(No Model.) 5 Sheets—Sheet 1.

H. A. J. RIECKERT.

SELF BINDER.

No. 429,958. Patented June 10, 1890.

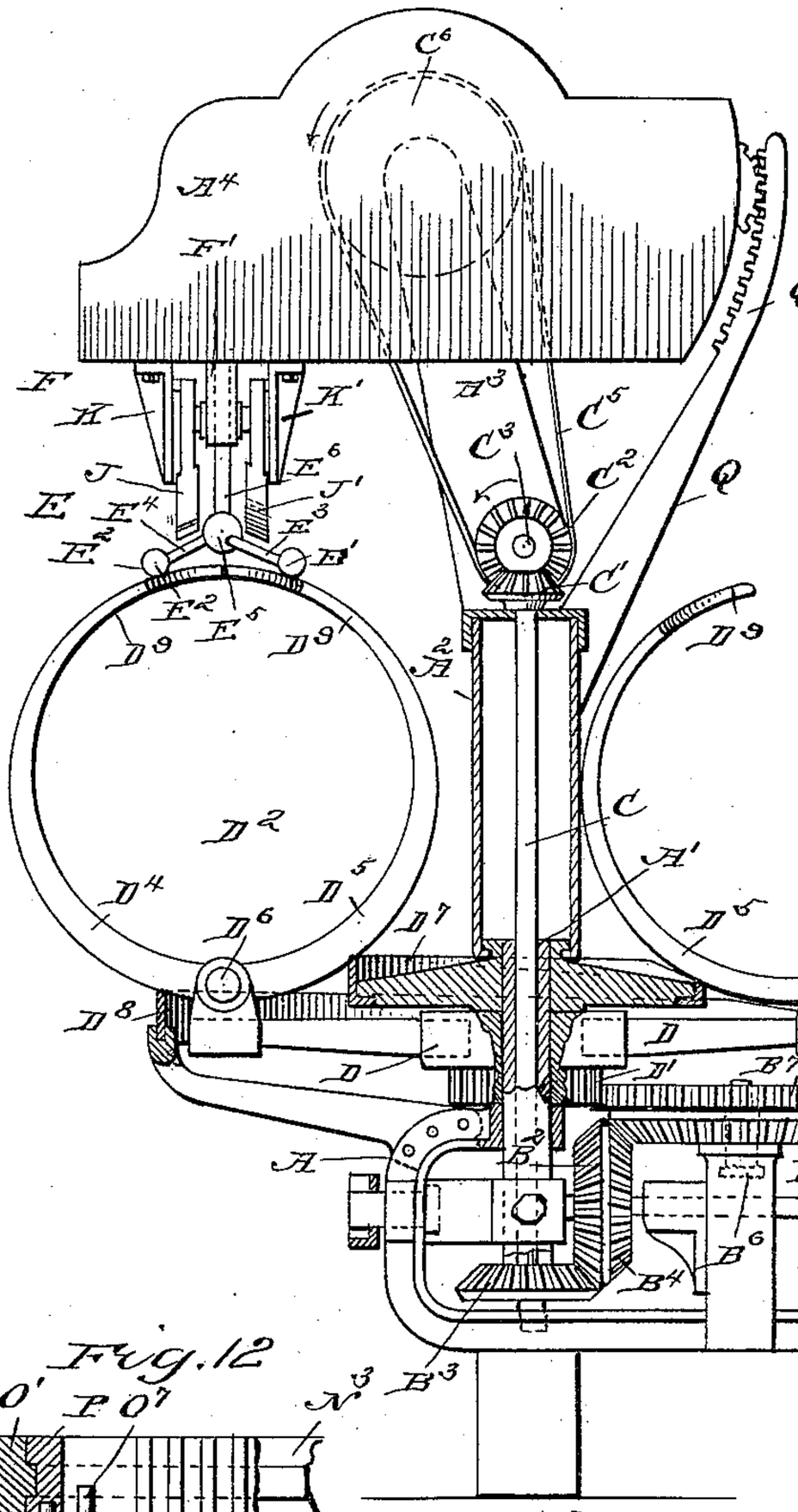


Fig. 1.

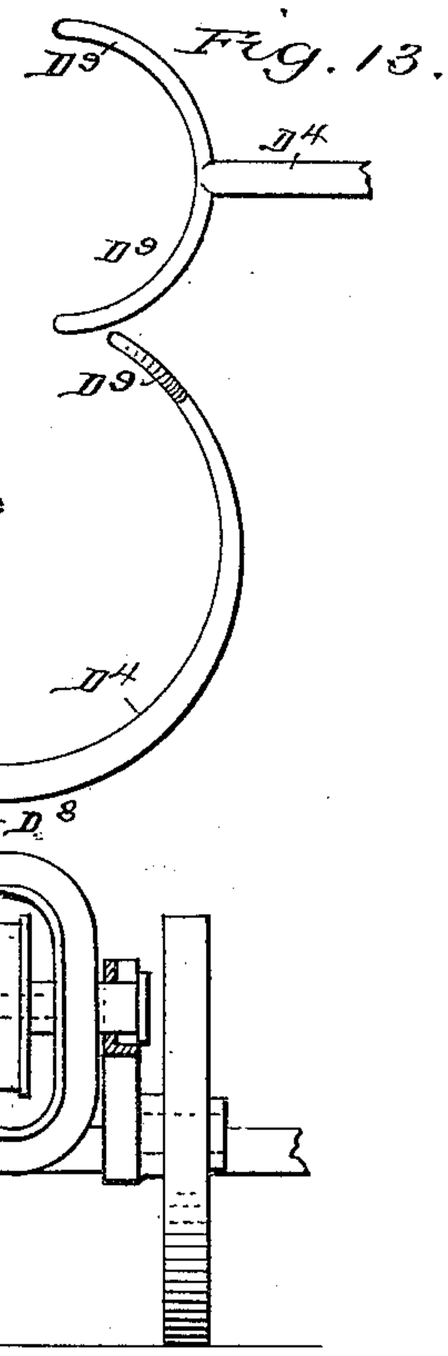


Fig. 13.

