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C. P. ALLING.

GRAIN HARVESTING MACHINE.

No. 589,380. Patented Aug. 31, 1897.

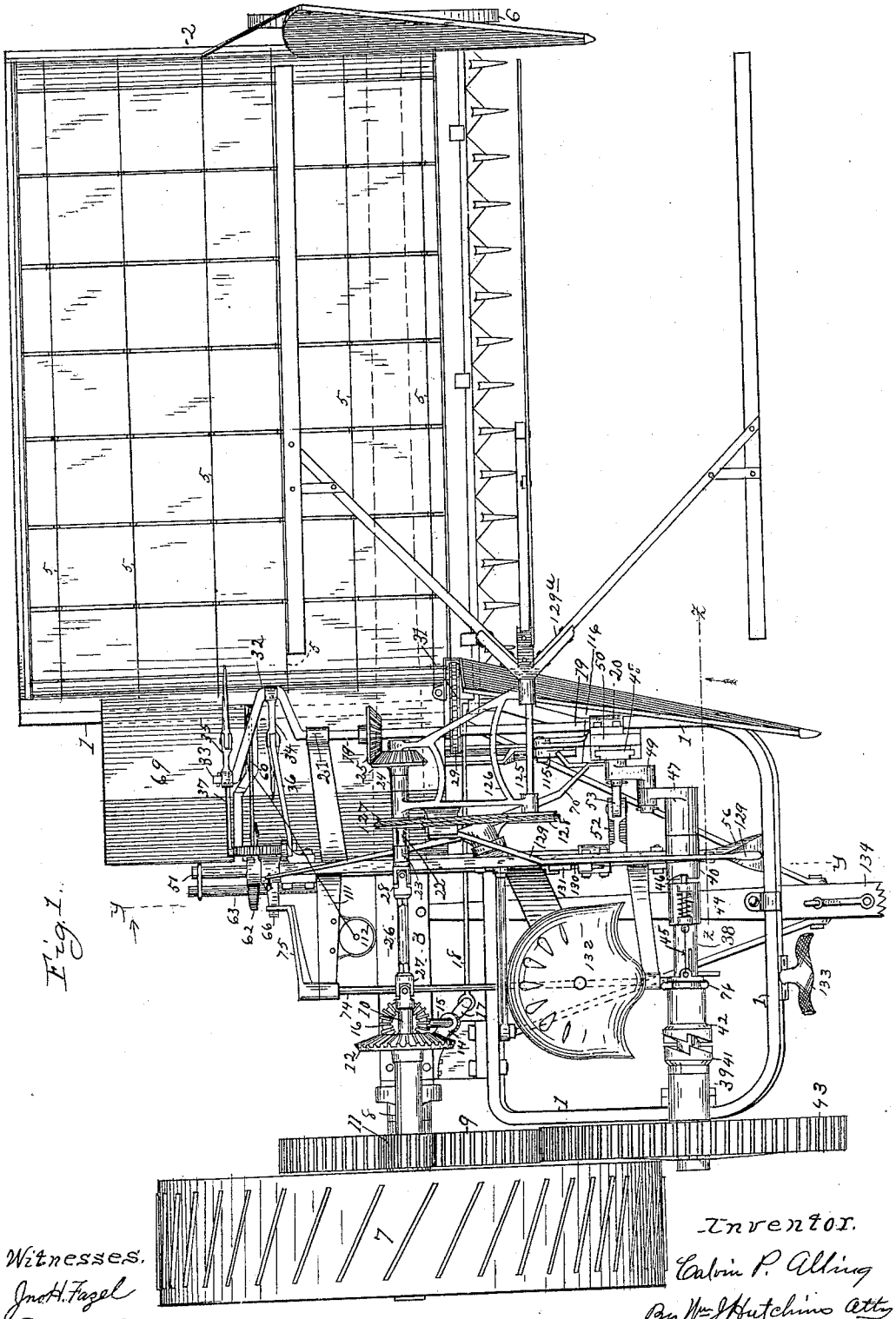


Fig. 1.

