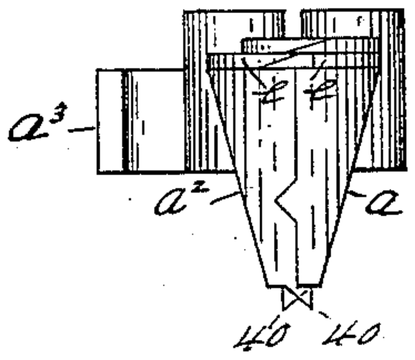


Fig 25

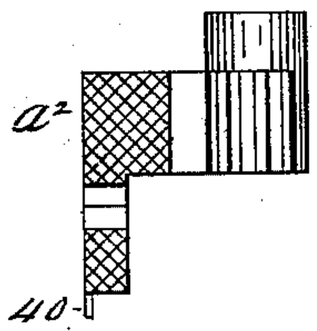
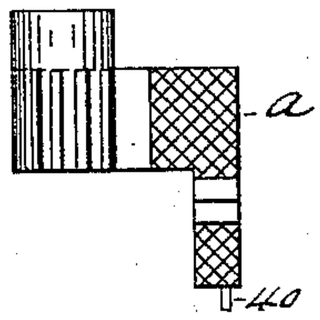


Fig 26



Witnesses,
R. F. Hyde
Wm H Chapin

Inventors,
Charles M Richardson
and Jacob S Gibbs
by Henry A. Chapin
Atty

(Model.) 6 Sheets—Sheet 5.

C. M. RICHARDSON & J. S. GIBBS.

KNOT TYING MECHANISM FOR GRAIN BINDERS.

No. 300,009. Patented June 10, 1884.