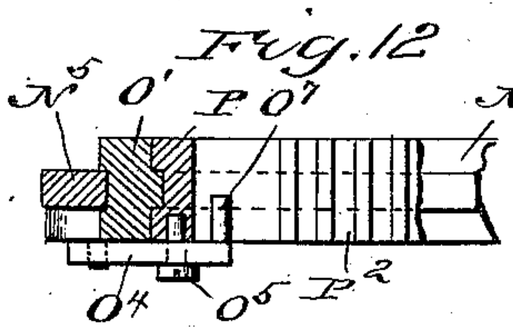
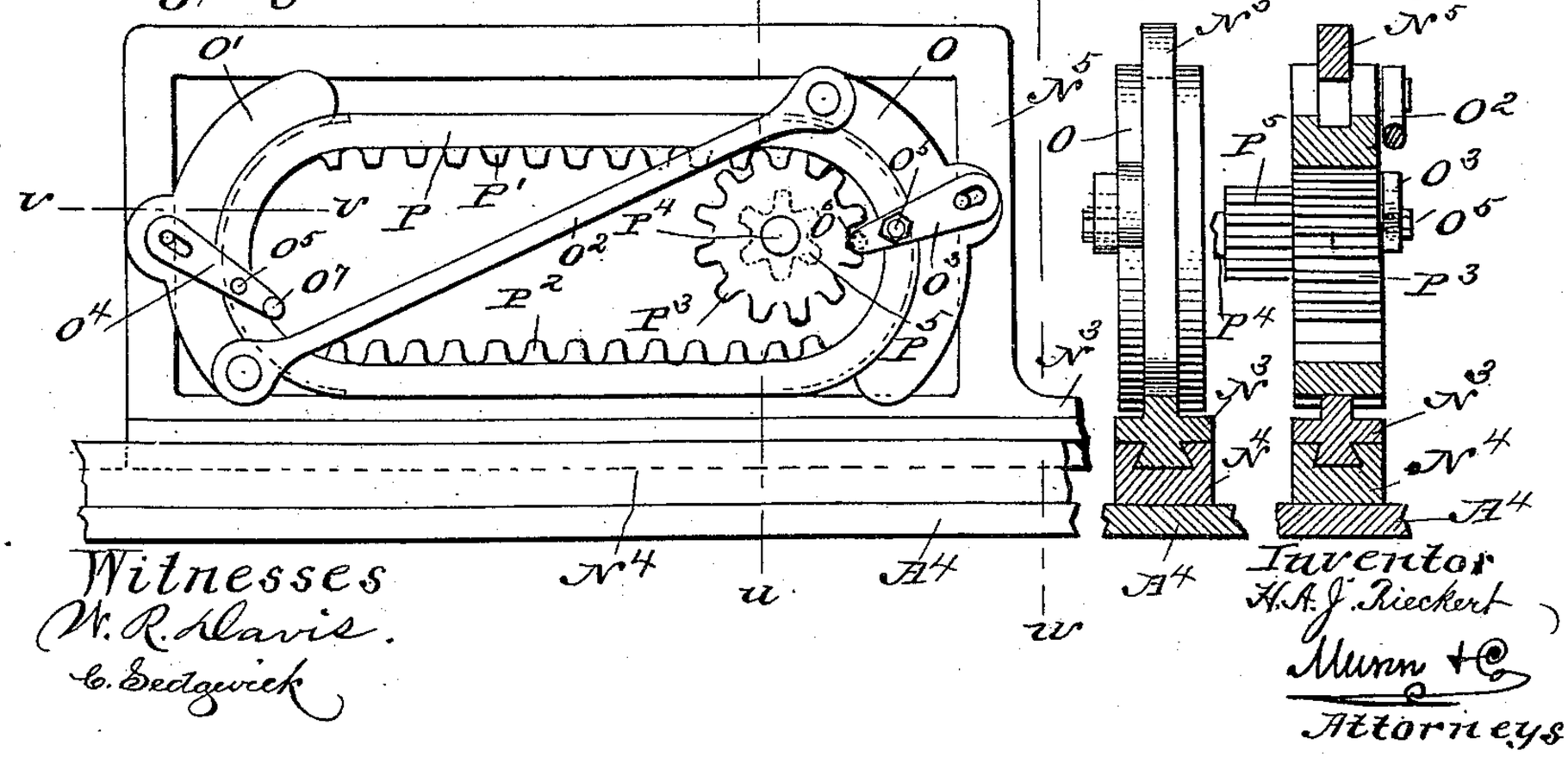


Fig. 12

Fig. 9.

Fig. 10

Fig. 11.



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(No Model.)

5 Sheets—Sheet 2.

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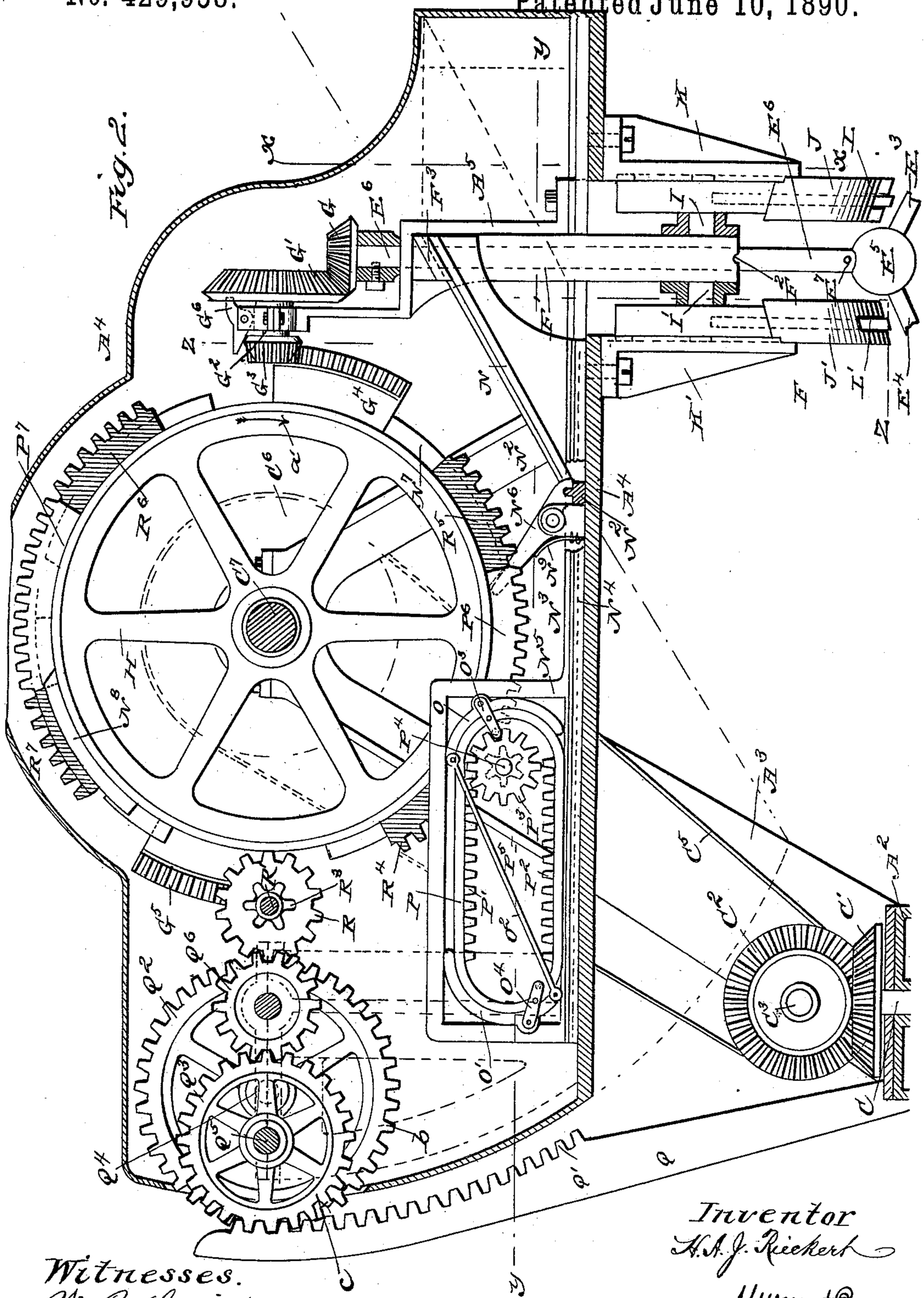
SELF BINDER.

No. 429,958. Patented June 10, 1890.

Fig. 2.



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5 Sheets—Sheet 3.

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SELF BINDER.

No. 429,958. Patented June 10, 1890.

Fig. 3.

