(No Model.) 5 Sheets—Sheet 1.

# G. SCHUBERT.

## GRAIN BINDER.

No. 468,552. Patented Feb. 9, 1892.

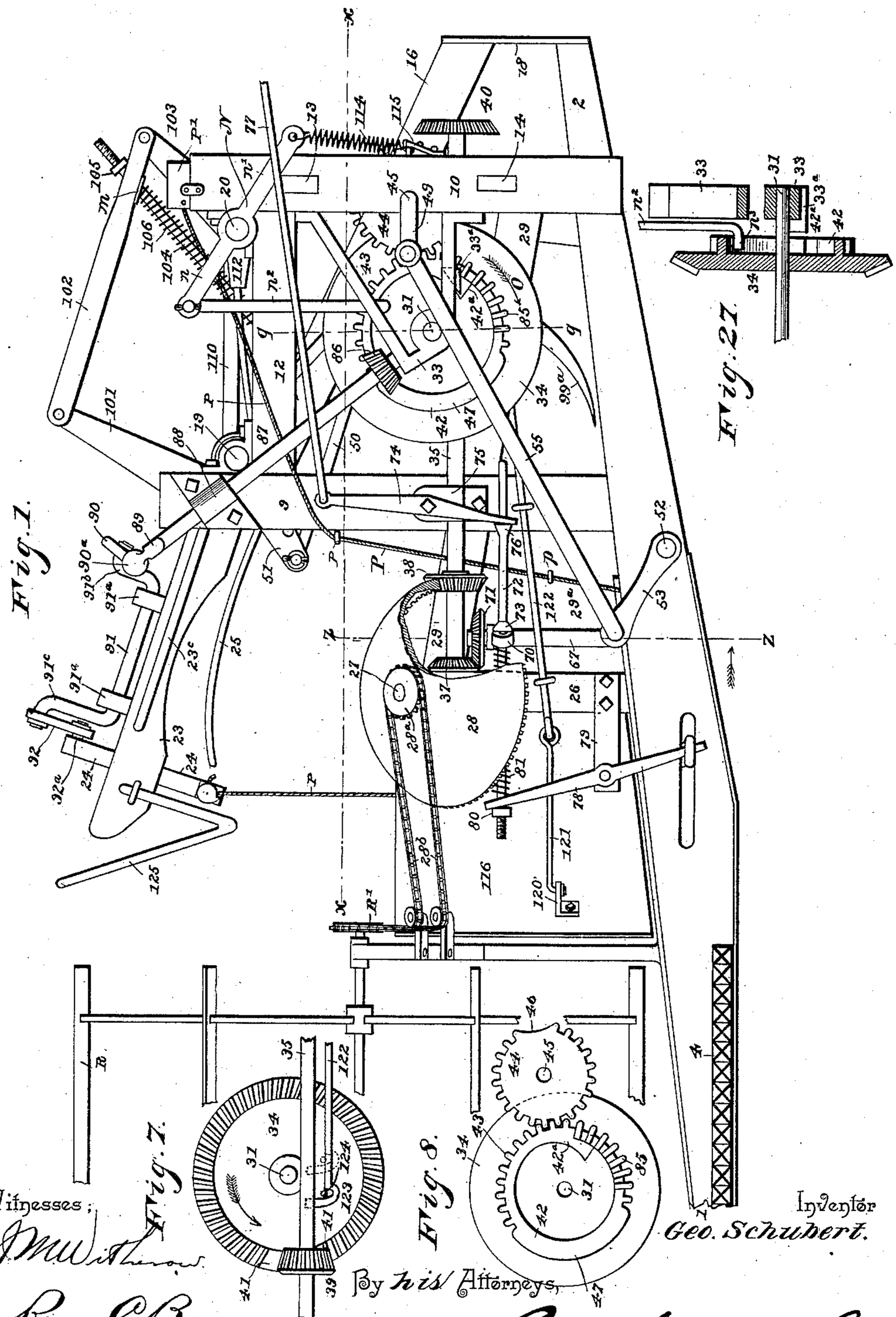

Fig. 1.



Fig. 27.



Fig. 7.



Fig. 8.

Witnesses;

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# G. SCHUBERT.

## GRAIN BINDER.

No. 468,552. Patented Feb. 9, 1892.

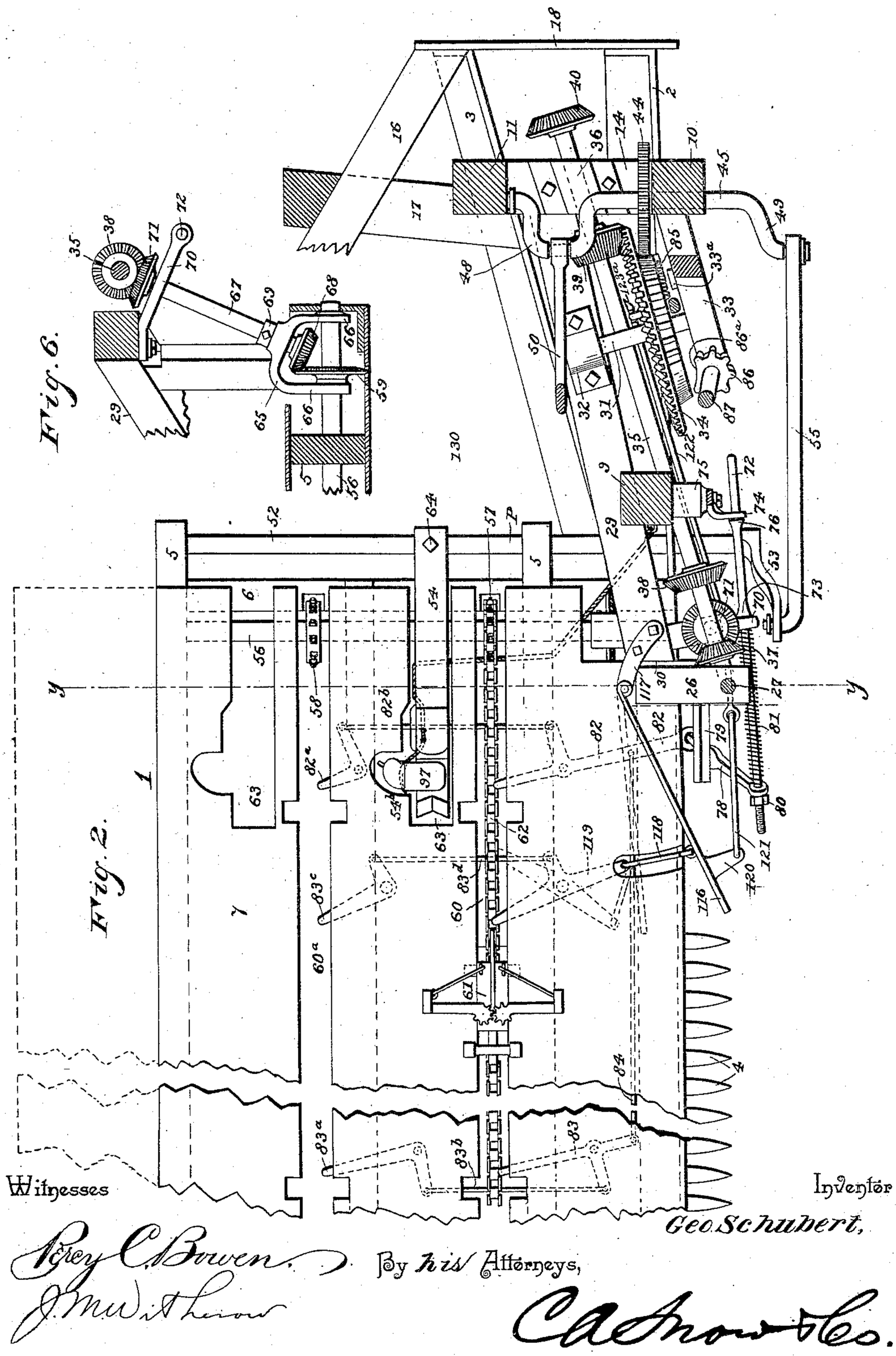

Fig. 6.



Fig. 2.

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(No Model.) 5 Sheets—Sheet 3.

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## GRAIN BINDER.

No. 468,552. Patented Feb. 9, 1892.

