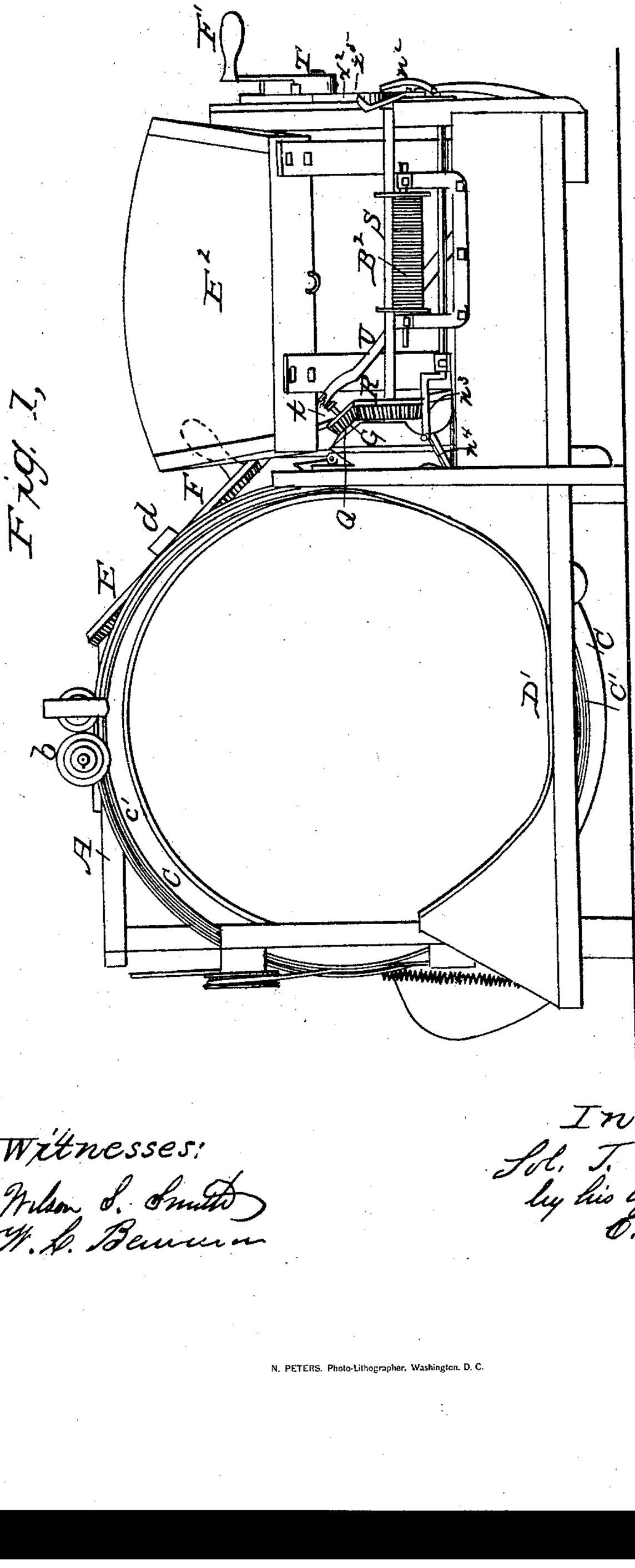
5 Sheets—Sheet 1.

S. T. HOLLY.

Grain Binder.

No. 41,378. Patented Jan. 26, 1864.

Fig. 1.



Witnesses:

Wilson S. Smith

W. L. Bennum

Inventor:

Sol. T. Holly

by his attorney

O. T. Renwick

5 Sheets—Sheet 2.

S. T. HOLLY.

Grain Binder.

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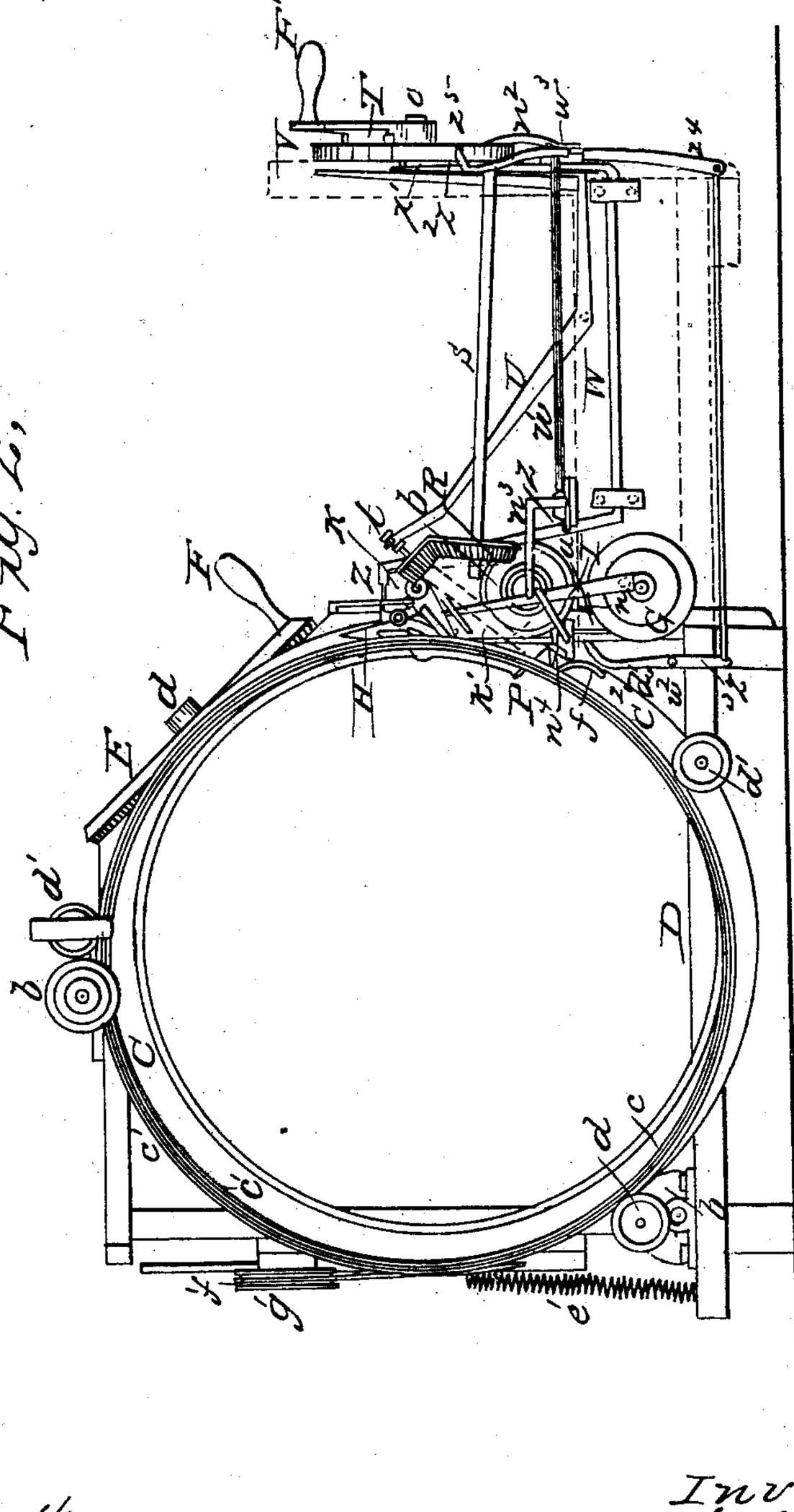
Fig. 2.