Fig 27

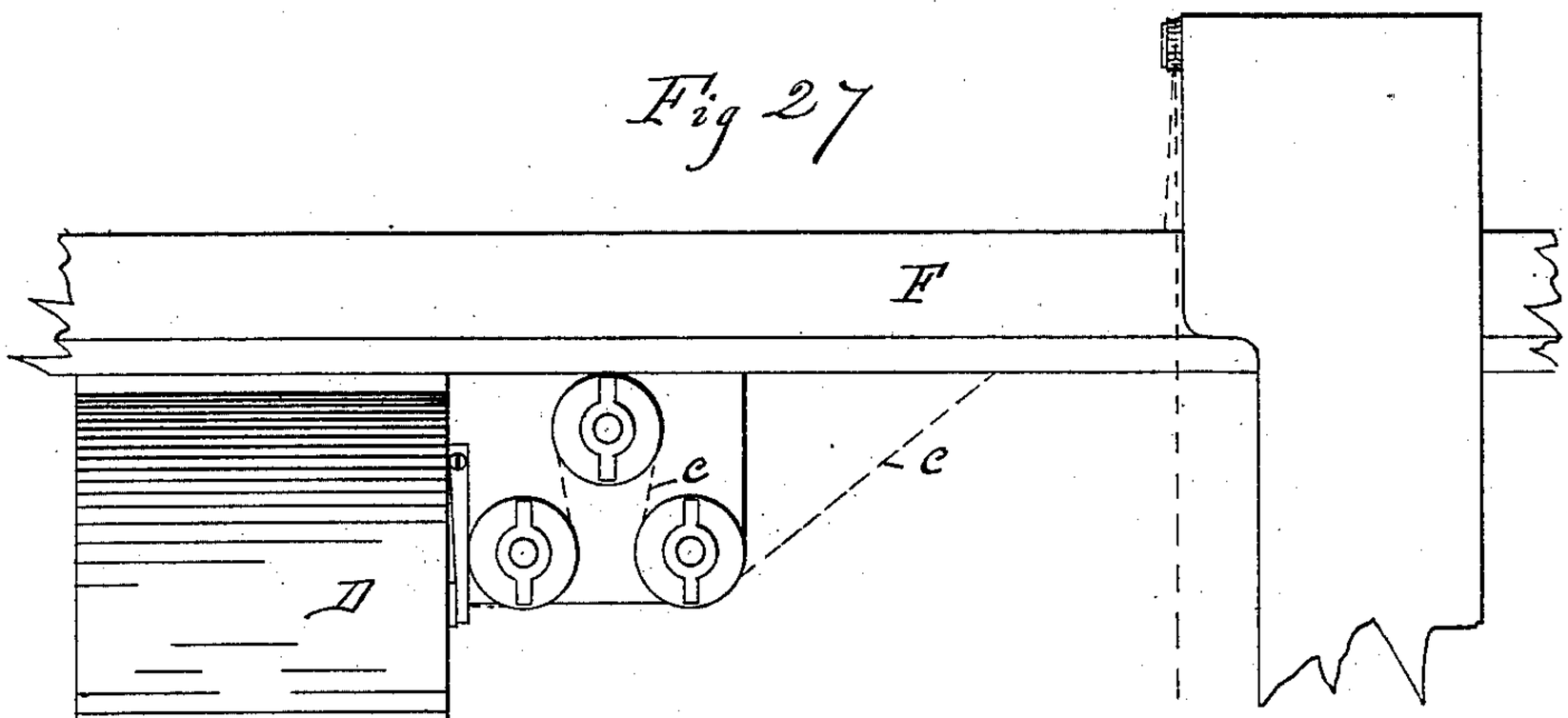