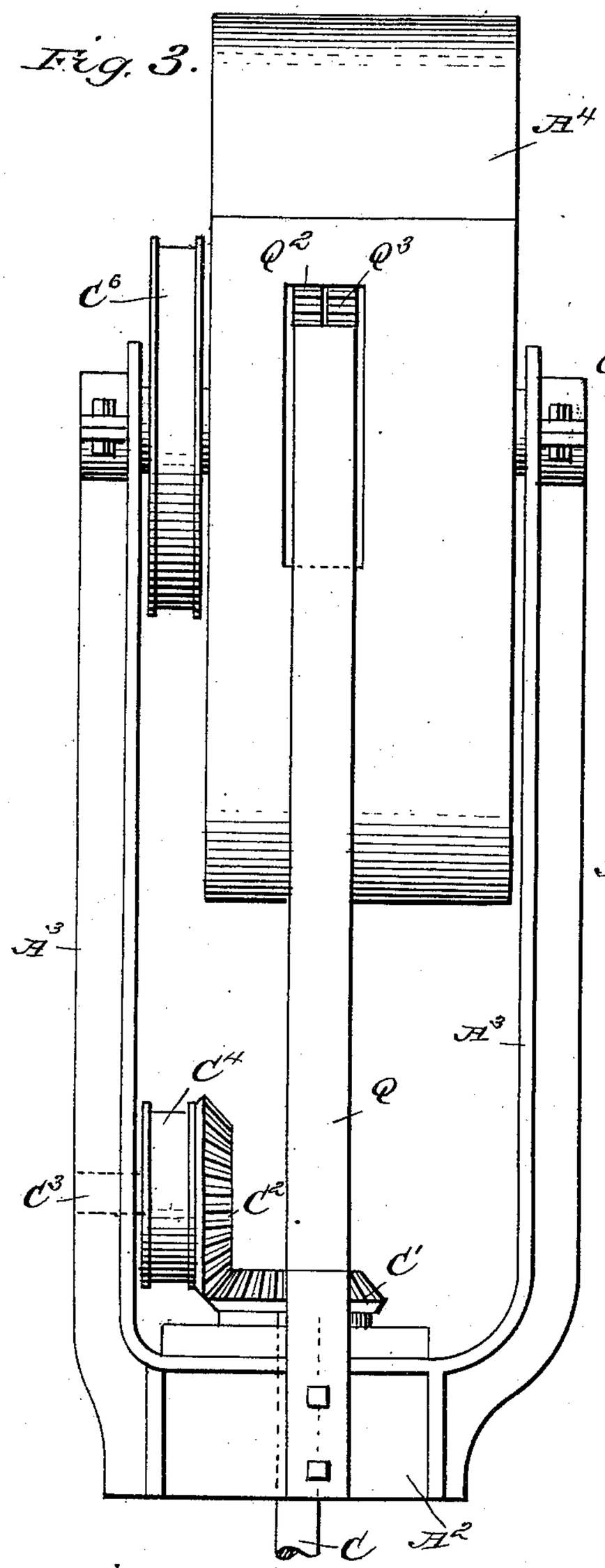
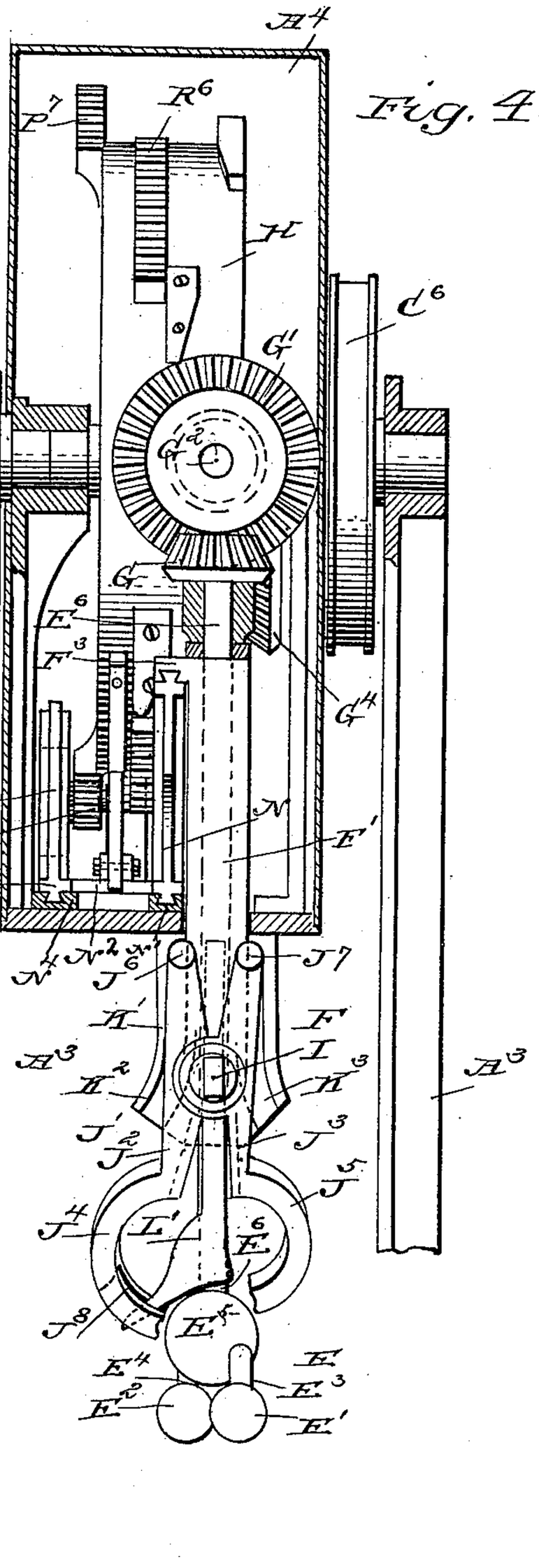


Fig. 4.



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5 Sheets—Sheet 4.

H. A. J. RIECKERT.

SELF BINDER.

No. 429,958. Patented June 10, 1890.

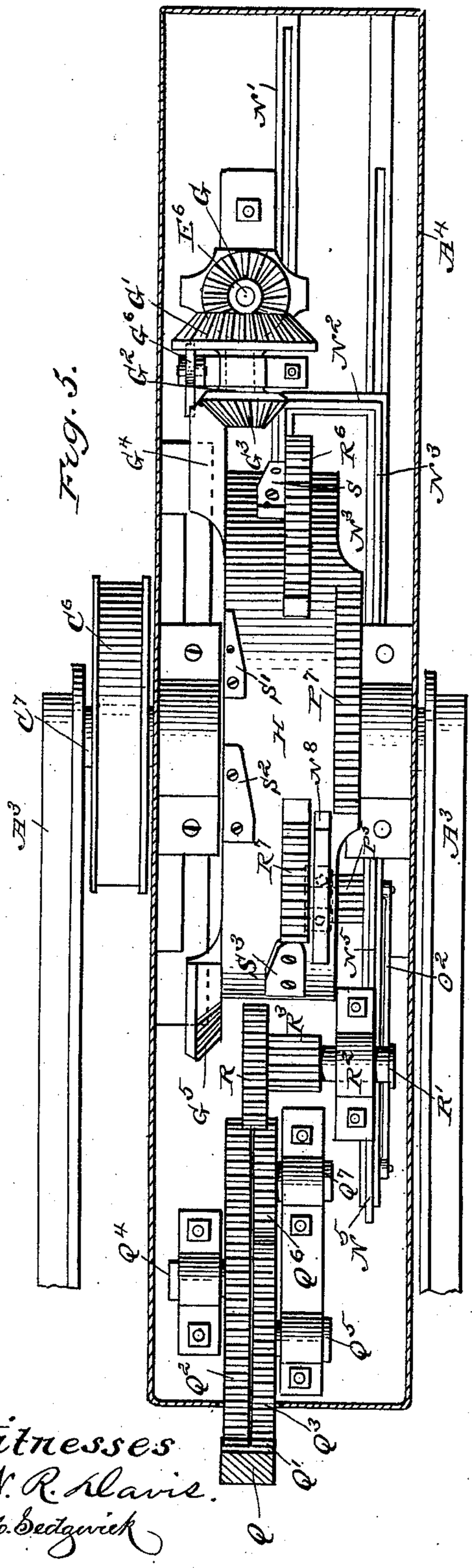

Fig. 5.