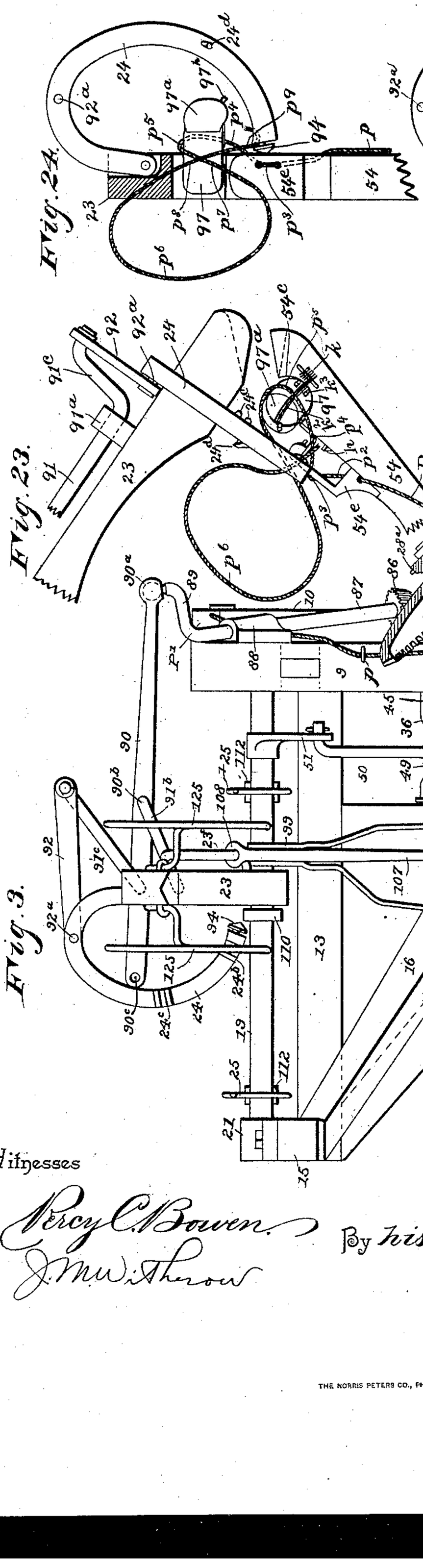

Fig. 24.

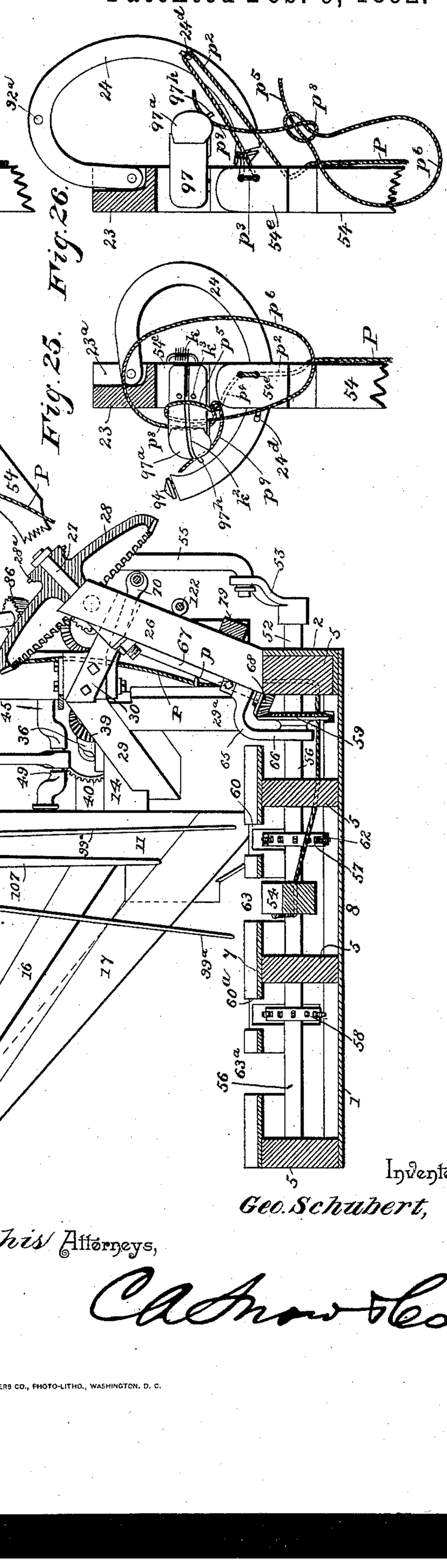

Fig. 26.



Fig. 25.



Fig. 23.



Fig. 3.

Witnesses

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(No Model.) 5 Sheets—Sheet 4.

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## GRAIN BINDER.

No. 468,552. Patented Feb. 9, 1892.

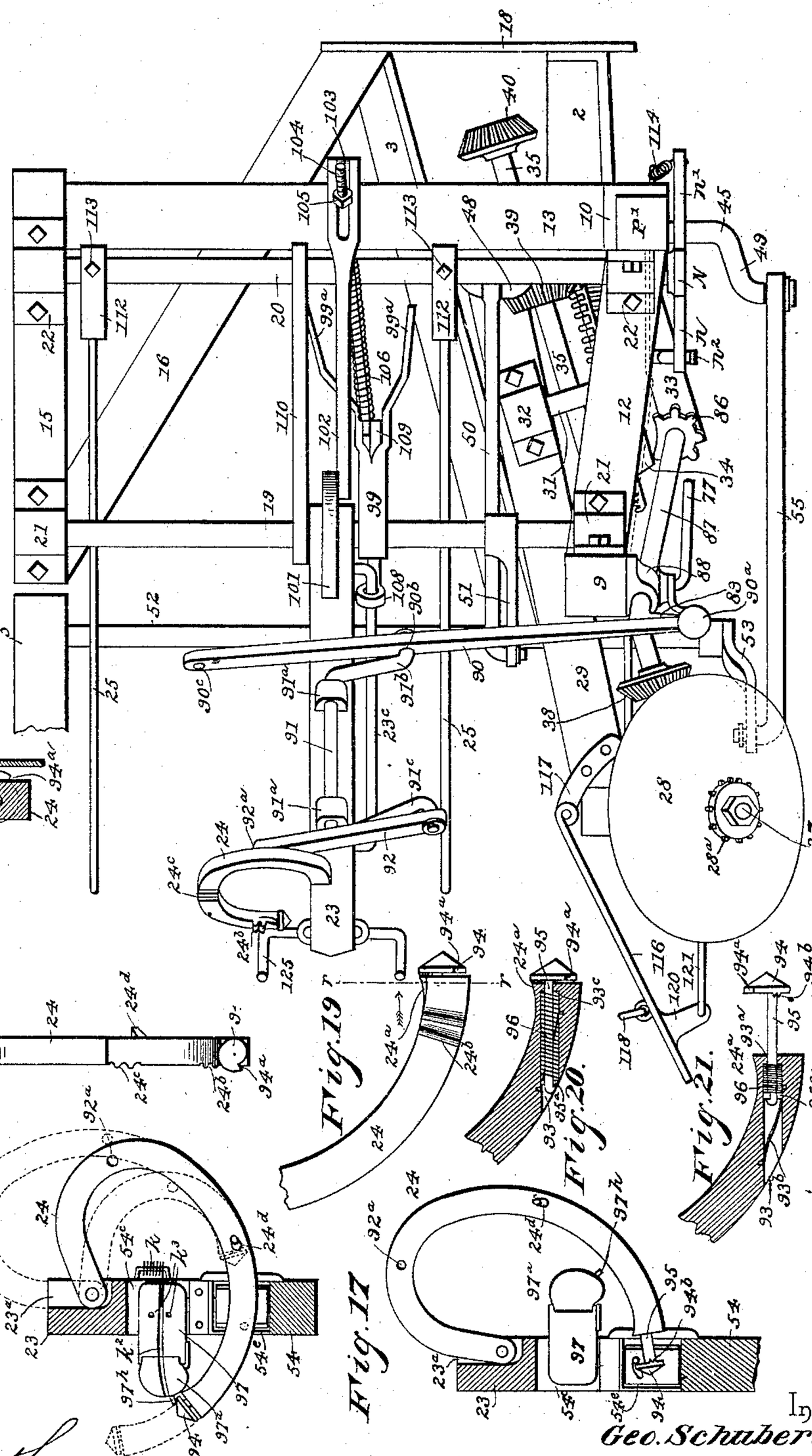

Fig. 4.

Fig. 22.



Fig. 18.



Fig. 19.



Fig. 20.



Fig. 21.



Fig. 16.



Fig. 17.

