(Model.) 6 Sheets—Sheet 1.

# J. KELLER.

## GRAIN BINDER.

No. 391,371. Patented Oct. 16, 1888.

Fig. 1

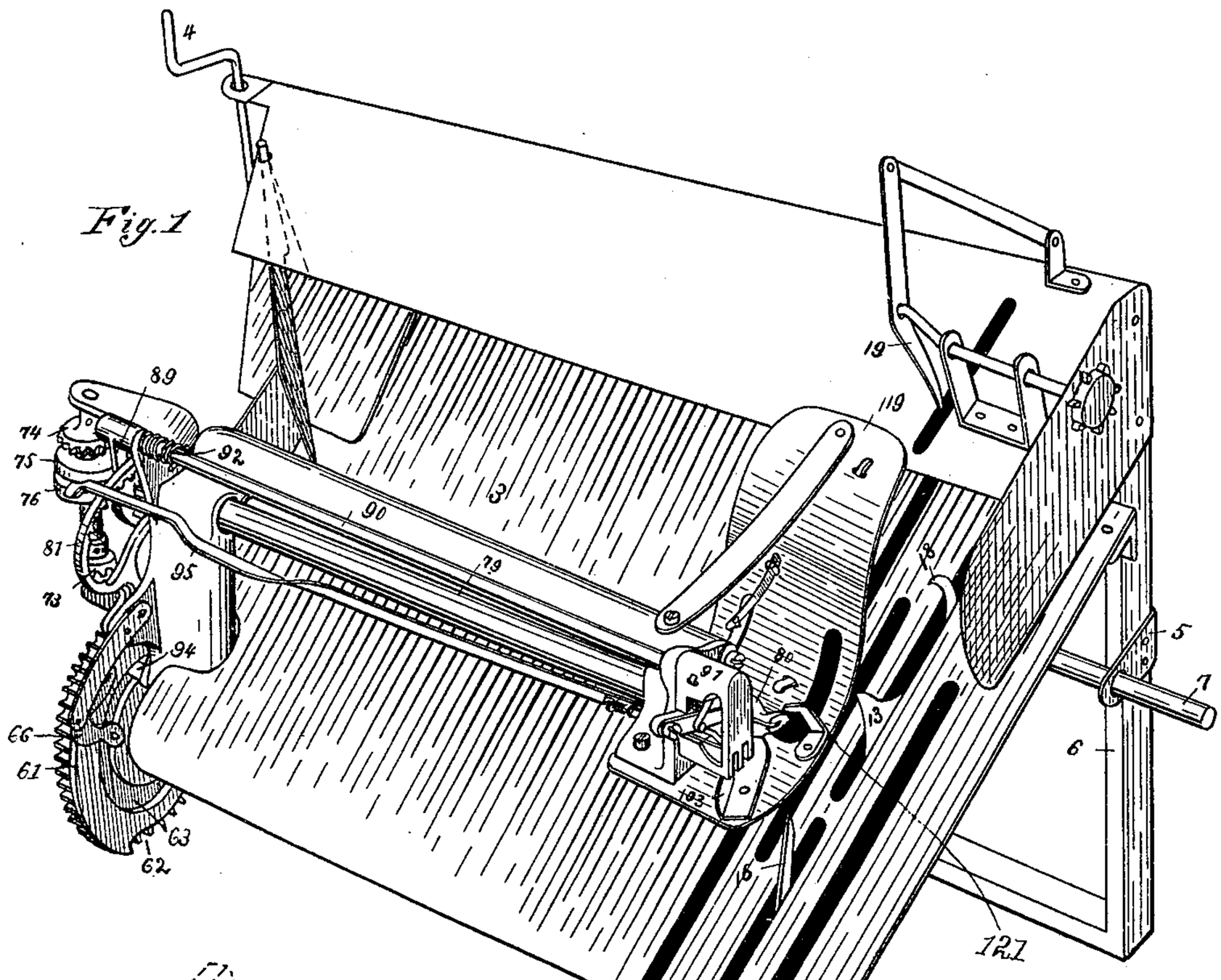
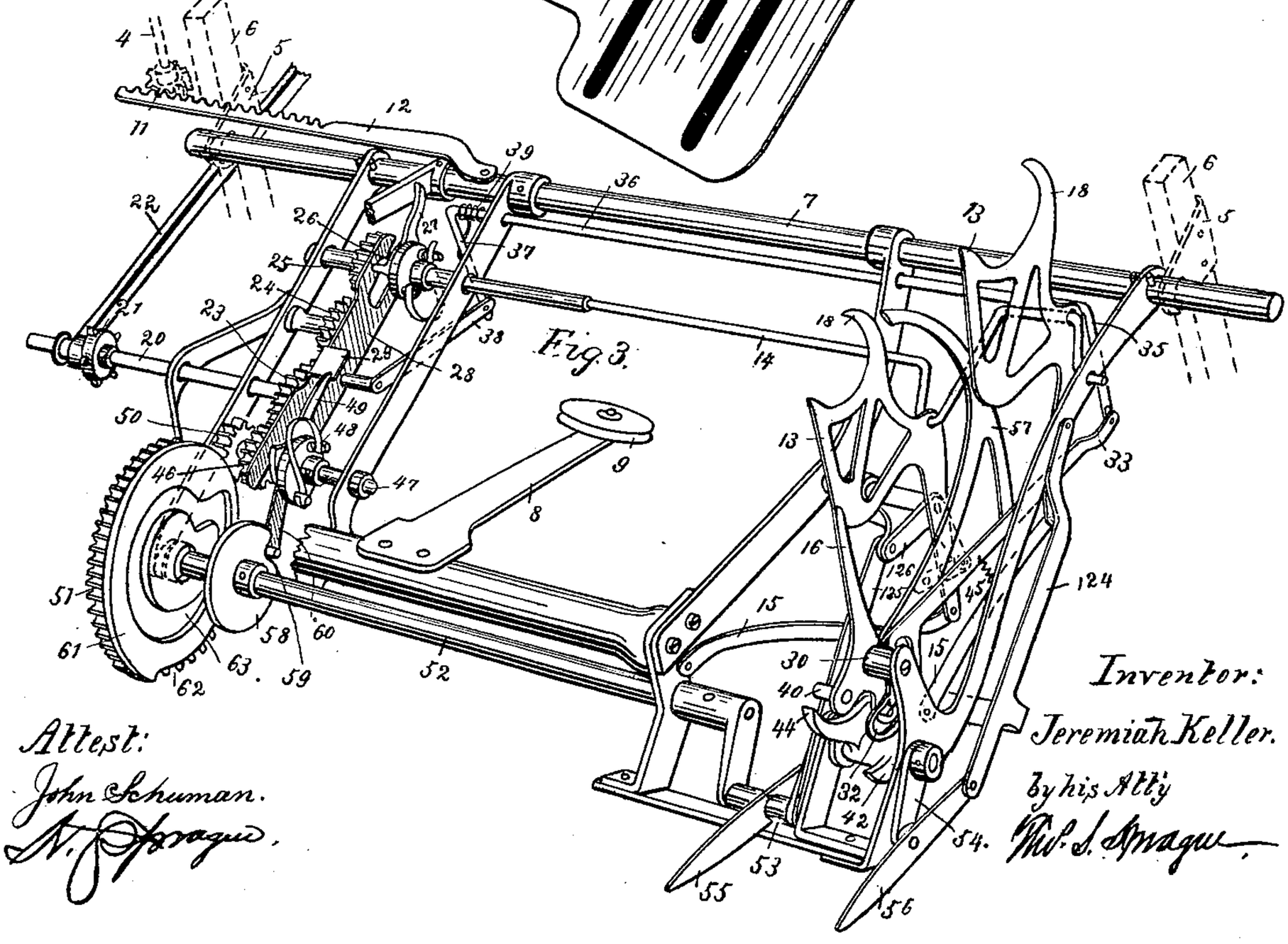


Fig. 3.



Attest:
John Schuman.
N. Sprague.

Inventor:
Jeremiah Keller.
by his Atty
Thos. J. Sprague.

(Model.)

6 Sheets—Sheet 2.

# J. KELLER.

## GRAIN BINDER.

No. 391,371. Patented Oct. 16, 1888.

