(Model.)

4 Sheets—Sheet 1.

F. T. & F. A. LOMONT.

GRAIN BINDER.

No. 261,007. Patented July 11, 1882.

Fig. 1

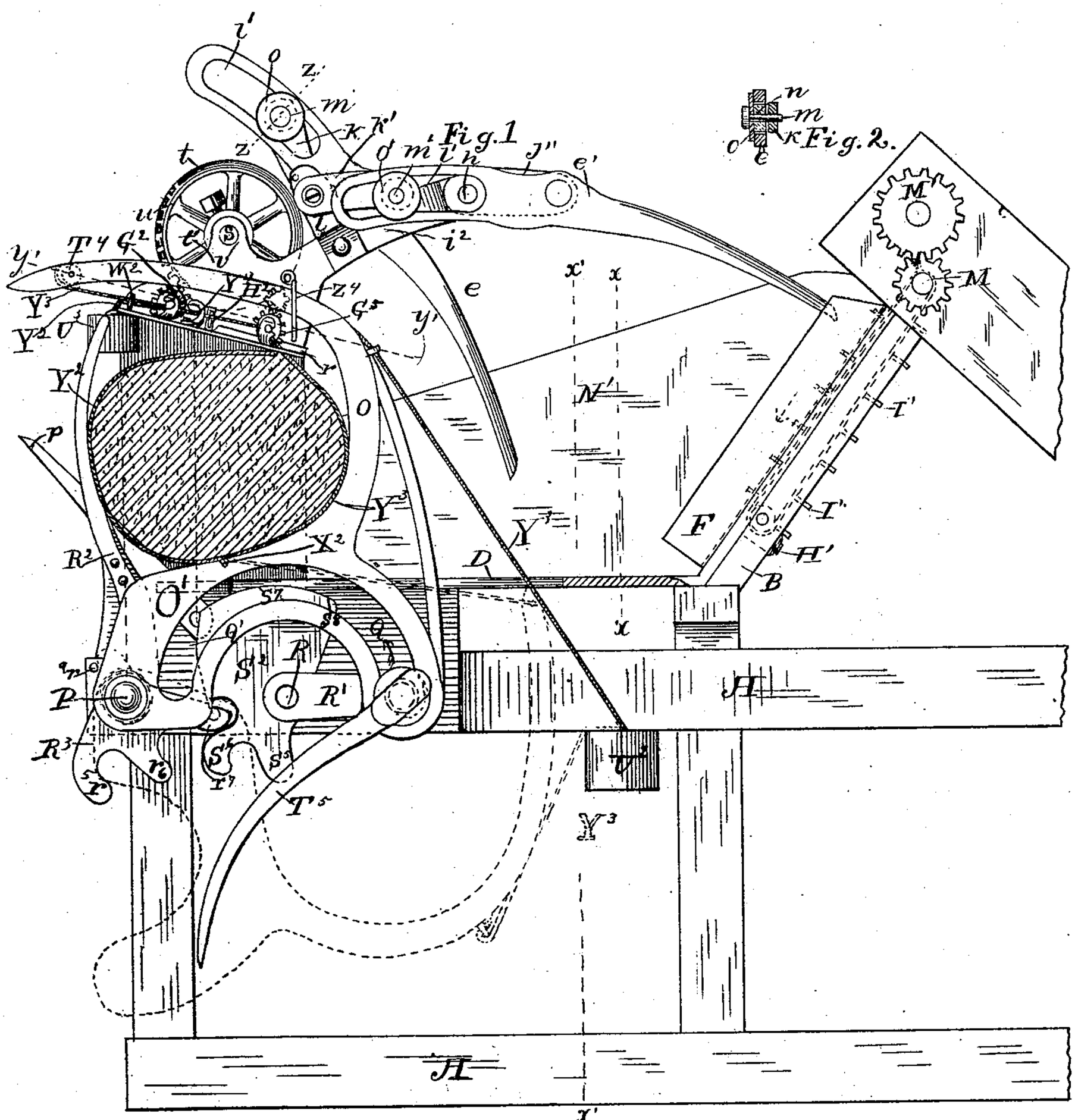
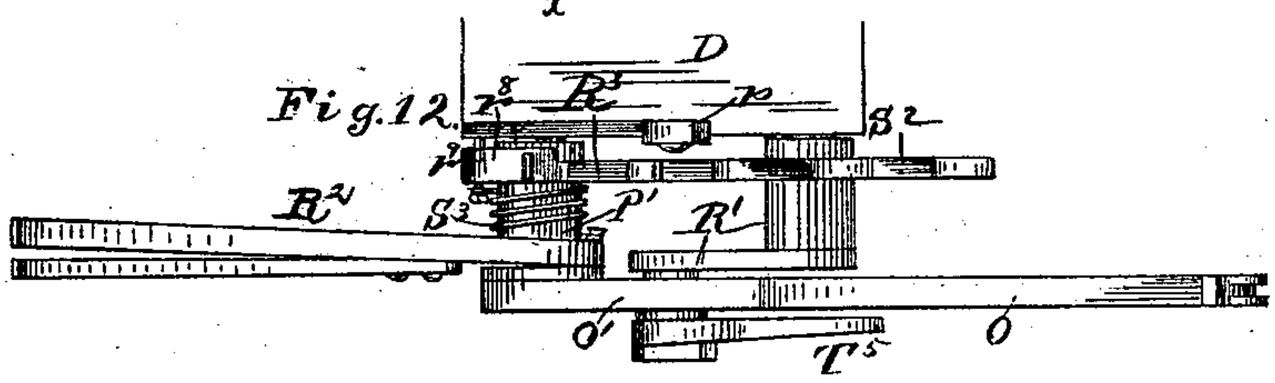


Fig. 2.

Fig. 12.



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(Model.)

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Fig 5.