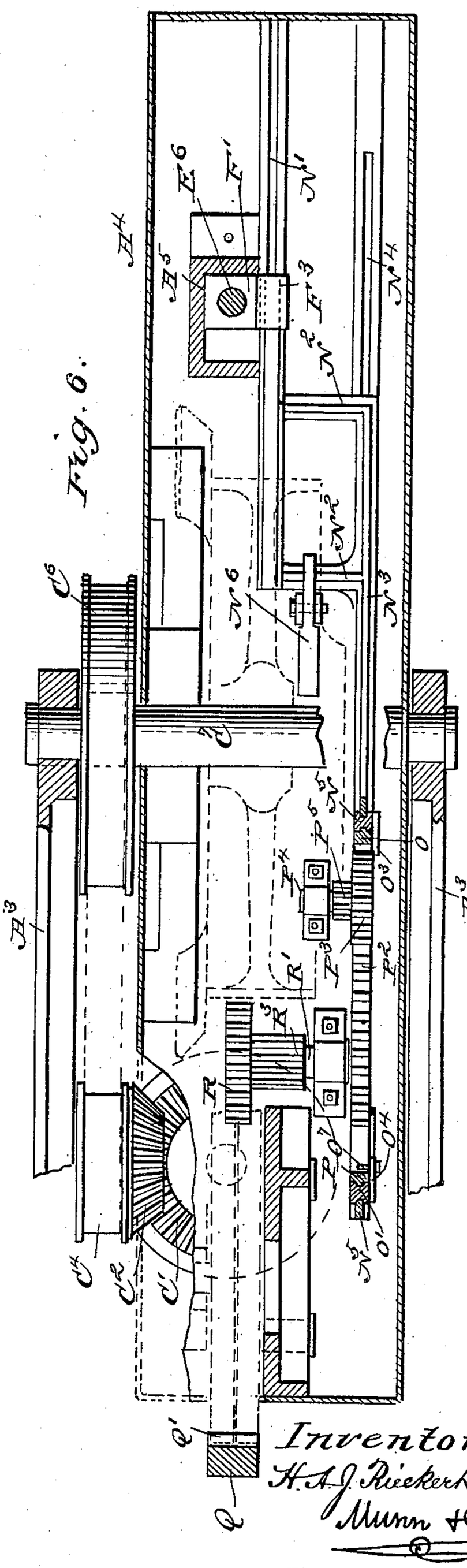

Fig. 6.

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(No Model.) 5 Sheets—Sheet 5.

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SELF BINDER.

No. 429,958. Patented June 10, 1890.

Fig. 7.

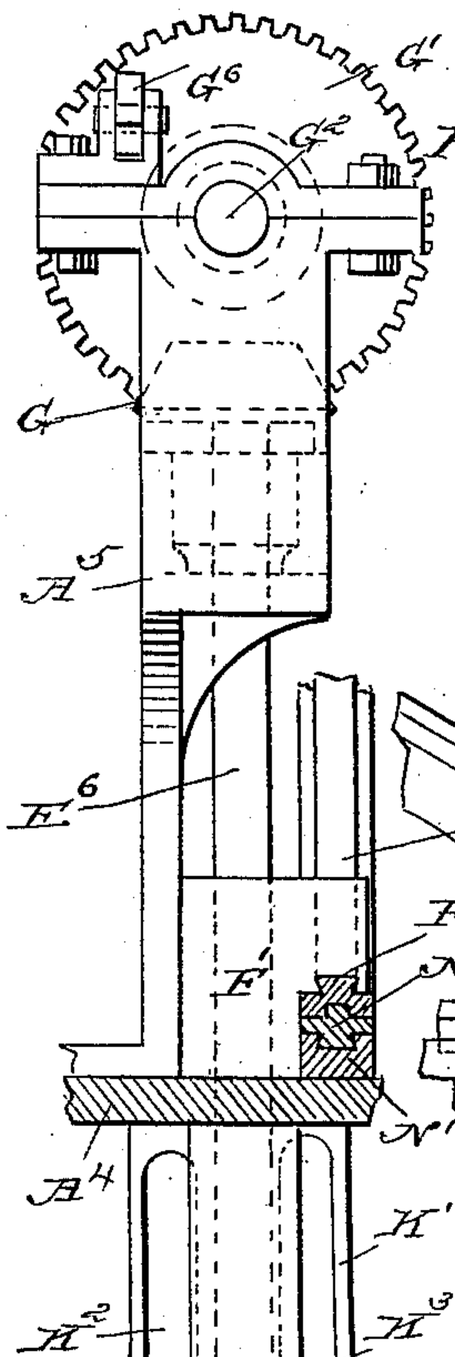
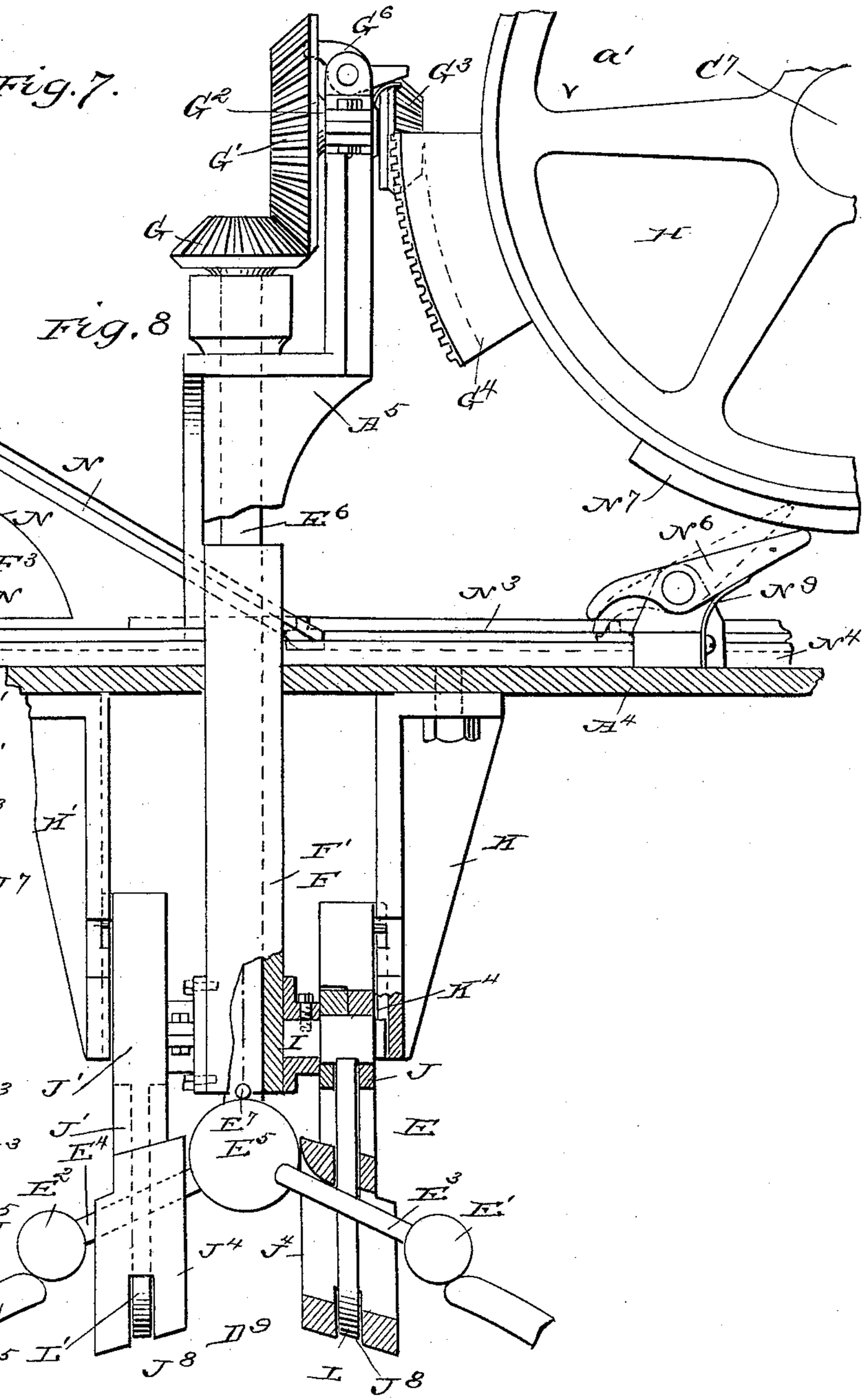


Fig. 8



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UNITED STATES PATENT OFFICE.

HERMAN A. J. RIECKERT, OF NEW YORK, N. Y.

SELF-BINDER.

SPECIFICATION forming part of Letters Patent No. 429,958, dated June 10, 1890.

Application filed August 31, 1889. Serial No. 322,528. (No model.)

To all whom it may concern:

Be it known that I, HERMAN A. J. RIECKERT, of the city, county, and State of New York, have invented a new and Improved Self-Binder, of which the following is a full, clear, and exact description.