Fig. 4

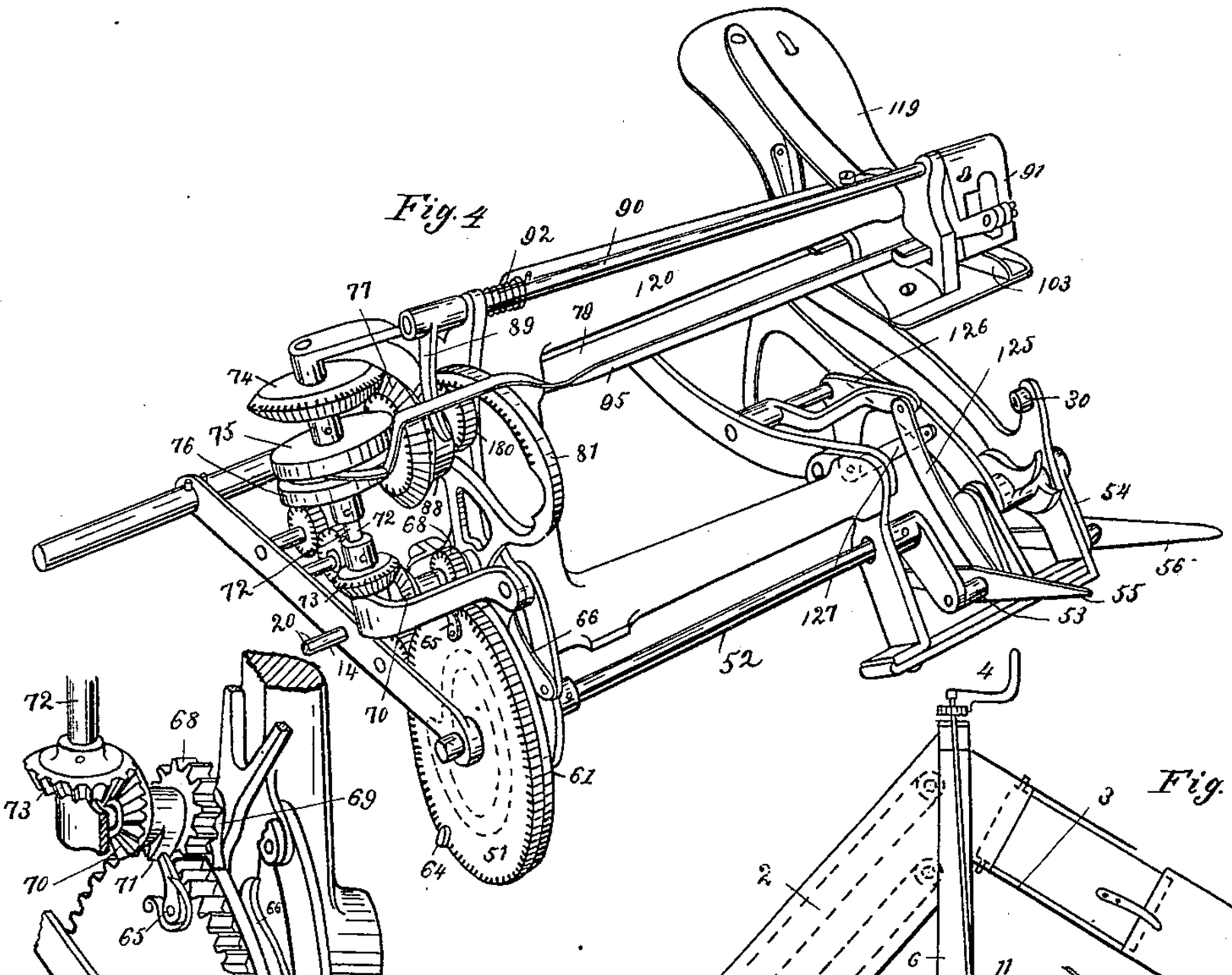



Fig. 13




Fig. 2

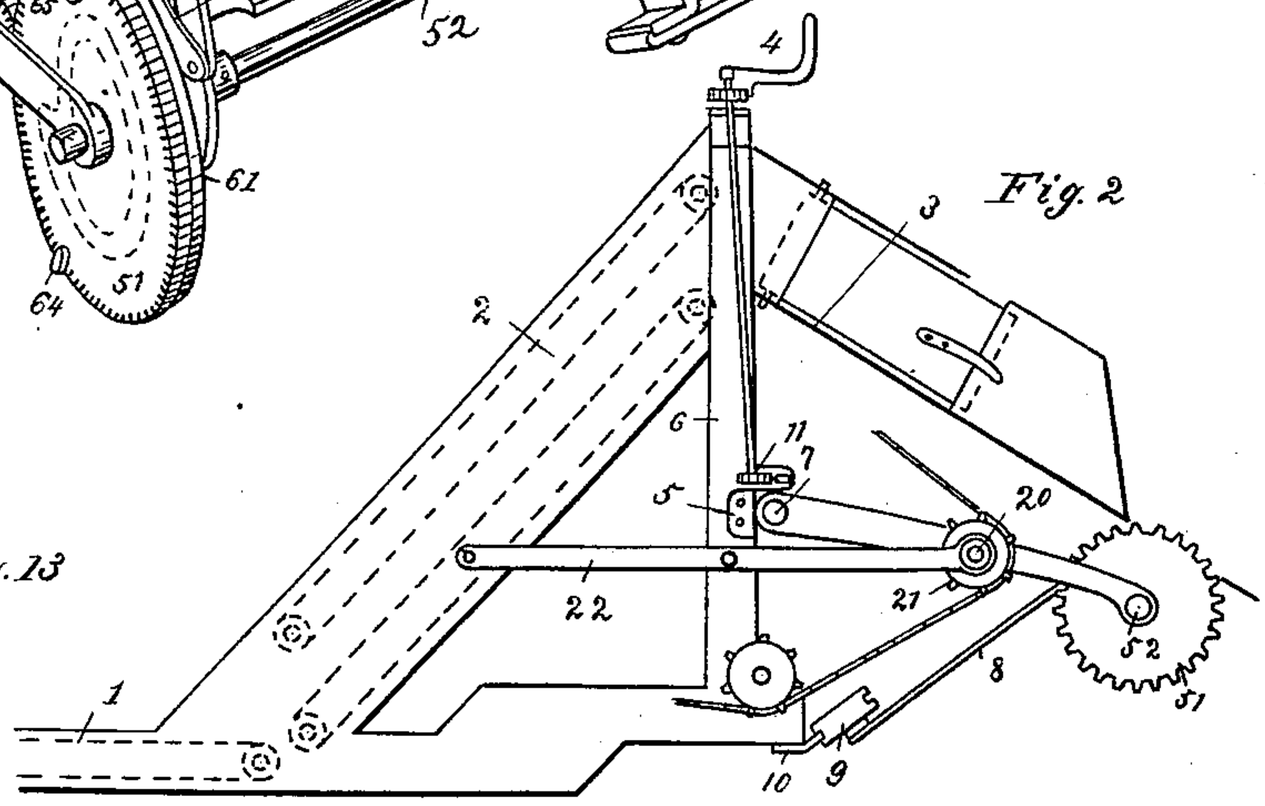



Fig. 11

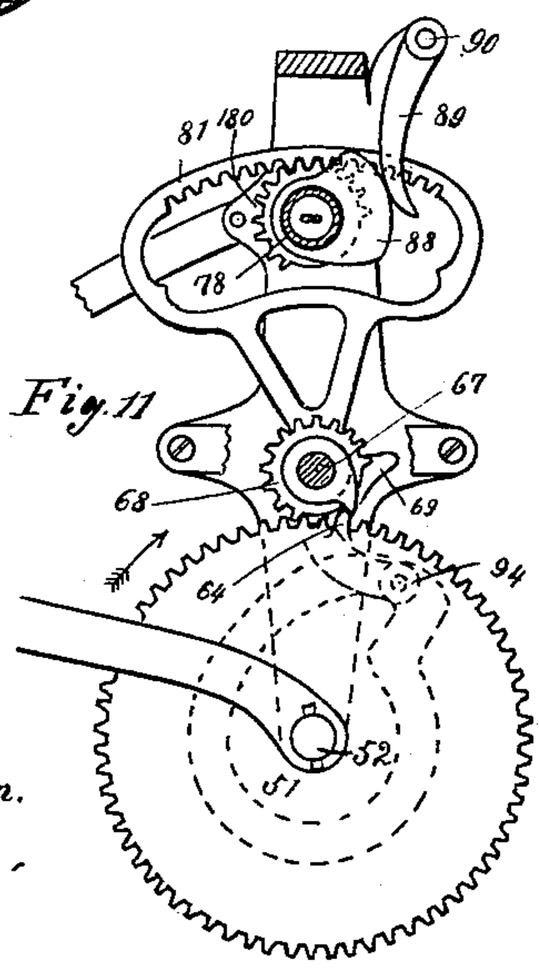



Fig. 12

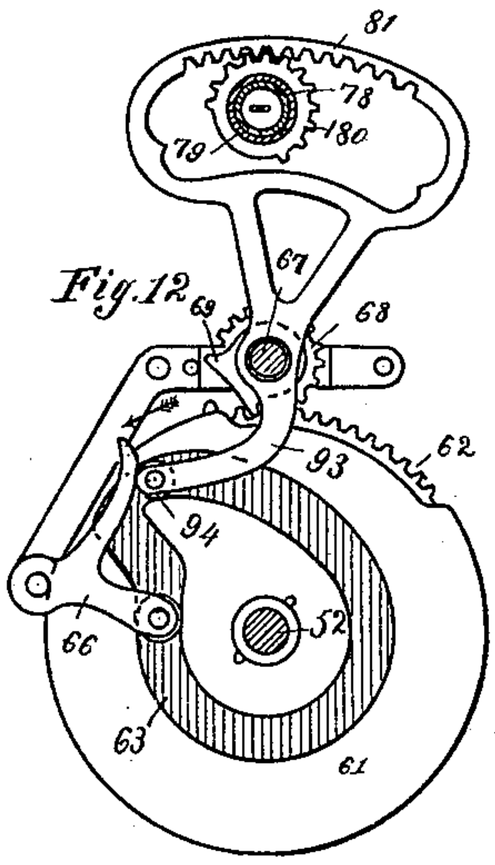
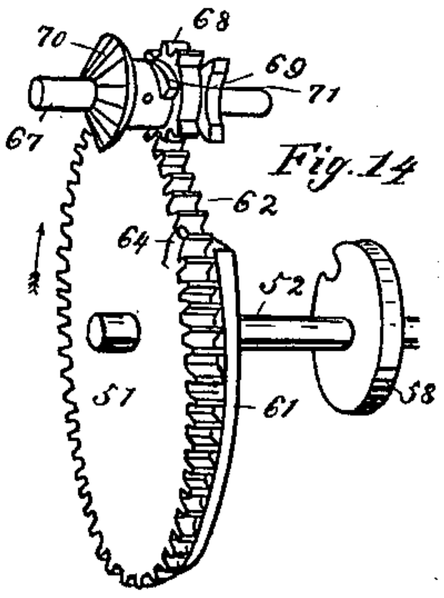



Fig. 14




Attest:
John Schuman.
N. J. Sprague.

Inventor:
Jeremiah Keller.
by his Atty
Thos. L. Sprague.

(Model.)

6 Sheets—Sheet 3.

# J. KELLER.

## GRAIN BINDER.

No. 391,371. Patented Oct. 16, 1888.

Fig. 5

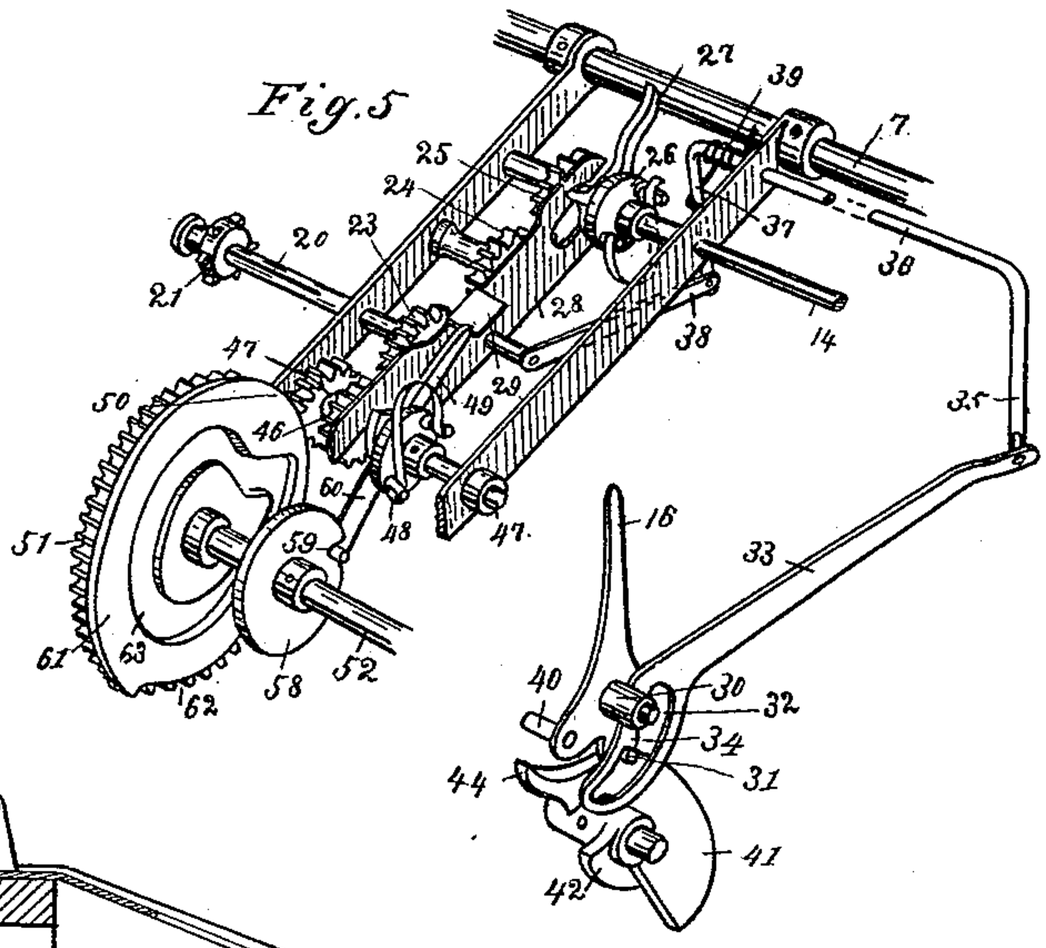
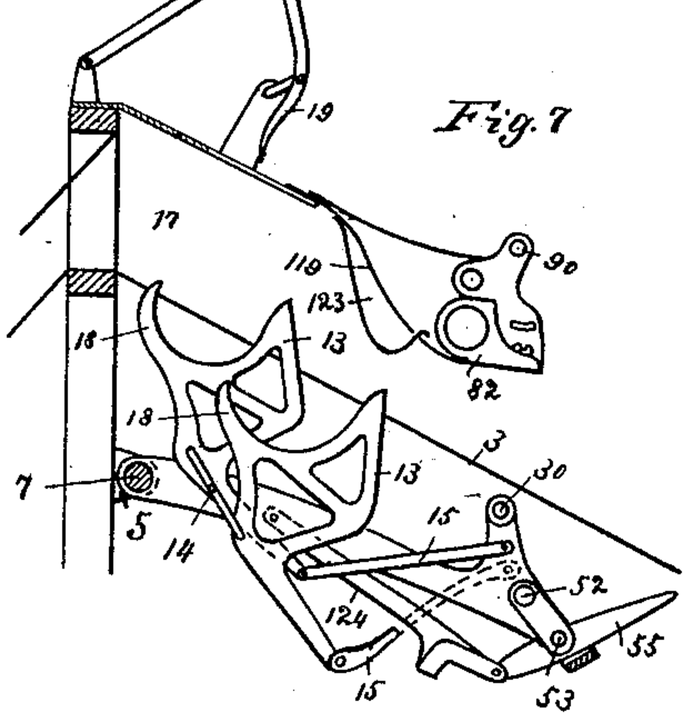