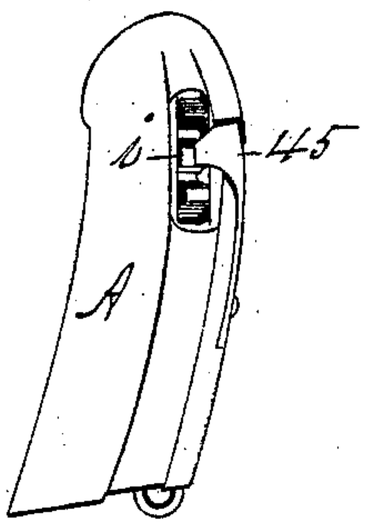
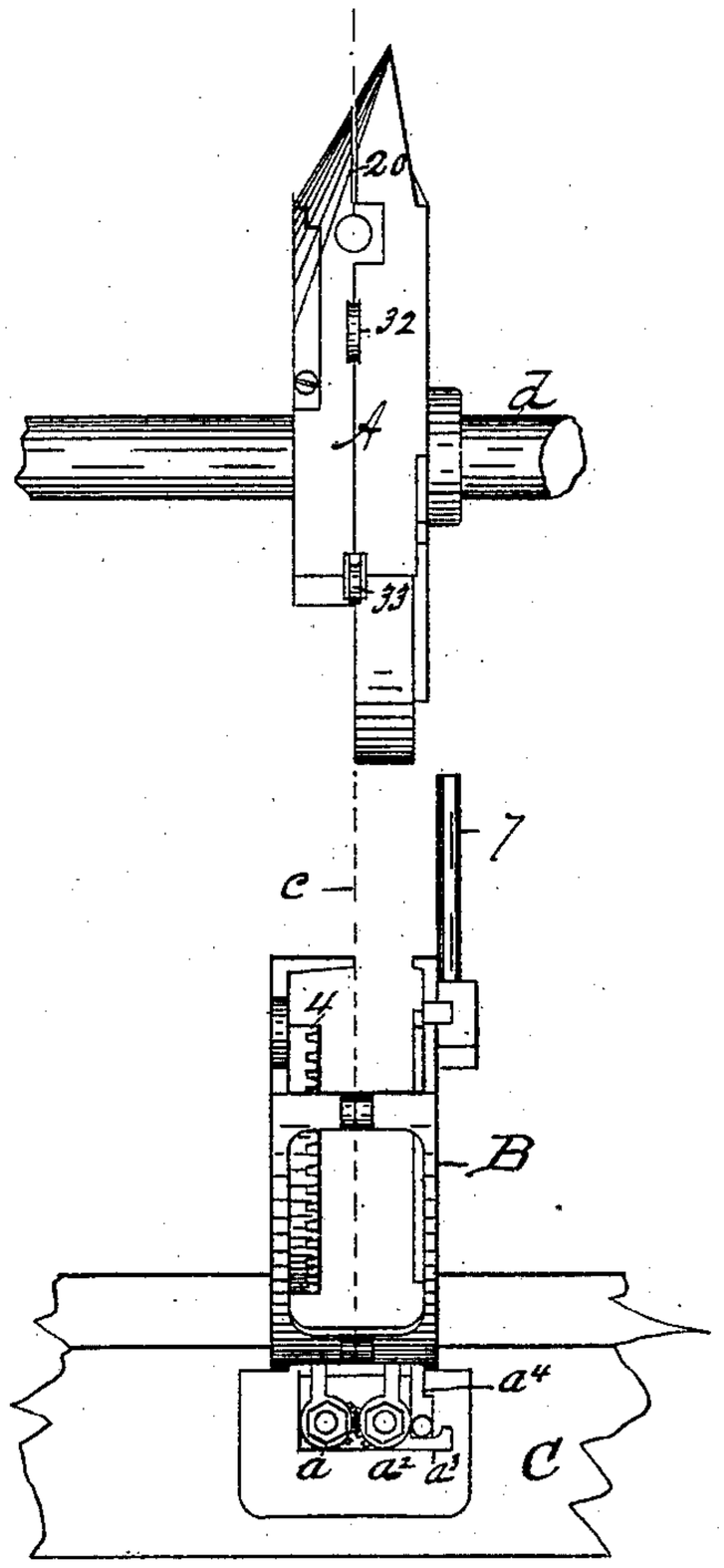