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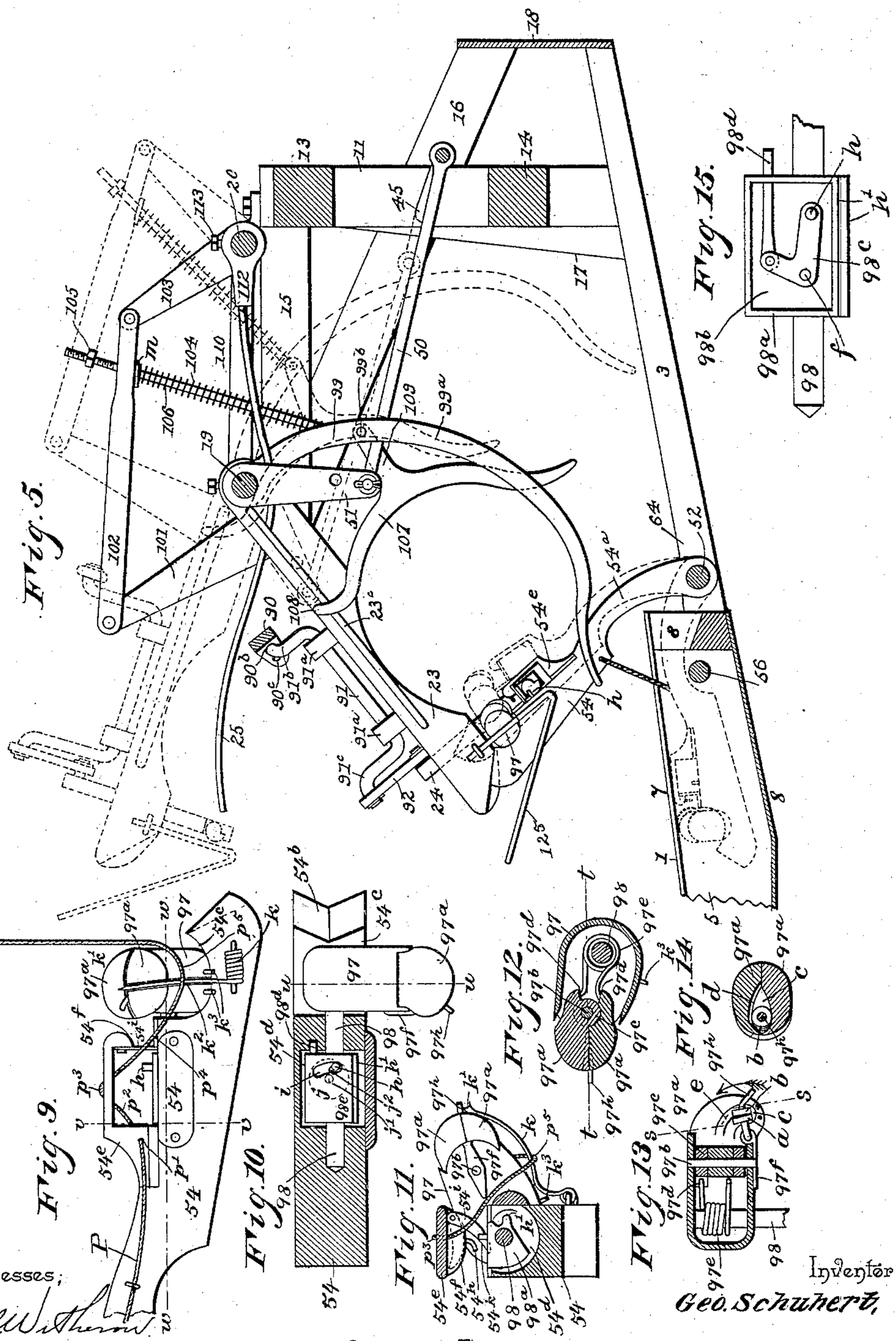
(No Model.) 5 Sheets—Sheet 5.

# G. SCHUBERT.

## GRAIN BINDER.

No. 468,552. Patented Feb. 9, 1892.




Witnesses;

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# UNITED STATES PATENT OFFICE.

GEORGE SCHUBERT, OF WALNUT, TEXAS.

## GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 468,552, dated February 9, 1892.

Application filed June 20, 1889. Serial No. 315,030. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE SCHUBERT, a citizen of the United States, residing at Walnut, in the county of Bosque and State of Texas, have invented a new and useful Grain-Binder, of which the following is a specification.

My invention is an improvement in grain-binders, and has for its object to provide a machine of this class which can be so constructed as to receive the grain direct from the platform of the reaper without the assistance of elevating mechanism, thereby producing a machine which will be comparatively simple in construction and equally adapted to tie light and heavy gavels, inasmuch as the difficulty of elevating heavy gavels will be entirely obviated.

A further object of this invention is to produce a machine which will tie what is commonly known as a "sailor's knot," which cannot be slipped apart, may be tied by means of simple mechanism, and is a very superior knot to that tied by the grain-binders in present use.

A further object is to provide binding mechanism which will be in operation only at the time of tying a gavel and will be automatically thrown out of gear as soon as the aforesaid operation has been completed, thus preventing unnecessary wear upon the parts.

A still further object of the invention is to provide a binder which will compress and bind a large or small gavel perfectly and without any adjustment.

These objects and such others as fairly fall within the scope of the invention I attain by means of the mechanism illustrated in the accompanying drawings, the peculiar construction, combination, and arrangement of which will be fully described hereinafter, and the specific points of novelty particularly pointed out in the claims.

In the drawings, Figure 1 is a front elevation of my invention, showing only so much thereof as is necessary to convey a clear conception of the same. Fig. 2 is a horizontal sectional view taken on the line *x x* of Fig. 1, showing the platform and lower parts in plan view. Fig. 3 is a vertical sectional view taken on the line *y y* of Fig. 2. Fig. 4 is a plan view of the left-hand side of my invention. Fig. 5 is a vertical sectional view showing the position of the needle-bar and knotter-bar when tying a gavel. Fig. 6 is a detail sectional view on the line *z z* of Fig. 1, looking in the direction of the arrow. Figs. 7 and 8 are detail views of opposite sides of the gear-wheel which operates the binding mechanism. Fig. 9 is a side elevation of one end of the knotter-bar with the knotter in its normal position. Fig. 10 is a horizontal sectional view of the same, taken on the line *w w* of Fig. 9, showing the knotter in plan view. Fig. 11 is a transverse sectional view of the same, taken on the line *v v* of Fig. 9. Fig. 12 is a sectional view of the knotter, taken on the line *u u* of Fig. 10. Fig. 13 is a sectional view of the same, taken on the line *t t* of Fig. 12. Fig. 14 is a similar view taken on the line *s s* of Fig. 13. Fig. 15 is a plan view of the locking device for the knotter, the inclosing-plate being removed. Fig. 16 is a view of the needle, showing the point thereof passing the end of the knotter, the needle-bar and knotter-bar being in section. Fig. 17 is a similar view showing the needle in the act of being withdrawn from the knotter-bar. Fig. 18 is an elevation showing the edge and point of the needle. Fig. 19 is a side elevation, slightly enlarged, of the end of the needle. Fig. 20 is a sectional view of the same, showing the point in its normal position. Fig. 21 is a similar view showing the point withdrawn from the needle. Fig. 22 is a transverse sectional view taken through the end of the needle on the line *r r* of Fig. 19, looking in the direction of the arrow. Figs. 23 to 26 are detail views showing the successive positions assumed by the needle and knotter during the process of tying the knot. Fig. 27 is a detail sectional view taken on the line *q q* of Fig. 1.

Similar letters and numerals of reference designate corresponding parts in the several views.

1 designates the platform, and 2 3 lateral extensions thereof, which may be formed of angle-irons or other suitable pieces. The platform 1 is provided with a finger-bar 4 upon its front edge, as is usual in this class of machines. Upon the platform 1 and the extensions 2 3 are mounted the operating parts of the machine.

The frame of the platform 1 is composed of

the beams 5 5 5 5 and 6, to the opposite sides of which are secured the top and bottom 7 and 8. Three uprights 9, 10, and 11 are secured to the extensions 2 3 and are braced by a horizontal beam 12, connecting the upper ends of the uprights 9 10, and by similar beams 13 and 14, which connect the uprights 10 and 11. The beam 13 extends from the upright 10 over the upright 11 to the rear of the machine. Upon the rear end of the beam 13 is secured one end of a beam 15, the opposite end thereof being supported by a diagonal brace 16, and the rear end of the beam 13 is supported by a diagonal brace 17. A flat guard-piece 18, which acts also as a brace, is secured to the ends of the extensions 2 3 and the brace 16.

The aforesaid uprights, beams, and braces form the frame which carries the operating mechanism of my invention.

Two shafts 19 and 20 extend from front to rear of the frame and have their bearings in the boxes 21 21 and 22 22 upon the beams 12 and 15 of the frame. Upon the shaft 19 is mounted the needle-bar 23, which carries the needle 24, and on the shaft 20 are mounted the discharging-arms 25.

Upon the front edge of the platform 1 is secured an upright 26, which is inclined forward and has a spindle 27 extending in an upwardly-inclined direction from its upper end. A convex disk 28 is loosely mounted upon the spindle 27, said disk having bevel gear-teeth upon its lower edge, as shown in Fig. 3.

A beam 29 is secured to the upright 9 at a short distance above the platform 1 and extends toward the left-hand side of the frame, slightly inclined backwardly and downwardly, having its outer end secured to the beam 14. A bracket 30 connects the inner end of the beam 29 to the upright 26, thereby bracing the same. A guard-board 29[a] is placed between the inner end of the beam 29 and the platform 1 to prevent the grain from getting into the operating parts of the machinery. A shaft 31 is mounted at one end in a journal-box 32 upon the beam 29 and at its opposite end in a bracket 33, secured to the side of the upright 10. Upon the shaft 31 is mounted a bevel gear-wheel 34, the peculiar construction of which is more clearly shown in Figs. 7 and 8, and will be described fully hereinafter.

A shaft 35 is journaled at one end in the upper end of the upright 26 and at its opposite end in a journal-box 36 upon the beam 14. Said shaft 35 carries four bevel-gears 37, 38, 39, and 40, one of which 38 meshes with the teeth on the convex disk 28, and another 39 meshes with the bevel gear-wheel 34. The bevel-pinion 40 on the outer end of the shaft 35 is adapted to be driven from the carrying-wheel of the machine through suitable mechanism, (not shown in the drawings,) and thus impart motion to the operating parts of the binder.