Fig. 7



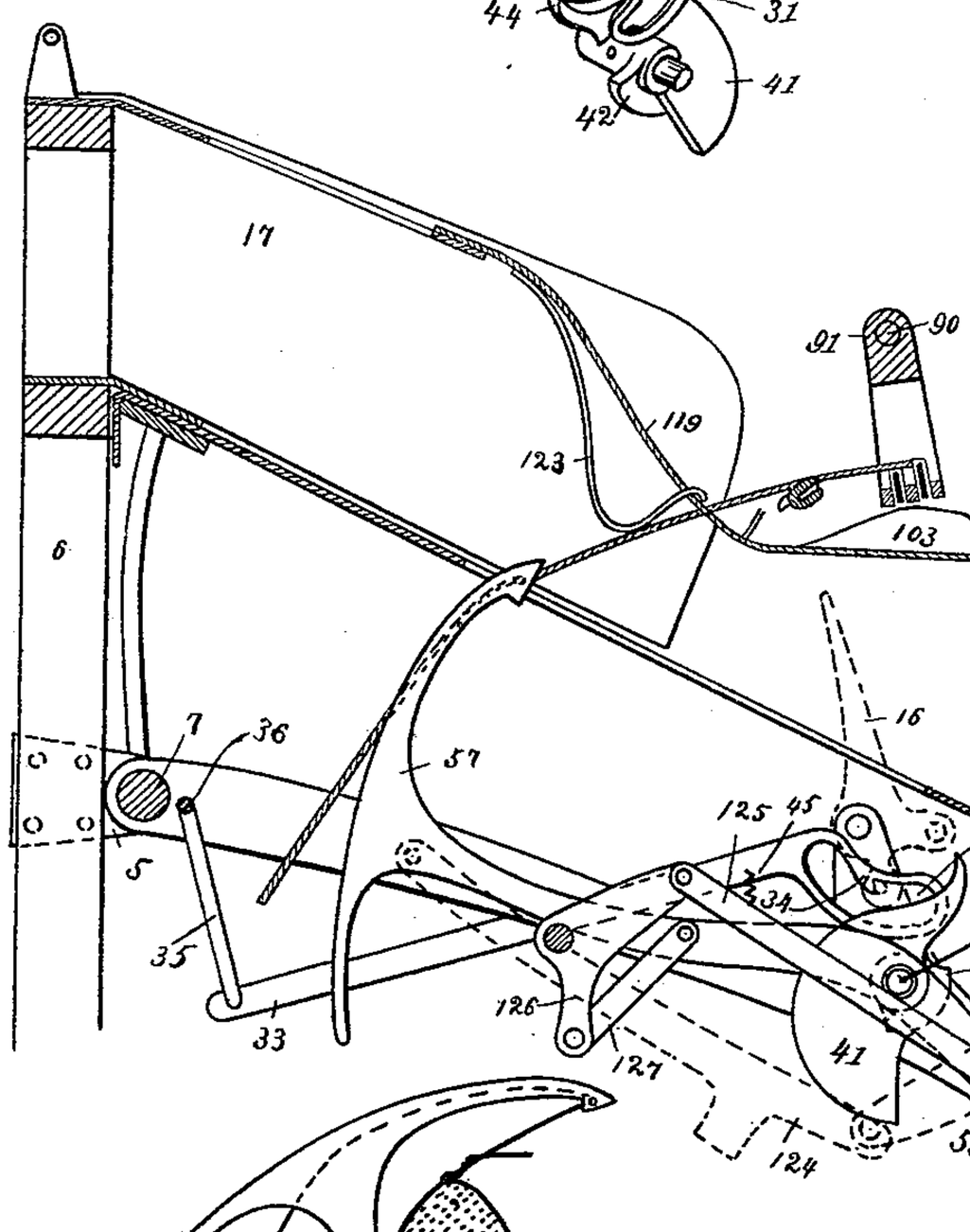




Fig. 6

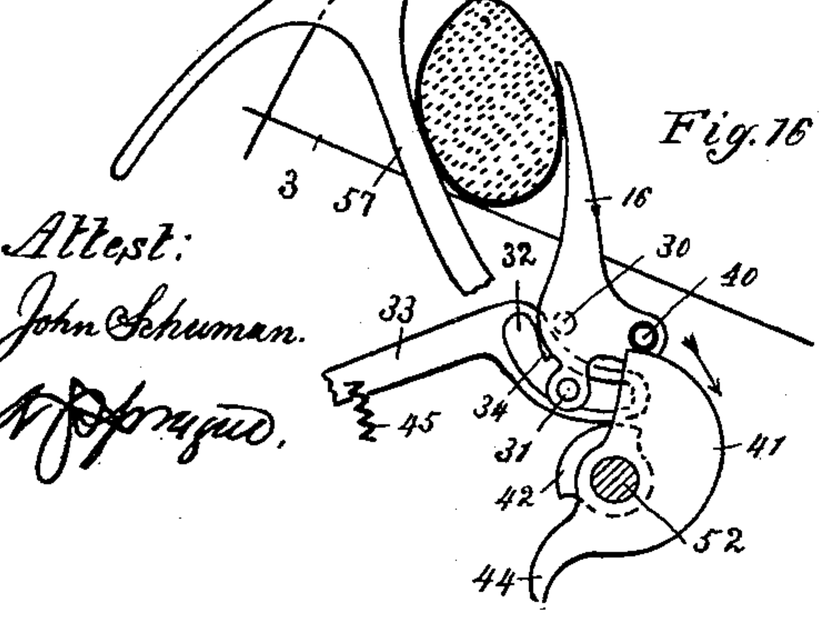



Fig. 16

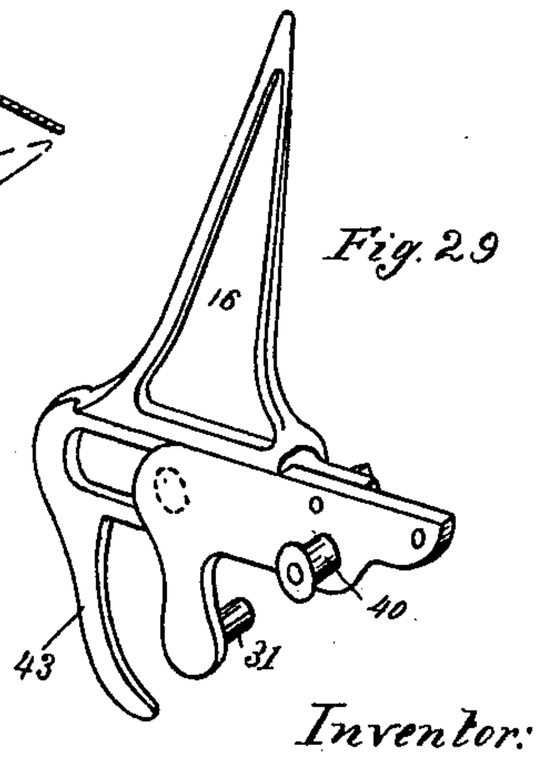



Fig. 29

Attest:
John Schuman.
[illegible]

Inventor:
Jeremiah Keller.
by his Atty
Thos. A. Sprague

(Model.)

6 Sheets—Sheet 4.

# J. KELLER.

## GRAIN BINDER.

No. 391,371. Patented Oct. 16, 1888.