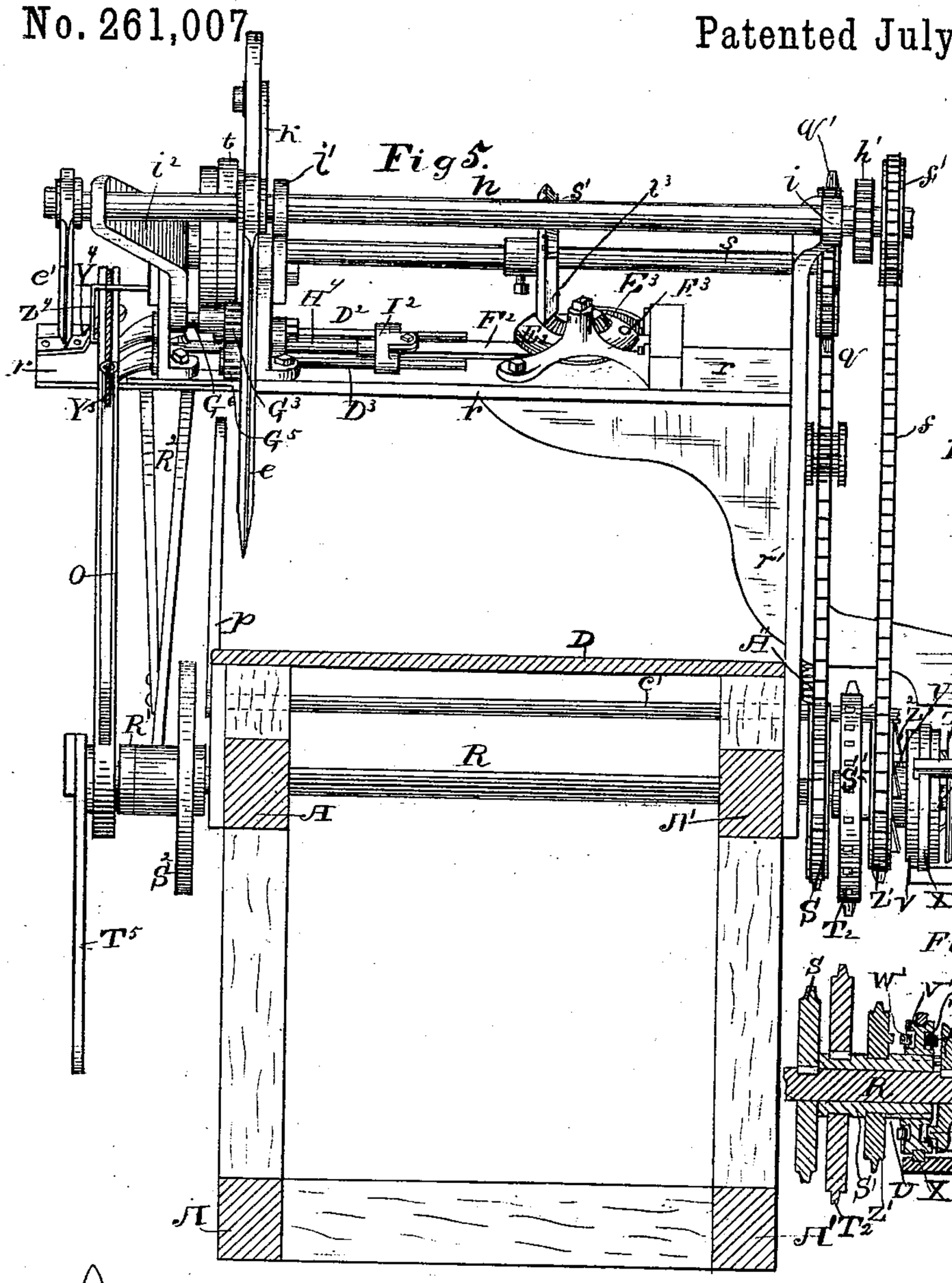


Fig. 9.

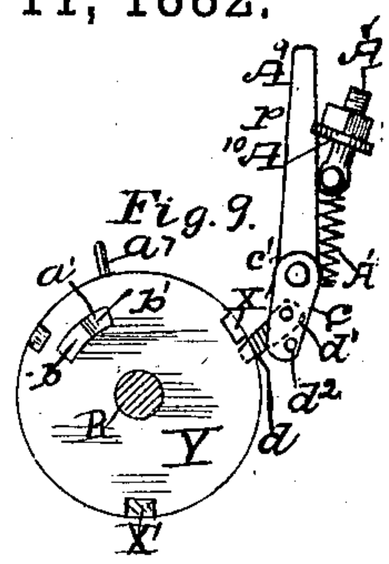


Fig. 8.

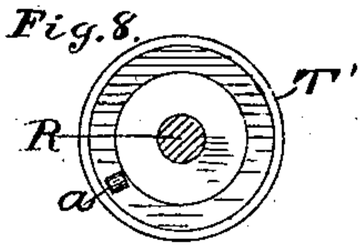
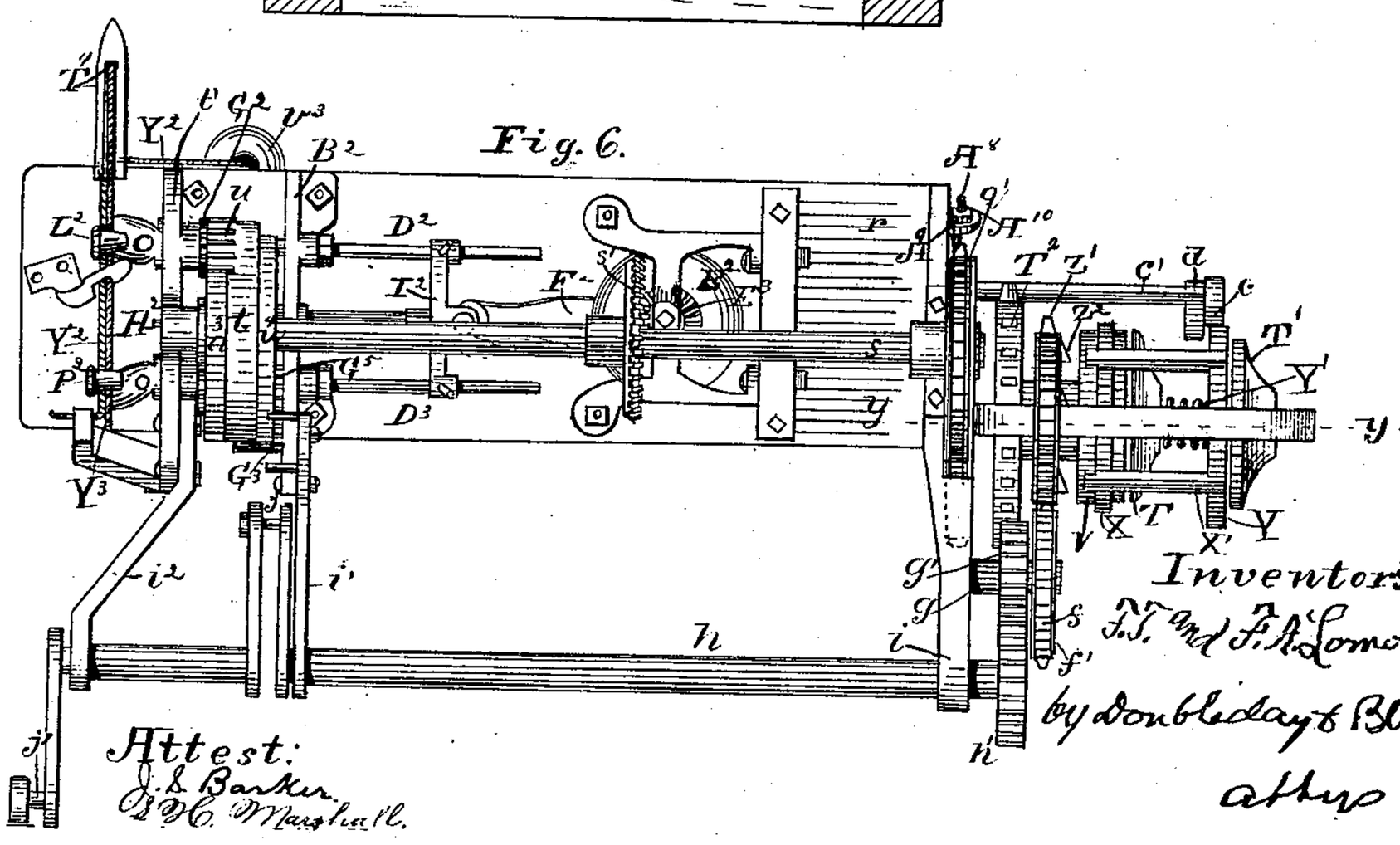


Fig. 7.

Fig. 6.



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GRAIN BINDER.

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Fig. 3.