Witnesses:
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C. L. Renwick

5 Sheets—Sheet 3.

S. T. HOLLY.

Grain Binder.

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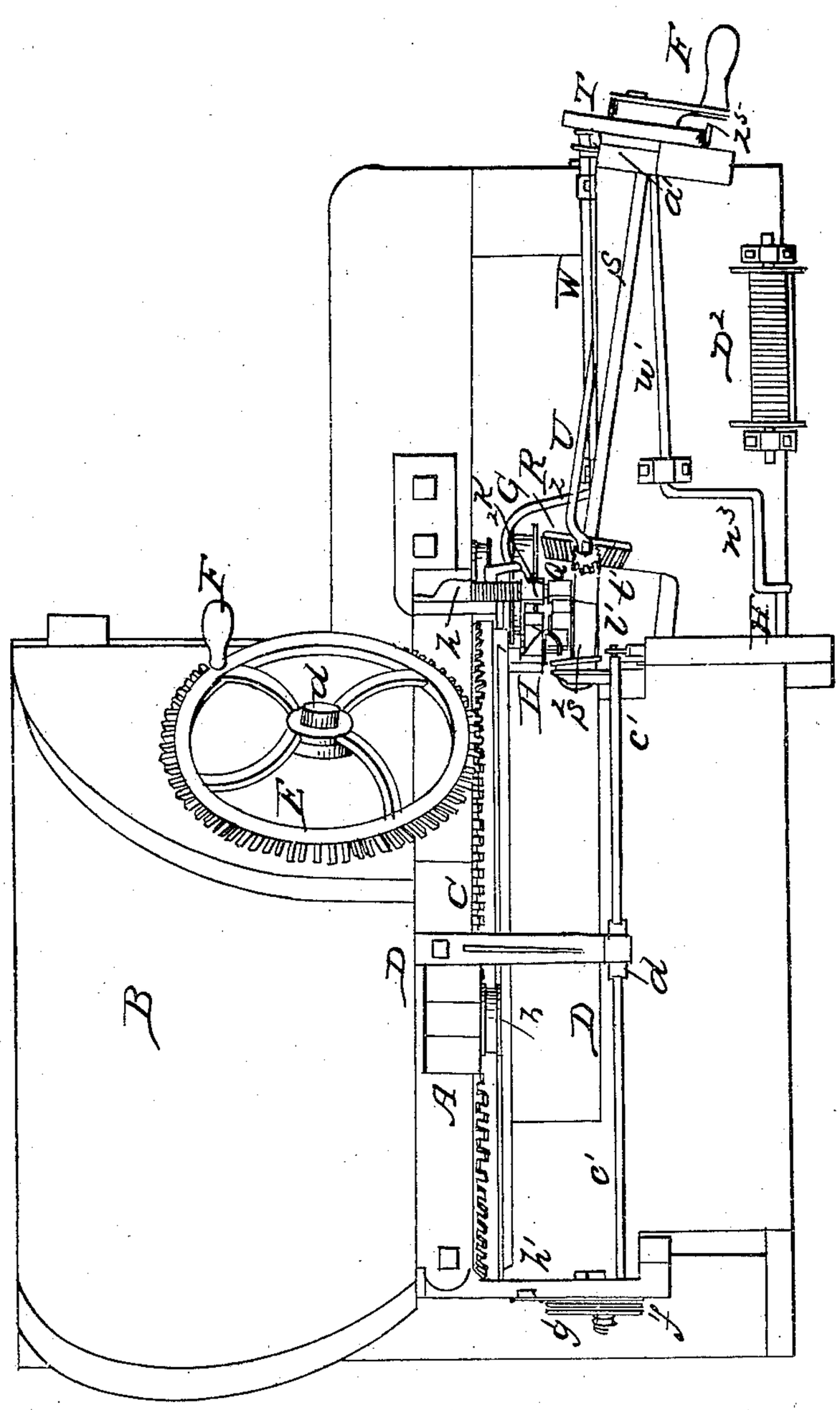
Fig. 3.



Witnesses,
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H. L. Bennett

Inventor:
Sol. T. Holly
by his attorney
C. S. Reinwick

5 Sheets—Sheet 4.

S. T. HOLLY.

Grain Binder.

No. 41,378. Patented Jan. 26, 1864.