Fig. 9

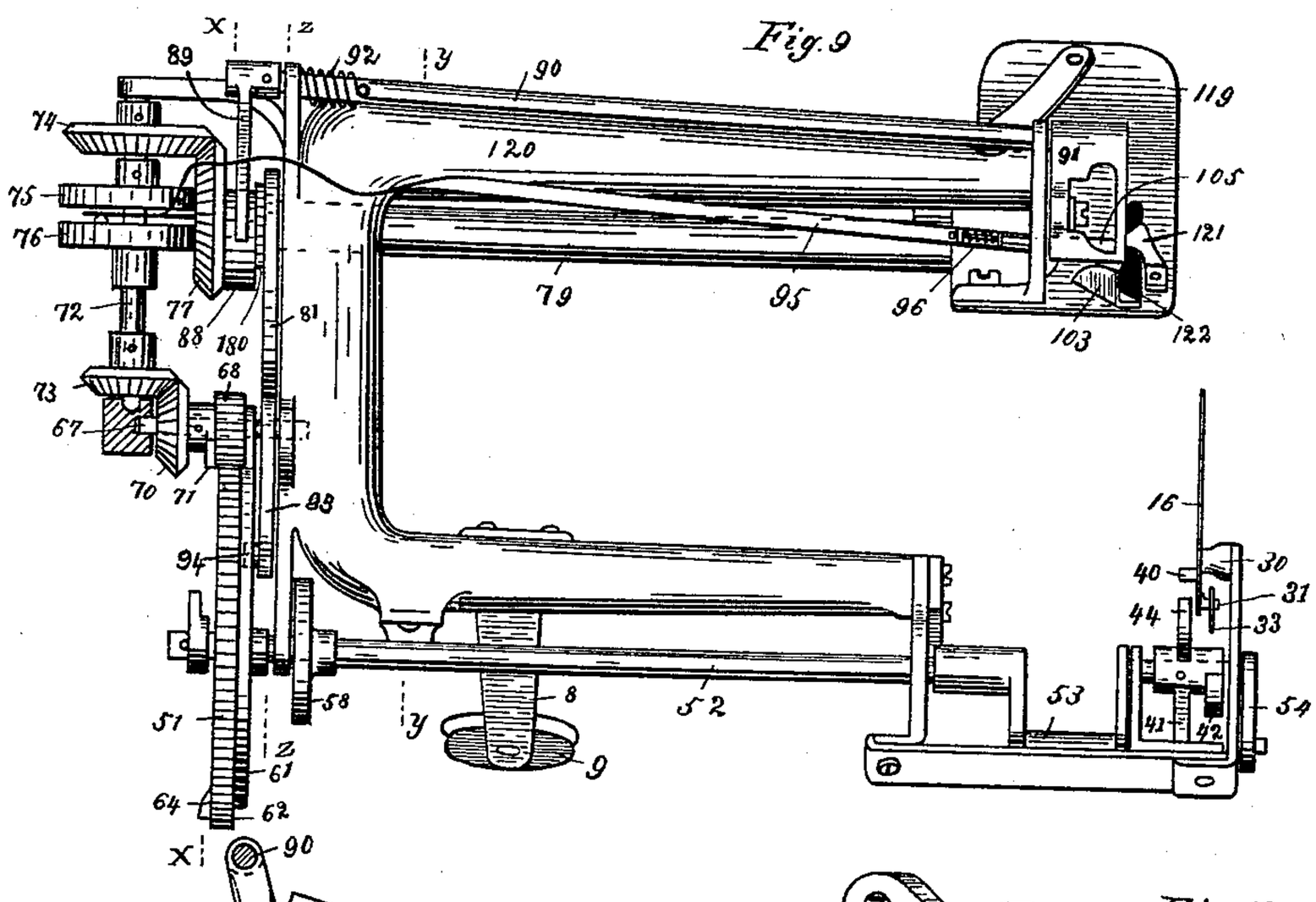



Fig. 10

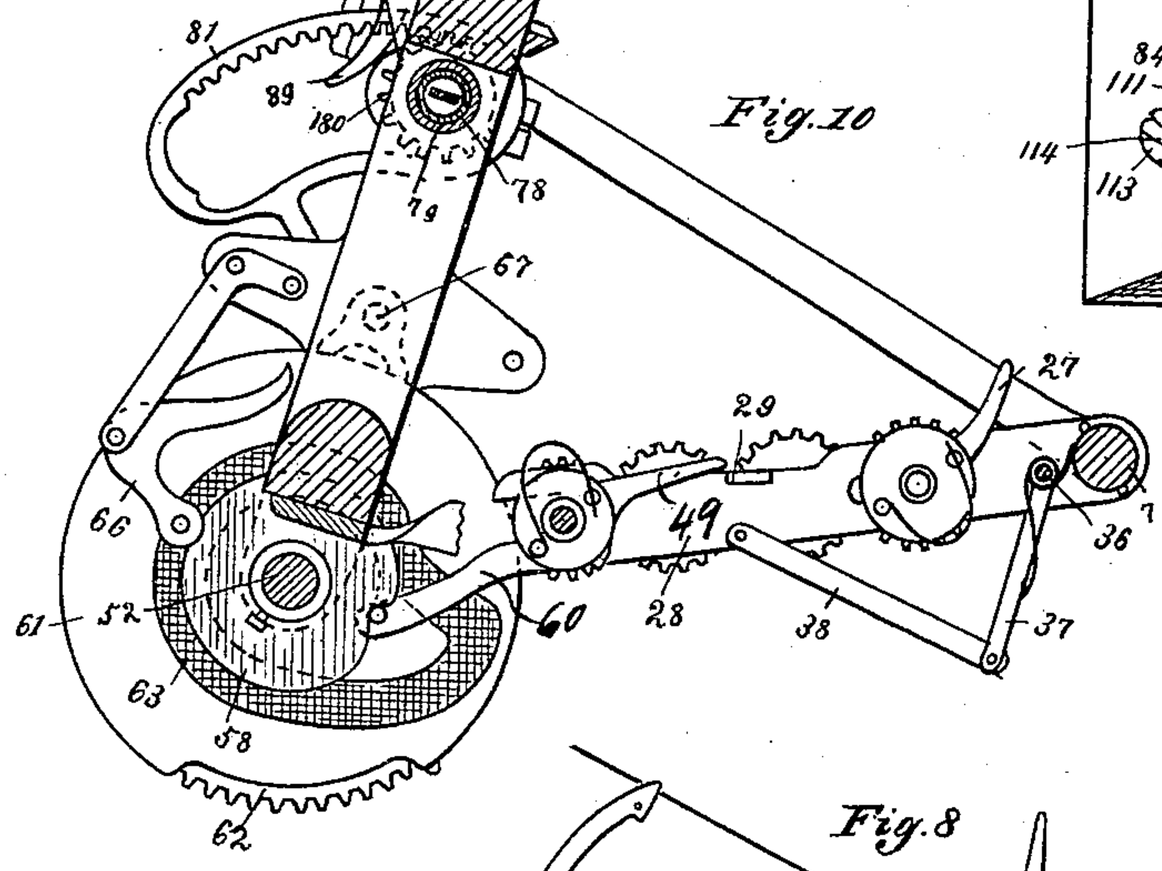



Fig. 19




Fig. 21

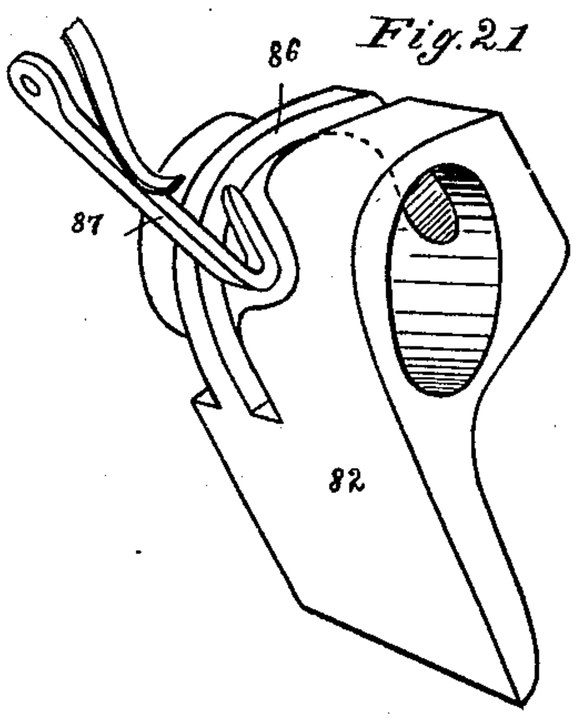
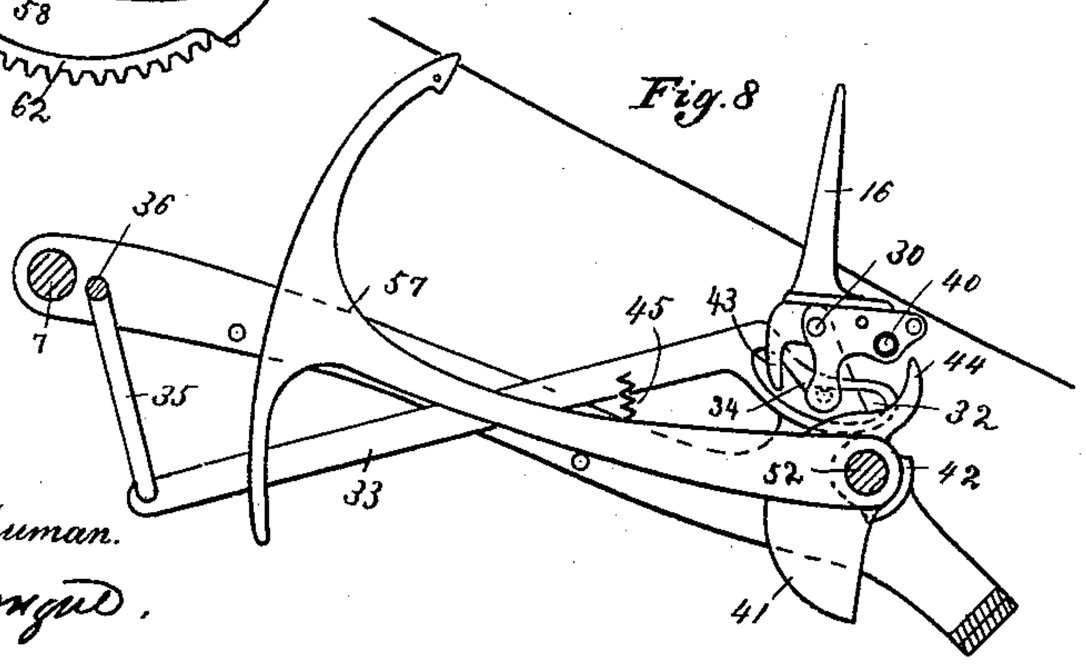



Fig. 8




Attest:
John Schuman.
W. Sprague.

Inventor:
Jeremiah Keller.
by his Atty
Thos. L. Sprague.

(Model.) 6 Sheets—Sheet 5.

# J. KELLER.

## GRAIN BINDER.

No. 391,371. Patented Oct. 16, 1888.