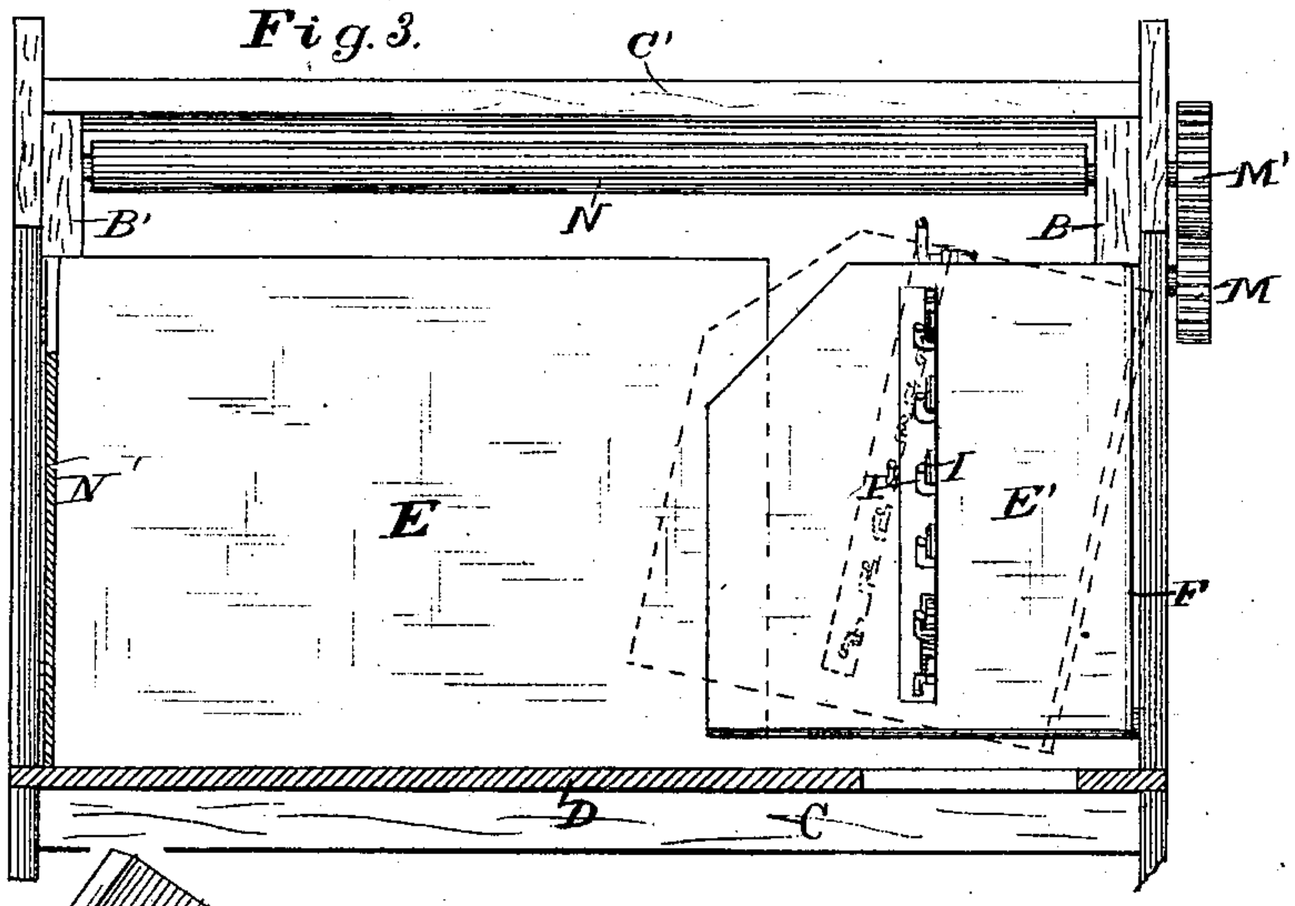
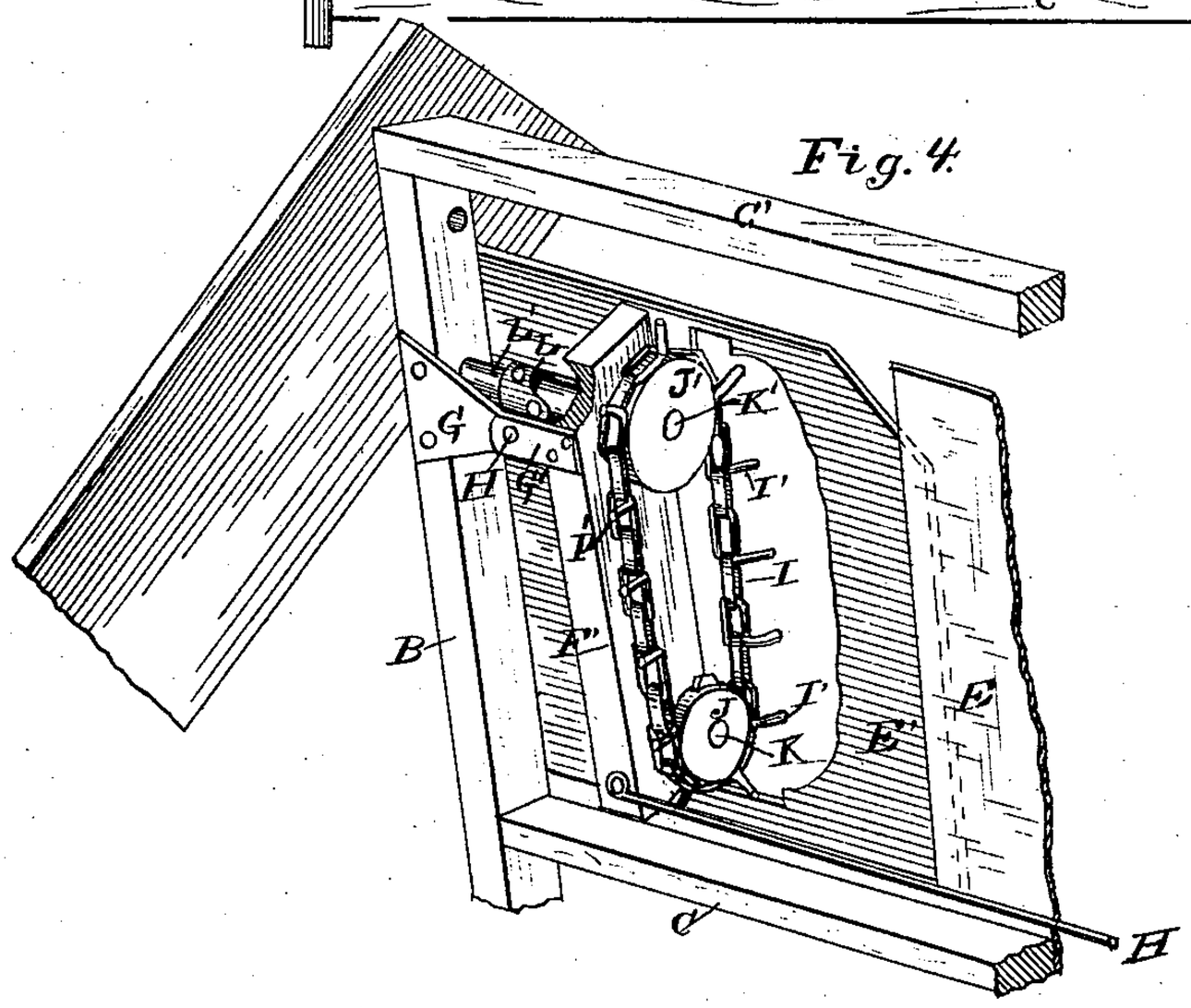


Fig. 4.



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F. T. & F. A. LOMONT.

GRAIN BINDER.

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Fig. 10.