Fig. 6,

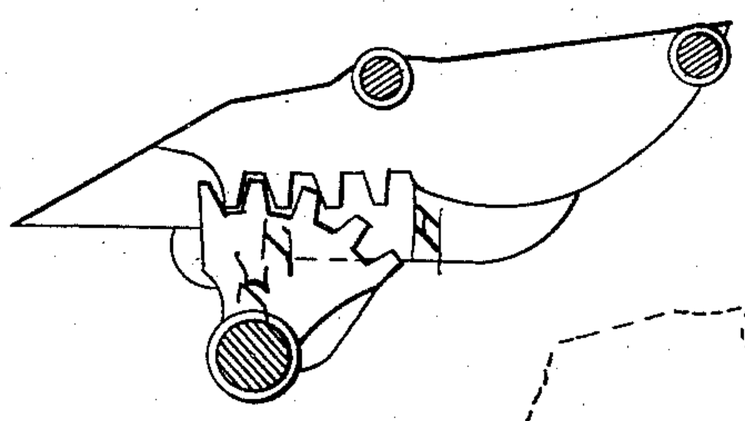


Fig. 7,

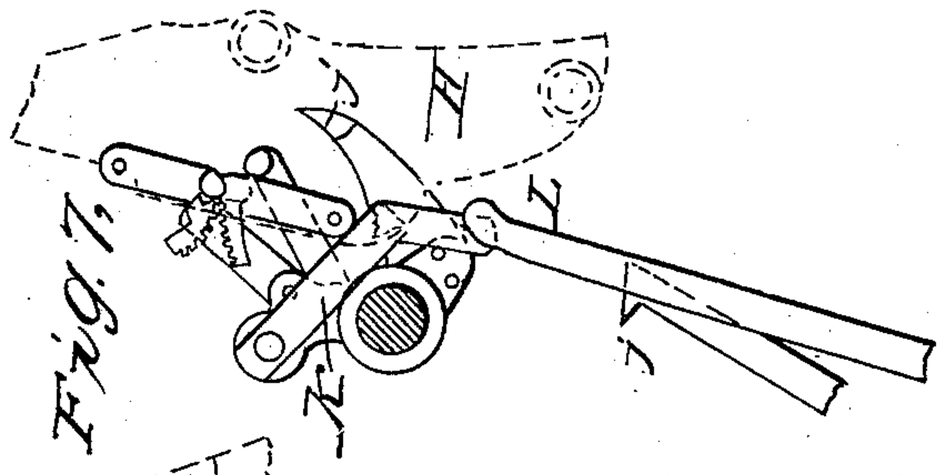


Fig. 5,

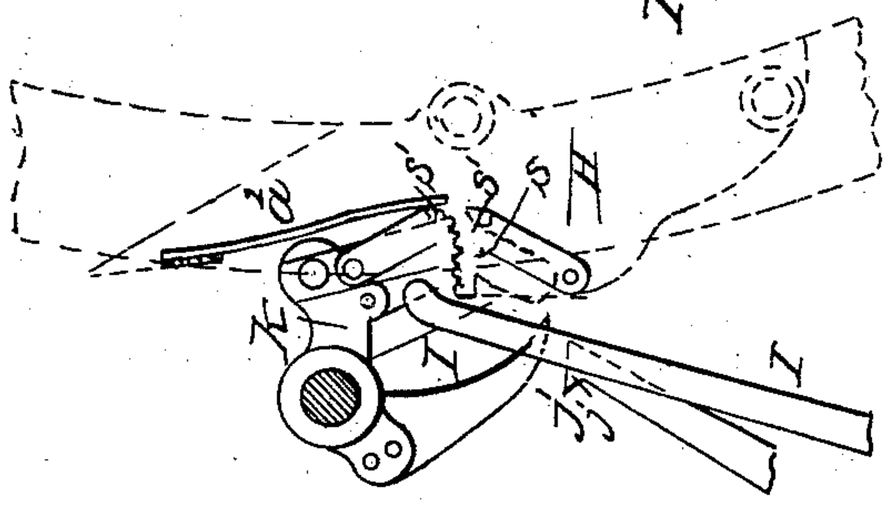


Fig. 9,

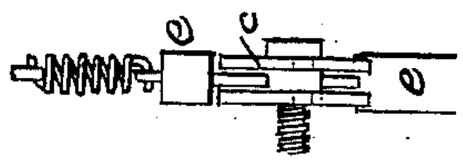


Fig. 4.

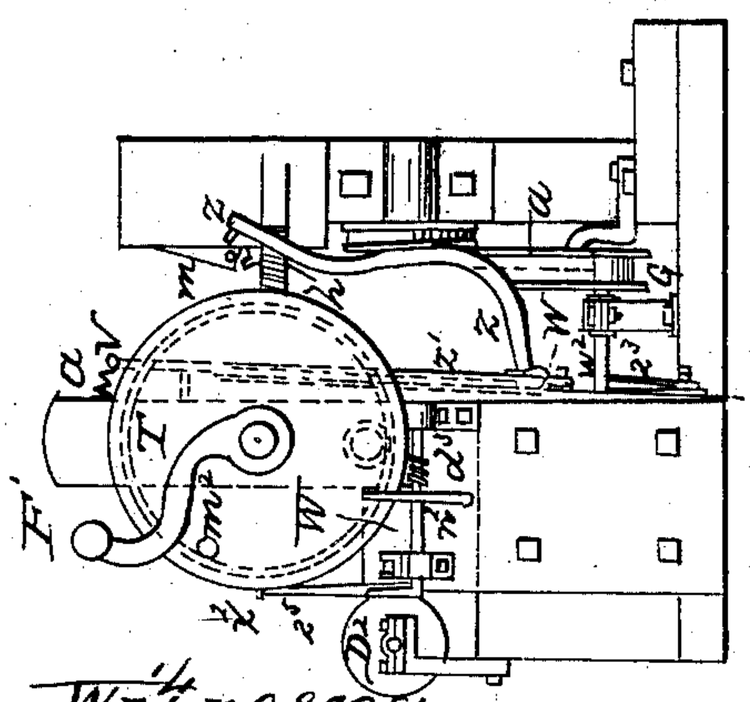
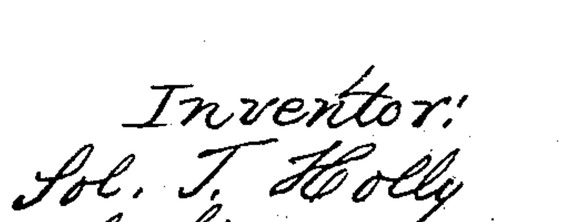


Fig. 14,



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5 Sheets—Sheet 5.

S. T. HOLLY.

Grain Binder.

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Fig. 15.

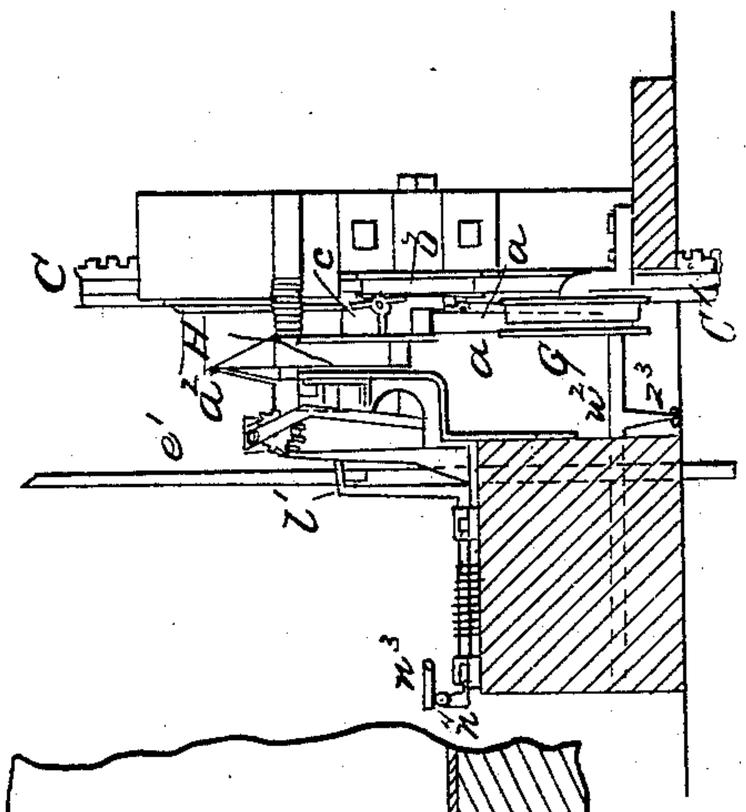


Fig. 16.

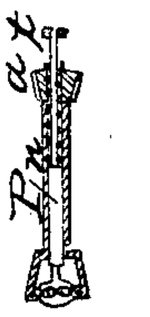


Fig. 11.

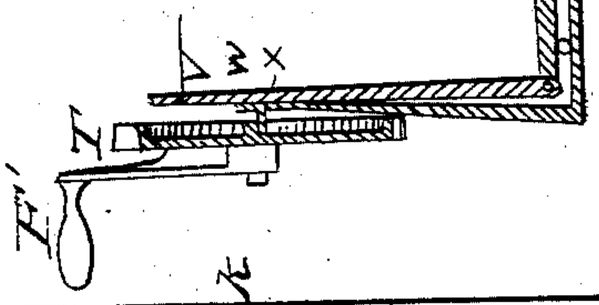


Fig. 10.