Fig. 15

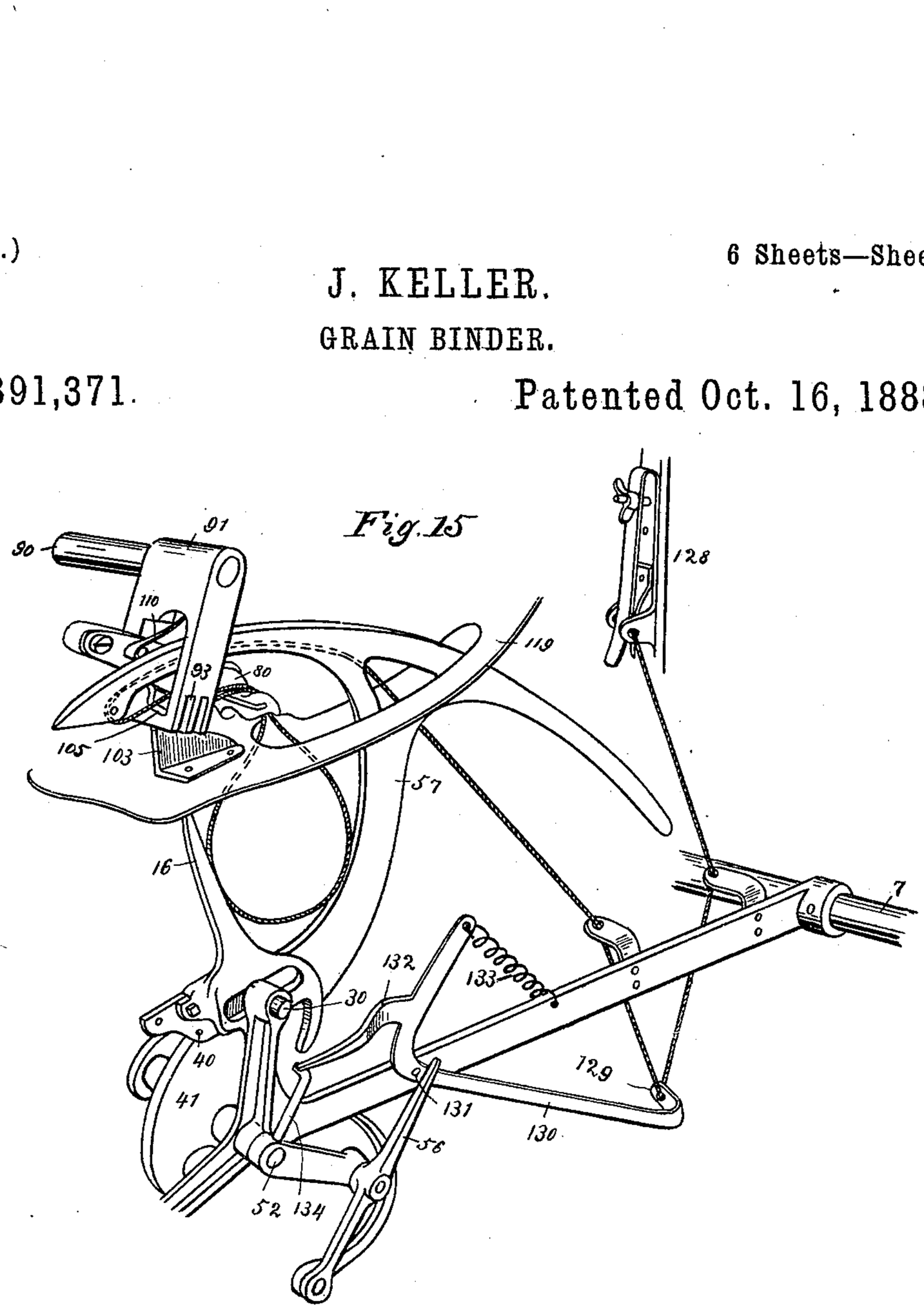



Fig. 17

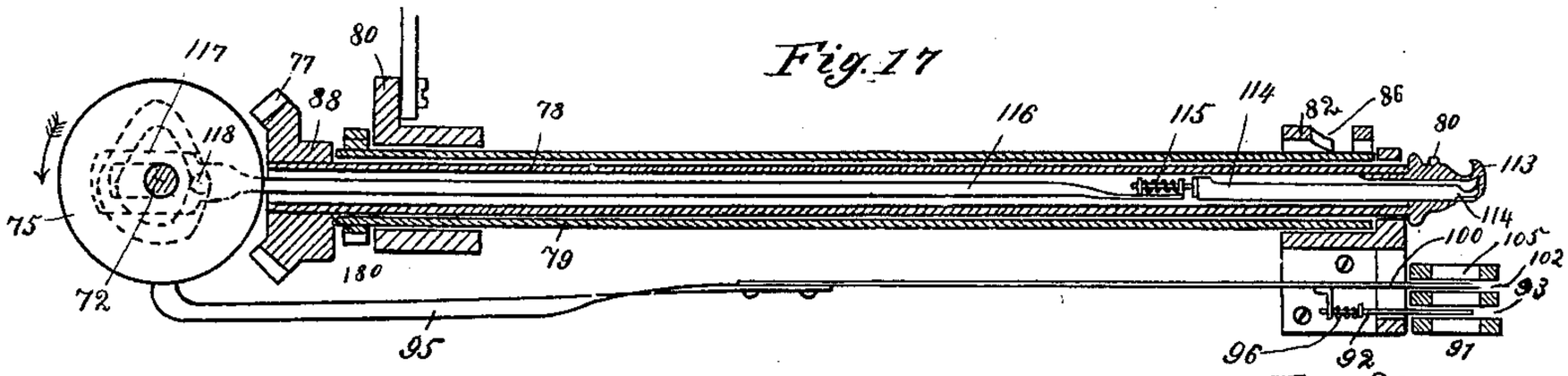



Fig. 30

Fig. 26

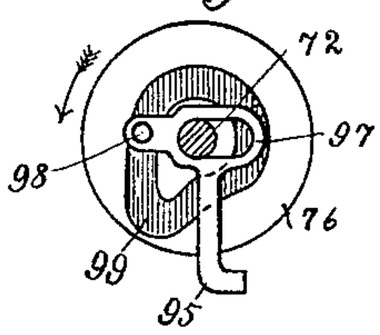



Fig. 27

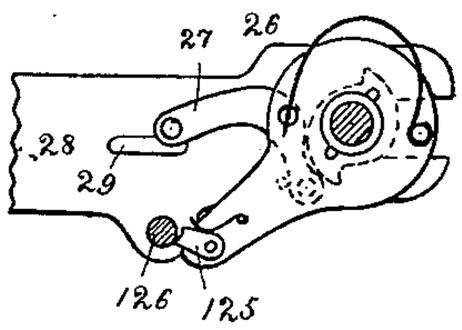
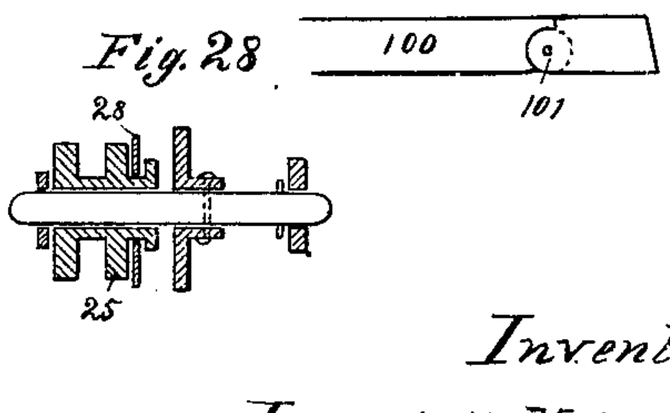



Fig. 28




Attest:
John Schuman.
N. J. Sprague.

Inventor:
Jeremiah Keller.
by his Atty
Wm. L. Sprague.

(Model.)

6 Sheets—Sheet 6.

# J. KELLER.

## GRAIN BINDER.

No. 391,371. Patented Oct. 16, 1888.