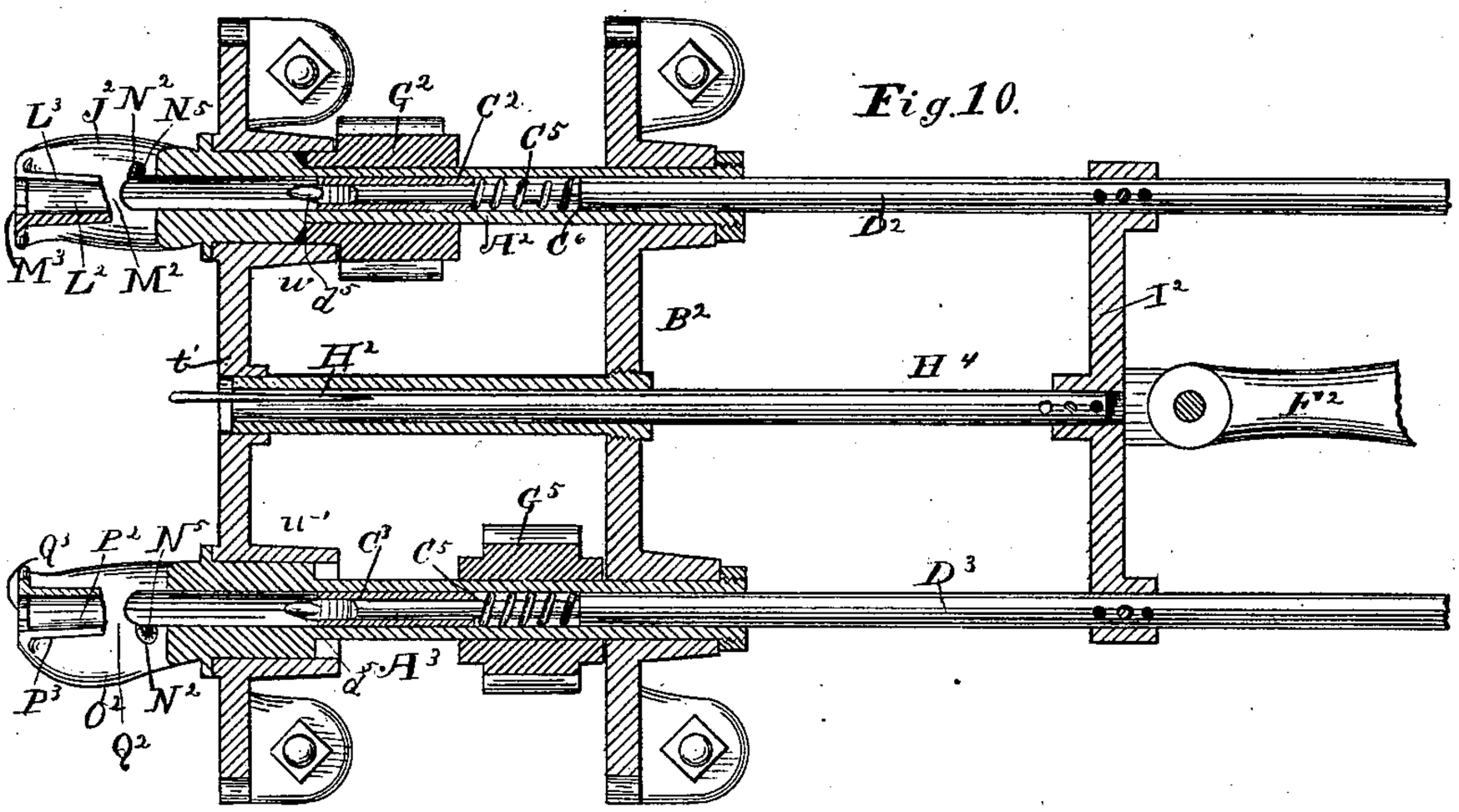


Fig. 11.

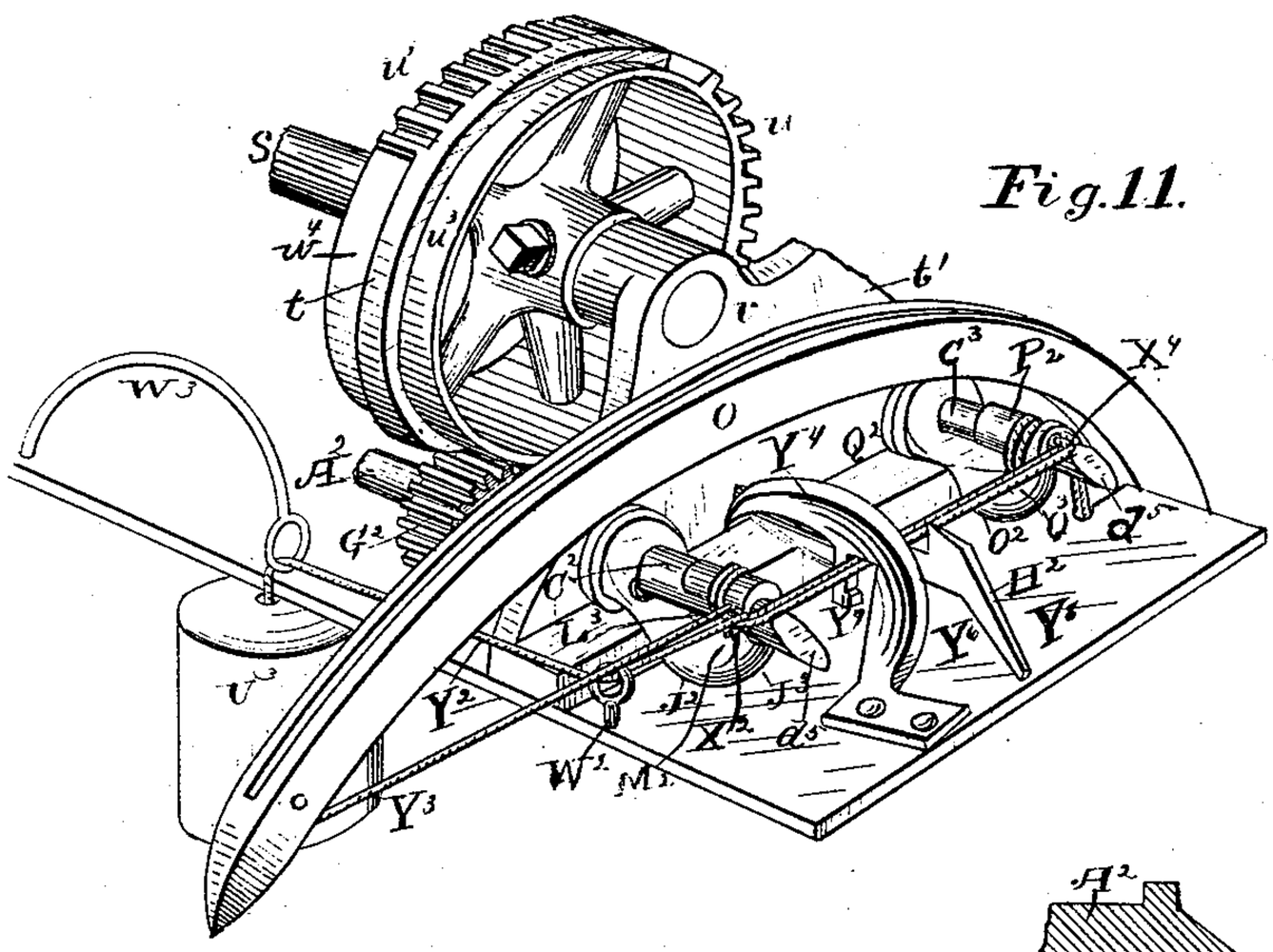
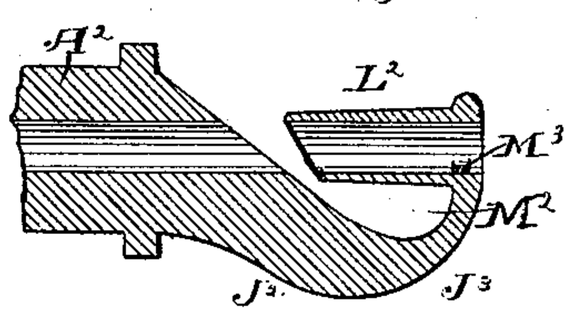


Fig. 13.



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UNITED STATES PATENT OFFICE.

FRANCOIS T. LOMONT AND FRANCIS A. LOMONT, OF CEDAR RAPIDS, IOWA.

GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 261,007, dated July 11, 1882.

Application filed April 1, 1882. (Model.)

To all whom it may concern:

Be it known that we, FRANCOIS T. LOMONT and FRANCIS A. LOMONT, citizens of the United States, residing at Cedar Rapids, in the county of Linn and State of Iowa, have invented certain new and useful Improvements in Grain-Binders, of which the following is a specification, reference being had therein to the accompanying drawings.