Witnesses.
Jno. H. Fazel
D. M. Brown

Inventor.
Calvin P. Alling
By Wm. J. Hutchins Atty

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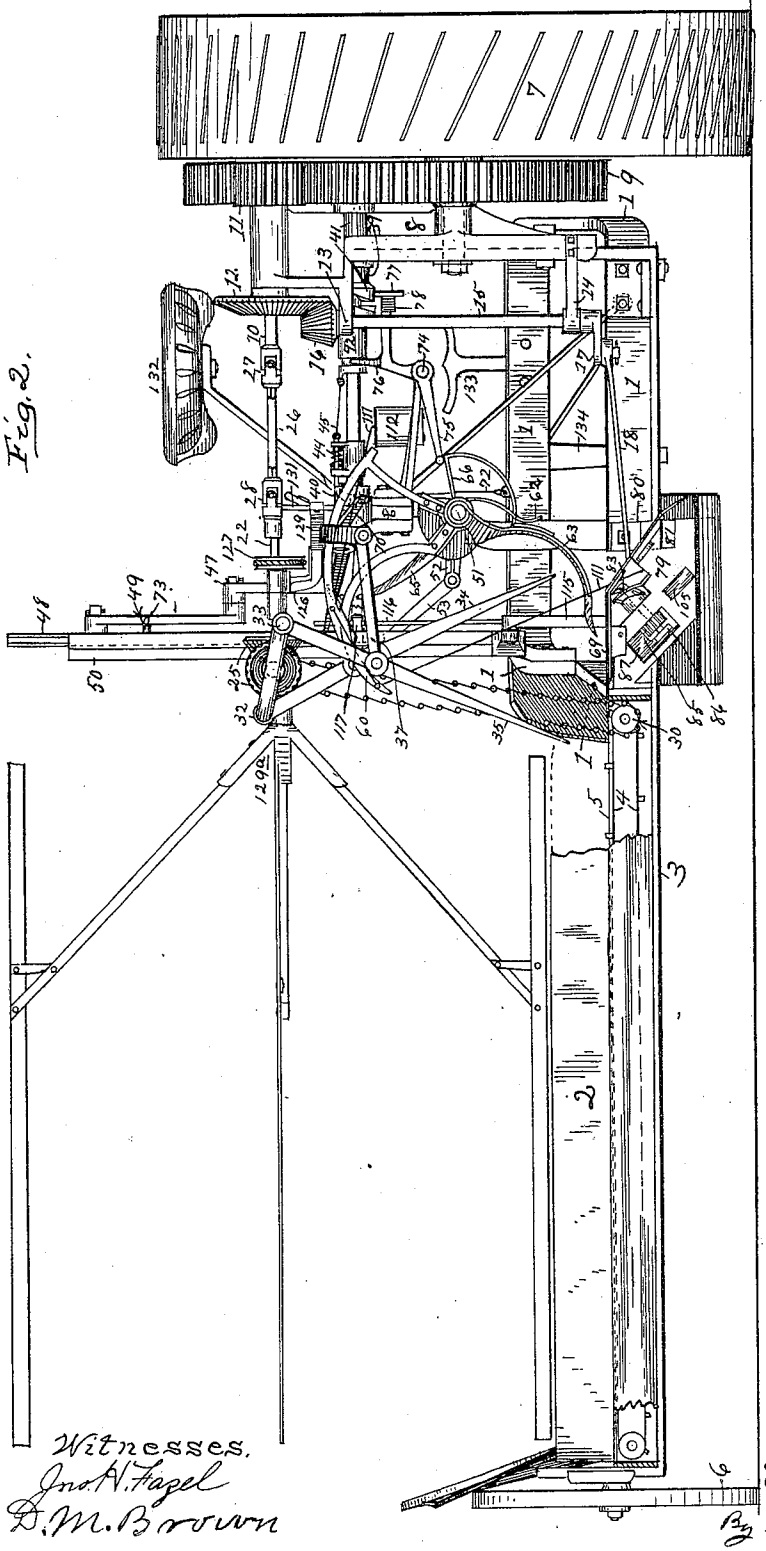
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Fig. 2.