The invention relates to self-binders using a prepared straw band; and the object of the invention is to provide a new and improved self-binder which is simple and durable in construction and very effective in operation, drawing the straw band tight around the sheaf and then rapidly and securely tying the band.

The invention consists in certain parts and details and combinations of the same, as will be described hereinafter, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a side elevation of the improvement as applied to a harvester, parts being in section. Fig. 2 is an enlarged side elevation of the improvement with the casing in section. Fig. 3 is an end elevation of the same. Fig. 4 is a sectional end elevation of the same on the line *x x* of Fig. 2. Fig. 5 is a plan view of the same with the casing in section. Fig. 6 is a sectional plan view of the same on the line *y y* of Fig. 2, with parts broken out. Fig. 7 is an enlarged sectional end elevation of part of the improvement on the line *z z* of Fig. 2. Fig. 8 is a side elevation of the same with parts in section. Fig. 9 is an enlarged front view of the mechanism for raising and lowering the prongs. Fig. 10 is a sectional end elevation of the same on the line *w w* of Fig. 9. Fig. 11 is a like view of the same on the line *u u* of Fig. 9. Fig. 12 is a sectional plan view of part of the same on the line *v v* of Fig. 9, and Fig. 13 is a plan view of the upper end of one of the sheaf-holders.

The improved machine is mounted on a frame A, which forms part of the harvester on which the binder is applied. In suitable bearings in the main frame A is mounted to turn a shaft B, carrying a pulley or sprocket-wheel B′, connected by a band or sprocket-chain with the driving-pulley of the harvester, the proportion of the pulleys or sprocket-wheels being so arranged that one turn of the driving-pulley of the harvester imparts two full revolutions to the main shaft B.

On one end of the shaft B is secured a bevel gear-wheel B^2, which meshes into a bevel gear-wheel B^3, secured on the lower end of an upright shaft C, mounted to turn in a sleeve A′, secured on the main frame A. On the shaft B, next to the gear-wheel B^2, is secured another bevel gear-wheel B^4, which meshes into a horizontally-arranged bevel gear-wheel B^5, turning on a stud B^6, secured on the main frame A. On the upper face of the bevel gear-wheel B^5 is arranged a gear-wheel B^7, provided with two sections of gear-teeth adapted to mesh alternately into a gear-wheel D′, mounted to turn loosely on the sleeve A′, previously mentioned. The gear-wheel B^7, by means of its two sections of gear-teeth, imparts an intermittent motion to the gear-wheel D′.

On the face of the gear-wheel D′ are secured arms D, extending in opposite directions radially from the shaft C. On the outer ends of the arms D are held two grain-holders D^2 and D^3, alike in construction and each provided with two segmental arms D^4 and D^5, pivoted at D^6 to the outer end of the respective arm D. When the arms D^4 and D^5 are closed, they form a circle, as shown to the left in Fig. 1, and when open, as shown to the right in Fig. 1, they are ready to admit the grain as cut by the harvester. The arms D^4 and D^5 of each holder D^2 or D^3 are alternately closed and opened by fixed circular cams D^7 and D^8, of which the cam D^7 supports the outer edges of the arms D^5, while the other cam D^8 supports the outer edges of the arms D^4. The lowest points of the cams D^7 and D^8 are to the right of the shaft C, so that the arms D^4 and D^5, by their own weight resting on the said cams, are opened to receive the grain. When the gear-wheel D′ is turned one-half a revolution by one of the teeth-sections of the gear-wheel B^7, then the respective open arms D^4 and D^5 close by passing over the cams D^7 and D^8, and are entirely closed when they arrive in the position shown to the left in Fig. 1. Thus one holder is always open while the other is closed.

The straw band used for tying the grain is preferably prepared by suitable mechanism—

such, for instance, as shown in application, Serial No. 317,082, for Letters Patent for a straw-band-twisting machine, filed by me under date of July 10, 1889, and allowed October 2, 1889. The straw band is placed into the arms D^4 and D^5 by hand or some equivalent well-known device. The twisted and somewhat stiff straw band rests against the inner edges of the arms D^4 and D^5, their outer ends projecting through the semicircular forks D^9, formed on the upper end of each of the arms D^4 and D^5. (See Fig. 13.)

The cam D^8 is supported on suitable brackets of the main frame A, while the cam D^7 is secured to the upper end of the sleeve A′, which latter also supports an upwardly-extending bracket A^2, in the upper end of which is journaled the upper end of the shaft C. The latter carries at its outer end a bevel gear-wheel C′, meshing into a bevel gear-wheel C^2, secured on a short shaft C^3, mounted to turn in suitable bearings formed in upwardly-extending arms A^3, secured to the bracket A^2. On the shaft C^3 is also secured a pulley C^4, over which passes a belt C^5, also passing over a large pulley C^6, fastened on a shaft C^7, mounted to turn in suitable bearings in the upper ends of the said arms A^3. When the main shaft B is rotated, it transmits its motion to the shaft C by the bevel gear-wheels B^2 and B^3, and the shaft C, by the bevel gear-wheels C′ and C^2, turns the shaft C^3 and the pulley C^4, which latter by the belt C^5 rotates the pulley C^6, so as to turn the shaft C^7 in the direction of the arrow a' and at the same speed as the driving-pulley on the harvester.

The shaft C^7 operates the twisting mechanism E, operating over the closed grain-holder D^2 or D^3, as shown to the left in Fig. 1. This twisting mechanism E is provided with two balls E′ and E^2, secured on the outer ends of the arms E^3 and E^4, respectively, fastened on a ball E^5, secured on the lower end of a vertical shaft E^6, passing through a sleeve F′ of knotting mechanism F, and having its bearings in a bracket A^5, secured on a casing A^4, supported by the shaft C^7. On the upper end of the shaft E^6 is secured a bevel-pinion G, which meshes into a bevel gear-wheel G′, fastened on the end of a shaft G^2, carrying a pinion G^3, adapted to be engaged alternately by the segmental gears G^4 and G^5, respectively, secured on the rim of a master-wheel H, fastened on the shaft C^7. When the latter is rotated, as above described, in the direction of the arrow a', said segmental gear-wheels G^4 and G^5 alternately impart a rotary motion by the pinion G^3 to the shaft G^2, which latter, by the gear-wheels G′ and G, rotates the shaft E^6, carrying on its lower end the arms E^3 and E^4, supporting the balls E′ and E^2, respectively. The balls E′ and E^2, when the shaft E^6 is turned, travel on the semicircular forks D^9, formed on the upper ends of the arms D^4 and D^5 of the holders D^2 and D^3, respectively. The ends of the band held in the closed holder D^2 or D^3 project through the forks D^9 and are taken hold of by the arms E^3 and E^4 and twisted when the shaft E^6 is turned. Any desired number of revolutions may be given to the shaft E^6. Three or four, however, will be sufficient to make three or four twists in the ends of the band. As the motion given to the shaft E^6 is intermittent, by means of the segmental gear-wheels G^4 and G^5, the said shaft is locked in place after each movement by a pawl G^6, pivoted on the upper end of the bracket A^5 and engaging with one end a recess formed in the back of the bevel gear-wheel G′. The other end of the said pawl is operated on by the ends of the respective segmental gears G^4 or G^5 before the latter is in mesh with the pinion G^3. As soon as the segmental gear-wheel moves out of contact with the pinion G^3 said pawl G^6 drops its inner end in the recess of the gear-wheel G^2 and locks the latter in place, and consequently the shaft E^6.

The knotting mechanism F is located near the twisting mechanism E and is provided with the sleeve F′, previously mentioned, which latter is provided at its lower end with a notch F^2, adapted to engage, when in its lowermost position, a pin E^7, secured on the lower end of the shaft E^6, so as to additionally lock the latter in place when the sleeve F′ is in its lowermost position.

Near the lower end of the sleeve F′ are secured on opposite sides the trunnions I and I′, on which are fulcrumed tongs J and J′, respectively, alike in construction, and each provided with two prongs J^2 and J^3, of which the former is provided on its lower ends with a semicircular offset J^4, and the other prong J^3 is provided with a similar but smaller semicircular offset J^5, as illustrated in Fig. 7.