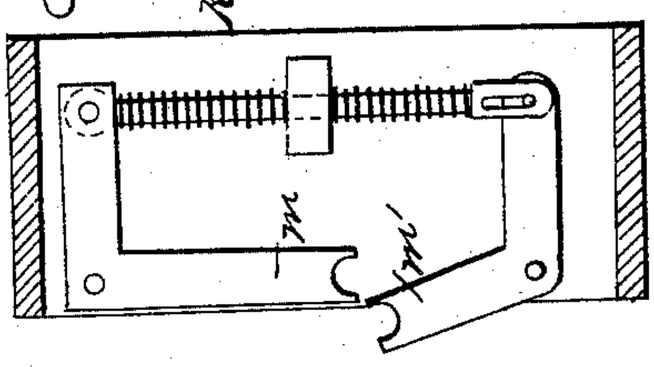


Fig. 13.

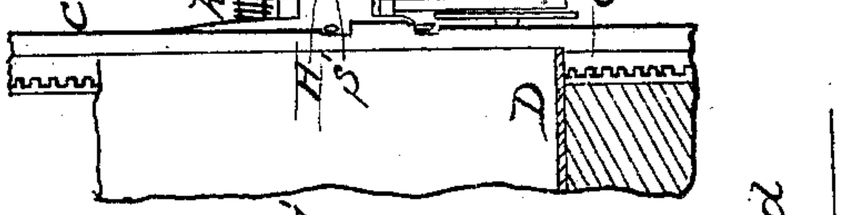


Fig. 12.

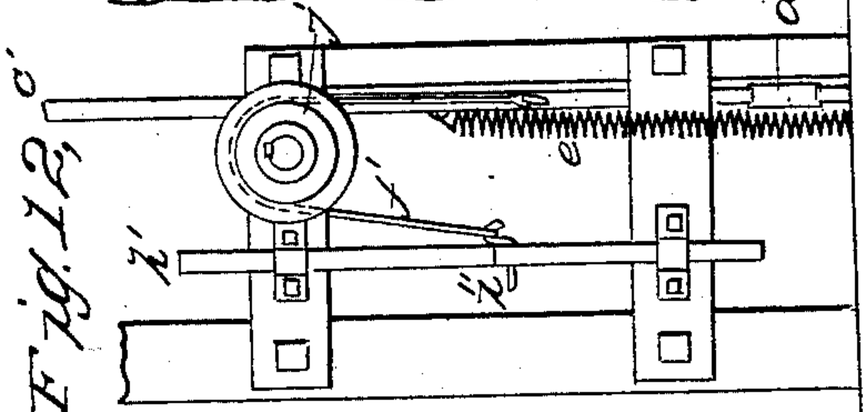
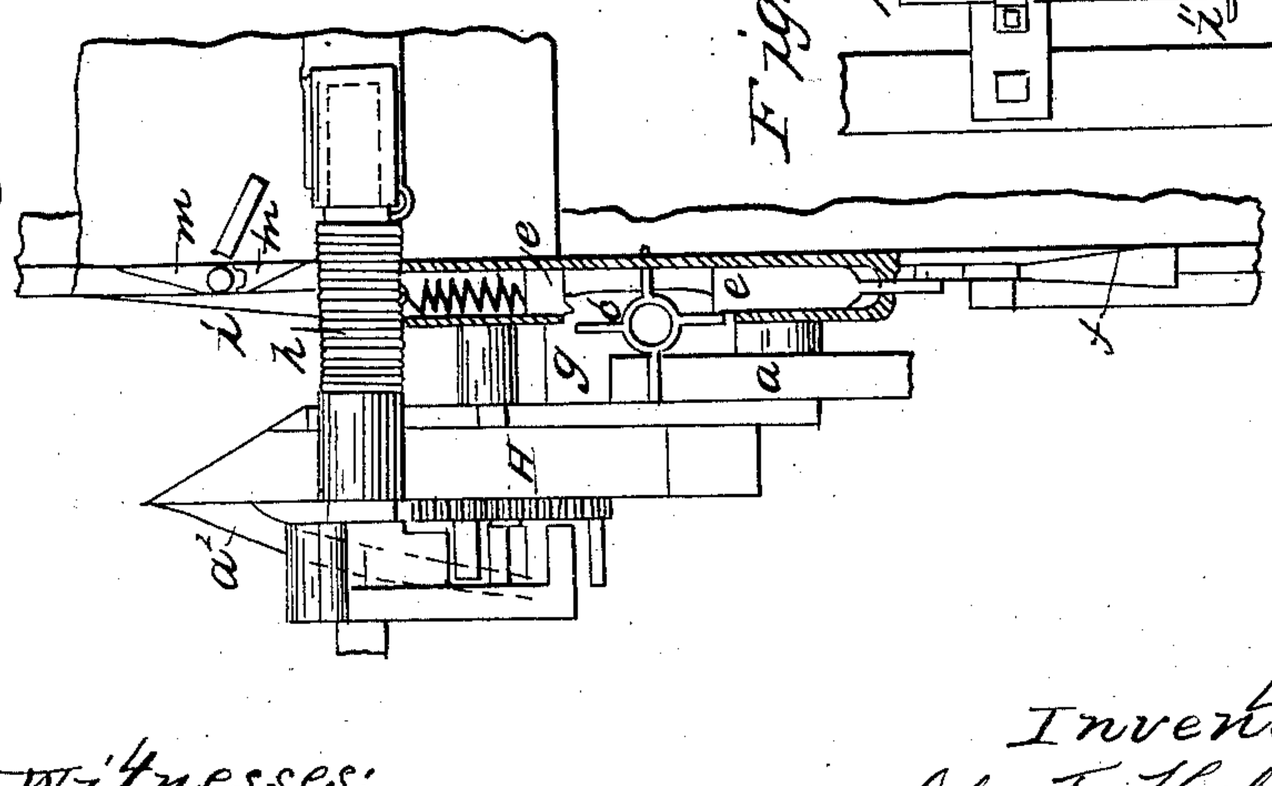


Fig. 8.



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Inventor:
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by his attorney
E. S. Renwick

UNITED STATES PATENT OFFICE.

SOLOMON T. HOLLY, OF ROCKFORD, ILLINOIS.

IMPROVEMENT IN MACHINES FOR BINDING GRAIN.

Specification forming part of Letters Patent No. 41,378, *dated January* 26, 1864.

To all whom it may concern:

Be it known that I, SOLOMON T. HOLLY, of Rockford, in the county of Winnebago and State of Illinois, have invented certain new and useful Improvements in Mechanism for Binding Grain, any of which may be employed to bind other substances to which they are applicable; and I do hereby declare that the following is a full, clear, and exact description of my said invention, reference being had to the accompanying drawing, in which—

Figure 1 represents an elevation of the rear of a binding apparatus embodying my invention, and suitable to be applied to a reaping-machine. Fig. 2 represents a view of the same with certain parts of the frame-work and the binder's seat removed. Fig. 3 represents a plan of the apparatus. Fig. 4 represents an end view of certain portions of the same. Figs. 5, 6, and 7 represent views of parts of the apparatus, looking from the front side of the apparatus, and Fig. 8 represents an edge view of the same, all upon an enlarged scale. Fig. 9 represents an edge view of the strap-holder upon an enlarged scale. Fig. 10 represents a section of the stop-case upon an enlarged scale. Fig. 11 represents a section of the annular wheel and its detent mechanism. Fig. 12 represents an end view of a portion of the apparatus, looking in the direction of the arrow in Fig. 3. Fig. 13 represents a sectional transverse section of a portion of the apparatus, looking in the same direction. Fig. 14 represents a rear view of a portion of the ring-carrier and the traveling finger-stock. Fig. 15 represents a sectional transverse view of a portion of the apparatus, looking in a direction opposite to that indicated by the arrow in Fig. 3; and Fig. 16 represents several views of the cord-twister.