The shaft 35 is situated below the shaft 31, as shown in Fig. 7, and the teeth upon the wheel 34 are inclined, as shown in the same figure, to properly mesh with the pinion 39. A blank or space without teeth 41 is left in the bevel portion of the said wheel 34, in which the bevel-pinion 29 may revolve without affecting the gear-wheel 34. A raised ring or annulus 42 is secured to or formed integral with the bevel gear-wheel 34 on the opposite side to the inclined gear-teeth, as shown in Fig. 8, said ring having gear-teeth 43, extending about two-thirds round its periphery, with which mesh the teeth on the gear-pinion 44, carried by a crank-shaft 45, the said pinion 44 being provided with a blank 46, which as the pinion revolves will come opposite to the blank 47 on the ring 42 and thus cause the rotation of the pinion to cease until the blank 47 upon the ring 42 has passed the blank 46 upon the pinion.

The crank-shaft 45 has two cranks 48 and 49, and to the inner crank 48 is connected a pitman 50, which connects at its opposite end with a crank-arm 51, secured to the shaft 19, which carries the needle-bar. It will thus be seen that when the crank-shaft 45 is revolved the pitman 50 will act with the crank-arm to turn the shaft 19 and thus oscillate the needle-bar 23.

A shaft 52 is journaled in and passes through the beams 5 5 of the platform 1 and carries at its front end a crank-arm 53 and intermediate of its length the knotter-bar 54. A pitman 55 connects the crank-arm 53 with the crank 49 on the crank-shaft 45, so that when the crank-shaft is revolved it will oscillate the shaft 52 and also the knotter-bar.

A shaft 56 is arranged through the beams 5 5 of the platform 1 parallel with the shaft 52 and carries two sprocket-wheels 57 and 58 and a bevel-gear 59.

In the top 7 of the platform 1 are formed two slots 60 60[a], one above each of the sprocket-wheels 57 and 58, the said slots being of the proper size and shape for a suitable conveyer 61 to travel in, the sprocket-chain 62 of which passes over one of the sprocket-wheels 57 on the shaft 56 and over a similar sprocket-wheel (not shown in the drawings) at the opposite end of the platform 1.

The conveyer used in this invention may be any suitable form of reciprocating conveyer; but I have shown in the drawings and prefer to use such a conveyer as that shown and described in my former application filed May 5, 1888, and patented February 17, 1891, No. 446,473, as that form is more especially adapted to the present invention.

Two slots 63 63 are made in the top 7 of the platform 1 adjacent to and parallel with the slots 60 60, and through one of the slots 63 the knotter-bar will pass as it nears the end of its downward movement, the said slot being of the proper shape to receive the knotter-bar and knotter, as shown in Fig. 2 of the drawings. The purpose of having two of each of the slots 60 and 63 is to provide a way

in which the position of the knotter-bar and conveyer may be changed when necessary—as, for instance, should the grain be very tall the conveyer and knotter-bar may be moved into the rear slots 60 and 63 in order to bind near the center of the gavel. This, however, will seldom be necessary, as the position shown in the drawings—*i. e.*, in the forward slots—will answer for all ordinary work. The above transposition of parts is accomplished by loosening the set-screw 64, which binds the knotter-bar 54 upon the shaft 52, and moving the said knotter-bar along the said shaft until the proper position opposite the rear slot 63 is reached, as will be obvious. The chain of the conveyer may be removed from the sprocket-wheel 57 and placed upon the sprocket-wheel 58 in the rear slot 60. The needle-bar and mechanism attached thereto may be moved along the shafts 19 and 20 to correspond with the position of the knotter-bar, as will be readily understood.

65 designates a bracket having two downwardly-projecting arms 66 66, in the lower ends of which is journaled the end of the shaft 56 in such position that the bevel gear-wheel 59 is situated between the downwardly-projecting arms 66. A shaft 67 has its lower end journaled in the upper portion of the bracket 65 and has a gear-pinion 68 at its lower extremity, which meshes with the gear-wheel 59, as will be seen by reference to Fig. 6. A collar 69 is secured in any suitable manner upon the shaft 67 to bear upon the upper surface of the bracket 65 and support the shaft 67. The said shaft 67 is slightly inclined from the vertical position and is supported at its upper end in a bearing formed in an arm 70, pivoted to the lower side of the beam 29. A bevel gear-wheel 71 is rigidly fixed to the upper end of the shaft 67, above the arm 70, and is situated between the two gear-wheels 37 and 38 upon the shaft 35.

From the foregoing construction it will be seen that if the arm 70 be moved about its pivot it will move the upper end of the shaft 67 and with it the gear-wheel 71, the bracket 65 turning upon the shaft 56, thereby permitting the gear-wheel 71 to be brought into gear with either of the bevel gear-wheels 37 or 38. The normal position of the gear-wheel 71 is between the gear-wheels 37 and 38, but not in contact with either.

A rod 72, having a shoulder 73, is arranged through an opening in the extremity of the arm 70, the shoulder 73 resting against one side of the said arm. The outer end of the rod 72 passes through an opening in the lower end of a lever 74, pivoted upon a block 75, upon the front of the upright 9, which block 75 also forms a third bearing for the shaft 35. The lower end of the lever 74 rests against a shoulder 76, formed upon the rod 72, and the upper end of the said lever is connected by a rod 77 with a suitable handle, (not shown in the drawings,) by means of which the said lever may be operated to force the gear-wheel 71 into mesh with the gear-wheel 37, as will be readily understood. The inner end of the rod 72 passes through an eye in the upper end of a lever 78, pivoted upon a stud 79, projecting inwardly from the upright 26, and the extremity of the said rod 72 is screw-threaded to receive a nut 80. A coiled spring 81 is placed upon the said rod, one end of which spring bears against the end of the arm 70 and the opposite side against the eye of the lever 78, so that when the upper end of the said lever 78 is moved toward the arm 70 it will cause the spring 81 to bear against the said arm, thereby forcing it and the rod 72 outwardly and bringing the gear-wheel 71 into mesh with the gear-wheel 38 upon the shaft 35, thereby reversing the direction of rotation of the said gear-wheel 71, the shaft 67, and the mechanism operated thereby.

A lever 82 (shown in dotted lines in Fig. 2) is pivoted between the top and bottom of the platform 1, the forward longer arm of which extends beyond the front of the said platform and has an eye formed thereon through which the lower end of the lever 78 passes, the rear shorter arm of the lever 82 extending backward into the slot 60 in the path of the conveyer 61. A lever 83 is pivoted in the said platform 1, near the right-hand side thereof, the longer arm of the said lever 83 extending into the slot 60 and the shorter arm being connected by a rod 84 with the longer arm of the lever 82, as shown in dotted lines in Fig. 2. From this construction it will be understood that if the lever 74 be moved by hand to force the bevel gear-wheel 71 into engagement with the bevel gear-wheel 37, as shown in Fig. 1, the effect will be to cause the shaft 67 and gear-wheel 68 to rotate and impart rotary motion to the gear-wheel 59 and shaft 56 and sprocket-wheels 57 and 58, which will operate the sprocket-chain 62 to cause the conveyer 61 to travel toward the binding mechanism, which it will continue to do until it comes in contact with the inner end of the lever 82, and move the said lever a short distance. The effect of this movement upon the shorter arm of the lever 82 will be to cause the longer arm of said lever, to which is attached the lower short arm of the lever 78, to move a greater distance than the shorter arm of the lever 82 and in an opposite direction. This movement will impart movement to the lever 78, causing the upper longer arm thereof to move against the tension of the spring 81 toward the arm 70, first compressing the said spring, which will react upon the arm 70 to force the latter to turn upon its pivot, thus carrying the gear-wheel 71 into engagement with the gear-wheel 38. It will thus be seen that a very short movement of the rear end of the lever 82 will cause considerable movement of the upper end of the lever 78, and this movement, assisted by the spring 81, will carry the wheel 71 from the wheel 37 to the wheel 38. Should the movement of the lever 78 be too great, it will simply compress the

spring 81 and do no damage. When the gear-wheel 71 passes into engagement with the gear-wheel 38, the direction of rotation of the shaft 67 and the shaft 56 will be reversed, thereby moving the conveyer in the opposite direction and returning it to the right-hand side of the platform. When the conveyer has reached the extremity of its return movement, it will come in contact with the rear longer arm of the lever 83 and move it to the right, thereby moving the shorter arm of the said lever a shorter distance to the left and operating through the medium of the rod 84, levers 82 and 78, and rod 72 to move the gear-wheel 71 out of engagement with the gear-wheel 38. In this instance, however, since the conveyer acts upon the long arm of the lever 83, it will have to move it much farther in order to move the wheel 71 a given distance. Thus it will be seen that after the gear-wheel 71 has left the gear-wheel 38 the movement of the conveyer will cease before the lever 83 has been moved far enough to carry the gear-wheel 71 into engagement with the gear-wheel 37, and the spring 81 will act to prevent the gear-wheel 71 from being thrown over into engagement with the said gear-wheel 37. Thus the movement of the conveyer will be stopped. The relation of the movement of the conveyer to the operation of the binding mechanism will be explained hereinafter.