On the upper end of each of the prongs J^2 and J^3 are formed pins J^6 and J^7, respectively, engaging guideways K^2 and K^3, respectively, formed in each of the brackets K and K′, respectively, secured on the under side of the casing A^4. It is understood that the bracket K is provided with two grooves K^2 and K^3 for the pins J^6 and J^7 of the tongs J, while the bracket K′ has two grooves for a similar purpose for the tongs J′. The trunnions I and I′ project slightly beyond the tongs J and J′, respectively, and pass into vertical guideways K^4, arranged between the guideways K^2 and K^3 on the brackets K and K′, respectively.

In the lower end of the semicircular offset J^4 of each prong J^2 is formed a slot J^8, in which is adapted to pass a tail-piece L or L′, respectively, extending through the tongs J and J′, respectively, and secured to the trunnions I and I′.

The sleeve F′ is adapted to slide vertically up and down on the shaft E^6 by a mechanism hereinafter more fully described. When the sleeve F′ is in its uppermost position, as shown in Figs. 2 and 4, the arms E^3 and E^4 of the twisting mechanism are below the lower ends of the tongs J and J′. The pins J^6 and

J^7 of the prongs J^2 and J^3 of the tongs J and J′ are then close together in the upper parts of the guideways K^2 and K^3, so that the lower semicircular offsets J^4 and J^5 are opened. When the sleeve F′ is now moved downward, the open semicircular offsets J^4 and J^5 of the tongs J and J′ pass over the arms E^3 and E^4, and when the sleeve F′ arrives in its lowermost position the offsets J^4 and J^5 close into the position shown in Fig. 7, by the pins J^6 and J^7 traveling in the outer tip-end parts of the guideways K^2 and K^3. (See Figs. 7 and 8.) The trunnions I and I′, by traveling in the guideways K^4 in the brackets K and K′, firmly guide the sleeve F′ in its up and down motion and prevent said sleeve from turning. The ends of the offsets J^5 of the prongs J^3 are adapted to press on one side of the straw band, while the end of the larger semicircular offset J pushes the end of the straw band under the part of the band surrounding the sheaf of grain, as is hereinafter more fully described. The ends of the bands have previously been pressed down by the tail-pieces L and L′.

The mechanism for moving the sleeve F′ and its connections up and down consists, principally, of a dovetailed incline N, engaging the correspondingly-shaped offset F^3 on the upper end of the sleeve F′. The incline N is provided at its horizontal bottom with a dovetail fitting in a dovetailed groove N′, formed in the bottom of the casing A^4, so that the incline N is guided in its forward and backward movement. The lower part of the incline N is connected by rods N^2 with a horizontally-extending dovetailed rod N^3, mounted to slide in suitable guideways N^4, arranged parallel to the guideways N′ in the bottom of the casing A^4. On one end of the rod N^3 is secured a rectangular frame N^5, (see Fig. 9,) in the ends of which are fitted the curved arms O and O′, respectively, pivotally connected at diagonal ends by a rod O^2, as is plainly shown in Fig. 9.

On the arms O and O′ are pivoted the levers O^3 and O^4, pivotally connected by bolts O^5 with the semicircular ends of an elongated frame P, mounted to slide at the said ends in the arms O and O′. In the top arm of the elongated frame P is arranged a rack P′, opposite which is located a parallel rack P^2, arranged in the lower arm of the said frame. The racks P′ and P^2 are adapted to be engaged alternately by a gear-wheel P^3, secured on a shaft P^4, mounted to turn in suitable bearings erected in the bottom of the casing A^4, and on the said shaft P^4 is secured a pinion P^5, adapted to be engaged alternately by the segmental gear-wheels P^6 and P^7, formed diametrically opposite each other on the rim of the wheel H. (See Fig. 2.) The gear-wheel P^3 is adapted to engage alternately the studs O^6 and O^7 on the levers O^3 and O^4, so as to shift the respective lever to throw the frame P up and down, permitting the gear-wheel P^3 to alternately engage the racks P′ and P^2, so that when the segmental gear-wheel P^6 or P^7 meshes in the pinion P^5 and turns the shaft P^4 and the gear-wheel P^3, then the latter, by engaging the rack P′, moves the frame N^5, the rod N^3, and consequently the incline N, forward, so that the sleeve F′ is lowered, and when the said gear-wheel P^3 engages the pin O^7 on the lever O^4, then the said lever is thrown upward. Thereby the frame P is raised parallel with the rod N^3 until the said gear-wheel P^3 engages the rack P^2, so that by the next segmental gear-wheel P^6 or P^7 engaging the pinion P^5 said gear-wheel P^3 meshes in the rack P^2 and moves the frame N^5, the rod N^3, and the incline N rearward, so that the sleeve F′ is again raised to the position shown in Fig. 2. It is understood that the segmental gear-wheel P^6 moves the incline N in one direction, while the oppositely-arranged segmental gear-wheel P^7 moves the incline N back to the former position.

A pawl N^6, pivoted in the bottom of the casing A^4, is adapted to engage one of the cross-arms N^2, so as to lock the latter, and consequently the incline N, the rod N^3, and the frame N^5, in place when the sleeve F′ is in a raised position. The pawl N^6 is disengaged from the arm N^2 by the cams N^7 and N^8, arranged directly opposite each other on the rim of the wheel H. (See Fig. 2.) A spring N^9 presses against the upwardly-projecting end of the pawl N^6, so as to hold the pawl in contact with the arm N^2 until operated on by the respective cam N^7 or N^8.

The casing A^4, with its contents, is swung into an angular position, as shown in dotted lines in Fig. 2, as soon as the knot is tied, so as to move the twisting device E, as well as the knotting device F, away from the respective holder D^2 or D^3. In order to accomplish this an arm Q is secured on the frame A^2, and is provided at its upper end with a segmental rack Q′, in which mesh the two gear-wheels Q^2 and Q^3, mounted to turn on shafts Q^4 and Q^5, respectively, held in suitable bearings arranged in the casing A^4. The gear-wheel Q^2 is considerably larger than the gear-wheel Q^3, and in the latter meshes a smaller gear-wheel Q^6, of such size as to make the two gear-wheels Q^3 and Q^6 equal in diameter to the diameter of the gear-wheel Q^2. The teeth of the gear-wheel Q^6 thus coincide with the teeth of the gear-wheel Q^2, so that both gear-wheels Q^6 and Q^2 can be in mesh with a gear-wheel R, secured on a shaft R′, mounted to turn and to slide transversely in a bearing R^2, secured in the casing A^4. On the shaft R′ is also secured a pinion R^3, adapted to be engaged alternately by segmental gear-wheels R^4, R^5, R^6, and R^7, arranged on the periphery of the wheel H. The gear-wheel R can be thrown either in contact with the gear-wheel Q^2 or the gear-wheel Q^6, or it may be in mesh with both, as shown in Fig. 5. In the latter case a movement of the gear-wheels Q^2, Q^3, and Q^6 is impossible, as