The object of my invention is to bind grain with cord and secure the ends of the band with facility and dispatch. The system which I employ for this purpose is to compress the grain into a sheaf by means of a flexible strap, to encircle it with binding-cord, and to secure the ends of the band by twisting them together and upon a portion of the band which encircles the grain. My machinery for carrying this invention into effect consists of many parts, some of which may be used with advantage in combination with other means of securing the ends of the band than those herein described, and others of which may be used in connection with other means of compressing the grain or of encircling it with binding-cord.

The first part of my invention consists in the combination of devices for compressing and binding grain with a funnel-mouthed cradle to hold the gavel during binding, so that the grain can be partially compressed or gathered together by the operation of forking it endwise into the cradle.

The object of the second part of my invention is to draw the compressing-strap around the gavel of grain to be bound, whereby the gavel is compressed and caused to assume a more cylindric form. It consists in the combination of a flexible compressing-strap with a tension apparatus therefor and with a ring-carrier, or its equivalent, for carrying the end of the strap around the position of the gavel of grain to be compressed.

The object of the third part of my invention is to enable the instrument for carrying the end of the compressing-strap round the grain to be moved always in the same direction, thus saving the time and labor required to reverse its movement. This part consists in the combination of a flexible compressing-strap, and apparatus for withdrawing it from the sheaf with a detachable strap-holder which lets go the end of the strap after binding is effected and seizes it again before the next gavel is to be compressed.

The fourth part of my invention consists in the combination of a pair of fingers, or other instrumentality to hold the binding material, with a ring-carrier to carry it around the position of the gavel of grain to be bound.

The fifth part of my invention consists in the combination of a pair of spring-fingers, to deliver the end of the binding-cord to the cord-carrying or traveling fingers, with an oscillating finger-stock, in such manner that the former pair of fingers deliver the binding-cord to the latter pair and leave it seized thereby by the oscillation of the finger-stock.

The sixth part of my invention consists in the combination of a pair of traveling spring cord-carrying fingers, and mechanism for car-

rying them around the position of the gavel of grain, with a stop by which the fingers are opened to release the binding-cord as they are moved along, thereby doing away with the necessity of having a special moving device for opening these fingers when the cord is to be released.

The seventh part of my invention consists in the combination of a knife-blade with the oscillating finger-stock, in such manner that the knife is operated to cut the binding-cord by the oscillation of the finger-stock.

The eighth part of my invention consists in the combination of a carrier, operating to carry a compressing-strap, or the binding material, or both of these, around the position of the gavel of grain, with a locking mechanism which prevents the retrograde movement of the carrier after the strap or binding material is applied to the gavel, and permits the movement of the carrier after the process of binding is completed.

The ninth part of my invention consists in the combination of devices for carrying the binding-cord around the position of the gavel, with a movable shield and a cord-twister, or their equivalent, the arrangement and operation of the combination being such that the ends of the band are first twisted together, and are then permitted to twist around an adjacent portion of the band encircling the gavel of grain, whereby the band is secured.

The tenth part of my invention consists in the combination of the stop which stops the movement of the ring-carrier, or its equivalent, for encircling the gavel with binding-cord, with a detent operating upon the band-securing mechanism, so as to permit the operation of the latter when the gavel is properly encircled with binding-cord, whether the detent operates upon a part or the whole of the band-securing devices.

The eleventh part of my invention consists in the combination of a detachable compressing strap-holder, with the mechanism for securing the ends of the band, so that the end of the strap is released when the band is secured.

All the parts of my invention are embodied in the binding apparatus represented in the accompanying drawing, which is of a suitable form to be applied to a harvesting-machine. The cradle of this apparatus, in which the grain to be bound is secured, is formed of wood lined with sheet-iron, and has a flaring or funnel-formed mouth, B, so that the gavel of grain shoved into it by a fork is partially compressed and caused to enter through the circular frame A, which sustains the ring-carrier C, which in this example carries the compressing-strap *a* and the binding-cord around the gavel. The ring-carrier C is held in place and guided in moving by wheels *b b b*, whose grooved rims embrace the rim of the ring-carrier; its interior is larger in diameter than the interior of the circular frame A of the cradle, so that the grain may pass freely through it, and be supported clear of the carrier by the two parts D and D′ of the cradle, between which the ring-carrier is arranged to turn. It has a series of cog-teeth upon one of its faces which engage with the corresponding teeth of a cog-wheel, E, that is arranged to turn upon a stud, *d*, and is fitted with a crank-handle, F, so that by turning this cog-wheel the ring-carrier is caused to revolve in its wheel supports.

The ring-carrier has a strap-holder, *c*, upon it, to seize and carry the compressing-strap around the gavel of grain. The compressing-strap *a* is made of leather, so as to be flexible and strong, and is coiled upon a drum, G, within which there is a spring that is similar in construction and operation to a clock-spring, and is of sufficient strength to effect the compression of the grain. The spring-drum thus forms a tension apparatus for the compressing-strap. The drawing off of the compressing-strap is resisted by the spring, and the strap is always under tension as it is drawn around the gavel by the movement of the ring-carrier. The strap-drum G is supported upon an arbor in the vicinity of the band-securing devices, and the ring-carrier carries the end of the strap entirely around the grain in the cradle. As the strap is under tension it draws over the gavel while its end is so carried, and by its friction causes the grain to partially turn or roll in the cradle, the effect of which is to cause the gavel to assume a more cylindrical form.

The ring-carrier might be arranged to turn backward after the grain is bound, to remove the compressing-strap from it; but as this would cause a loss of time, the strap-holder *c* in the present machine is made detachable, so that it lets go the end of the compressing-strap after the sheaf is bound, permits the spring-drum G to withdraw the strap from the sheaf, and seizes upon the end of the strap as it is passing it, so as to hold it ready to be carried around the next gavel of grain. The detachable strap-holder *c* is a four-armed instrument which revolves upon a pivot secured to the ring-carrier. Each of its arms has a slot in it of the proper size to admit the body of the compressing-strap *c*, but too narrow to permit the passage of the end of this strap, which is made thick by doubling it. The ends of these arms revolve within the range of a spring-detent, *e*, which prevents their revolution until it is withdrawn by means of an elbow-lever, *f*; whereupon the strap-holder is permitted to turn a quarter of a revolution, at the end of which it is again stopped by means of the detent. The elbow-lever is operated by the band-securing mechanism, as will be hereinafter described, so that the detent *e* is controlled by the movement of the band-securing device, and is withdrawn to permit the compressing-strap to be removed from the gavel when the band is secured.