Witnesses.
Jno. N. Fapel
D. M. Brown

Inventor.
Calvin P. Alling
By Wm. J. Hutchins atty

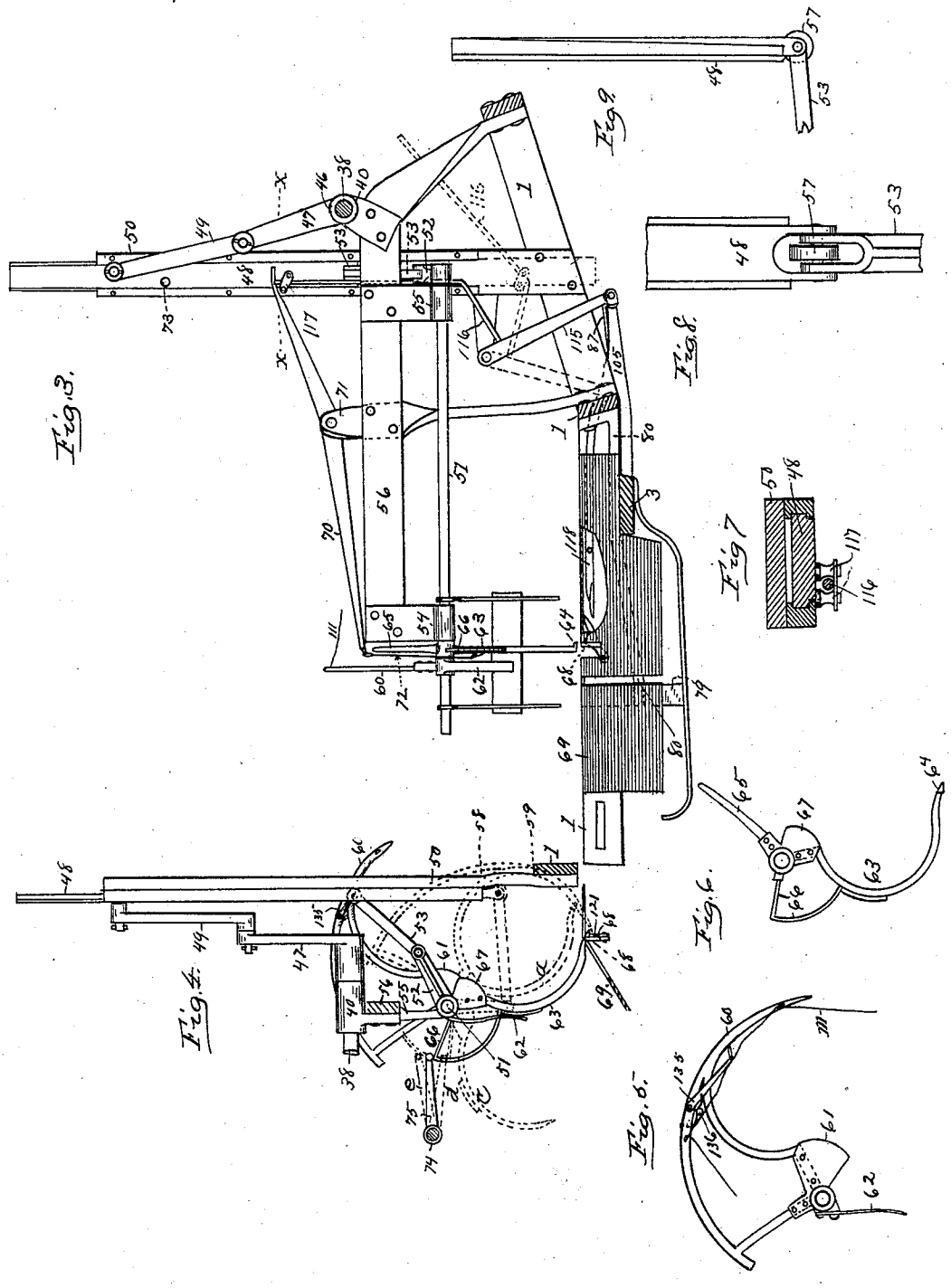
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GRAIN HARVESTING MACHINE.