the gear-wheels Q^2 and Q^3 are both in mesh with the rack Q and turn in opposite directions. When the gear-wheel R is in mesh with the gear-wheel Q^2, and is turned so as to rotate said gear-wheel Q^2, then the latter travels downward on the rack Q′, whereby the casing A^4 swings into an inclined position, (shown in dotted lines in Fig. 2,) the shaft C^7 being the center. When, however, the gear-wheel R is in mesh with the gear-wheel Q^6 and is rotated, then the said gear-wheel Q^6 turns, and also turns the gear-wheel Q^3, which now travels up the teeth on the rack Q′ until the casing A^4 is moved back to its former horizontal position. At this point the gear-wheel R is shifted so as to be in mesh with both gear-wheels Q^2 and Q^6, whereby the casing A^4 is locked in place, as previously described. The device for moving the gear-wheel R alternately in contact with the gear-wheels Q^2 and Q^6 consists of a series of inclined blocks arranged on the periphery of the gear-wheel H. Two sets of such blocks are placed diametrically opposite each other on the periphery of the wheel H. Each set of blocks contains the four blocks S, S′, S^2, and S^3, each provided with an incline adapted to engage, when the wheel H rotates, one of the faces of the gear-wheel R, so as to shift the latter transversely for the purpose above described. The block S is adapted to engage the front face of the wheel R, (see Fig. 5,) so as to move the wheel R in mesh with the gear-wheel Q^2. At this time the segmental gear-wheel R^6 meshes into the pinion R^3, rotates the latter, and consequently the wheels R and Q^2, whereby the latter travels downward on the rack Q′ and the casing A^4 is shifted into an inclined position. As soon as the said segmental gear-wheel R^6 has moved out of mesh with the pinion R^3 then the block S′ engages the outer face of the gear-wheel R and moves the latter in mesh with the two gear-wheels Q^2 and Q^6, whereby the several wheels Q^2, Q^3, and Q^6, as well as the casing A^4, are locked in place. The next following block S^2 moves the gear-wheel R out of mesh with the gear-wheel Q^2 and farther into mesh with the gear-wheel Q^6. As soon as this takes place the segmental gear-wheel R^7 engages it and turns the pinion R^3, whereby the wheels R, Q^6, and Q^3 are turned and the wheel Q^3 travels up the rack Q′ to move the casing A^4 back into its horizontal position, as above described. As soon as this is accomplished the segmental gear-wheel R^7 leaves the pinion R^3, and the next following block S^3 moves the gear-wheel R into mesh with both gear-wheels Q^6 and Q^2, so as to lock the several parts in place, as above described. This entire movement, as above mentioned, is repeated for every set of blocks S, S′, S^2, and S^3.

The operation is as follows: When the harvester is set in motion, the shaft B is rotated and the several parts of the self-binder are actuated. The shaft C^7 rotates at the same speed as the driving-shaft of the havester, while the shaft C makes two revolutions for every revolution of the shaft C^7. The prepared straw band is placed in the open holder D^2 or D^3, after which the grain is passed into the said holder about midway, so that the band encircles the grain in the usual manner, the ends of the straw band projecting upward above the forks D^9, on account of being twisted and consequently sufficiently stiff for the purpose. The movement of the main shaft B intermittently turns the arms D, so that the holder D^2 or D^3 is moved to the left side of the machine, and its arms D^4 and D^5 are closed by traveling over the cams D^7 and D^8, as previously described, so as to bring the said holder into the position shown to the left in Fig. 1—that is, directly under the twisting mechanism E and the knotting mechanism F. The balls E′ and E^2 now rest on the semicircular forks D^9 of the arms D^4 and D^5, respectively, and as the shaft E^6 now receives a rotary motion by the action of the segmental gear-wheel G^4 or G^5 the arms E^3 and E^4, carrying the said balls, take hold of the upwardly-projecting ends of the straw-band and give the same several twists. As soon as this is accomplished the rotary motion of the shaft E^6 ceases and the incline N is set in motion, as previously described, so as to move the sleeve F′ downward until the notch F^2 of the said sleeve engages the pin E^7, and the shaft and sleeve are locked together. The downward motion of the sleeve F′ operates the tongs J and J′, as previously described—that is, one of the tongs engages one end of the straw band while the other tongs operates on the other end of the straw-band. The tail-pieces L and L′ press the ends of the band down so that the ends can be engaged by the prongs J^4. Each prong J^5 rests against one side of the end of the straw band, while the other J^4 in closing presses the end of the straw band underneath the circular part of the band—that is, it presses the end of the straw band over the bundle of grain and underneath the circular part of the band. As soon as this is accomplished the sleeve F′ is again moved upward and the casing A^4, with its contents, is swung into an inclined position, as previously described, and then the position of the holders D^2 and D^3 is again changed to bring a filled holder under the twisting and knotting devices, while the holder containing the bound sheaf opens its arm to permit of the moving the bound sheaf before it reaches its former position on the right-hand side of the machine, as shown in Fig. 1. The new band is then placed in the empty holder and the above-described operation is repeated. During this time the casing A^4 is again swung into a horizontal position, as previously described, so that the balls E′ and E^2 of the twisting device E again rest on the semicircular forks D^9 of the arms D^4 and D^5 of the holder D^2 or D^3 under the binding mechanism E. The above-described operation is then repeated.

It is understood that the ends of the straw band are pressed in opposite directions under the band on each side of the twisted part.

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

1. In a self-binder, the combination, with an intermittently-rotated arm and two semicircular holding-arms pivoted at the ends of said arm, of two circular cams concentric with the axis of the rotary arm, the two inner pivoted arms resting on the inner cam and the two outer arms resting on the outer cam, substantially as set forth.

2. In a self-binder, the combination, with a holder, of a shaft arranged vertically and mounted to turn, downwardly-inclined arms projecting in opposite directions from the lower end of the said shaft, and a knotter movable vertically past said arms, substantially as shown and described.

3. In a self-binder, the combination, with a holder, of a shaft arranged vertically and mounted to turn, and downwardly-inclined arms projecting in opposite directions from the lower end of the said shaft, balls held on the outer ends of the said arms, and a knotter at opposite sides of the shaft and movable vertically past said arms, substantially as shown and described.

4. In a self-binder, the combination, with a holder provided with arms having semicircular ends through which pass the straw-band ends, of a twisting mechanism comprising a shaft mounted to turn, and downwardly-inclined arms rigidly connected with and projecting from the said shaft and traveling at their extremities around the said semicircular ends, substantially as shown and described.

5. In a self-binder, the combination, with a holder provided with arms having semicircular ends through which pass the straw-band ends, of a twisting mechanism comprising a shaft mounted to turn, downwardly-inclined arms projecting from the said shaft and operating over the said semicircular ends, and balls held on the outer ends of the said arms and adapted to travel on the said semicircular ends, substantially as shown and described.

6. In a self-binder, the combination, with the rotary twister having inclined arms, of two sets of tongs, each provided with semicircular ends adapted to open and close around said arms and connected for simultaneous vertical movement, substantially as shown and described.

7. In a self-binder, the combination, with two tail-pieces adapted to press on the ends of the straw bands, of two sets of tongs adapted to engage the ends of the straw bands and press the same between the band and the grain, substantially as shown and described.

8. In a self-binder, the combination, with the vertical shaft having inclined arms, of tongs provided with two prongs, each having a semicircular offset of different diameter curved toward each other to close around said arms and engage the binding material, substantially as shown and described.

9. In a self-binder, a pair of tongs provided with two prongs, each having a semicircular offset of different diameter, in combination with a tail-piece held in the opening formed by the said semicircular offsets and projecting through a slot in the larger offset, substantially as shown and described.

10. In a self-binder, a pair of tongs provided with two prongs, each having a semicircular offset of different diameter, in combination with a tail-piece held in the opening formed by the said semicircular offsets and projecting through a slot in the larger offset, and means, substantially as described, for moving the said tongs and tail-piece simultaneously up and down, at the same time closing the prongs of the tongs, substantially as set forth.

11. In a self-binder, a pair of tongs provided with two prongs, each having a semicircular offset of different diameter, in combination with a tail-piece held in the opening formed by the said semicircular offsets and projecting through a slot in the larger offset, and fixed curved guideways engaged by the upper ends of the said prongs, substantially as shown and described.

12. In a self-binder, a pair of tongs provided with two prongs, each having a semicircular offset of different diameter, in combination with a tail-piece held in the opening formed by the said semicircular offsets and projecting through a slot in the larger offset, fixed curved guideways engaged by the upper ends of the said prongs, and a sleeve having a reciprocating motion and carrying the pivots of the said tongs, substantially as shown and described.

13. In a self-binder, the combination, with two parallel stationary brackets, each having on its inner face a pair of vertically-extending guideways curved outwardly and downwardly at their lower ends, of a vertically-reciprocating sleeve between said brackets, two pairs of tongs pivoted between their ends to opposite sides of said sleeve and provided at their upper ends with projections entering said ways, the lower ends of each pair of tongs provided with prongs, substantially as set forth.