The spring-drum is below the place from which the strap-holder starts, and to which it is returned by the revolution of the ring-carrier; hence the effect of a revolution is to cause the strap to encircle the strap-holder as well as the grain. While in this position the strap leading from the grain to the spring-drum bears upon the plate *g* of the ring-carrier to which the strap-holder is pivoted, where it is within the range of motion of the forked arm of the strap-holder next succeeding that one which holds the end of the strap. Hence when the strap-holder is permitted to turn to release the end of the strap from one of its forked arms, that turning causes the next succeeding forked arm to embrace the strap in its fork; and, as the strap is drawn off the grain by the spring-drum, it passes freely through that forked arm of the strap-holder until its thick end strikes that forked arm and is prevented from escaping. The compressing-strap is thus released and seized anew by the detachable strap-holder, so that it is in the proper condition to be carried round a succeeding gavel of grain. The combination of a detachable strap-holder with the carrier thereof thus permits the withdrawal of the compressing-strap from the bound sheaf without the necessity of moving the carrier backward for that purpose.

In order to carry the binding-cord around the gavel the ring-carrier C is fitted with a pair of spring fingers or forceps, *s' s''*. (Shown in Figs. 5 and 7.) Each of these is secured to a cog-segment which is fast to an arbor that turns in a finger stock or hand, H, which projects laterally from the ring-carrier. The teeth of the two cog-segments engage, so that the fingers open (in the direction of the arrow applied to the segments in Fig. 7) and close simultaneously, and when closed always have the same positions in the machine. The arbors of the fingers pass into the finger-stock and are fitted with springs, which tend to keep the fingers closed. The adjacent side of one finger is fluted, and that of the other is wedge-shaped to fit into the former, so as to hold the binding-cord securely, and the movement of the fingers by the springs on their arbors beyond the point where they meet is prevented by stops. In order to open these fingers and release the end of the binding-cord grasped by them, a stationary stop is provided. This stop consists of a post, I, having a projecting head which is within the range of motion of the end of the segment of one of the fingers; hence when the fingers are carried past the position of this stop by the movement of the ring-carrier, the end of the segment bearing against the inclined under side of the head of the stop is pushed inward (as shown at Fig. 5) and the fingers are opened; and when the finger-segment passes by the stop the fingers are permitted to close.

The traveling fingers thus described receive the binding-cord from another pair of fingers, *s s*, which for distinction may be called the cord-feeding fingers. These are secured to a finger-stock, K, which has a shaft supported in stationary bearings, and is caused to oscillate by the movement of the ring-carrier C. This oscillating finger-stock is located in close proximity to the band-securing devices. It is provided with a cog-segment, L, having a sufficient number of teeth to cause it to oscillate the distance required to perform the work, and these teeth engage with and are operated by the teeth of a cog-segment formed upon the finger-stock H, which is carried by the ring-carrier C. The shaft of the oscillating finger-stock has a spring, *h*, coiled upon it, to move it back after the cog-teeth of the carrier have ceased to act upon it; and the distance to which it can be moved back by the spring is limited by a stop, so that it then stands in the proper position for the teeth of its segment to be operated upon by the segment secured to the carrier. The cord-feeding fingers *s s* (shown in Figs. 5 and 7) are similar in construction to the traveling fingers s^1 s^1. One of them is connected with the oscillating finger-stock by a fixed arm; the arm of the other is connected therewith by an arbor, so that this finger can move toward or from its mate to seize or release the binding-cord, and the arbor is furnished with a spring which tends to hold the fingers closed. The traveling fingers are so applied to the ring-carrier that the curve they describe in moving overlaps the circular curve described by the cord-feeding fingers in the oscillation of their finger-stock; and the cog-teeth of the two segments are so arranged that the cord-feeding fingers pass between the traveling fingers at the lower intersection of the two curves, and are struck by the traveling fingers at the upper intersection of the two curves. The cord-feeding fingers pass between the traveling fingers when the latter are opened by the stop I, and carry the end of the binding-cord held by them through the traveling fingers, which close upon it as the movement of the ring-carrier carries them past the stop I. When, on the other hand, the continued movement of the ring-carrier carries the traveling fingers against the inner sides of the cord-carrying fingers at the upper intersection of the two curves of movement, the traveling fingers are prevented from yielding to the pressure by the stops applied to their cog-segments, and consequently the cord-feeding fingers are opened by the pressure against them, permit the traveling fingers to carry the cord between them, and close upon the cord behind, which renders through them as the traveling fingers carry its end around the gavel of grain. In order that the cord may render freely during this operation, the cord-feeding fingers are opened by a spring finger-opener, which consists of a wedge (shown in dotted lines in Fig. 7) secured to one side of an elbow-formed plate, M, depending from an

arbor which is carried by the oscillating finger-stock K. The arbor of this finger-opener has a spring applied to it, which tends to force the wedge to enter between the cord-feeding fingers from their inner sides, and the spring is made of greater strength than the spring which tends to keep the fingers closed, so that the finger-opener operated by it will open the fingers and hold them open whenever it is permitted to act upon them. The cord-feeding fingers may remain open during the greater part of the movement of the traveling fingers, but must be closed to seize the cord just before it is cut, and must continue closed until the cord is fed to and seized by the traveling fingers. In order to prevent the finger-opener from operating during this period it is so formed that the traveling finger-stock H bears against its outer edge and presses it toward the arbor of the oscillating finger-stock, and consequently away from the fingers before the cord is severed, and holds it thus until the traveling finger-stock passes by the oscillating finger-stock.

The cord to form the band is severed from that upon the cord-reel at a point between the cord-feeding fingers and the grain, so that the end of the cord upon the reel is retained by these fingers. The means of cutting the cord are a stationary knife, *j*, and a moving knife, *j'*, which act in combination like shears. The moving knife is secured to an arm projecting from the oscillating finger-stock K, so that as the latter oscillates the edge of the knife describes a circular curve; and the stationary knife is so placed with reference to this finger-stock that the first movement of the latter (by the segment secured to the traveling finger-stock) causes the edge of the moving knife to pass by that of the stationary one and cut the cord.

In the present machine the band-securing devices are arranged to seize upon the cord just before it is cut, and before the end of the band carried by the traveling fingers is released from them by the operation of the stop I. As soon as these operations are effected the traveling fingers remain stationary until the band is secured. As the traveling fingers are carried by a ring-carrier which is arranged to move always in one direction, and as the stopping of their movement always at the same place is a matter of importance, automatic locking mechanism is provided in this machine to stop the movement of the ring-carrier when the traveling fingers and the compressing-strap have been placed in the positions which they are to occupy while the band is secured, and also to prevent the ring-carrier from being turned backward to an extent which would produce injury. This locking mechanism consists of a pair of latch-stops, *m* *m*[1], which are secured to the frame of the cradle in proper positions to act upon a pin, *i*, which projects radially from the ring-carrier C. Each of these latch-stops consists of an elbow-formed latch turning on a pivot at its elbow, and having its head notched to receive the pin of the ring-carrier. The heads of the stops point in opposite directions, so that the upper one, when protruded from the case in which it is pivoted, prevents the forward movement of the ring-carrier; and the lower, when similarly protruded, prevents it from being turned backward. The horizontal arm of the upper latch-stop has a rod, *k*, (see Fig. 10,) pivoted to it, whose lower end is slotted to receive a pin which is secured to the horizontal arm of the lower stop, in such manner that the pin of the lower stop bears against the end of the slot; hence when the head of the lower stop is pushed into the stop-case, that of the other is of necessity protruded from the case. A spring is provided to protrude the head of the lower stop *m*[1] from the stop-case, and another to withdraw the upper stop *m* into the case. When the ring-carrier is being turned to encircle the gavel with cord and with the compressing-strap, the latch-stops occupy the positions they are represented in at Fig. 10, so that the pin of the ring-carrier as it turns upward bears against the lower stop, pushes it inward, and causes the head of the upper to protrude, (by reason of the rod *k* between the horizontal arms of the two latch-stops,) so that it stops the further forward movement of the ring-carrier; and as soon as the pin of the ring-carrier passes by the lower stop and enters the notched head of the upper one, the head of the lower is protruded by its spring beneath the pin, so that it is in position to stop the retrograde movement of the ring-carrier (caused by the strain upon the compressing-strap when the force applied to turn the ring-carrier forward is withdrawn) as soon as it has retrograded the small distance required to move the pin *i* into the notch in the lower slot. As this notch is deep enough to receive the pin *i*, the movement of that pin into it releases the upper latch, which is then withdrawn into the casing by the action of its spring.