The raised ring 42 upon the front side of the bevel gear-wheel 34 has upon the face thereof a number of teeth 85 extending about one-quarter around the said ring. A bevel-pinion 86, having a corresponding number of teeth and a blank $86^a$, is mounted upon a shaft 87, having the lower end journaled in the bracket 33 upon the upright 10. The position of the bevel-pinion 86 is such that it will be close to the face of the ring 42 and engaged by the teeth 85 upon the said ring as the gear-wheel 34 revolves, and during one-quarter of the revolution of the gear-wheel 34 the pinion 86 will make one complete revolution, and after the teeth 85 have passed the said pinion will stop and remain with the blank $86^a$ next to the plain surface of the ring 42 during the remaining three-fourths of the revolution of the gear-wheel 34. A crank-arm 89 is formed upon the upper end of the shaft 87, and a pitman 90 is connected therewith by a ball-and-socket joint $90^a$, said pitman 90 extending over the needle-bar 23 and having two perforations $90^b$ and $90^c$. A crank-shaft 91 is mounted in suitable bearings $91^a$ upon the needle-bar 23, having at one end a crank-arm $91^b$, which is pivoted in the opening $90^b$ of the pitman 90, and at its opposite end a crank-arm $91^c$, longer than the crank-arm $91^b$, to which is pivoted one end of a link 92, having its opposite end pivoted to the needle 24. By reference to Figs. 3 and 4 it will be seen that by this construction each rotation of the pinion 86 and shaft 87 will oscillate the needle 24. The needle 24 is pivoted in a recess $23^a$ in the needle-bar 23 and is curved, as shown in Figs. 16 and 17, the link 92 being pivoted to the highest point $92^a$ of the curve of the said needle. A cylindrical recess 93 (more clearly shown in Figs. 20 and 21) is formed in the lower end of the said needle 24, and the outer end of the said recess is reduced, as shown at $93^a$. The needle 24 is provided with a point 94, which is cone-shaped and approximately round having a notch $94^a$. (See Figs. 18 and 19.) The said point 94 is secured eccentrically upon the end of a round shank 95, which passes in through the reduced portion $93^a$ of the opening 93 and has a flat pin $95^a$ passed through the inner end thereof. The said pin $95^a$ is slightly longer than the diameter of the opening 93, and one end thereof is arranged to slide in a spiral groove $93^b$, formed in the inner surface of the opening 93. Thus it will be seen that as the point 94 is withdrawn the end of the pin $95^a$, traveling in the spiral groove $93^b$, will impart a partial rotation to the shank 95, carrying the point 94. A coiled spring 96 is arranged upon the shank 95 and bears at one end against the shoulder $93^c$, formed by the reduction of the outer end of the opening 93, and at its opposite end against the pin $95^a$ in the end of the shank 95. The said spring 96 serves to keep the shank 95 normally drawn within the opening 93 and the point 94 close to the end of the needle, as shown in Figs. 19 and 20. The needle-point 94 is further provided with a pair of points $94^b$, which project toward the end of the needle and when in the normal position rest in contact with a lug $24^a$, formed upon the inner side of the end of the needle. Upon the right-hand side of the needle, near the end thereof, are formed a pair of gear-teeth $24^b$, and at a point about midway between the end of the needle and the point $92^a$ are formed a similar pair of gear-teeth $24^c$ upon the same side of the needle. Upon the opposite or left-hand side of the needle, slightly in advance of the teeth $24^c$, is formed a stud $24^d$, which is inclined backward or away from the point of the needle, as shown in Fig. 18. The purpose of this construction of needle will be explained hereinafter.

The knotter-bar 54 is mounted at one end upon the shaft 52 and is curved upwardly, as at $54^a$, to clear the shaft 56, as will be understood by reference to Fig. 5. The free end of the said knotter-bar is V-shaped, as shown at $54^b$ in Fig. 10, to fit the correspondingly-shaped end of the needle-bar when in the position shown in solid lines in Fig. 5, and the said needle-bar is cut away upon the upper side to form a depression $54^c$, and is also provided with a recess $54^d$ in the upper side adjacent to the depression $54^c$. A guard $54^e$ is secured upon the upper side of the said needle-bar and extends over the recess $54^d$, said guard being provided with a depending lug $54^f$. A short rearwardly-inclined hook $54^h$ depends from the lug $54^f$ of the guard $54^e$, and a curved knife $54^i$, having a cutting-

edge $54^k$ on the inside of the curve, is pivoted at its upper end to the said lug $54^f$. The normal position of the said knife is as shown in Fig. 11, its free end resting upon the knotter-bar 54; but it may be raised, as shown in dotted lines in the same figure, for a purpose to be hereinafter explained.

The knotter is secured upon the end of a shaft 98, which passes through the recess $54^d$ and has bearings on each side thereof in the knotter-bar, as shown in Fig. 10. This shaft 98 may be inclined upwardly at its outer end to cause the knotter to press deeper into the gavel to catch the twine, if found desirable to do so in practice. The said knotter consists of a shell 97, through which the shaft 98 passes. Two jaws $97^a$ $97^a$ are pivoted in the open end of the shell 97 upon a pin $97^b$, which passes therethrough, the said jaws having lugs $97^c$, through which the said pin passes. Lips $97^d$ are formed upon the inner sides of the lugs $97^c$, and a spring $97^e$ is coiled around the shaft 98 and arranged so that its ends will press against the lips $97^d$ and serve to keep the jaws $97^a$ closed, as shown in Fig. 12. Upon one side of the shell 97 is secured a narrow plate $97^f$, the outer end of which is bent into the open end of the shell 97, where it is formed into an eye in which is pivoted a short lever $97^h$, which extends out between the front edges of the jaws $97^a$, where it is bent, as shown in Fig. 13. Upon the said lever $97^h$ are mounted two rollers *a* and *b*, which travel in recesses *c*, cut in the said jaws. Within the recesses *c* are formed two inclined bearing-surfaces *d* and *e*, the bearing-surface *d* being in the upper jaw for the inner roller *a* to travel upon and the surface *e* in the lower jaw for the outer roller *b* to travel upon. By inspection of Figs. 13 and 14 it will be understood that if the lever $97^h$ be moved in the direction of the arrow the rollers *a* and *b*, traveling upon the inclined surfaces *d* and *e*, will cause the jaws $97^a$ to open, and when the said lever is released the spring $97^e$ will force the said jaws together and return the said lever to its normal position.

Upon the shaft 98, within the recess $54^d$, is a block $98^a$, the upper side of which is recessed, as at $98^b$. A bell-crank lever $98^c$ is pivoted at a point *f* within the said recess and has pivoted to one end thereof a bolt $98^d$, which extends through one end of the said block $98^a$ into one end of the recess $54^d$, thus locking the block, shaft 98, and knotter in their normal position. Upon the other arm of the bell-crank lever $98^c$ is a stud *h*, which projects upwardly through a slot *i* in the inclosing plate $98^e$. A circular washer *j* (shown in dotted lines in Fig. 10) is pivoted at a point *j'* to the under side of the plate $98^e$ and serves to close the slot *i*. A slot $j^2$ is formed in the washer *j*, through which the stud *h* projects. The block $98^a$ is provided with two or more longitudinal gear-teeth *h'*, which are engaged by the teeth $24^b$ and $24^c$ of the needle to turn the shaft 98 and the knotter at the proper times during the operation of the machine, as will be hereinafter explained.

A spring *k*, which is coiled at one end and secured to one side of the knotter-bar beneath the knotter, extends in a curved direction along the said knotter and terminates at the edges of the jaws adjacent to the lever $97^h$. The free end of the said spring is flattened and notched, as at *k'*, and when the knotter is turned over the said end *k'* of the spring rides in a groove $k^2$ in the shell 97 and the lower jaw $97^a$ of the said knotter. The shell 97 is further provided with two studs $k^3$ $k^3$, projecting therefrom on opposite sides of the grooves $k^2$. The purpose of the said spring and studs will be explained hereinafter.

A compressor-bar 99 is loosely mounted upon the shaft 19, close to one side of the needle-bar, and is divided just below the said needle-bar into two compressor-fingers $99^a$, which extend downwardly and are curved forwardly, as shown in Fig. 5. Projecting upwardly from the rear end of the needle-bar is a standard or arm 101, to the upper end of which is pivoted a link 102, connecting the said arm with a similar arm 103, mounted loosely upon the shaft 20. The outer end of the link 102 is bifurcated to receive the upper end of the arm 103. A rod 104 is pivoted at one end between the arms $99^a$ at the point $99^b$ near their upper ends, and the said rod extends upwardly through the slot formed by the bifurcation of the link 102 and has screw-threads upon its extremity to receive a nut 105. A coil-spring 106 is placed around the rod 104 and bears at its lower end against the fingers $99^a$ and at its upper end against a washer *m*, which is disposed around the said rod and against the under side of the link 102, and serves to press the fingers $99^a$ against the gavel when the needle-bar descends, as shown in Fig. 5. A compressor 107 is arranged to act between the fingers $99^a$ and assist in compressing the gavel when the needle-bar and knotter-bar come together, as shown in Fig 5. The said compressor 107 is formed with an eye 108 at its upper end, which slides upon a guide-rod $23^c$ upon one side of the needle-bar, and the said compressor is further provided with an arm 109, the end of which is pivoted upon the pin $99^b$, passing through the fingers $99^a$. From inspection of the figure it will be seen that as the fingers $99^a$ turn about the shaft 19 and move the arm 109 outwardly and upwardly and the needle-bar rises to its normal position the eye 108 will slide along the guide-rod $23^c$ toward the shaft 19 and thus move the compressor 107 out of the way of the sheaf, as shown in dotted lines in Fig. 5. The shafts 19 and 20 are braced by a bar 110, journaled at each end upon one of the said shafts, near the center thereof, close to the needle-bar.