14. In a self-binder, the combination, with two parallel stationary brackets, each having on its inner face a pair of vertically-extending guideways curved outwardly and downwardly at their lower ends, and a straight guideway between each pair, of a vertically-reciprocating sleeve having trunnions guided in said straight guideways, a pair of tongs pivoted on each of said trunnions and having projections at their upper ends engaging said curved guideways, and curved prongs at their lower ends, substantially as set forth.

15. In a self-binder, the combination, with

the two parallel brackets, each having two vertically-extending guideways on its inner face curved downwardly and outwardly at their lower ends, and a vertically-reciprocating sleeve between the brackets, having two pairs of tongs pivoted to opposite sides and having projections at the upper ends of their two members engaging said guideways, and curved prongs at their lower ends, of an intermittently-rotated shaft extending down through the sleeve and provided with twisting-arms at its lower end to operate in conjunction with the said prongs, substantially as set forth.

16. In a self-binder, the combination, with two sets of fixed curved guideways, of a sleeve having an intermittent reciprocating motion between the said guideways, trunnions formed on the said sleeve, sets of tongs pivoted on the said trunnions and guided by the said guideways to alternately open and close the said tongs, and semicircular offsets of different diameter formed on the prongs of the said tongs and moving in opposite directions, substantially as shown and described.

17. In a self-binder, the combination, with two sets of fixed curved guideways, of a sleeve having an intermittent reciprocating motion between the said guideways, trunnions formed on the said sleeve, sets of tongs pivoted on the said trunnions and guided by the said guideways to alternately open and close the said tongs, and semicircular offsets of different diameter formed on the prongs of the said tongs and moving in opposite directions, and a tail-piece secured on each trunnion and projecting through the opening of the tongs and through a slot in the larger offset, substantially as shown and described.

18. In a self-binder, the combination, with a holder adapted to receive the straw band and grain, of a master-wheel above said holder, a casing mounted to swing vertically on the axis of said wheel, a band-twisting device, and a knotting device held on the said casing and operated from said master-wheel, substantially as shown and described.

19. In a self-binder, the combination, with a vertical continuously-rotated shaft, an arm having an intermittent rotary movement about said shaft and provided with holders, and a drive-shaft geared to said shaft and arm; of a master-wheel mounted above said arm and geared to said vertical shaft, a vertically intermittently swinging casing mounted on the axis of said master-wheel, and the twisting and knot-forming mechanism carried by said casing toward and from the holders and operated from the master-wheel, substantially as set forth.

20. In a self-binder, the combination, with a wheel provided with segmental gears placed diametrically opposite each other, of a casing or frame mounted to swing vertically on the axis of said wheel, a twisting device, comprising a shaft carried by said casing and turned intermittently by the said gear-wheels, and downwardly-inclined arms held on the said shaft, substantially as shown and described.

21. In a self-binder, the combination, with a wheel provided with segmental gears placed diametrically opposite each other, of a casing or frame mounted to swing vertically on the axis of said wheel, a twisting device comprising a shaft carried by said casing and turned intermittently by the said gear-wheels, downwardly-inclined arms held on the said shaft, balls held on the outer ends of the said arms, and the holder having semicircular upper ends on which the balls travel, substantially as shown and described.

22. In a self-binder, the combination, with a vertical sleeve supporting the knotting device, of a transversely-extending incline engaging the said sleeve to raise and lower it and having an intermittent forward and backward motion, substantially as shown and described.

23. In a self-binder, the combination, with a vertically-reciprocating sleeve supporting the knotting device, of a horizontal incline engaging the said sleeve and having an intermittent forward and backward motion, and a rack and pinion, substantially as described, for imparting an intermittent forward and backward motion to the said incline to raise and lower the sleeve, as set forth.

24. In a self-binder, the combination, with a sleeve supporting the knotting device, of an incline engaging the said sleeve and having an intermittent forward and backward motion, means, substantially as described, for imparting an intermittent forward and backward motion to the said incline, and a locking device for locking the said incline in place, as set forth.

25. In a self-binder, the combination, with a shaft carrying a wheel, of a casing mounted to turn on the said shaft, two gear-wheels mounted in the casing adapted to be turned alternately and in opposite directions from the said wheel, and a fixed segmental rack secured to the frame and engaged by the said two gear-wheels to raise and lower said casing, substantially as shown and described.

26. In a self-binder, the combination, with a shaft and a wheel held on the said shaft and provided with segmental gears and wedge-shaped blocks, of a casing mounted to turn on said shaft, parallel gear-wheels mounted in the casing, the pinion R^3, mounted in the casing to slide and to turn, and adapted to engage either or both of said parallel gear-wheels and to be engaged by the said segmental gears and by the said blocks, and a stationary rack on the frame of the machine engaged by said two wheels, whereby the casing may be raised, lowered, and locked, substantially as shown and described.

27. In a self-binder, the combination, with a shaft and a master-wheel held on the said shaft and provided with segmental gears and wedge-shaped blocks, of the casing mounted

to turn on said shaft, the pinion R^3, mounted in said casing to slide and to turn and adapted to be engaged by the said segmental gear-wheels and by the said blocks, the gear-wheel R, held on the said gear-wheel R^3, two gear-wheels Q^2 and Q^6, adapted to be engaged simultaneously or alternately by the said pinion R, the gear-wheel Q^3, meshing into the gear-wheel Q^6, the fixed rack into which the gears Q^2 Q^3 mesh, and the band-tying mechanism carried by the casing and operated from the master-wheel, substantially as shown and described.

28. In a self-binder, the combination, with a shaft and a wheel held on the said shaft and provided with segmental gears and wedge-shaped blocks, of the pinion R^3, mounted to slide and to turn and adapted to be engaged by the said segmental gear-wheels and by the said blocks, the gear-wheel R, held on the said gear-wheel R^3, two gear-wheels Q^2 and Q^6, adapted to be engaged simultaneously or alternately by the said pinion R, an additional gear-wheel Q^3 in mesh with the said gear-wheel Q^6, and the fixed rack Q′ in mesh with the gear-wheels Q^2 and Q^3, substantially as shown and described.

29. In a self-binder, the combination, with a gear-wheel having an intermittent rotary motion, of an elongated frame provided on opposite sides with rack-teeth adapted to be engaged alternately by the said gear-wheel, levers pivotally connected with the said elongated frame, and pins projecting from the said levers and adapted to be engaged by the said gear-wheel, substantially as shown and described.

30. In a self-binder, the combination, with a gear-wheel having an intermittent rotary motion, of an elongated frame provided on opposite sides with rack-teeth adapted to be engaged alternately by the said gear-wheel, levers pivotally connected with the said elongated frame, pins projecting from the said levers and adapted to be engaged by the said gear-wheel, and curved arms connected with each other and mounted to slide and carry the pivots for the said levers, substantially as shown and described.

31. In a self-binder, the combination, with a gear-wheel having an intermittent rotary motion, of an elongated frame provided on opposite sides with rack-teeth adapted to be engaged alternately by the said gear-wheel, levers pivotally connected with the said elongated frame, pins projecting from the said levers and adapted to be engaged by the said gear-wheel, curved arms connected with each other and mounted to slide and carry the pivots for the said levers, and a frame mounted to slide forward and backward and supporting the said curved arms, substantially as shown and described.

32. The combination, with the vertically-reciprocating knotter-sleeve, of the incline engaging said sleeve for raising and lowering it, the reciprocating frame connected with said incline, a rack-frame within said first-named frame, having upper and lower racks, connected curved arms between the two frames at their ends, levers pivotally connected with the ends of the rack-frame and with said curved arms, pins projecting from said levers, and the gear-wheels within the rack-frame to alternately engage said pins, and upper and lower racks, substantially as set forth.

33. The combination, with the twister-shaft, the reciprocating knotter-sleeve thereon, and the master-wheel having opposite gears for rotating said shaft, of the incline engaging said sleeve, a locking-pawl therefor operated by the master-wheel, and a reciprocating frame connected with said incline, provided with an automatically-operated reversing mechanism and operated from said master-wheel, substantially as set forth.

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Witnesses:
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