The ring-carrier then is permitted to remain at rest until the band is secured, the sheaf is removed, and a new gavel of grain is placed in the cradle, when it is again caused to revolve. As the ring-carrier is moved with considerable speed, its pin, *i*, tends to strike the stop with force and jar the mechanism. This jarring is materially lessened by blocks of vulcanized india-rubber inserted between the shank of the radial pin and the sides of the socket in the ring-carrier in which it is secured, so that the india-rubber forms a species of spring-bumper.

In order to twist the ends of the band together and around the portion of the band which encircles the gavel, a cord-twister is provided, also means to hold the cord in the proper position during twisting, and a shield or removable plate which separates the ends

from the band until they are sufficiently twisted, and is removed at the proper time to permit the twisted ends of the band to twist around the portion encircling the gavel. The cord-twister P has a pair of jaws hinged to a hollow shaft, *n*, which is supported in a box, and is fitted with a beveled pinion, Q, by which it is caused to revolve. The beveled pinion is driven by a beveled wheel, R, secured to one end of a counter-shaft, S, which has at its opposite end a pinion, (shown in dotted lines in Fig. 4;) this pinion is driven by an annular wheel, T, that turns upon a stud, *o*, and is fitted with a crank-handle, F′, so that by turning the crank-handle a single revolution the cord-twister is caused to revolve a sufficient number of times to secure the band. The jaws of the cord-twister are connected with a piston, *t*, which traverses the hollow shaft *n* and is fitted with a spring, which tends to hold the jaws closed. The head of this piston is received in the forked end of one arm of a lever, U, whose opposite arm is connected with a standard, V, having at its upper end a finger, *x*, which is within the range of motion of a snug, *w*, that projects from and revolves with the annular wheel T, so that this snug bears upon the standard, and, acting through it and the forked lever U, upon the piston of the cord-twister, opens the jaws of the last. As the movement of this standard by the snug *w* is limited, (by a pin placed under the lever U,) it also acts as a stop to stop the movement of the cord-twister when its work is done. It is also used as a detent to permit the movement of the cord-securing devices when the gavel is encircled with cord. In order that it may act as a detent it must be withdrawn out of the range of motion of the snug *w*, so as to liberate it and the wheel to which it is secured; and as this liberation is effected in this machine by the lower stop m^1 of the ring-carrier, the detent-standard is combined with it. To this end a rock-shaft, W, is provided, which has two arms; one, *z*, of these arms projects upward to the stop-case, and its end enters a slot therein, so that the lower stop m^1 can bear against and move it when the stop is forced into the stop-case by the pin of the ring-carrier. The other arm, z^1, of the rock-shaft projects upward in front of the annular wheel T, and has a slot in its end, through which the finger of the detent-standard V passes. Hence when the one arm *z* of the rock-shaft W is moved by the latch-stop m^1 the other arm z^1 carries the finger of the standard laterally from beneath the snug *w* of the annular wheel T, thus freeing the latter and permitting it to be turned to operate the cord-twister. The same lateral movement of the standard also permits the jaws of the cord-twister to be closed by the spring-piston *t*, because, as soon as the detent-standard V is withdrawn laterally from beneath the snug of the annular wheel T, that snug no longer opposes the action of the spring of the piston inclosing the jaws. Hence in this machine the stop mechanism of the traveling cord-fingers, which are secured to the carrier, is combined with the detent that permits all the parts of the band-securing mechanism to operate when the gavel is encircled with cord. When the snug *w* has passed by the detent-finger *x*, the latter is again placed in the position to stop the revolution of the annular wheel T the next time by a spring, a^1, which draws the detent-standard V and the rock-shaft arm *z* toward the axis of the wheel T.

In the present machine the ends of the band are first twisted together, and are then permitted to twist around a portion of the band encircling the sheaf. In order that the ends may be first twisted together to a sufficient extent, they are separated during this operation (as before stated) from the portion of the band encircling the sheaf by a removable shield, which is withdrawn after the ends of the band are sufficiently twisted together, to permit them to come in contact with and twist upon an adjacent portion of the band encircling the sheaf. This shield *b′* is made fast to a ring, *c′*, which is supported by friction-wheels, d^1, and is connected with a spring, *e′*, which tends to hold the shield in the upper position it occupies (as shown in dotted lines in Fig. 13) during the twisting of the ends upon a portion of the band encircling the sheaf. The shield-ring is also connected by a cord, *f′*, passing over a pulley, *g′*, with a slide-bar, *h′*, which has an arm, *i′*, projecting from one of its sides within the track of the radial pin *i* of the ring-carrier C, so that as this turns, its pin, bearing upon the arm of the slide-bar *h′*, depresses that bar, and, acting through it and the cord *f′* upon the shield-ring *c′*, turns this last and draws down the shield to the position it is to occupy during the twisting of the ends of the band together, as shown in Fig. 13. When the slide-bar *h′* is depressed sufficiently for this purpose, its arm is just without the track of the pin of the ring-carrier, so that the pin then ceases to move it further; and when the shield is thus drawn down, it is retained in that position by a spring-catch, with which a pin, *l′*, secured to the shield-ring, engages until the ends of the band are sufficiently twisted together, after which the shield is released and is withdrawn by its spring, *c′*. In order to release the shield at the proper time, a pin, m^2, is secured to the back of the annular wheel T. This pin acts upon one arm, n^2, of a rock-shaft, w^1, which has another arm, n^3, that acts upon the arm n^4 of the spring-catch, and causes it to liberate the tooth *l′*, so that the shield is permitted to be withdrawn by its spring, *e′*, when the annular wheel T has made about three-quarters of a revolution. Hence about three-quarters of a revolution of the annular wheel are employed to twist the ends of the band together, and the remaining quarter of a revolution to twist them round a portion of the band encircling the gavel.