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Witnesses.
Jno. H. Fagel
D. M. Brown

Inventor.
Calvin P. Alling
By Wm. J. Hutchins atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

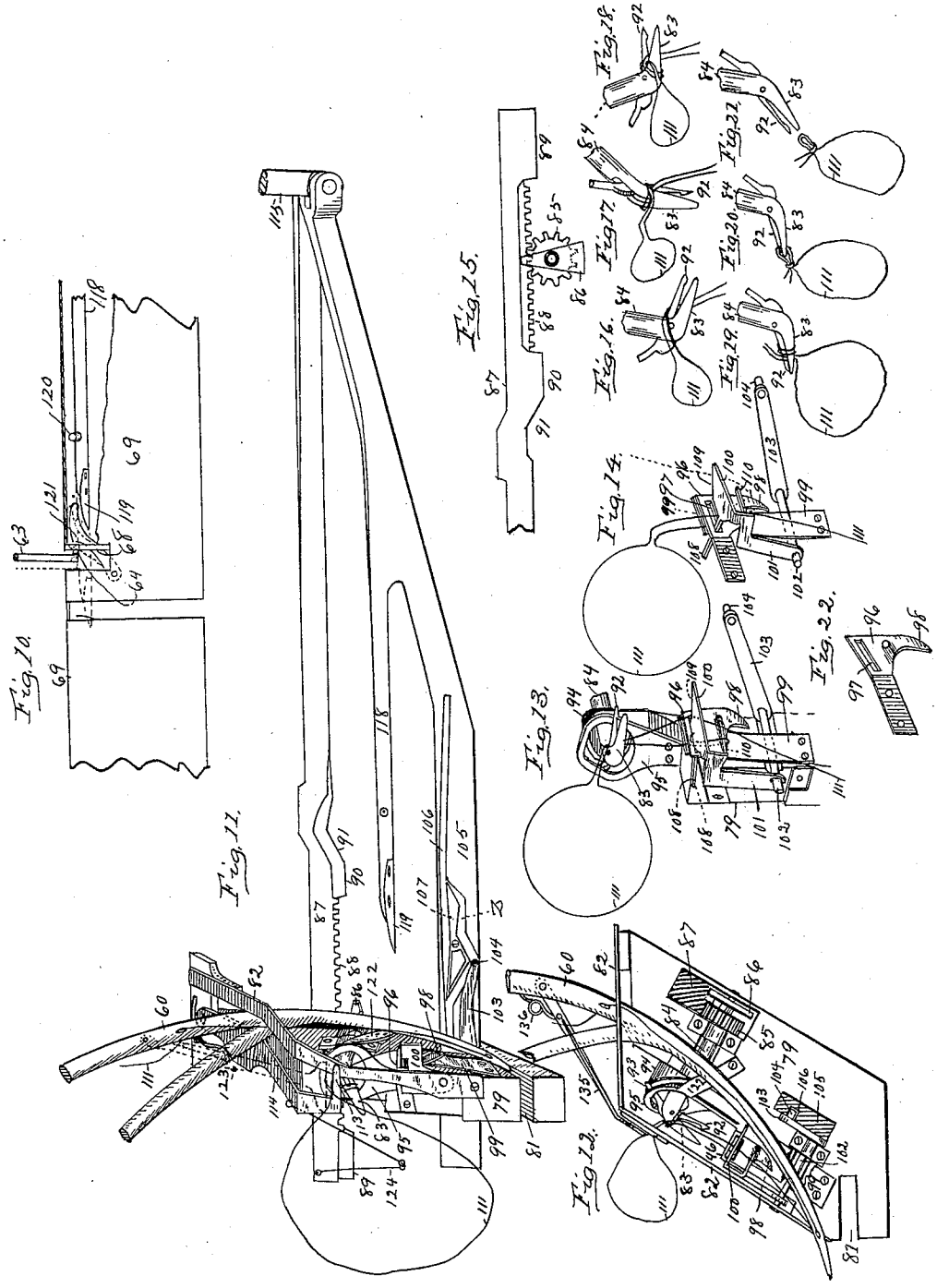
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C. P. ALLING.