Figure 1 is a view mainly in front elevation, partly in section, of a binder embodying our invention, the parts being in the positions occupied at the instant the needle has completed its upward movement, and just before the knotting and tying operations begin. Fig. 2 is a cross-section on line *z z*. Fig. 3 is a section on line *x x*, Fig. 1, looking toward the delivery-table. Fig. 4 is a perspective view of the adjustable part of the table and the carrier for advancing the grain. Fig. 5 is a sectional view of the machine, taken on line *x' x'*, Fig. 1, and looking toward the stubble side. Fig. 6 is a top plan view of the binder, the gathering-arms being removed and a portion of the needle being broken away. Fig. 7 is a vertical section on line *y y* of Fig. 6. Fig. 8 is a face view or inside elevation of the cam-wheel which throws the clutch out of engagement with the binding mechanism and into engagement with the gathering devices. Fig. 9 is a face view or elevation from the outside of the rocking and sliding plate which shifts the clutch. Fig. 10 is a horizontal section of the looping, knotting, and cutting devices, taken on line *y' y'* of Fig. 1 Fig. 11 is a perspective view of the looping-tubes, the knot-hooks, the wheel which rotates the loopers, the knife, and the upper end of the needle, the strands of cord being shown in the positions occupied at the instant the loops are formed and the knife begins to cut the strands and the knot-hooks begin to retract for forming the knot. Fig. 12 is a top view of the needle, the compressor, the toothed segment which operates the compressor, the tripping-arm, and a portion of the part of the platform which supports these devices, the compressor being in the position occupied by it when the needle is down and after the bound gavel has been discharged. Fig. 13 is a vertical section of the looper J^2 J^3 L^2.

A represents the front wall or sill of binder-frame, and A' the rear wall or sill. These may be connected by any number of suitable girts or cross-pieces. The main frame-work does not essentially enter into the invention, and therefore may be of any suitable character. This binder-frame is connected with the main frame of the harvester in the ordinary manner, and is properly related to the harvester-elevator. We use an inclined frame between the main binder-frame and the harvester-elevator frame, shown in the drawings to be constructed of inclined uprights B B', a bottom cross-piece, C, and a top cross-piece, C'.

D represents the binding-platform, and to this the grain is guided over an inclined table supported upon the inclined frame B B' C C'. This inclined table is formed in two parts, one part, E, being stationary upon the frame, and the other part, E', being arranged to swing at the lower end. This latter part is formed with a flange or wall, F, arranged to have the butts of the grain strike against it as they are passing downward to the binding-platform. It will be seen that if the part E', carrying the flange or wall F, can be oscillated at the lower end inward and outward a means is provided for regulating the position at which the butts of the grain shall be delivered to the binding-table. We provide such oscillation as follows: Upon the under side of the part E' of the inclined table we place a bar, F'. This bar is pivotally connected to the piece B of the inclined frame by means, preferably, of two plates, G G', attached respectively to the part B and the bar F', and a pivot, H, passing through said plates. The driver while sitting in his seat can adjust the position of the oscillating part E' on the table, by means of levers and links. Thus a link, H', may project backward and be connected by bell-cranks and levers with the driver's platform, so that he can move it into and lock it in any desired position.

It is well known that as the grain is being delivered from the elevator to the binding-platform there is a tendency for the heads to travel faster than the butts. We insure that the butts shall reach the platform simultaneously with the heads by the following devices: I is an endless chain having teeth or arms I' projecting outwardly. The chain runs upon sprocket-wheels

J J′, which are mounted upon pins or shafts K K′, projecting from the bar F′. The shaft K′ projects through the bar F′ and by a universal coupling, L, is connected to a shaft, L′.

M is a pinion upon the outside of the frame B, and with it engages a wheel, M′, carried by the shaft on the roller N.

The wheels J and J′ are so situated relatively to the table E E′ that the arms I′ shall project a short distance through the said table.

When the machine is in operation the roller N is rotated and it, through the wheels M′ and M and the shafts K′ and L′, rotates the wheels J and J′ and the chain I in such manner that the arms I′ are caused to engage with the butts of the grain and force them downward, thus accelerating their speed and delivering that portion of the straw upon the table simultaneously with the heads.

The universal coupling at L is situated on substantially the same line as the pivot H, and therefore, as will readily be seen, in whatever position the part E′ of the table is placed there will be no interference with the movements or operation of the chain I I′.

N′, Fig. 1, represents a shield at the rear end of the inclined frame, adapted to prevent the grain from sliding backward off from said end, and adapted also to assist in throwing the heads forward as the straw is being carried over the binding-platform.

The compressing and tying mechanisms are situated at or near the outer side of the binding-platform, the compressing mechanism being mounted below the plane of the platform and the tying and cutting mechanism above the same.

O O′ represent the needle or carrying arm. It is pivoted at P on a stud-shaft, P′, projecting outwardly from the front side of the binder-frame. It is formed with a curved part, O, and the heel-plate O′. In this latter part is formed a curved cam-slot, Q Q′. The needle is reciprocated by the crank-arm R′, carried by the shaft R, the crank R′ passing through and traveling in the slot Q Q′. On the shaft R are mounted a sprocket-wheel, S, a sleeve, S′, a clutch-wheel, T, and a cam-wheel, T′, the sprocket-wheel S and the two wheels T T′ being keyed to said shaft, and the sleeve S′ being loose thereon. The sleeve S′ has a sprocket-wheel, T^2, and feathers or splines U. The sprocket-wheel T^2 receives power from any suitable point upon the harvester and imparts it alternately to the gathering mechanism and to the needle-arm and tying mechanism. The alternation in the imparting of power is caused by a sliding clutch constructed as follows:

V is a wheel surrounding the sleeve S′. It is rotated by said sleeve by means of the feathers U, which, however, permit it to slide longitudinally on the sleeve. The wheel V has annular grooves V′ V^2 in its faces, V′ being toward the drive-wheel T^2 and V^2 being toward clutch-wheel T. In the grooves are mounted two or more rollers, W W′, whereby the wheel may be used for clutching. The wheel has a circumferential groove in which fits loosely a surrounding ring, X.

X′ X′ are arms rigidly attached to the ring X at one end, and at the other end they are each attached to a sliding plate, Y, mounted loosely on the shaft R, between the clutch-wheel T and the cam-wheel T′.

Y′ is a coiled spring around shaft R, bearing in one direction against the clutch-wheel T and in the other against the sliding plate Y. The clutch-wheel T is provided with clutching-teeth Z, adapted to engage with the rollers W on wheel V.

Z′ is a sprocket-wheel mounted loosely on the sleeve S′, between the power sprocket-wheel T^2 and the sliding clutch-wheel V. It is provided with laterally-projecting clutch-teeth Z^2, adapted to engage with the rollers W′ in groove V′.