Fig 31





Witnesses,
R. F. Hyde
Wm. H. Chaplin

Inventors,
Charles M. Richardson
and Jacob S. Gibbs
by Henry A. Chaplin Atty

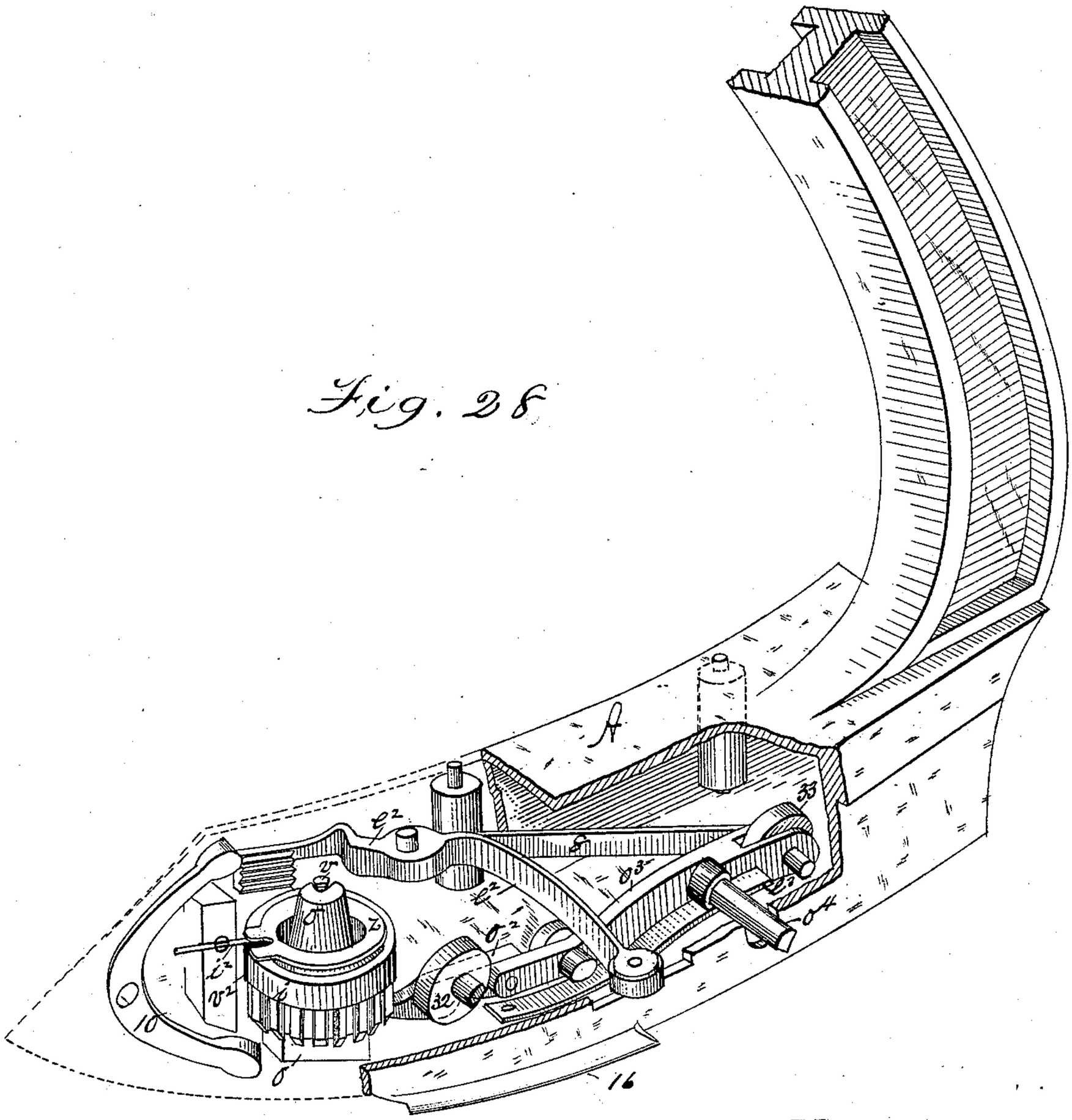
(Model.) 6 Sheets—Sheet 6.

C. M. RICHARDSON & J. S. GIBBS.

KNOT TYING MECHANISM FOR GRAIN BINDERS.

No. 300,009. Patented June 10, 1884.

Fig. 28



Witnesses;

Walter Fowler.

R. F. Hyde

Inventors;

Charles M. Richardson

and Jacob S. Gibbs

by Henry A. Chapin

Atty

UNITED STATES PATENT OFFICE.

CHARLES M. RICHARDSON AND JACOB S. GIBBS, OF BRIDGEPORT, CONNECTICUT, ASSIGNORS TO THE BRIDGEPORT TWINE BINDING COMPANY, OF SAME PLACE.

KNOT-TYING MECHANISM FOR GRAIN-BINDERS.

SPECIFICATION forming part of Letters Patent No. 300,009, dated June 10, 1884.

Application filed March 11, 1882. (Model.)

To all whom it may concern:

Be it known that we, CHARLES M. RICHARDSON and JACOB S. GIBBS, citizens of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have jointly invented new and useful Improvements in Knot-Tying Mechanism for Grain-Binders, of which the following is a specification.

This invention relates to improvements in knot-tying mechanism for grain-binders and other analogous machines for tying ordinary twine or cord or soft metallic wire, the object being to automatically carry a binding-twine around a gavel of grain, cut off and firmly tie said twine around the gavel, thereby making a compact bundle, and to tie a knot that cannot slip.