When it is desired to adjust the machine for binding very long grain, as hereinbefore

explained in relation to the knotter-bar, the needle-bar, the compressing devices, and the brace 110 may be moved rearwardly along the shafts 19 and 20 and secured in the proper position with relation to the knotter-bar, the crank-arms $91^b$ being moved to the opening $90^c$ in the pitman 90. The discharging-fingers 25 are rigidly secured to the shaft 20 by means of the perforated heads 112 112 and the set-screws 113 113. The shaft 20 extends through the front bearing 22 and has secured to the forward end thereof a lever N, having oppositely-extending arms $n$ $n'$. A depending rod $n^2$ is pivoted to the end of the arm $n$ and hangs between the bracket 33 and the annulus 42 upon the gear-wheel 34. The lower end of the said rod $n^2$ is bent inwardly, as at $n^3$, and extends within the annulus 42, as shown in Fig. 27. A cam $42^a$ is formed on the interior of the annulus 42, and as the gear-wheel 34, to which it is attached, revolves in the direction of the arrow O (see Fig. 1) the said cam $42^a$ will engage the end $n^3$ of the rod $n^2$ and carry it around for a short distance, thus pulling the arm $n$ of the lever N downwardly and turning the shaft 20 to depress the discharging-fingers 25, as will be readily understood. The forward end of the cam $42^a$ is straight and extends from the annulus toward the center of the gear-wheel. (See Fig. 8.) Thus the front of the said cam is in proper position to engage the hook $n^3$ of the rod $n^2$ when it makes contact therewith at the upper part of the annulus; but as the cam $42^a$ descends and the front thereof passes below the center of the wheel it will become so inclined upwardly as to allow the hook $n^3$ to slip therefrom. When this takes place, the shaft 20 and mechanism attached thereto will be returned to their normal positions by the coil-spring 114, one end of which is attached to the end of the arm $n'$ of the lever N and the other end attached to a bracket 115 upon the frame of the machine. An inclined lug $33^a$ is secured to the lower side of the bracket 33 and extends into the path of the rod $n^2$ to cause the said rod to slip from the cam at the right moment of time.

A board 116 is hinged upon the top 7 of the platform 1 and in a bracket 117, secured to the end of the beam 29, and has pivoted to its rear side a link 118, the opposite end of which is pivoted to the forward arm of a lever 119, pivoted at a suitable point in the platform 1. The rear end of the lever 119 extends into the path of the conveyer 61 to be operated thereby.

Upon the front of the board 116 is a standard 120, to the end of which is pivoted a link 121, connected at its opposite end with a rod 122, which extends through suitable bearings to the gear-wheel 34. The extreme end of the rod 122 is hooked, as shown at 123 in Fig. 7, and is situated in close proximity to the face of the gear-wheel 34, slightly below the center thereof. A short stud 124 projects from the face of the said gear-wheel in proper position to pass into and be held by the hook 123 of the rod 122, and thus stop the said gear-wheel, for a purpose to be explained hereinafter.

A sprocket-wheel $28^a$ is secured upon the top of the convex disk 28, from which may be operated the reel R through the medium of the sprocket-wheel R′ and the chain $28^b$, arranged to run over suitable guides.

When the conveyer and binding mechanism are moved rearwardly to accommodate the machine to the binding of long grain, the conveyer is placed in the rear slot $60^a$ in the platform, and bell-crank levers $82^a$, $83^a$, and $83^c$ are pivoted in the platform, with one arm extending into the slot $60^a$ into the path of the conveyer to be operated thereby. The other arms of the bell-crank levers $82^a$, $83^a$, and $83^c$ are connected by the rods $82^b$, $83^b$, and $83^d$ with the levers 82, 83, and 119, respectively, as shown in Fig. 2.

The operation of my invention is as follows: When the parts are in their initial position, the conveyer is at the extreme right-hand side of the platform and the knotter-bar depressed within the slot 63 of the top 7 thereof, but not at its lowest point, the needle-bar being raised to its highest point, and the gear-wheel 34 is held from movement by the hook 123 of the rod 122, engaging the stud 124 upon the said gear-wheel. At this time the pinion 39 is free to revolve in the blank 41 without imparting motion to the gear-wheel 34, the shaft 35 being driven by suitable mechanism connecting the gear-wheel 40 with the driving-wheel of the machine. Thus it will be seen that while the machine is reaping the binding mechanism remains at rest. The twine P passes from the twine-box P′ (which may be situated on top of one of the uprights 9 10 or other convenient place) through eyes $p$ upon the standard 9 and the guard-board $29^a$, beneath the said guard-board, under the shaft 56, and through one of a series of holes in one of the beams 5 of the platform 1 to the knotter-bar, through which it passes at a suitable point. The twine is then carried along the side of the knotter-bar to the guard $54^c$ and, passing through a hole $p'$ therein, extends under the guard, as at $p^2$, then up through the guard, as at $p^3$, and returning through the guards, as at $p^4$, makes a loop $p^5$ under the knotter, as shown in Fig. 9, and is then passed up to the needle 24 and secured beneath the point 94, where it is held in position by the points $94^b$, which press thereon by the tension of the spring 96. Thus the twine is extended from the knotter to the point of the needle. As the grain is cut in the usual manner it is laid upon the platform 1 by the reel R over the slot 60, in which moves the conveyer. When a sufficient quantity of grain has accumulated, the operator pulls upon the rod 77, thereby operating the lever 74 and rod 72 to bring the gear-wheel 71 into gear with the gear-wheel 37 upon the shaft 35, thus starting the shaft

67, which through the gear-wheels 68 and 69 rotates the shaft 56, carrying the sprocket-wheels 57 and 58, over one of which passes the conveyer-chain 62. Thus the conveyer 61 is caused to travel toward the binding mechanism, carrying with it the grain which is then upon the platform. As the conveyer moves onward it comes in contact with the inner end of the lever 119, which extends into the slot 60, and moves that end to the left, thus moving the forward end to the right, which operates through the link 118 to move the hinged board 116 inwardly, as shown in dotted lines in Fig. 1. The board 116 is designed to strike the butts of the grain and bring them all up even. When the said board is moved up by the conveyer, it operates through the standard 120 and the link 121 to pull the rod 122 to the right and thus turn the gear-wheel 34, by means of the stud 124, far enough to bring the teeth of the said gear-wheel into engagement with the pinion 39, thus causing the wheel 34 to rotate. By reference to Fig. 7 it will be seen that when the hook 123 is moved to the position shown in dotted lines the stud 124 will be free to move out of the said hook when the wheel is rotated in the direction of the arrow. The gear-wheel 34 imparts motion to the pinion 44, thus turning the crank-shank 45, the crank 48 of which operates the needle-bar and is arranged slightly in advance of the crank 49, which operates the knotter-bar. Thus the needle-bar will begin to descend immediately; but the knotter-bar will first move to the lowest extremity of its movement and then begin to ascend, thus giving the conveyer time to deliver the grain upon the knotter-bar before the latter rises through the top of the platform. The grain is delivered against the twine, which it presses backward as it passes upon the knotter-bar, thus beginning the formation of a loop $p^6$, which as the needle descends encircles the gavel, as will be readily understood. As the conveyer nears the end of its left-hand movement, having passed the lever 119, and the latter having sprung far enough back by the elasticity of its connections to be again within the path of the conveyer, the latter comes in contact with the inner end of the lever 82. As has been hereinbefore explained, a very small movement of the inner end of the lever 82 is sufficient to throw the gear-wheel 71 from the gear-wheel 37 into engagement with the gear-wheel 38. Thus when the conveyer strikes the lever 82 the rotation of the shafts 67 and 56 will be reversed and the conveyer will begin its right-hand movement in time to move out of the way of the knotter-bar as the latter rises. The conveyer will now continue its right-hand movement, coming in contact, first, with the lever 119, which restores the board 116 and the mechanism attached thereto to their normal positions, and, finally, at the end of its movement moving the lever 83 to throw the gear-wheel 71 out of engagement with the wheel 38 and thus stop the movement of the conveyer. The knotter-bar will continue to rise, carrying with it the gavel until it is met by the needle-bar. By reason of the needle-bar traveling slightly in advance of the knotter-bar the needle will pass down above the knotter, as shown in Fig. 23, thus forming the loop $p^6$, which encircles the guard. As the needle-bar descends the arm 101 thereof operates the link 102 to cause the fingers $99^a$ and the compressor 107 to act upon the gavel to compress the same. When the needle-bar reaches its lowest point, it is met by the knotter-bar and the parts assume the position shown in Fig. 5—*i. e.*, the point of the needle in position to enter the guard $54^e$. The guards 125 upon the ends of the needle-bar are for the purpose of warding off any grain which might become entangled in the knotting mechanism. When the parts have assumed the position shown in Fig. 5, the blank 46 on the pinion 44 will have arrived opposite to the blank 47 on the annulus 42, and thus the pinion 44 and the needle and knotter bars will stop. The gear-wheel 34, however, will continue its rotation, and the teeth 85 upon the face of the annulus 42 will engage the pinion 86 and thus rotate the shaft 87, which will act through the pitman 90 to cause one oscillation of the crank-shaft 91, which through the medium of the link 92 will cause one oscillation of the needle, the effect of which is as follows: The needle-point 94, carrying the end of the twine, will enter the guard $54^e$ and strike the stud $h$, which projects through the top plate of the block $98^a$, as shown in Fig. 5, pressing the stud $h$ round in the slot $i$, thereby first withdrawing the locking-bolt $98^d$ and then turning the block $98^a$ and the shaft 98 until the stud $h$ turns below the line of the needle-point. By thus turning the teeth $h'$ upon the said block have been turned up into engagement with the teeth $24^b$ upon the needle, which as the needle passes on will turn the block $98^a$, the shaft 98, and the knotter over, as shown in Figs. 16 and 25. Before the needle enters the guard the parts are in the position shown in Fig. 24, the loop $p^6$ of the twine encircling the gavel, the parts $p^7$ $p^8$ being crossed upon the knotter and the end $p^9$ held by the needle-point. As the needle-point enters the guard $54^e$ it carries the end $p^9$ of the twine under the part $p^4$ and through the guard, and as the knotter turns over it carries the parts $p^7$ and $p^8$ over with it. Thus the part $p^4$ and the end of the twine are carried beneath the lug $54^f$ of the guard, striking the back of the knife and raising it. These parts of the twine pass freely through beneath the hook $54^h$, the knife dropping back into place afterward. The end of the needle will carry the twine on until the point 94 strikes the end of the lever $97^h$, which projects from the jaws $97^a$ of the knotter, as shown in Fig. 16, pressing the said lever around upon its pivotal point, causing the rollers *a* and *b* to roll upon the inclined surfaces *d* and *e* to