Fig. 18

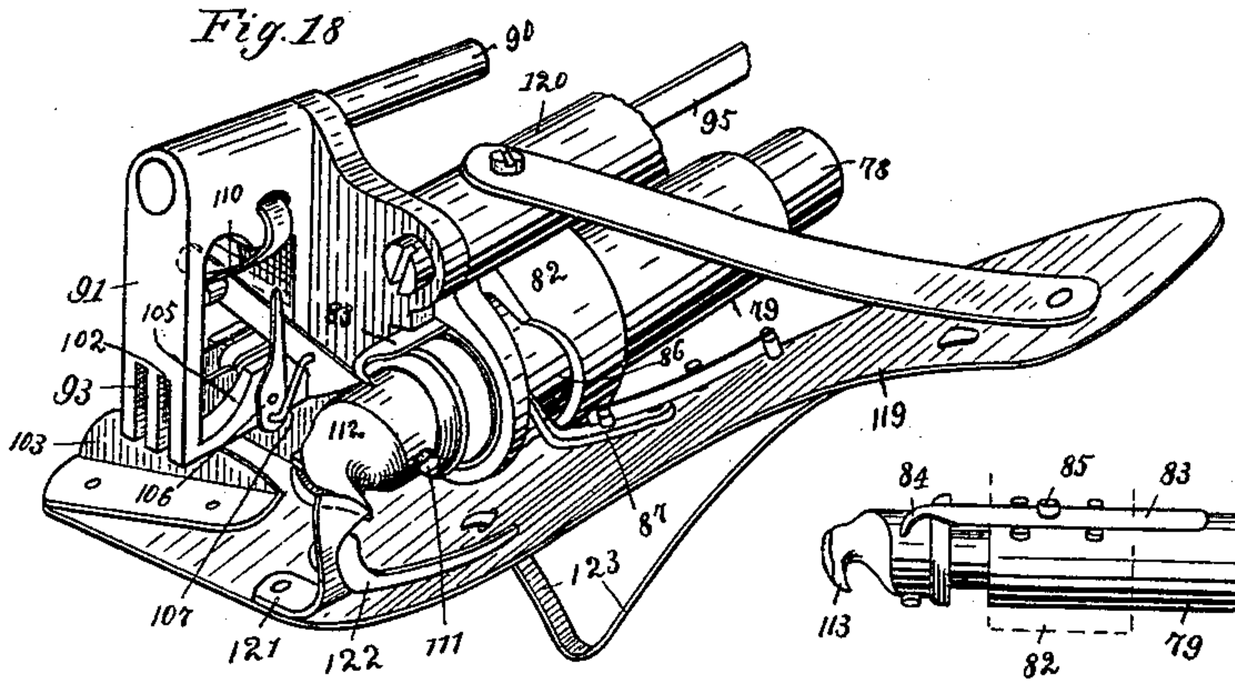



Fig. 20

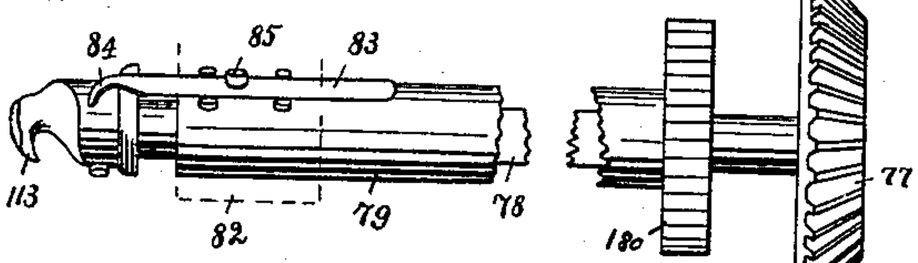



Fig. 22

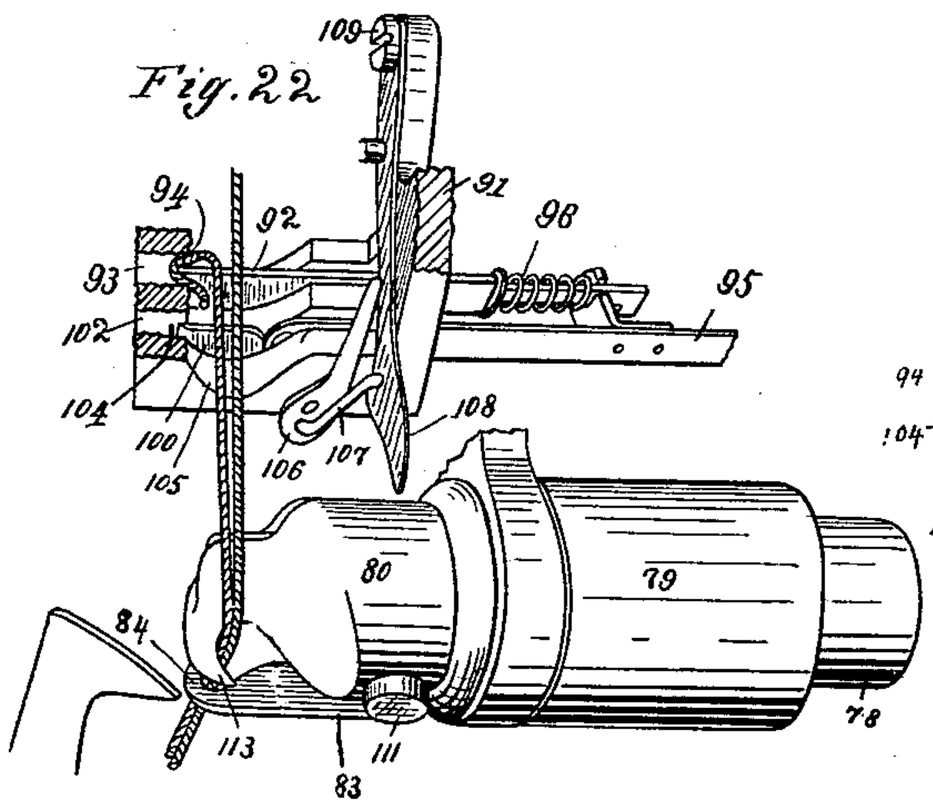



Fig. 23

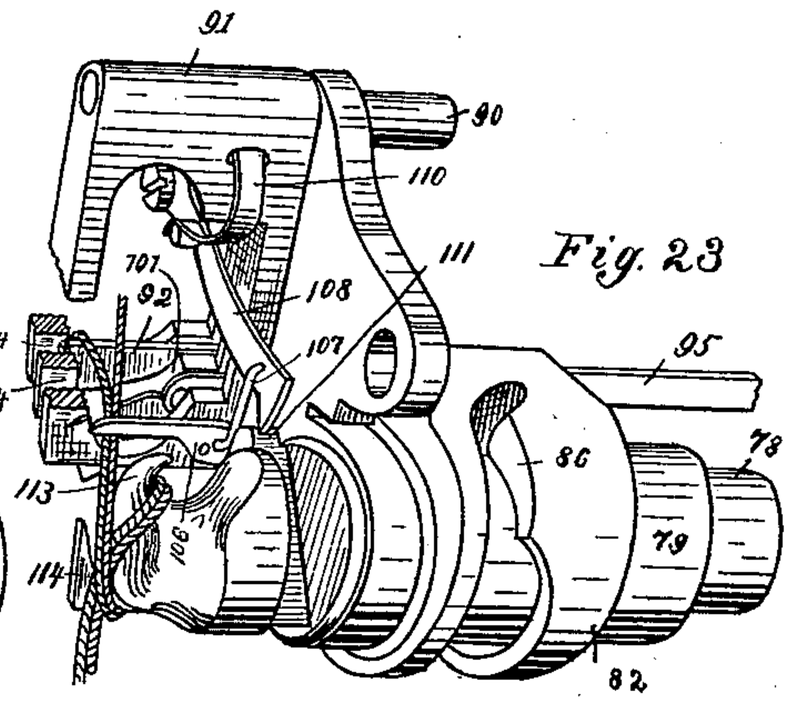



Fig. 24

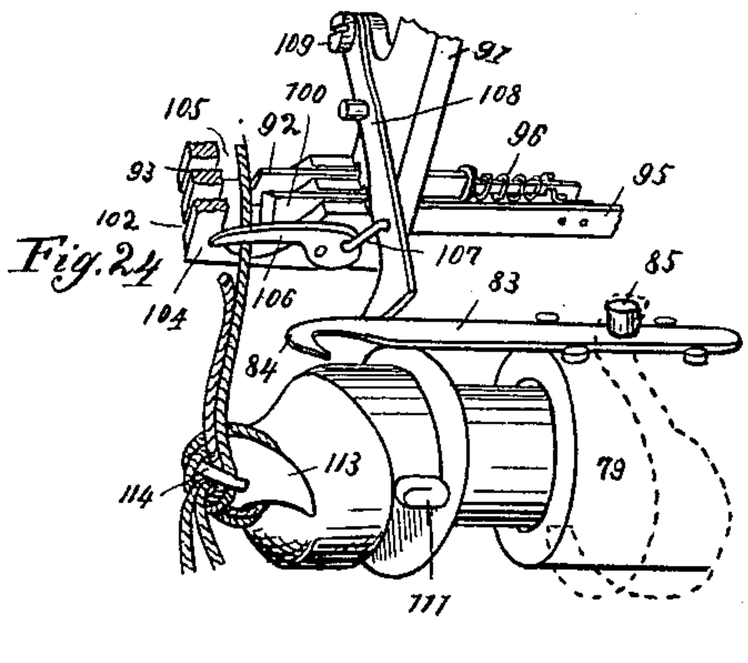
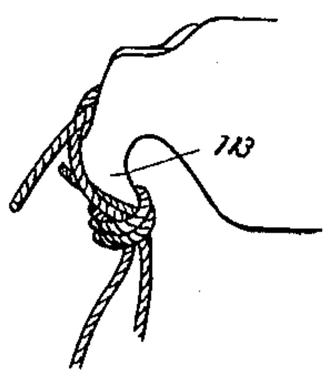



Fig. 25.




Attest:
John Schuman.
N. Sprague.

Inventor:
Jeremiah Keller.
by his Atty
Wm. S. Sprague.

# UNITED STATES PATENT OFFICE.

JEREMIAH KELLER, OF SANDUSKY, OHIO.

## GRAIN-BINDER.

SPECIFICATION forming part of Letters Patent No. 391,371, dated October 16, 1888.

Application filed January 14, 1886. Renewed March 6, 1888. Serial No. 266,366. (Model.)

*To all whom it may concern:*

Be it known that I, JEREMIAH KELLER, of Sandusky, in the county of Erie and State of Ohio, have invented new and useful Improvements in Grain-Binders; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to an improvement in harvester-binders of that class commonly called "twine-binders."

The invention consists in the improved construction, arrangement, and combination of the various parts of the binder mechanism, all as more fully hereinafter described, and specifically set forth in the claims.

In the accompanying drawings, which form a part of this specification, Figure 1 is a perspective view of the improved binder detached from the harvester. Fig. 2 is a diagram rear elevation showing the binder in connection with the harvester platform and grain-elevator. Fig. 3 is a perspective view of that part of the binder mechanism which is located below the binding-platform, and therefore hidden from view in Fig. 1. Fig. 4 is another perspective view of the binding mechanism divested of the binder-platform and its supporting-frame and with the packers and yielding arm left out. Fig. 5 is a perspective view showing only a detached portion of the mechanism shown in Fig. 3. Figs. 6, 7, and 8 are vertical central cross-sections of the binder, parts of the binding mechanism being omitted in each section to show the remaining portions unobstructed. Fig. 9 is an elevation showing the knot-tying device, its actuating mechanism, and supporting-frame. Fig. 10 is a cross-section on line *y y* in Fig. 9, looking at the left. Fig. 11 is a cross section on line *x x* in Fig. 9, looking at the right. Fig. 12 is a cross-section on line *z z* in Fig. 9, looking at the left. Figs. 13 and 14 are detail views of some parts shown in smaller scale in Fig. 4. Fig. 15 is a detail perspective illustrating the operation of the tension take-up. Fig. 16 is a detail view illustrating the compressing of the bundle. Fig. 17 is a horizontal section through the axis of the knotter-shaft. Figs. 18 and 19 are perspective views of the knotting apparatus. Fig. 20 is a plan of the knotter detached. Fig. 21 is a detached view of the guide-cam of the looper-hook shown in Figs. 18 and 19. Figs. 22, 23, 24, and 25 are perspective views illustrating the manner in which the knot is tied. Fig. 26 is a plan of the cam actuating the plunger of the twine-holder. Fig. 27 is a side view, and Fig. 28 a section, of one of the trip-clutches in the binder mechanism. Fig. 29 is a detached perspective of the compressor-arm. Fig. 30 is a detached view of the knife of the knotting apparatus.

The binding mechanism is arranged to work in connection with a harvester of that well-known kind which, as shown in Fig. 2, has a traveling platform, 1, and an elevator, 2, which delivers the grain upon the binding-table 3. The position of the band on the sheaf is regulated for long or short straw by means of a lever, 4, which moves the table with the binding apparatus backward or forward, so as to place the band around the middle of the bundle either in long or short grain. To this end the frame of the binder is constructed in two parts, one part being stationary and the other movably secured thereon. The movable part of the frame carries the binding-table and all the binding mechanism. The stationary part of the frame has boxes 5, secured to its uprights 6, through which the bar 7 of the movable frame slides freely, and an inclined brace, 8, secured to the movable frame and provided with a traveler, 9, supports the weight of the movable frame against a fixed rail, 10, on the stationary frame. The shifting-lever 4 is secured to the stationary part of the frame in proximity to the seat of the driver. It is provided at its upper end with a suitable locking device and at its lower end with a pinion, 11, which engages with a rack-bar, 12, Fig. 4, which is secured to the movable part of the frame. Thus the driver from his seat can at any time during the operation of the machine adjust the binding-table backward or forward by turning the shifting-lever in one direction or in the opposite.

The packing apparatus which regulates the size of every sheaf, making them all uniform as long as the adjustment provided for is not altered, is arranged and constructed as follows: Two packers, 13, journaled upon cranks formed on the shaft 14, underneath the binding-table, work through slots in said table.

As the lower ends of these packers are pivotally attached to links 15, the motion of the cranks gives to the packers an up and-down and backward-and-forward motion, which carries the grain down against the yielding arm or compressor 16.

To enable the packers to prevent any choking of grain in the throat 17 at the upper end of the binding-table, the packers are provided with rearwardly-extending forks 18, which work in the throat of the binding-table and draw away the grain as fast as it is carried up by the elevator, feeding it downward until it comes within reach of the packers.

A fork, 19, operating through a slot in the top of the throat, assists the forks 18 to clear the throat which forms the discharge end of the elevator. This fork 19 may be conveniently driven by chain-connection with the reel of the harvester, or in any other suitable manner, it being not necessary to discontinue its motion during the operation of the binding mechanism, as is the case with the packers.

The motion for operating the packers is derived from the shaft 20, which is the main shaft of the binder, to which the power is applied by means of the chain-wheel 21, which slides on a feather, and is held in a fixed position by an arm, 22, Fig. 2, so that it cannot change its relative position when the binding-table is shifted.

The inner end of the main shaft 20 is provided with a pinion, 23, which drives two intermediate pinions, 24 25. The latter is loose on the shaft of the packers and has secured to it one part of the trip-clutch, 26, the other part of which is fast on the shaft, so that as long as the clutch is closed the shaft will revolve; but when the clutch is tripped it will stop. In Figs. 3, 5, 27, and 28 the construction of this clutch is plainly shown, 27 being a pawl on the fast part of the clutch, which, by means of its spring, is normally held in engagement into one of two notches on the loose part of the clutch. A sliding plate, 28, actuated by the compressor, has a projecting stop, 29, which, when moved into the path of the pawl, trips the latter and opens the clutch, thus arresting the motion of the packers. This is done automatically by the compressor, which yields under the regulated amount of pressure which the compacted bundle exerts against it as soon as it has attained its proper size.

The compressor 16, against which the bundle is formed, is pivotally secured at 30 and works through a slot in the binding-table. It has an extension below its pivot, into which a pin, 31, is secured. This pin enters the curved slot 32 in the tripping-bar 33, in which slot there is formed a shoulder, 34, against which the pin rests. The tripping-bar 33 is pivotally connected with the rock-arm 35 of the rock-shaft 36, which latter has another rock-arm, 37, to which one end of the link 38 is pivotally secured, while at its other end it is pivotally secured to the sliding plate 28. A spring, 39, exerts its tension to resist the yielding of the compressor-arm. Thus as soon as the pressure of the compacted bundle overcomes the tension of the spring 39 the compressor-arm begins to yield, and by means of the connection before described actuates the sliding plate 28 and moves the stop 29 into the path of the pawl of the clutch, thereby tripping it and arresting the motion of the packers and throwing the binder mechanism into gear, as later on described.

The size of the bundle can be regulated by means of the compressor-arm, which is made adjustable backward or forward by making it in two parts adjustably secured together, as shown in Fig. 29, one part being provided with an elongated slot and the other with a stud projecting through said slot, as clearly shown in said figure, which stud is designed to be provided with an adjusting thumb-nut for holding the parts in their adjusted positions—a common and well-known expedient. The compressor is also provided with a heel extension, in which a wrist, 40, is secured. This wrist in the further stages of binding the bundle is forcibly lifted by the compressor-cam 41, located underneath, as shown in Fig. 16, all so arranged as to oscillate the compressor-arm in the proper manner to compress the bundle. Another cam, 42, on the same shaft is made to lift the curved end of the tripping-bar 33, so as to allow the compressor-arm to turn backward after the cam has done its work, and the bundle is pushed off the binding-table by the ejectors. To prevent any sharp corners arresting the bundle in pushing it off the binding-platform, the compressor-arm is provided with a curved guard, 43. After the bundle is pushed off the binding-table, the compressor-arm is then righted again to its normal position by a cam, 44, which strikes the wrist-pin 40 and turns up the compressor-arm until its pin 31 rests again against the shoulder 34 in the curved slot of the tripping-bar 33, which latter has a spring, 45, to assist such engagement.