In the drawings forming part of this specification, Figure 1 is a side elevation of the binder-arm carrying the head, and showing also the segmental case of a grain-binder embodying our improvements. Fig. 2 is a side elevation of the binder-head and a section of the segmental case, showing said parts in operative relation. Fig. 2^a is a side elevation of one side of said case. Figs. 3 and 5 are sections of Fig. 4 taken on line *x x*, Fig. 4. Fig. 4 is a rear elevation, partly in section, of the binder-head. Fig. 6 is a transverse section on the line *a a*, Fig. 4. Fig. 7 is a side elevation of the looping-pinion and slotted collar, partly in section, detached from the head, and showing the position of the twine thereon after the pinion has commenced to turn. Fig. 8 is a similar view to Fig. 7, but showing the parts in a different position. Figs. 9 to 26, inclusive, are detail views, which will be explained further on. Fig. 27 is a plan view of the central portion of that part of the binder embracing the knot-tying devices, and showing the position of the twine-box. Fig. 28 is a perspective view of the head with a part of its shell broken away to show its interior. Fig. 29 is a plan view, partly in section, of the concave edge of the case. Fig. 30 is a detail view. Fig. 31 is a plan of the exterior of the part shown in Fig. 3.

In the drawings, B is the segment-shaped case. A is the binder-head. D is the twine-box. *c* indicates the twine in dotted lines. *d* is the shaft on which the head A and the binder-arm are hung, and by which it is rotated. C is the beam on which the case B is secured. F is the inner beam of the machine. *a* a^2 are pivoted cord clamps and cutters on case B. a^3 is an arm on one of said clamps. a^4 is an elbow-lever pivoted also on said case. *e e* are knives on said clamp-jaws. e^2 is a twine-clamping lever. e^4 is a serrated-faced cord-clamping boss on said head. e^3 is a spring. *i* is a looping-pinion. *z* is a collar on said pinion. i^2 is a twine-tension spring. *o* is a conical-ended knotting-post. o^2 and o^3 are simple levers constituting a compound lever. o^4 is an arm on the lever o^3. o^5 is the knotting-hook-operating rod. *v* is the knotting-hook. v^2 indicates a slot in the edge of the pinion *i*. 2 5 5^a 5^c indicate cams (shown in dotted lines) on the side of case B. 6 indicates a V-shaped groove in the knotting-post *o*. 4 is a rack in said case. 16 is a lifting-cam on the side of head A. 15 is a cam, also on the side of said head. 10 is a spring. 20 indicates a twine-slot in head A. 23 is a twine-trip on case B. 30 is a cam on the upper end of said case. 35 is a safety spring-tooth at the end of rack 4. 8 is a cord-clamp spring. 32 and 34 are twine-rolls on head A. 33 is a small twine-roll in the end of lever o^3.

Like letters refer to like parts in the different figures.

The segmental-shaped case B is constructed, so far as general shape is concerned, of the form usual in this class of machines, but is specifically adapted to co-operate with our peculiarly-constructed knot-tying devices for the purposes hereinbefore stated. To this end the case B is provided on its interior with the cams 2 5 5^a 5^c, and the cam 30, partly within and partly without said case. All of said cams, excepting one end of that numbered 30, are shown in dotted lines in Fig. 2^a. A slot, 3, is formed in one side of the case, and the well-known twine-tripping device common to many machines of this class is applied to the open side of said case. The side of case B opposite to that on which are said cams, is

provided with a rack, 4, the last tooth, 35, in which, is secured to a flat spring, 36, secured against the outer side of the case. The function of the spring-tooth 35 is described further on. Said case B is also provided with a pair of spring-operating cord-holding jaws, *a* a^2, which are provided with twine-cutting knives *e e*, and are located on its convex edge, and are made to open and close as follows:

Figs. 19 to 26, inclusive, illustrate details of the construction of said jaws and knives. Said jaws are properly pivoted on a support, which is bolted to said case, and the hubs through which their pivot-bolts pass are provided with interlocking gear-teeth, as in Figs. 19, 20, 25, and 26, so that they may both be opened by operating upon one. An arm, a^3, projects from one jaw thereof, a^2, at right angles to its axis. An elbow-lever, a^4, is pivoted to said support at the side of one of said jaws, its short arm standing vertically near said arm a^3, and its long arm projecting into case B. A spring, 9, connected to said arm a^3 and to case B, swings said clamp-jaws together with much force, and their inner faces are roughened and provided with suitable projections and matched depressions, to cause them to grasp a cord or twine, so that it cannot slip through them, and when they close together the twine runs across two bevel-edged points, 40, at their lower ends, as shown in Fig. 24, whereby the strain on said twine tends to draw said jaws closer together. Said jaws *a* a^2 are caused to open by the passage of the head A up through case B, by the action of the cam 16, Fig. 1, on the side of said head A, against the long arm of said elbow-lever a^4, whereby the parts are thrown into the position shown in Fig. 20, and immediately that the head passes by said lever said jaws spring together, as in Figs. 19 and 24. The upper ends of said jaws are provided with two twine-cutting knives, *e e*, whose edges shut by each other sufficiently to cut off the twine which is caught between them.

The above-mentioned twine-trip on case B is operated by the cam 15 on head A, Fig. 1, as the latter swings through said case, said cam acting on spring 23^a. The head A is constructed of the usual form, and is adapted to be passed through the above-described case B in the usual manner of operating such machines.

The general arrangement of the above-mentioned knot-tying devices in said head is shown in Figs. 2, 3, 4, 5, and 28. Head A is made of two hollow sections, within which said devices are inclosed. The forward end of said head A has a twine-slot, 20, formed in it, (see Fig. 4,) said slot being formed therein in the line of its movement through case B. A spring, 10, is located on one side of said slot 20, over which the twine slides as it enters said slot. A looping-pinion, *i*, is hung on the knotting-post *o*, which is fixed in the head A. Said knotting-post *o* has a cone-shaped end projecting beyond the face of pinion *i*, and it has a V-shaped groove, 6, on one side of said post at the end, and the post is also grooved from the base of groove 6 to its opposite end, as in Fig. 15, and is slotted transversely, as there shown. Said grooves and slot in post *o* provide for placing therein the knotting-hook *v* and its operating-rod o^5. The form of said post *o* is shown in Figs. 14, 15, and 16, and the knotting-hook and its rod are fully shown in Figs. 17 and 18, and the arrangement of the latter in said post is shown in Figs. 7, 8, 11, and 12. As shown, said knotting-hook consists of an elbow-lever, one arm of which works in said groove 6, and the extremity of the other arm enters said transverse slot in post *o* and is pivoted to the latter, as shown in said figures. Said knotting-hook rod o^5 is connected to said knotting-hook by a link, 42, the latter being pivoted to the knotting-hook at the junction of its two arms. Thus, when the rod o^5 slides one way in said knotting-post *o*, the arm of the knotting-hook, which lies in the groove 6 therein, is thrown down, as in Figs. 8 and 11, and the movement of said rod in the opposite direction throws the hook-arm up into said groove. Said pinion *i*, fits on post *o*, and its teeth project through the side of head A and engage in the rack 4 on case B. When head A is passed through said case, said pinion is revolved on post *o*. The pinion *i* has fixed to it an annular collar, *z*, on the periphery of which is a slotted collar or projection, the slot in which coincides with a slot, v^2, transversely across the periphery of said pinion. An annular groove, 29, is formed between the collar *z* and the side of pinion *i*, in which is placed the circular twine-tension spring i^2, the form of which is shown in Fig. 10, said spring being secured by one end to a block on the interior of head A, and being made to encircle and bear against the part of pinion *i* at the base of said annular groove, excepting at intervals, as shown in said last-named figure, but not extending across the slot v^2 in said pinion *i*. A twine-clamping lever, e^2, is pivoted in head A, having a serrated-faced block on its short arm near the pinion *i*, which is arranged to bear against a boss, e^4, on said head, (see Fig. 5,) having a like face, and clamp the twine between said faces after it has been drawn into slot 20 in the head. A spring, 8, swings lever e^2, so as to carry the end of its short arm away from the boss e^4; but the long arm of said lever projects a little beyond one side of said head, and has a friction-roll pivoted therein, as shown. When head A is moved through case B, as aforesaid, the projecting end of the lever e^2 rides upon the cam 2 in the case, swinging said lever, and thereby causing said two serrated faces to be pressed forcibly together and to clamp immovably between them the twine which was previously drawn into slot 20 in the head A, and when the end of the lever runs off from the cam said twine is released. The end of said lever e^2 projects through the slot 3, Fig. 1, in the side of case B. Two