The cam-wheel T′ has a roller, *a*, adapted to engage with a cam, *a′*, on the sliding plate Y. This cam *a′* has an inclined part, *b*, and a part, *b′*, parallel to the direction of rotation of the shaft R. At every revolution of shaft R the cam-wheel T′ engages with the cam *a′*, and thrusts the plate Y, ring X, and the sliding clutch-wheel V inward into engagement with the sprocket-wheel Z′. Thrusting the clutch-wheel V into engagement with the sprocket-wheel Z′ thrusts said clutch-wheel out of engagement with clutch-wheel T, and inasmuch as throwing the wheel V out of engagement with the wheel T disengages the power from the shaft R, that shaft will be stationary until the clutch is thrown back into engagement with clutch-wheel T, and therefore the cam-wheel T′ will have its roller *a* upon the surface *b′* of cam *a′*, and while the roller is in this position the plate Y will be held at its innermost position. The cam *a′* is disengaged from the roller *a* by the following devices: *c* is an arm or short lever keyed to a rock-shaft *c′*. It carries a short pivoted lever or arm, *d*, pivoted at *d′*, said arm *d* being arranged to engage with the sliding clutch V X X′ Y by means of one of the arms X′, against which it strikes when the shaft *c′* is rotated. When it (said arm *d*) engages with the arm or bar X′ it causes a partial rotation of the plate Y, sufficiently to carry the cam *a′* beyond the roller *a*. After the cam passes the roller the spring Y′ forces the sliding plate Y into its outermost position, carrying with it ring X and clutch-wheel V. The clutch-wheel then engages with the keyed clutch-wheel T, and further rotation of wheel T^2 causes a rotation of shaft R through sleeve S′ and the clutch. The rock-shaft *c′* is mounted below the binding-platform, and extends across to the other side of the platform. At the end opposite to the lever *c* it carries an arm, *p*, secured rigidly to the shaft. This arm *p* projects upwardly above the binding-platform. The straw is pressed against this arm by the gathering-fingers, and when a sufficient amount has been

accumulated the pressure caused by the straw against the arm results in a rocking of the shaft c', which in turn, by means of the arms c and d, causes a partial rotation of the plate in the manner above described.

Although we have shown that form of the clutch T which we prefer, and of the part Y which moves the sliding clutch V, it will be readily understood that these parts can be moved without departing essentially from the spirit of our invention; and also that other devices may be substituted which are well-known equivalents. Instead of a circular plate like that at T carrying the clutch-teeth, use may be made of one or more pins inserted through or into the shaft R and arranged to engage with teeth on the sliding clutch-plate V. Instead of a circular plate, Y, a collar with projecting arms may be used if the arms be connected to the sliding clutch by bars. Instead of the circular wheel or plate T', use may be made of a collar and an arm to support the projecting part which engages with the cam a' to thrust the part Y inward.

When the clutch V is engaging with the sprocket-wheel Z', power is through them conveyed to the gathering-arms e e' by means of a chain, f, a sprocket-wheel, f', on a stud-shaft, g, a spur-wheel, g', on said stud-shaft, a crank-shaft, h, and a spur-wheel, h', meshing with the spur-wheel g'. The crank-shaft h is mounted in arms i i' i^2, projecting laterally from the binder-frame toward the elevator-frame. The stud-shaft g is secured to and projects rearwardly from the rear arm, i. Between the supporting-arms i' i^2 a crank, j, is formed on the shaft h, and in front of the arm i^2 another crank, j', is formed. The cranks j j' are diametrically opposite to each other.

k is a link pivoted to the arm i', outside the crank j, and k' is a similar link pivoted to the arm i^2 or to a supporting-piece, l, projecting therefrom. The gathering-arms e e' are pivoted to the cranks j j' at or near their centers longitudinally. Each is formed with elongated slots l' l'. The slotted portions are connected with the links k k' by means of pins m m' passing through the slots l' l'.

n n, Fig. 2, are rubber rollers mounted on the pins m m', and o o' are plates between the heads of pins m m' and the rollers n n. These rubber rollers in the slots in the gathering-arms obviate many of the difficulties that have been met with in using packer-arms as heretofore constructed. The gathering or packing arms as heretofore made and mounted have been so arranged as to always travel over the same paths. Therefore when the tripping mechanism has been employed the grain is forced against the trip with the same pressure when the bundle is nearly finished that is exerted when the bundle is commenced. Experience, however, has shown that the pressure should vary during the formation of the bundle. By the flexible rollers n n the packer-arms are permitted to yield so that their paths of travel are not as long when the bundle is nearly completed as they are when the bundle is commenced.

Power is transmitted to the tying and cutting mechanism from the sprocket-wheel S by means of a chain, q, this chain engaging with a sprocket-wheel, q', mounted on the upper platform, r. This platform may be supported in any suitable way. We prefer to support it by means of an upright, r', extending upwardly from the binding-platform and at the rear side thereof. Above this upper table, r, is mounted a shaft, s, to which is keyed the sprocket-wheel q'. To this shaft s, besides the sprocket-wheel q', are keyed a wheel, s', near the center, and a wheel, t, this latter carrying on its periphery two sets of spur-teeth u u', the sets of teeth being in different vertical planes (see Fig. 11) and extending around but a portion of the periphery. The shaft s at the front end is mounted in a standard or frame-piece, t'. This frame-piece has bearings not only at v for shaft s, but also at w and w', Fig. 10, for two rotating tubes or sleeves, A^2 A^3. The sleeves A^2 A^3 are at their rear ends mounted in another frame-piece, B^2. They (the sleeves) project forward through the frame-piece t', and are shaped to form loopers at their front ends. Within the sleeves or tubes A^2 A^3 are placed sliding tubes C^2 C^3.

D^2 D^3 are knotting-rods provided with hooks d^5 d^5. They are situated within the tubes C^2 C^3, and arranged to slide out and back through the sleeves or tubes A^2 A^3. The rods D^2 D^3 and the tubes C^2 C^3 are thrust forward and drawn back by means of a crank-wheel, E^2, mounted on a vertical axis. Upon its upper face it has a bevel-gear wheel, E^3, and to its under face is connected a pitman, F^2, by a crank-pin, F^3. The pitman F^2 at its forward end is pivoted to a cross-head, I^2, which cross-head is secured rigidly to the knot-hook rods D^2 D^3.

The wheel s' at or near the center of shaft s is provided with a segmental bevel-gear with teeth of sufficient number to impart one revolution to the wheel E^2 at every revolution of the wheel s'. Therefore at every revolution of said wheel s' the knot-hook rods D^2 D^3 will be thrust outward and drawn back once.

G^2 G^3 are small pinions—one, G^2, keyed to the sleeve or hollow tube A^2, and the other to a counter-shaft, G^6, Fig. 5—wheel G^2 being situated in the plane of the spur-teeth u on the wheel t, and the wheel G^3 being in the plane of teeth u'. G^5 is a pinion on sleeve or tube A^3, driven by wheel G^3. The sleeves A^2 A^3 are situated upon opposite sides of the wheel t, and the pinions G^2 G^3 are so related to said wheel and to each other that the spur-teeth u begin to engage with the wheel G^2 at the same time that the teeth u' begin to engage with the wheel G^3. It results in a simultaneous revolution of the rotating sleeves A^2 A^3, the sleeves being revolved in opposite directions.

H^2 represents the knife. It is carried by a

rod, H^4, which slides in bearings formed in the frame-pieces t' and B^2. It is situated midway between the looping-tubes A^2 A^3, and is reciprocated by the cross-head I^2. The outer ends of the looping-tubes are situated in the vertical plane in which the needle travels. Therefore when the needle comes up it carries the cord across the tubes and lays it in proper position to have two knots tied therein. The looping portion of the tube or sleeve A^2 is formed to have an enlarged flaring part, J^2, so shaped that its outer surface at J^3, Fig. 13, shall permit the loop to slide off from the end. At L^2 there is formed a tube large enough to receive the sliding tube C^2 and the knot-hook on rod D^2. One side of the tube L^2 has a slot, L^3, extending from end to end. The tube L^2 projects inwardly from the end of the looping portion, so as to form an open eye at M^2, wherein the strands of the twine can be received and retained during certain times in the operation. At the outer end of the tube L^2 there is formed a stop, M^3, against which the sliding tube C^2 strikes to prevent its moving beyond the tube L^2.

By an examination of the drawings it will be seen that the looping portion of the tube is formed upon curved lines, the head part J^2 being situated on a line inclined to the line of the tube A^2, but curved around so as to bring the tube L^2 into line with the part A^2. At N^2 there is formed a socket or recess to receive the knot as the strands are being drawn in by the knot-hook. The looping-head upon the tube A^3 is formed with parts analogous in shape and relation to those described on tube A^2. Thus the curved head is shown at O^2 O^3, a slotted tube at P^2 P^3, forming an eye, Q^2, and having a stop, Q^3.