In order that the ends of the band may twist properly together and then be in a position to twist upon the band, the place where the two extremities of the band meet upon the gavel must not be radially opposite the cord-twister, but must be at a short distance therefrom. The lower edge of the shield is therefore permitted to remain above the level of the cord-feeding fingers (as shown in dotted lines in Fig. 13) until the traveling fingers have passed by it, and is subsequently depressed (by the action of the pin of the ring-carrier upon the sliding bar h') to force the binding-cord passing under its lower edge down to the position below the level of the cord-twister, where the extremities of the band are to meet upon the gavel. And in order that the cord may not escape from the shield the lower edge of the latter is notched.

In order that the twisted ends of the band may be made to twist around a portion of the band encircling the gavel, the twisted ends must be held at an acute angle thereto. This may be effected either by arranging the shaft of the cord-twister at an acute angle to a line drawn tangentially to the perimeter of the gavel at the place where the two extremities of the band meet upon the gavel, or by arranging the shaft of the cord-twister radially to the gavel and using guides to hold the cord in the proper position. Either mode of carrying my invention into effect may be used, but I prefer the former and have embodied it in the machine I am now describing. The shaft of the cord-twister, as represented in the drawings, is therefore arranged at an acute angle to a line drawn tangentially to the perimeter of the sheaf.

In order that the end of the band carried by the traveling fingers may extend between the jaws of the cord-twister when they close, the cord-twister is so arranged in the machine that its head is in the track of the traveling finger-stock and its fingers; and the snug w is so placed upon the annular wheel that the revolution of the cord-twister is stopped by the detent-standard V when its jaws are opened by the action of the lever, and stand, the one inside and the other outside of the track of the traveling fingers, so that these in their movement carry the end of the band directly between the jaws. In order that the other end of the band may be between the jaws of the cord-twister when they close, the cord proceeding through the cord-feeding fingers is placed between the jaws by the action of the shield b'. To this end an inclined guard, s^2, is placed over the cord-twister, so that when the cord is forced down by the shield it shall not catch upon the head of the cord-twister, but shall be conducted to the side thereof nearer the ring-carrier. The center of the notch of the ring-carrier is in the same plane as the axis of the cord-twister, so that it tends to draw the cord leading from the traveling fingers toward the center of the cord-twister, and causes it to enter between the open jaws thereof as soon as it is depressed low enough by the downward movement of the shield.

In order to prevent the traveling fingers from catching upon the cord or upon the cord-twister as they pass between its jaws, a spring-guard, a^2, is applied to the finger-stock H. This guard slopes laterally, as it extends back from the point of the finger-stock, sufficiently to protect the extremities of the traveling fingers, and it is constructed in such manner as to be a spring in itself, or it may have a spring applied to it to keep it bearing upon the ends of the traveling fingers and permit it to yield when they are opened.

The manner in which the elbow-lever of the detent of the detachable strap-holder is operated by the band-securing devices is as follows: A rock-shaft, w^2, is secured to the frame of the machine in such a position that an arm, z^2, projecting from it can bear against the longer arm of the elbow-lever f, when the ring-carrier is at rest during the securing of the band. This rock-shaft has a second arm, z^3, which is connected by a rod with the lower arm z^4 of a second rock-shaft, w^3, in the vicinity of the annular wheel T. This second rock-shaft has an upper arm, z^5, which projects by the side of the annular wheel in a position to be borne against by a projection, x^2, on the said wheel, just as it is completing the revolution required to secure the band. Hence, as this wheel completes its revolution, the projection x^2, bearing upon the arm z^5, operates through the rock-shafts w^3 w^2 and their arms upon the elbow-lever f of the detent e, and withdraws this last, thus freeing the end of the compressing-strap, which is immediately pulled around the sheaf by the action of its spring-drum, G. As the annular wheel moves forward, its projection, x^2, passes by the end of the arm z^5, which, being pushed back by a spring, d^3, engages beneath the projection and operates as a pawl to prevent the backward movement of the wheel and of the band-securing devices operated by it. At the same time the snug w upon the face of the wheel operates upon the detent V, as before described, so that the band-securing devices are held stationary with the jaws of the cord-twister in proper positions to receive the band until a new length of cord is carried round the succeeding gavel of grain, when the detent-finger x is removed laterally, as before described.

After the withdrawal of the compressing-strap, the bound sheaf may be removed by a fork operated by hand or by other means. The grain to be bound may be supplied to the cradle of the binding mechanism by hand, or by automatic machinery adapted to this purpose. The binding-cord is contained upon a reel, D^2, and this reel is beneath the binder's seat E^2. The latter is supported on spring-standards, and is so placed that the binder can apply his left hand to the crank-handle F,

which operates the mechanism for compressing the gavel and encircling it with cord, and his right hand to the crank-handle F′, which operates the band-securing mechanism. The end of the cord is passed through an eye, or cord-guide, under the driver's seat, and thence through an eye upon the finger-opener M to the cord-feeding fingers *s*.

I have found it convenient to represent my improvements in a machine which is operated by hand, but they may be operated by power. In this case the binding-mechanism should be arranged to operate at intervals as required for binding the gavels. The invention described is not limited to the binding of grain, as it may be applied to the binding of other substances to which it is applicable. Neither is it essential that all the parts described should be used in connection, as the means for compressing the gavel and surrounding it with cord may be used with means for securing the band operating upon a different principle from those herein described. Equivalents for one or more of the devices in the claimed combinations may also be substituted in their place without departing from my invention; and the construction and arrangement of the apparatus may be varied to meet the views of the builders of machines, or to suit the circumstances under which it is used, so long as the combinations as entities retain substantially the same modes of operation.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The combination of instrumentalities for compressing and binding grain with a funnel-mouthed cradle, substantially as set forth.

2. The combination of a flexible compressing-strap with a tension apparatus therefor and with a ring-carrier, the combination as a whole operating substantially as set forth.

3. The combination of a flexible compressing-strap and apparatus for withdrawing it from the sheaf, with a detachable strap-holder, the combination as a whole operating substantially as set forth.

4. The combination of fingers, or other instrumentality to hold the binding material, with a ring-carrier to carry it around the position of the gavel to be bound, substantially as set forth.

5. The combination of cord-feeding fingers with an oscillating finger-stock, substantially as set forth.

6. The combination of traveling cord-fingers and mechanism to carry them around the position of the gavel to be bound, with a stop by means of which they are opened to release the cord at the proper time, the combination as a whole operating substantially as set forth.

7. The combination of a knife-blade with the oscillating finger-stock, substantially as set forth.

8. The combination of a carrier arranged to turn in one direction around the position of the gavel, with a locking mechanism, the combination as a whole operating substantially as set forth.

9. The combination of instrumentalities for surrounding the gavel with cord, with a cord-twister and shield, the combination as a whole operating substantially as set forth.

10. The combination of the stop which stops the movement of the ring-carrier for encircling the gavel with cord, with detent mechanism that permits the operation of the cord-securing devices when the gavel is encircled with cord, the combination as a whole operating substantially as herein set forth.

11. The combination of a detachable holder for the compressing-strap, with the mechanism for securing the ends of the band, so that the strap is released when the band is secured, the combination as a whole operating substantially as herein set forth.

In testimony whereof I have hereunto subscribed my name.

SOLOMON T. HOLLY.

Witnesses:
SILAS G. TYLER,
B. ROBERSON.