levers, o^2 o^3, are pivoted together, and each within head A, the latter having a friction-roll, 33, pivoted in the end of its long arm, and an arm, o^4, thereon standing at right angles thereto and projecting through one side of the head. The friction-roll 33 also projects through a side of said head, as seen in Fig. 2, and as said head moves through case B, as aforesaid, the arm o^4 rides on the edges of the cams 5, 5^a, 5^c, and 30, causing the end of said lever to be moved down against the action of the spring e^3 under it, and back again by said spring as said arm passes between cams 5 and 5^a, and again to be carried down as it moves over the latter cam, and then, by the contact of said arm with cam 5^c, said lever is swung with a positive force in a contrary direction to that in which cams 5 and 5^a moved it, and with more force than spring e^2 can exert, and finally said arm encounters the cam 30, by which said lever is moved in the same direction as by cams 5 and 5^a.

It will be seen by reference to Fig. 18 and other detail illustrations that the knotting-hook rod o^5, which, as above described, slides in the knotting-post o, has a notch, 43, in one side of it, and the free end of said lever o^2 engages in said notch 43 in said slide, the object of said combination of the levers and slide being to cause the knotting-hook v, whose connection with said slide has already been described, to swing alternately away from and into the V-shaped groove 6 in the side of the conical part of post o. A pinion stop-spring, 45, Fig. 31, is located on head A, the free end of which is adapted to fall against the pinion i at the end of the movement of said head through case B. If said pinion stops at just the position to bring its slot v^2 in a line with the base of the slot 20 in the head, as seen in Fig. 4, said spring will drop between two of the teeth in the pinion; but if the rotary movement of said pinion should stop a little too soon, said spring will fall against the side of one of the teeth in pinion i and force it slightly around to bring said two slots into coinciding positions.