On the needle-shaft a compressor, R^2, is mounted. It is arranged oppositely to the needle, and is forced toward the needle against the straw by means of a toothed segment, R^3, on the needle-shaft P', and a toothed segment, S^2, on the shaft R. S^3 is a coiled spring arouud the needle-shaft, interposed between the toothed segment R^3 and the compressor R^2, the spring being fastened at one end to the compressor and at the other to the toothed segment. This spring and the segment together operate to bring the compressor R^2 toward the needle against the straw with a yielding pressure.

On the outer end of the crank which operates the needle there is secured an arm, T^5, which operates to throw the bound gavels or bundles off from the platform.

We employ two twine-receptacles, situated at suitable points. One is preferably located below the binder-platform and the other above the supplemental platform r, though other positions than these may be used, if desired. The needle is provided with an eye, T^4, near the point for guiding the cord. The cord passes backward for a short distance along the periphery of the needle in a groove, and thence to the cord-receptacle U^2. If desirable, a suitable take-up mechanism may be employed between the cord-receptacle and the needle. Another cord runs from the receptacle U^3 to the cord in the needle, passing through an eye, W^2, near the looping-head J^2 J^3, there being a take-up mechanism at W^3. The two cords are knotted together, as shown at X^2. For convenience in description and in illustration we have lettered the cords respectively Y^2 Y^3.

At Z^4 there is a guide which, as the needle comes up, operates to guide the strands of the cord down into the eye M^2 Q^2 on the looping-heads.

The toothed segment S^2 on crank-shaft R has the teeth s^5 s^6 and a segmental piece, s^7. The segment R^3 has two teeth, r^5 r^6, and a short arm, r^7. When the crank-shaft R begins to elevate the needle the tooth s^5 on segment S^2 engages with the tooth r^5 on the segment R^3, and begins to throw the compressor R^2 up. When the teeth s^5 and r^5 disengage, teeth r^6 and s^6 engage and continue to throw the compressor upward. When the latter disengage, the segmental piece s^7 engages with the arm r^7, and this insures that the compressor shall be held in its uppermost position until the end s^8 of the segment reaches the arm r^7, which occurs at the instant the needle comes down, when the bound gavel is to be removed. After the end s^8 passes the arm r^7 the compressor is free to drop outward and drops until the shoulder at r^8 on the toothed segment R^3 strikes the stop r^9 on the frame. This stop r^9 holds the segment in such position that at the next revolution of the crank-shaft R tooth r^5 shall be in position to be engaged by the tooth s^5 of the segment S^2.

A^{11} is a spring connected at one end with the rock-shaft c' and at the other to the stationary part of the frame. It operates to return the arm p into its upright position, after the gavel is discharged, by partially turning the rock-shaft. With this spring A^{11} adjusting devices may be combined, as I have shown in Figs. 6 and 9, wherein A^{10} is a plate carried by the frame of the machine, A^8 is a bolt or threaded rod passing through the plate and connected to the spring A^{11}, and A^9 is a nut by which the position of the bolt or rod can be adjusted and with it the tension of the spring A^{11}. If the tension of the spring be increased, it will take a greater force to move the arm p, and therefore a larger gavel will be required to trip the binding mechanism. In this way the size of the bundles may be varied as circumstances may require. The cross-head I^2, which is attached to the reciprocating knot-hook rods, may be adjusted along the rods in such manner as to insure that they shall move the proper distances. So also the rod H^4 of the knife may be adjustably secured to the cross-head to regulate the operation of the knife. The knife should be so adjusted as that it will sever the strands of cord soon enough to prevent the tension of the cord from interfering with the knotting mechanism.

Y^4 is a guide, which insures that the strands

of the cord shall be delivered properly to and retained in the eye M^2 on the looper-head J^2 J^3.

C^5 C^5 are coiled springs placed around the knotting-rods D^2 D^3. They bear against the inner end of the sliding tube C^2 in one direction, and in the other direction bear against a shoulder at C^6 formed on the knotting-rod. After the tube C^2 has been moved outward and strikes against the stop M^3, the spring C^5 permits the knotting-rod to move a short distance farther out, so that the hook on the end can grasp the strands beyond the tube C^2.

Having thus described the construction of the various parts of the machine, their methods of attachment, and their positions relatively to each other, we will now describe the operation of the mechanism.

Suppose the clutch V to be in engagement with the sprocket-wheel Z′, (which, through chain *f*, rotates the crank-shaft *h*,) and therefore out of engagement with the clutch-plate T′. The shaft R is at rest, and also the needle and the tying mechanism. The trip-arm *p* is in its upright position, and the needle is below the platform. The shaft *h* is rotating, and the arms *e e′* are reciprocating and gathering the straw and forcing it against the arm *p*. After a sufficient amount has been compressed against said arm, the shaft *c′* will be rocked. The rocking of the shaft *c′* elevates the arms *c* and *d*, which, engaging with one of the arms X′, give a partial rotation to the sliding plate Y. This partial rotation of plate Y releases cam *a′* from the roller *a*. After this release the spring Y′ forces the plate outward, drawing the clutch-wheel V away from sprocket-wheel Z′ and into engagement with the clutch-wheel T′. This instantly stops wheel Z′, shaft *h*, and gathering-arms *e e′*, and sets in motion shaft R, crank R′, toothed segment S^2, and shaft *s*. The crank R′ elevates the needle upon the inside of the gavel, and the tooth-segments S^2 R^3 throw up the compressor-arm R^2 upon the outside of the gavel. At the instant the needle begins to rise the cords Y^2 Y^3 are in the positions shown in dotted lines in Fig. 1—that is to say, the cord Y^3 extends from the lower receiver along the periphery of the needle, thence under the gavel to the knot X^2, and the cord Y^2 extends from the upper receiver, U^3, through the eye W^2 and eyes M^2 and Q^2, down inside of the supplemental platform *r*, around the outside of the gavel to the knot X^2. At the instant the needle has completed its upward movement the cords are in the position shown in full lines in Fig. 1—that is to say, the cord Y^3 has been brought up by the needle and placed in the eyes M^2 Q^2 by the side of the cord Y^2. As soon as this is accomplished the partial gears *u u′* on wheel *t* engage with the spur-wheels G^2 G^3, and impart to tubes A^2 A^3 one revolution, the tube A^2 revolving in one direction and the tube A^3 in the opposite. This revolution of the tubes forms two loops. As soon as the partial gears *u u′* disengage from the pinions G^2 G^3, the partial gear on wheel *s′* engages with bevel-wheel E^3 and imparts one revolution to it and to the crank-wheel E^2 formed therewith. This revolution of wheel E^2 slides the cross-head I^2 forward and back. The cross-head carries forward with it the knot-hook rods D^2 D^3 and the knife H^2. The knot-hook rods D^2 D^3 carry forward the lower sliding tubes, C^2 C^3, pushing them out until they are stopped by the stops M^3 and Q^3. Notwithstanding the stopping of the sliding tubes C^2 C^3, the knot-hook rods D^2 D^3 still slide outward sufficiently far to carry their hooks d^5 d^5 out beyond the ends of the tubes L^2 P^2. The knife H^2 is at the same time and by the same operation thrust out beyond the two strands lying between the two looping-tubes. Before the knot-hooks are thrust out the cords are in the position shown in Fig. 6. After said hooks are thrust out the parts are in the position shown in Fig. 11, the hooks now catching the strands which cross the two loops. Immediately after catching them they (the rods D^2 D^3) are retracted, as is also the knife H^2. The knife cuts the strands between the two looping-tubes, and the knot-hooks d^5 d^5 pull the cross-strands through the loop-tubes C^2 C^3, operating to give the hooked ends of the rods a firm grip upon the twine. The hooks pull the cut ends through the loops, and thus form two knots. As soon as the knots are formed the tension of the cords pulls the knots from the tube, the knot X^4, Fig. 11, being that which ties the ends of the cord that passes around the gavel, and the knots X^2 being the one which ties together again the cord Y^3, running from the cord-receptacle U^2, and cord Y^2 from receptacle U^3. Immediately at the close of this operation the needle is retracted downward, for it will be understood that the crank R′ during these last-described operations is continuing to move, making its one revolution, the first part of this revolution having been required to elevate the needle, the last part to retract it. At the same time that the crank throws the needle downward it brings up the arm T^5, which from behind the gavel presses against it and pushes it over the arm *p* off the platform. As soon as the bound gavel escapes the arm *p* is thrown into its uppermost position again by the spring A^{11} engaging with the rock-shaft *c′*. At this same instant—that is to say, at the instant at which the needle reaches its lowest position—the roller *a* engages with cam *a′*, and thrusts plate Y inward, which in turn throws the clutch-wheel V out of engagement with clutch-wheel T and into engagement with the sprocket-wheel Z′. The said sprocket-wheel begins again to rotate, actuating the crank-shaft *h* and the gathering-arms *e e′* for a new bundle-forming-and-tying operation.