open the jaws $97^a$. The end of the twine is at this time in position to pass between the said jaws, after which the point of the needle passes by the end of the lever, thus allowing the spring $97^c$ to close the jaws upon the twine and hold it while the needle-point goes on. Thus the twine will be pulled from the point of the needle and held in the jaws of the knotter, as shown in Fig. 25. As the knotter turns over the end $k'$ of the spring $k$ moves downward in the groove $k^2$, passing under the loop $p^5$ of the twine, the studs preventing the twine from being carried downward by the end of the spring. The needle continues its movement until the teeth $24^c$ thereon have passed the block $98^a$. When the needle begins its return movement, the teeth $24^c$ will engage the teeth $h'$ and turn the block $98^a$ and the knotter back to their normal positions. As the knotter turns back, the notched end $k'$ of the spring $k$ will pass upward in the groove $k^3$ and engage the loop $p^5$ of the twine, thus "stripping" it from the knotter, which is equivalent to pulling the end $p^9$ of the twine through the loops formed about the knotter, thus forming the knot. As the knotter comes over, the part $p^4$ of the twine will be caught by the hook $54^h$, which projects downwardly and rearwardly from the outer part of the lug $54^f$, thus preventing the twine from being cut by the knife at this stage of the operation. As the needle returns through the guard $54^e$ the stud $24^d$ thereon engages the part $p^2$ of the twine, which hangs under the said guard, and draws it out, as shown at $p^2$ in Fig. 26, thus taking up the slack and drawing the knot nearly tight. When the point of the needle passes through the guard $54^e$, the lug $24^a$ thereof will pass over the stud $h$, as shown in Fig. 22; but the back of the point 94 of the needle will impinge against the stud $h$, thus drawing the said stud around in the slot $i$ to project the bolt $98^d$ and thus lock the block $98^a$ in its normal position. When the stud $h$ can move no farther, the needle, continuing to move, will draw the point 94 out, as shown in Fig. 17, thus allowing the part $p^4$ of the twine, which at this time rests upon the end of the needle, to fall in between the point 94 and the end of the needle. As the point 94 is drawn out the pin $95^a$ in the shank thereof, traveling in the spiral groove $93^b$, will impart a rotary motion to the said point, thus turning it in the direction of the arrow in Fig. 18 until the notch $94^a$ passes over the stud $h$, allowing the point 94 to be withdrawn into the end of the needle by the spring 96 and causing the said point 94 to catch the twine between the points $94^b$ thereof and the end of the needle. As the point 94 is drawn into the end of the needle it is turned by the pin $95^a$, traveling in the spiral groove $93^b$, and the points $94^b$, between which the twine is caught, are turned so as to cause the twine to project from the point over the lug $24^a$ in proper position to pass between the jaws of the knotter when tying the next gavel. The continued movement of the needle will now draw the twine against the cutting-edge $54^k$ of the knife $54^i$ and thus sever it between the needle-point and the knot, leaving the end of the twine attached to the point of the needle. At this stage the knot is formed, but is still attached by one end of the twine to the jaws of the knotter, as shown in Fig. 26. When the pinion 86 has made one complete revolution, thereby causing one complete oscillation of the needle, the teeth 85 upon the raised annulus 42 (corresponding in number to the teeth on the pinion) will have passed the said pinion, and the blank $86^a$ upon the latter will rest against the smooth face of the annulus 42 during the remainder of the revolution of the gear-wheel 34. Thus the rotation of the pinion 86 will stop. By the time the teeth 85 have passed the pinion 86 the blank 47 on the periphery of the annulus 42 will have passed the blank 46 on the pinion 44, and the teeth 43 upon the said annulus will engage the teeth on the said pinion and rotate the same, causing it and the crank-shaft 45 to complete their revolution. When the said crank-shaft 45 begins the last half of its revolution, the needle-bar, which has been at its lowest point, will begin to ascend; but the knotter-bar will continue to rise for a short distance, as seen in dotted lines in Fig. 5. This will carry the knotter-bar a little above the needle and cause the loop of the twine $p^2$ to come off of the stud $24^d$, and will also allow the needle-point carrying the end of the twine to pass upward below or behind the knotter, thus placing the twine around the said knotter, as at $p^5$, in position for tying the next gavel. As the needle-bar rises the fingers $99^a$ fall away from the sheaf and the compressor 107 moves upward and backward, as shown in dotted lines in Fig. 5, thus leaving room for the sheaf to pass downward into the opening 130 in the frame of the machine. At the time that the needle-bar begins to rise the front edge of the cam $42^a$ in the annulus 42 will engage the lower bent end $n^3$ of the rod $n^2$ and carry it downwardly to depress the discharge-arms 25, as hereinbefore described, and the said discharge-arms will press upon the upper side of the sheaf as it leaves the knotter-bar, forcing the sheaf downward and pulling upon the end of the twine which is held in the jaws of the knotter, thus drawing the knot tight, and finally pulling the twine from the knotter and discharging the sheaf through the opening 130 in the frame of the machine. When this is accomplished, the bent end $n^3$ of the rod $n^2$ will slip off of the cam $42^a$ and the spring 114 will return the discharge-arms 25 to their normal position, and the gear-wheel 34 will continue to rotate until it has completed one revolution and returned the binding mechanism to its normal position, when the pin 124 on the said wheel 34 will strike the bevel side $123^a$ of the hook 123 upon the end of the rod 122, causing the said rod to bend laterally away from the wheel 34 far

enough to allow the said pin to pass into the loop 123, after which the rod will spring back into its normal position and hold the pin within the hook, as shown in Fig. 7. At the time the pin 124 enters the hook 123 the blank space 41 in the teeth of the wheel 34 will arrive opposite to the pinion 39. Thus the said pinion will cease to rotate the wheel 34 and the latter will be held from further movement by the rod 122, as will be readily understood.

It will be understood that I do not wish to limit myself to the precise details of construction herein described, as I am aware that many modifications may be made therein without departing from the spirit of my invention.

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

1. In a grain-binder, an oscillating needle-bar and a needle pivoted upon said needle-bar, in combination with an oscillating knotter-bar and a knotter suitably mounted upon said knotter-bar and arranged to act in conjunction with the said needle to tie a knot in the twine, substantially as described.

2. In a grain-binder, a knotter consisting of a shell, jaws pivoted to the open end of said shell, a spring or its equivalent arranged to press the said jaws together, a lever pivoted between the jaws and projecting therefrom, and rollers upon the said lever arranged to act upon the jaws to open the latter to receive the twine when the lever is operated, the said jaws being adapted to receive and hold the twine, substantially as described.

3. In a grain-binder, a knotter consisting of a shell, jaws pivoted in the open end of the said shell, a lever pivoted between said jaws and arranged to open them to receive the twine, a spring arranged to close the jaws upon the twine to hold the latter, a shaft 98, journaled in suitable bearings, upon which the knotter is mounted, a locking device upon the said shaft arranged to lock the knotter in its normal position, and spur-teeth $h'$ upon the said shaft, in combination with mechanism for operating said knotter, substantially as described.