The operation of our invention is as follows: The binding-twine c is deposited in the twine-box D, Fig. 7, whence it is drawn out over suitable tension-rollers and carried in a straight line from the inner part of the machine transversely through the circular line of movement of head A to the case B, which is secured to the beam C, and its end is placed between the clamp-jaws a a^2, below the knives e e thereon, where it is tightly held. The positions of the said case, head, and twine, as just described, are shown in Fig. 1, and the position of the head as it strikes the twine, receiving the latter into its slot 20, is shown in dotted lines in said figure. The grain having been deposited on the binder, the shaft d revolves, carrying the binder-arm and the head A, the latter catching the twine in the slot 20, causing it to slip by the ends of the spring 10 therein, and when said head enters case B the twine is drawn against the trip 23, and thereby forced into slot v^2 in the periphery of the pinion i. The end of clamp-lever e^2 now rides on the long cam 2, causing it to clamp the twine tightly. Said cord-trip is a well-known device in this class of machines, and is held across the open side of the case B by a spring, 23^a, which is freed from the trip by the action of the cam 15 on the outside of the head. (See Fig. 29.) The clamping-jaws a a^2 close upon the twine (said head having opened them and carried the cord between them) about the time that said cord-trip is operated. Said twine just mentioned as carried between the clamp-jaws a a^2 extends from the face of roll 32 to that of roll 33, as shown in Fig. 1 in dotted lines. Immediately after this the elbow-lever a^4 rides on the lifting-cam 16 on the side of the head, causing said clamp-jaws to open, and after the end first held by said jaws is carried up out of them they close upon the part which was brought around by the head, holding that, and as they close upon it, actuated by spring 9, after said cam 16 has left lever a^4, the knives e e cut the cord, leaving the main end of the twine between said jaws, as at first. The head A in passing up through case B is driven against that part of said twine close by jaws a a^2, causing it to enter slot 20 in the head and lie against that already in it, thereby bringing two ends of the twine together around the gavel, both now being held in the head, while the main end is left in the jaws, as just described. The looping-pinion i, in the slot v^2 of which both ends of said twine lie, now engages the rack 4 on the inner side of case B, and is at once turned three-fourths round, carrying the ends of the binding-twine under the tension-spring i^2 and winding it around the conical end of post o. Then the levers o^2 o^3 operate, as above described, to draw back the knotting-hook rod o^5, and so turning the knotting-hook v as to hook its free arm against the loop heretofore carried around the end of said post o, as shown in Fig. 8, and holding it, while the pinion i continues to revolve one-fourth round, carrying a part of the cord across the groove 6 in the post o, between the latter and said knotting-hook; and the latter now shuts into said groove and clamps the cord lying across the groove, as shown in Fig. 9, and releases the loop which it first engaged, letting the latter slip over the part now held in said groove, as just described, thus tying the knot, and said knotting-hook holds the ends of the twine until the arm o^4 on lever o^3 strikes the cam 30 on the side of the case B, whereby said ends are released, and the bound gavel is thrown from the binder by the revolving head. When the pinion i is first revolved, the binding-twine is carried under the tension-spring i^2, which causes said twine to be held back as it is wound around the end of post o, and keeps it drawn close thereon; but when said pinion has

turned far enough around to carry the twine under that portion thereof (see Fig. 10) which is bent up away from the base of the groove between collar *z* and said pinion, then the tension upon said twine ceases, and it is free to be drawn away after the knot has been tied, as above described.

What we claim as our invention is—

1. In a grain-binder, the combination of the case B, having two twine-clamping jaws pivoted thereto, a spring to shut said jaws, and the elbow-lever a^4, with the head A, adapted to move through said case, and provided with means for opening said jaws, substantially as described.

2. The combination, with the case B, having the rack, of the head A, having the twine-slot 20, the conical-ended knotter-post *o*, fixed in said head, the looping-pinion *i*, having the collar *z* thereon, and the transverse groove v^2 across its periphery, and the tension-spring i^2, substantially as set forth.

3. In combination with the case B, having the rack 4 thereon, the head A, adapted to move through said case, and carrying the conical ended knotter-post *o*, fixed in the head, a knotting-hook pivoted in the post *o*, having an arm to swing against and from the knotter-post, and mechanism within said head, substantially as described, for looping the twine around the conical end of the post *o*, and for oscillating the knotting-hook on its pivot within the knotter-post, substantially as set forth.

4. The combination, with the looping-pinion *i*, having the collar *z* thereon, of the tension-spring i^2, secured to the head A, and encircling that part of said pinion between the collar *z* and the main part of the pinion, substantially as and for the purpose set forth.

5. In combination with the head A, having the knotter-post *o*, the looping-pinion *i*, revolving thereon, the knotting-hook *v*, pivoted in said post, the rod o^5, connected to said hook, the levers o^2 o^3, connected with rod o^5, spring e^3, and the case B, having suitable cams thereon for contact with the arm o^4 on the lever o^3, substantially as set forth.

6. The pivoted clamp-jaws *a* a^2, having the bevel-edged points 40 on the lower end thereof, substantially as set forth.

CHARLES M. RICHARDSON.
JACOB S. GIBBS.

Witnesses:
HENRY A. CHAPIN,
C. D. LEET.