It will be seen that while the needle is rising to its uppermost position the blank space t^3 on wheel *s′* is rotated in proximity to the bevel-wheel E^3, and therefore said wheel is stationary; and, further, that the blank spaces u^3 u^4

on wheel *t* are in proximity respectively to the pinions G^2 and G^3. Hence while the needle is rising the looping and knotting mechanisms are at rest; but the partial gears on wheels *s'* and *t* are so related to their pinions that as soon as the needle is up the three pinions are rotated.

It will be further seen that by interposing a counter-shaft, G^6, between spur-teeth *u'* and pinion G^5 on tube A^3 there results a revolution of said tube A^3 opposite to that of A^2. This opposite revolution of the looping-tubes insures that there shall be a proper tension of the cord between the tubes. The slots L^3 and P^3 are upon opposite sides of the tubes L^2 and P^2, inasmuch as the strands which form the gavel (after the cords are cut which surround the gavel) extend inward, and therefore to escape must have the slot P^3 inward, and the strands which form the new band extend outward toward the eye W^2, and therefore the slot L^3 must be outward.

By tying two knots we avoid entirely the necessity of any grippers or clamping-jaws for grasping the cut end of the cord after it is severed by the knife. These grippers or clamping-jaws have been a source of great inconvenience and trouble in the operation of the grain-binders heretofore employed. It will be readily seen that our construction is much simpler than those now commonly used, requiring no delicately constructed and adjusted parts whatever.

We do not in this case claim anything except what is specifically set forth in the claims, reserving to ourselves the right to claim all other patentable subject-matter herein shown and described in another application heretofore filed, of which this is a division.

What we claim is—

1. The combination, with the binding-platform and the elevator, of the inclined table made in two parts, E E', the part E' being arranged to swing, and provided with a guide for the butts of the grain, substantially as set forth.

2. The combination, with the binding-table and the elevator, of the inclined table formed in two parts, E E', the part E' being arranged to swing, and the mechanism for facilitating the travel of the butts of the grain, substantially as set forth.

3. The combination, with the binding-platform, the elevator, the inclined table, consisting of the stationary part E and the swinging part E', and the chain I, mounted on said swinging part E', of a flexible power-transmitting device for rotating said chain, substantially as set forth.

4. The combination, with the needle, the crank-shaft R, which reciprocates the needle, the clutch-plate T, secured to said shaft, the sliding clutch V, the cam-wheel T', and the sliding plate Y, which carries the clutch V, of the rock-shaft *c'*, arms *c d*, and the tripping-arm *p*, secured to the shaft *c'*, substantially as set forth.

5. The combination, with the needle, the tying and cutting mechanism, the shaft R, the crank R', which vibrates the needle, the wheel S, keyed to the shaft, the power-transmitting devices between wheel S and the tying and cutting mechanism, the shaft *h*, the vibrating gathering-arms on said shaft *h*, the wheel Z', the power-transmitting devices between wheel Z' and shaft *h*, and the wheel T for rotating shaft R, of the sliding clutch around the shaft R, adapted to transmit power alternately to said wheel Z' and wheel T, substantially as set forth.

6. The combination, with the shaft R, which operates the needle, the fixed wheel S thereon, which operates the knotter and cutter, and the wheel Z', mounted loosely relatively to said shaft, of the power-wheel T^2, mounted loosely upon said shaft, and the mechanism adapted to alternately engage said wheel T^2 with the wheel Z' and with the shaft R, substantially as set forth.

7. The combination of the following elements, namely: the reciprocating arms for gathering the straw, the crank-shaft which operates them, the intermittently-operating needle, the intermittently-rotating shaft R, the continuously-rotating power-wheel T^2 thereon, the sliding clutch adapted to transmit power from said wheel T^2 alternately to the mechanism which operates the gathering-arms and to the shaft R, and an automatic tripping mechanism, which throws said clutch into engagement with the shaft R, substantially as set forth.

8. The combination, with the needle, of the shaft P', on which it is pivoted, the toothed segment R^2, the shaft R, the toothed segment S^2 on said shaft R, and the compressor R^2 on the shaft P', arranged, substantially as described, to drop when the binding has been completed and to be drawn toward the needle as the needle rises, as set forth.

9. The combination, with the needle, of the shaft P', on which it is mounted, the shaft R, having the crank R', the toothed segment S^2, the compressor R^2 on the needle-shaft, and the coiled spring S^3 between the compressor R^2 and the toothed segment R^3, substantially as and for the purposes set forth.

10. The combination, with the needle, of the shaft P', on which it is pivoted, the compressor R^2, the toothed segment R^3 on said shaft, the shaft R, having a crank, R', and the toothed segment S^2 on said shaft, having the teeth s^5 s^6 and the elongated curved surface s^7, substantially as set forth.

11. The combination, with the gathering-arms provided with the slots *l' l'* behind their pivots, and the links *k k'*, of the rollers made of rubber and situated within said slots, substantially as set forth.

12. In a grain-binder, the combination of two looping-tubes, two reciprocating knotting-hooks, a knife or cutter, and mechanism for reciprocating the knot-hooks and the cutter simultaneously, substantially as set forth.

13. The herein-described looping device,

consisting of the revolving tube A^2, having the expanded head J^2, with the curved outer ends at J^3, and the inwardly-projecting tube L^2, situated centrally relatively to the part A^2, to form an open eye, M^2, and provided with a slot, L^3, substantially as set forth.

14. In a grain-binder, the herein-described knotter, consisting of the revolving tube A^2, having the looping-head J^2 J^3, with the open eye M^2 and the slot L^3, in combination with the reciprocating hook-rod D^2 and the sliding tube C^2, substantially as set forth.

15. The combination, with the two reciprocating hook-rods and the reciprocating knife, of a wheel adapted to reciprocate said rods and knife, substantially as set forth.

16. The combination, with the reciprocating hook-rods and the reciprocating knife, of the cross-head I^2 and pitman F^2.

17. In a grain-binder, a knotting mechanism adapted to tie two knots, one knot uniting the strands around the gavel and the other uniting the cut ends of the cords on the machine, substantially as set forth.

18. In a grain-binder, the combination of two knotting mechanisms, two cord-receptacles, and a needle or cord arm, arranged and operating substantially as set forth.

19. In a grain-binder, the combination of two looping-tubes arranged to be rotated simultaneously in opposite directions to form two separate knots, and means for guiding into said tubes before they rotate two parallel strands of cord, said strands coming respectively from opposite sides of the gavel, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

FRANCOIS T. LOMONT.
FRANCIS A. LOMONT.

Witnesses:
ALEX. IRVING,
WM. FRAGER.