4. In a grain-binder, a knotter consisting of a shell, jaws pivoted in the open end of the said shell, a lever pivoted between said jaws and arranged to open them to receive the twine, a spring arranged to close the jaws upon the twine to hold the latter, a shaft 98, upon which the knotter is rigidly mounted, a knotter-bar in which the said shaft is journaled, a locking device upon the shaft 98 to lock the said shaft in its normal position upon the knotter-bar, and spur-teeth $h'$ upon said shaft 98, adapted to be engaged by similar teeth upon the needle to turn the shaft 98 and the knotter in its journal-bearings, in combination with a needle arranged to operate the knotter, substantially as described.

5. In a grain-binder, a knotter consisting of a shell, jaws pivoted in the open end of the said shell, a lever pivoted between said jaws and arranged to open them to receive the twine, a spring arranged to close the jaws upon the twine to hold the latter, a shaft 98, upon which the knotter is rigidly mounted, a knotter-bar in which the said shaft is journaled, means for turning the shaft 98 in its journal-bearings and for locking the said shaft in its normal position, a spring $k$, arranged to strip the loop of twine off of the knotter, and studs $k^3$ upon the knotter to assist the said spring in its function, in combination with means for operating the said knotter, substantially as described.

6. In a grain-binder, a knotter consisting of a shell, jaws pivoted in the open end of the said shell, a lever pivoted between said jaws and arranged to open them to receive the twine, a spring arranged to close the jaws upon the twine to hold the latter, a shaft 98, upon which the knotter is rigidly mounted, a knotter-bar in which the said shaft is journaled, spur-teeth $h'$ upon the shaft 98, a locking device upon the said shaft, means for stripping the loop of twine from the knotter, a guard $54^e$, arranged upon the knotter-bar, and a knife pivoted upon the guard $54^e$ to cut the twine at the proper time, in combination with a needle arranged to enter the said guard, operate the locking device, engage the spur-teeth $h'$ to turn the shaft 98 and the knotter, place the end of the twine in the jaws of the said knotter, and operate in conjunction therewith to tie the knot, substantially as described.

7. In a grain-binder, a needle, a recess in the end of said needle, and a spiral groove formed within the said recess, in combination with a point 94, having a shank 95 to reciprocate in the said recess, a pin $95^a$, arranged through the inner end of the said shank to travel in the said spiral groove and impart rotary motion to the point 94, and a spring 96, arranged upon the shank 95 to draw the said shank within the said recess and press the point 94 against the end of the needle, said point being provided with teeth $94^b$ to hold the end of the twine, substantially as described.

8. In a grain-binder, a needle-bar, a needle pivoted upon said needle-bar, a point having a shank arranged to slide within the end of said needle, and a spring to keep the said point normally pressed against the end of said needle to hold the end of the twine, in combination with a knotter journaled in a knotter-bar and arranged to be operated by the said needle to act in conjunction therewith to tie a knot in the twine, substantially as and for the purpose described.

9. In a grain-binder, a needle-bar, a needle pivoted upon said needle-bar, a point having a shank arranged to slide within the end of said needle, a spring to keep the said point normally pressed against the end of said needle to hold the end of the twine, teeth $24^b$ and $24^c$ upon one side of the needle, and a stud $24^d$ upon the opposite side thereof, in combination with a knotter journaled in a knotter-

bar, said knotter having teeth $h'$ with which the teeth upon the needle are adapted to engage to operate the knotter, which will operate in conjunction with the needle to tie the knot in the twine, and a knife pivoted upon the knotter-bar to cut the twine after the knot has been tied, the stud $24^d$ on the needle operating to take up the slack in the twine and draw the knot tight, substantially as described.

10. In a grain-binder, a gear-wheel having bevel-teeth upon one side thereof, said teeth having a blank space 41 left therein, a bevel-pinion 39, meshing with the said teeth, a stud upon one side of the gear-wheel, a rod 122, arranged to engage the stud and hold the said wheel from motion at the proper time, an annulus 42 upon the opposite side of the said gear-wheel, and spur-teeth 43, extending partly around the said annulus, in combination with a toothed pinion 44, arranged to mesh with the teeth 43 and provided with a blank space 46, and a crank-shaft 45, upon which the pinion 44 is rigidly mounted, the said crank-shaft having two cranks, one of which is connected to the shaft carrying the needle-bar and the other is connected to the shaft carrying the knotter-bar to oscillate the needle-bar and knotter-bar when the gear-wheel 34 is rotated, substantially as described.

11. In a grain-binder, the combination, with the platform to receive the cut grain and a reciprocating conveyer arranged to operate in said platform at the proper time to convey the grain upon the knotter-bar, of mechanism operated by the conveyer to first throw into gear the binding mechanism and then the mechanism for reversing the movement of the said conveyer, substantially as described.

12. In a grain-binder, the combination, with the platform to receive the cut grain, and a reciprocating conveyer arranged to operate in said platform at the proper time to convey the grain upon the knotter-bar, of mechanism operated by the conveyer to first throw into gear the binding mechanism and then the mechanism for reversing the movement of said conveyor, and when the conveyer has returned to its normal position mechanism operated thereby to throw the said conveyer out of gear and so stop the movement thereof, substantially as described.

13. In a grain-binder, the combination of the platform to receive the cut grain, a reciprocating conveyer arranged to operate in said platform at the proper time to convey the grain upon the knotter-bar, a lever 119, operated by said conveyer, a board hinged upon the platform and adapted to be moved by the lever 119 against the butts of the grain to make them even, and a rod connected to the said board 116 and arranged to throw the binding mechanism into gear when the said board is operated, substantially as described.

14. In a grain-binder, the frame of the machine, a shaft 35, journaled in the frame and arranged to be driven from the driving mechanism of the machine, gear-wheels mounted upon the shaft, shaft to drive the conveyer and reel, and a gear-wheel 39, also mounted upon said shaft, arranged to drive the gear-wheel 34, in combination with the gear-wheel 34, having teeth to mesh with the gear-wheel 39, an annulus provided with two sets of teeth 43 and 85, a pinion 44, arranged to mesh with the teeth 43, a crank-shaft 45, journaled in the said frame, upon which the said gear-wheel 44 is mounted, said crank-shaft 45 having cranks connected to the needle-bar and knotter-bar to oscillate the same, and a pinion 86, arranged to mesh with the teeth 85 and connected by a shaft and suitable connections to the needle to operate the same, substantially as and for the purpose set forth.

15. In a grain-binder, a gear-wheel 34, arranged to be driven at the proper times by the driving mechanism and having a set of teeth 85, in combination with a pinion 86, adapted to mesh with the teeth 85, mounted upon a crank-shaft 87, a crank-shaft 91, journaled upon the needle-bar and connected with the crank of the shaft 87, and the needle pivoted upon the needle-bar and connected with the crank-shaft 91, arranged to oscillate by the said connection when the pinion 86 is rotated, substantially as and for the purpose specified.

16. In a grain-binder, an oscillating needle-bar and compressor-fingers pivoted in the frame of the machine and suitably connected to the said needle-bar to be operated thereby, in combination with a knotter-bar arranged to approach the said needle-bar and act in conjunction with it and the compressor-fingers to compress a gavel of grain, and means for operating the said needle-bar and knotter-bar, substantially as described.

17. In a grain-binder, a gear-wheel 34, having teeth upon one side by which it may be driven from the driving mechanism of the machine, an annulus 42 upon the other side of the said gear-wheel, and a cam $42^a$ within the said annulus, in combination with discharge-arms 25, mounted upon a shaft 20, a lever N upon the shaft 20, a rod $n^2$, depending from one end of the said lever and having its lower end bent to lie in the path of the cam $42^a$, and a spring or its equivalent 114, attached to the lever N to return the said lever to its normal position, all arranged to operate substantially as and for the purpose described.

18. In a grain-binder, a gear-wheel 34, having bevel-teeth upon one side thereof, a bevel-pinion 39, driven from the driving mechanism of the machine and meshing with the bevel-teeth upon the wheel 34 to drive the latter, a blank space 41 in the teeth of the gear-wheel 34, in which the pinion 39 can revolve without imparting motion to the said gear-wheel, the latter being connected to the binding mechanism, and a pin 124 upon the said gear-wheel, in combination with a rod 122, having a hook 123 to engage the said pin 124 and hold the gear-wheel from motion, said rod being

connected to the operating parts of the machine so as to pull upon the said pin and so turn the gear-wheel into gear with the driving mechanism to start the binding mechanism at the proper time, substantially as described.

19. In a grain-binder, the platform to receive the cut grain and a reciprocating conveyer arranged to operate in the said platform, in combination with the mechanism for reversing the movement of the said conveyer, consisting of the shaft 67, having a bevel-pinion at its lower end in gear with the conveyer and a bevel-pinion at its upper end adapted to be thrown in gear with the driving mechanism, the shaft 67 being mounted in pivoted bearings, a lever 78, suitably connected with one of the bearings of the shaft 67, and a lever 82, fulcrumed in the platform and connected at one end with the lever 78, one end of the lever 82 extending into the path of the conveyer to be operated thereby to move the shaft 67 so as to throw the pinion on the upper end thereof into gear with a gear-wheel to reverse the motion thereof, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

GEORGE SCHUBERT.

Witnesses:
C. N. PARKHURST,
G. W. T. HALL.