The devices for binding the bundle comprise a binder-arm, a knotter, a twine-holder, a twine-cutter, a twine-tension, and discharging apparatus, which parts, together with their actuating mechanism, are constructed and arranged as follows: The pinion 23 on the main shaft meshes with a pinion, 46, on the shaft 47. This pinion is loose on its shaft and carries the loose part of the clutch 48, the fast part of which has a spring-pawl, 49, by which the clutch is tripped whenever the stop 29 on the sliding plate 28 is moved into its path. The stop 29 also trips the clutch 26, as before described, and as the clutches are upon opposite sides of the stop it will be seen that when one of the clutches is tripped by the stop moving into the path of its pawl the pawl of the other clutch is set free, and thus the packer and the binding apparatus are alternately thrown into and out of gear, one standing still while the other is doing its work. A pinion,

50, on the shaft 47 meshes with a gear-wheel, 51, on the shaft 52. This latter shaft actuates the binder-arm 57, the ejectors 55 and 56, and the cams 41 42 44. It is provided with two cranks, 53 54, on which the ejectors 55 56 are sleeved, and with a notched disk, 58, the notch 59 of which forms a stop for the sliding plate 28, which latter has a tail extension, 60, engaging into said notch. A circular disk, 61, partly cut away at 62, is also secured upon the shaft 52, or may form an integral part of the gear-wheel 51, as shown in the drawings, and an inner cam-groove, 63, is cut into said disk or gear-wheel.

To the outer side of the gear-wheel, near its periphery, is secured a lug, 64, and a dog, 65. A bell-crank, 66, pivotally secured to the frame, engages with one of its arms into the cam-groove 63, Fig. 10.

Above the gear-wheel 51, and meshing therewith, is secured on the shaft 67, Fig. 14, the mutilated pinion 68, the delay-shoe 69, the miter-pinion 70, and the lug 71.

An upright shaft, 72, Figs. 4 and 9, is provided near its lower end with the miter-pinion 73, and near its upper end with a bevel-gear, 74, and intermediately between are secured thereon the disks 75 76, each one being provided with an inner cam-groove, as shown in Figs. 17 and 26. The bevel gear-wheel 74 engages with a like bevel-gear, 77, which is secured to the end of the hollow shaft 78, Fig. 17, and which is journaled inside another hollow shaft, 79, and has secured to its opposite end the looper 80.

The hollow shaft 79 is journaled in the frame of the binder above the binding-table. To one end of it is secured the pinion 180, Figs. 12 and 17, which engages with an oscillating segment-rack, 81, and to the opposite end, which passes through the cam-sleeve 82, Figs. 19 and and 20, is secured the sliding looper-guide 83, which is provided at its projecting end with a hook, 84, and has a guide-pin, 85, Fig. 20, which enters a cam-groove, 86, in the sleeve 82. Into this cam-groove the switch-lever 87, Fig. 21, engages and forms a switch-track therein for the guide-pin 85 of the looper-guide. On the looper-shaft 78 is also secured a cam, 88, Figs. 17, 11, and 4, which actuates the rock-arm 89 of the rock-shaft 90, which latter is journaled above the binding-table and has secured to its free end the twine-holder 91. The tension of a spring, 92, holds the rock-arm 89 in engagement with the cam 88.

The oscillating segment-rack 81, which operates the looper, has for its pivot the shaft 67, and is provided with an arm, 93, which bears a roller-wrist, 94, engaging into the cam-groove 63.

The oscillating twine-holder 91, Figs. 9, 15, 17, 18, 22, 23, and 24, is provided with an aperture, through which the head of the binder-arm can freely pass, Fig. 15, to carry the twine across the path of the plunger 92, which, as shown in Fig. 22, moves in a groove or slot, 93, of the twine-holder. The latter is provided with a depression, 105, in the path of the twine, so that the plunger can hold the twine by nipping it against the shoulders 94, as shown in Fig. 22. The plunger is attached by means of a tension-joint, 96, Fig. 17, to the plunger-rod 95, which latter is provided with suitable means for lengthening or shortening it and terminates in a yoke, 97, Fig. 26, which engages with the shaft 72, and is provided with a wrist, 98, which engages into the cam-groove 99 of the cam-disk 76, and thereby gives a reciprocating motion to the plunger.

The oscillating twine-holder carries the knife 100, which is also attached to and operated by the plunger-rod. It reciprocates in a groove, 102, and is provided with a hinge-joint, 101, which allows the knife to drop out of the path of the twine whenever it is unsupported underneath by the fixed and inclined support 103, Figs. 9, 15, and 18. This support will uphold and guide the knife at a certain position of the twine-holder, so that it may nip the twine and cut it against the shoulders 104, while at another position of the twine-holder it allows the knife to drop out of the way, as shown in Fig. 23.

Pivotally secured to the twine-holder is a lever or tucker, 106, Fig. 22, which, as shown in Fig. 23, at a certain period of the operation of binding tucks the twine into the depression of the twine-holder. It is hinged by means of the link 107 to the free end of the lever 108. The latter is pivotally secured at 109 to the twine-holder, and is kept normally depressed by a spring, 110, except when its forward end strikes the projection 111, Fig. 22, on the revolving looper, when it is lifted up and turns the tucker into the position shown in Fig. 23.

The horn of the looper 80 is provided with a bent portion, 113. The looper is provided with an axial aperture, in which the knotter-hook 114, Fig. 17, reciprocates, and from which its hook is projected during a certain stage of the formation of the knot, as shown in Fig. 23. This knotter-hook is provided with a spring-connection, 115, which connects it with the rod 116. The latter passes through the hollow shaft 78, and has formed upon its free end a yoke, 117, which engages upon the shaft 72. It is also provided with a wrist, 118, which engages into the cam groove of the revolving disk 75. By this connection the desired reciprocation of the knotter-hook is obtained.

Above the binding-table, and immediately below the knotting apparatus, is placed a shield, 119, which is secured in any convenient manner to the overhanging arm 120 of the binder-frame. This shield protects the knotting apparatus from being entangled with the grain, and serves as a support for the stationary twine-guide 121, which prevents any accidental displacement of the twine in binding. This shield is provided with a slot, 122, to allow the binder-arm to pass through, and on the under side it has a yielding guard, 123,

which prevents the accidental withdrawal of grain, when the bundle is formed, by the retrograde movement of the packers.

The ejectors are, as above described, sleeved near their centers upon the crank of the shaft 52, which is journaled below the binding-table, and their rear ends are rearwardly connected to a guiding link, 124. By means of this arrangement the revolution of the shaft 52 gives them an irregular four-motion movement, which is slow while the ejectors move rearwardly into position, and fast while the ejectors perform their work of throwing off the bundle. Thus ample time is gained for the binding of the bundle.

The packers, having a similar four motion movement given to them, have their guiding-links 15 forwardly connected, Fig. 7, so that the packers are quickly moved into and out of their working positions. This arrangement prevents the packers from interfering with each other's operation and carries the grain evenly and in a steady flow over the binding-table.

The binder-arm, which is sleeved upon the shaft 52, has an intermittent oscillating motion, which is obtained in the following manner, Figs. 3, 4, and 6: A link, 125, is sleeved at one end upon the crank 53, and at its other end it is pivotally connected to one arm of the bell-crank 126, the other arm of which is hinged to the binder-arm through the medium of a link, 127. It will be seen that as soon as the shaft 52 begins to revolve, the binder-arm will be swung with a quick motion until it is in the position shown in Figs. 15 and 16, in which the bundle is completely encircled by the twine. During the compression of the bundle by the compressor-arm the link 127 is at or near its center with the arm of the bell-crank, to which it is attached, thus firmly supporting the binder-arm against the pressure of the bundle. At the end of the forward oscillation of the binder-arm a center is also formed between the crank 53 and the link 125, and while the operating parts of the binder are thus passing over these centers the binder-arm is held at rest, or nearly so, until the knot is tied, when the binder-arm is again quickly retracted into its former position.

The twine passes from the roll or canister, which is secured at a convenient place in the binder-frame, through a tension-clamp, 128, Fig. 15, of any of the known constructions; thence it passes through the eye 129 of the tension-take-up lever 130 to the binder-arm, and through the arc of the same to and around a roller in the head of the binder-arm, and thence to the twine holder, where the free end is held fast, as before described.

The tension-take-up lever 130, Fig. 15, is pivotally secured at 131, and is provided with an arm, 132, and a tension-spring, 133. Its arm 132 projects into the path of a striker-arm, 134, on the shaft 52, so that while said shaft is revolving the lever 130 is oscillated to a sufficient degree to draw from the canister the length of twine to be taken up in tying the bundle. As the spring 133 is of a less tension than the tension kept on the twine by the tension-clamp 128, it is seen that the whole operation of tying is thereby facilitated, as the stronger tension which has to be maintained on the twine during the rest of the operation is thereby superseded by a less tension.

Having now described the construction and arrangement of the different parts of the binding mechanism, I will proceed to describe the joint operation of these parts.

As soon as the compressor-arm yields under the pressure of the compacted bundle, it actuates the sliding plate 28, so that the stop 29 trips the clutch 26 and liberates the pawl of the clutch 48. This arrests the movement of the packers and throws the binding mechanism into gear, the motion being communicated from the main shaft 20 through the intermediate pinions, 46 and 50, onto the gear-wheel 51, which is now free to make one revolution, within which the whole binding operation is performed. During this revolution the pin in the arm 60 of the sliding plate 28 rides upon the face of the disk 58; but as soon as one revolution is completed it drops back again into the notch 59, from which it has been forcibly withdrawn by the yielding of the compressor-arm, under the action of the spring 39, and throws the binding mechanism again out of gear and the packer mechanism into gear. Simultaneously with the gear-wheel 51 the shaft 52 begins to revolve, and causes the binder-arm to oscillate and encircle the bundle with the twine, while the cam 41 on said shaft operates on the compressor-arm and causes it to compress the bundle. It also actuates the tension take-up and moves the ejectors into posion. The rest of the binding mechanism does not start up immediately; but as soon as the binder-arm has moved into position the cam-groove 63, Fig. 12, oscillates the segment 81, which, by means of its engagement with the pinion 180, partially revolves the hollow shaft 79, which carries the looper-guide 84. This guide, during the revolution of the shaft 79, is guided by the cam-groove 86 in such manner that it engages with its hooked end upon the twine and carries it under the twisted end of the horn of the looper, forming part of the loop, as shown in Fig. 22, after which it is reversed again into its original position. As this motion requires an abrupt turn in the cam-groove 68, the latter is provided with a switch-lever, 87, which facilitates the return of the looper-guide at its reversal by an easy track. The bell-crank 66, which also engages into the cam-groove 63, makes the reverse motion of the oscillating segment more positive than it would otherwise be, owing to the abrupt turn of the groove. It acts by pushing against it at the critical turn in the cam. The rest of the binding mechanism starts up as soon as the lug 64 on the gear-wheel 51 strikes the lug 71 and turns the shaft 67 sufficiently to throw the interrupted pinion 68 into mesh with the gear 51.

This gives just one revolution to the shaft 67, as the locking-block 69, which now is free to turn, owing to the cut-away portion of the disk 61, will again be forced to ride upon the face of said disk after having performed one revolution. The revolution of the shaft 67 also communicates one revolution to the shaft 72. The miter-pinion 74, engaging with the miter-pinion 77, gives one revolution to the looper 80, thus completing the loop of the knot. Before this revolution is completed the knotter-hook 114 is at first projected slightly to prevent the loop from slipping off, and then it is projected farther through the looper, as shown in Fig. 23, by the cam-groove of the disk 75, and the twine, being deflected by the bent portion 113 of the horn of the looper, is drawn into the knotter-hook, which immediately thereon withdraws and holds the twine in its grip with the tension of its spring-connection 115. Meanwhile the twine-holder, which holds the fast end of the twine, oscillates toward the looper, being actuated thereto by the cam 88. This lets the fast end of the twine approach sufficiently to give the necessary slack for forming the knot. As the oscillating twine-holder approaches the looper, the lever 108 is actuated by coming in contact with the looper or other suitable projection placed thereon in proper position. This throws the tucker into operation, as shown in Fig. 23. While both ends of the band are thus being tucked into the depression of the twine-holder and held fast the knife has passed by the inclined support 103 and dropped out of the way by being unsupported underneath. Now the twine-holder begins to oscillate back, and the plunger and knife are also withdrawn by the action of the cam-disk 76. This brings the parts into the position shown in Fig. 24, in which the fast end of the band has been let go by the twine holder, while the other end has been carried into the depression 105. Thus the knife and plunger upon reversing again will cut the band off and nip the severed end of the twine, while the binder-arm reverses after the end of the twine is held fast again. As soon as the knot-tying apparatus has done its work the ejectors have drawn into position and push the completed bundle off the binding-table, thereby stripping the knot off the looper, as shown in Fig. 25. The twist of the horn of the looper, aided by the tension of the knotter-hook, draws the knot tight while it is thus pulled off. As soon as the gear-wheel 51 has completed its one revolution the clutch 48 of the binding mechanism is tripped by the stop 29, which has been carried into its original position by the plate 28, which latter is actuated thereto by the spring 39. This again frees the clutch of the packer apparatus, which now starts up again to begin a new operation. When the clutch 26 is tripped, the cranks of the packers stop on their centers with the packers. This prevents the pressure of the grain from accidentally turning the packer-shaft. The clutch is also provided with a spring-dog, 125, which, when this clutch is tripped, as shown in Fig. 27, engages on a lug or other suitable projection, 126, on the sliding plate 28. This takes up the lost motion of the parts and locks the fast part of the clutch, and thereby the packer-shaft, against the tension of the spring of the pawl 27, which tends to reverse the packer-shaft. The dog 65 on the gear-wheel 51 is placed there for the same purpose.

What I claim as my invention is—

1. The combination, with the shaft 52 and notched disk 58 thereon, of the shaft 47, the trip-clutch thereon, sliding plate 28, arranged at right angles to said shaft, stop 29 on said plate, tail-extension 60, and the pawl 49, all substantially as described, and for the purposes specified.

2. In a binder, the combination of the parallel shafts 14 47, the trip-clutches 26 48 on said shafts, respectively, and having pawls 27 49, with the sliding plate 28 at right angles to said shafts guided on the shafts of the clutches, and having a stop, 29, the compressor, and connections between said compressor and sliding plate, substantially as described.

3. In a binder, the combination of the trip-clutch on the shaft of the packers, the trip-clutch on the shaft 47 in the actuating-gear of the binding mechanism, a sliding plate moving at right angles to the length of said shafts, having a stop adapted to alternately trip the clutches, and a tail-extension, and the notched disk, which forms a stop for the sliding-plate, substantially as described.

4. In combination, the pivoted yielding arm 16, having wrist-pin 31, the tripping-bar 33, having curved slot 32 and shoulder 34, the rock-shaft 36, having rock-arms 35 37, the spring 39, the link 38, the sliding plate 28, having stop 29, and the trip-clutches 26 48, all arranged and adapted to operate substantially as described.

5. The combination, with the packer-shaft having two cranks opposite each other constructed to operate the packers, of the trip-clutch 26, having two notches upon opposite sides for its pawl, the pawl 27, clutch 48, sliding plate 28, moving at right angles to said clutches, and the stop 29 on said plate between said clutches, substantially as and for the purpose specified.

6. The combination of the yielding arm 16, having pivot 30 and wrist-pins 31 and 40, of the shaft 52, actuated by the binding mechanism and arranged to make one revolution, the compressor-cam 41, tripping-bar 33, and cam 42, substantially as described.

7. The combination, with the pivoted yielding arm 16, having wrist-pins 31 and 40, and the trip-bar 33, having shoulder 34, of the shaft 52, actuated by the binding mechanism to make one revolution, the cams 41 and 42, spring 39, and curved guard 43 on the compressor-arm, substantially as and for the purposes specified.

8. In combination, the yielding arm 16, having pivot 30 and wrist-pins 31 and 40, the trip-bar 33, having curved slots 32 and shoulder

34, the shaft 52, actuated by the binding mechchanism to make one revolution, the compressing-cam 41, the cam 42, for lifting the trip-bar, and the cam 44, for restoring the yielding arm in position, all arranged and operating sustantially as described.

9. In combination, the yielding arm 16, having pivot 30 and wrist-pin 31, the trip-bar 33, having curved slot 32 and the shoulder 34, the shaft 52, actuated by the binding mechanism, and the cam 42, all arranged and operating substantially as described.

10. The arrangement and construction of the mechanical devices for obtaining one revolution of the looper at a stated period, the same consisting in the combination of the gear-wheel 51, provided with the lug 64 and interrupted flange 61, and arranged to make one revolution, the shaft 67, having lug 71 and mutilated pinion 68, a locking-pawl engaging said lug 71, the delay-shoe 69, arranged to ride on the flange 61, the shaft 72, the intermeshing bevel-pinions 70 73, the looper-shaft 72, and the intermeshing bevel-pinions 74 77, substantially as described.

11. The arrangement and construction of the mechanical devices for obtaining a reciprocating motion of the plunger and knife at a stated period, the same consisting in the combination of the gear-wheel 51, arranged to make one revolution and provided with the lug 64, and interrupted disk 61, shaft 67, having lug 71 and mutilated pinion 68, shaft 72, the intermeshing bevel-pinions 70 73, the disk 76, having an inner cam-groove, the plunger-rod 95, having a yoke, 97, and wrist 98, and the plunger 92, connected to said rod by a spring-connection, substantially as described.

12. In a binding mechanism having a looper of the kind described, the combination of the hollow shaft 79, pinion 180 thereon, and the rack 81, the hooked twine-guide 83, sliding on the hollow shaft 79 and provided with the pin 85, the sleeve 82, provided with a cam-groove into which the pin of the twine-guide engages, the switch-lever 87, engaging said cam-groove, and the hollow shaft 79, operated in the manner stated, all arranged and operating substantially as described.

13. In combination with the twine-guide 83, the shaft 79, on which said twine-guide is slidingly secured, the sleeve 82, having a cam-groove into which said twine-guide engages, the mutilated pinion 180, secured to said shaft, the oscillating toothed segment 81, engaging with said pinion and having a wrist, 94, and the cam 63, all arranged and operating substantially as described.

14. The mechanical devices for reciprocating the knotting-hook at a stated period in the revolution of the looper, the same consisting of the combination of the looper-shaft 78, the shaft 72, arranged to make one revolution, the cam-disk 75, and the rod 116, provided with a yoke engaging with the shaft 72, and with a wrist-pin engaging with the cam and the knotter-hook, and a spring-connection between said hook and rod, all arranged and operating substantially as described.

15. In a knot-tying mechanism, the combination of the revolving looper carrying a reciprocating knotter-hook, a movable looping-hook for engaging the twine with the looper, an oscillating twine-holder having a depression in the path of the twine across the guide-grooves of the reciprocating plunger and knife, a reciprocating plunger moving in a guide-groove of the twine-holder, a reciprocating knife moving in a guide-groove of the twine-holder and having a hinged joint, and an inclined support underneath the hinged joint of the knife, and a tucker for tucking the twine into the depression of the twine-holder, all arranged and operating substantially as described.

16. In combination with the rock shaft 90 and the oscillating twine-holder carried thereby and having a plunger and knife and a depression across the guide-grooves in which said plunger and knife are reciprocated, looper-shaft 78, cam 88 thereon, an arm or tucker pivoted to said twine-holder arranged to swing across the path of the twine and carry it into the aforesaid depression of the twine-holder, and a spring acting on said tucker, substantially as described.

17. The combination, with the oscillating twine-holder and revolving looper, of the tucker pivoted to the twine-holder, and a projection, 111, on said looper for operating said tucker, substantially as and for the purpose specified.

18. The combination, with an oscillating twine-holder and a revolving looper, of a tucker pivoted to said holder, its lever 108, and the projection 111 on the looper, substantially as and for the purpose specified.

19. The combination, with the oscillating twine-holder and the revolving looper, of the tucker 106, pivoted to said twine-holder, the lever 108, pivoted to said twine-holder, the link 107, connecting tucker and lever, and the projection 111 on said looper, substantially as and for the purpose specified.

20. The combination, with a revolving looper of an oscillating twine-holder having a reciprocating plunger and knife and a depression across the path of said plunger and knife, of the pivoted tucker 106, pivoted to said twine-holder, and of its actuating-lever 108, all so arranged that the tucker is operated at the stated time by the joint movement of the oscillating twine-holder and the revolving looper, substantially as described.

21. In a twine-holder having a reciprocating plunger, a reciprocating knife connected to and operated by the plunger-rod, said knife operating in a slot in said twine-holder and having a hinge-joint, and a stationary cam-support for said knife, all so arranged and operated in connection with said support underneath the hinged joint of the knife that said knife drops out of its prescribed path at a stated period, substantially as described.

22. The combination, with the oscillating twine-holder 91, having a knife provided with a hinge-joint, of the tucker 106, having an actuating-lever, 108, the inclined support 103 underneath the knife, and the looper 80, all so arranged, substantially as described, whereby the oscillation of the twine-holder slacks the twine for forming the loop, throws the tucker into operation, actuates the knife to drop out of the way, and withdraws the severed end of the twine from the twine-holder, substantially as described.

23. The oscillating knife-holder, with the knife formed of two parts hinged together, and the cam-support underneath the knife, substantially as described.

24. In combination with the looper and its knotting-hook 114, having spring-connection 115, the actuating-cam 75 of the knotting-hook, and intermediate connections actuated by said cam, and said cam having a substantially pear-shaped groove arranged to communicate three actuations to the knotting-hook, first to project it to form a shoulder on the bend of the horn of the looper, then to project it sufficiently to receive the twine, and then to retract it within the horn to permit the stripping off of the loop, substantially as described.

25. In combination with the looper 80 and twine-guide 84, operating as described, the sleeve 82, with its cam-groove 86, into which the twine-guide engages, and the spring-actuated switch-lever 87, engaging into said cam-groove, whereby the twine-guide can carry the twine by the outgoing track with an abrupt turn under the twisted horn of the looper, substantially as described.

26. In combination with the clutch 26 in the packer mechanism, the dog 125 and stop 126, operating in the described manner when the clutch is tripped, substantially as described.

27. In a binding mechanism, the gear-wheel 51, deriving its motion from the main shaft through the medium of a trip-clutch, 48, the shaft 52 of said gear-wheel carrying the notched disk 58, the spring-pawl 49, the sliding plate 28, moving at right angles to said shaft, carrying the stop 29, and a tail-extension, 60, engaging into the notch of the aforesaid disk, all so arranged that the motion of the gear-wheel is arrested after having made one complete revolution, substantially as described.

28. The mechanical devices for obtaining the periodicity of the movement of the knotting-gear, the same consisting of the gear-wheel 51, arranged to make one revolution, and having lug 64, dog 65, and interrupted flange or disk 61, in combination with the shaft 67, carrying mutilated pinion 68, lug 71, and delay-shoe 69, all arranged and operating substantially as described.

In testimony that I claim the above as my invention I hereby affix my signature this 20th day of May, 1885.

JEREMIAH KELLER.

Witnesses:
OTTO KROMER,
H. S. SPRAGUE.