GRAIN HARVESTING MACHINE.

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Witnesses.
Jno. H. Fagel
D. M. Brown

Inventor.
Calvin P. Alling
By Wm. J. Hutchins atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

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C. P. ALLING.

GRAIN HARVESTING MACHINE.

No. 589,380. Patented Aug. 31, 1897.

Fig. 23.

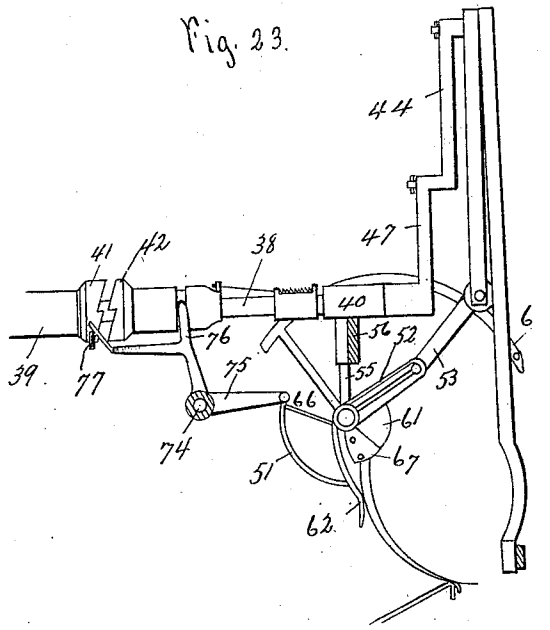


Fig. 24

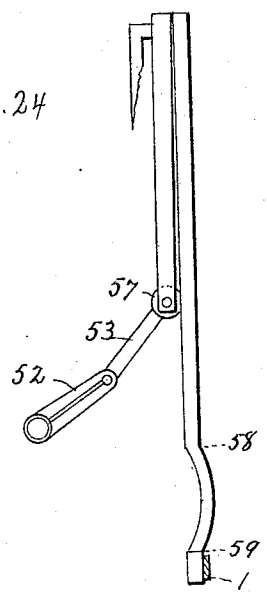


Fig. 25.

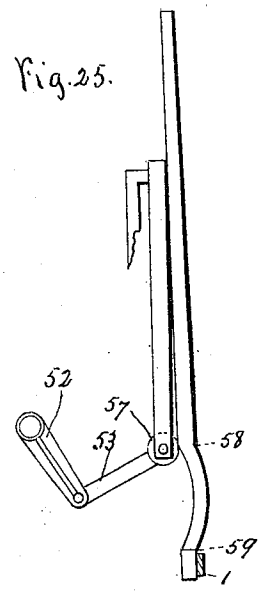
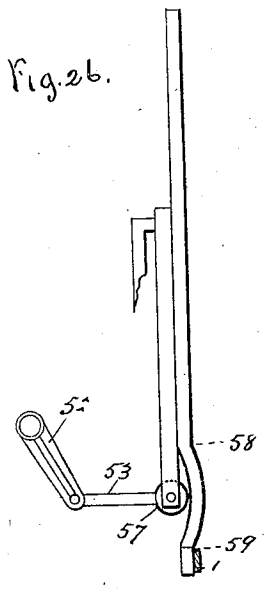


Fig. 26.



Witnesses
N. B. Hagen
J. E. Malstrom.

Inventor
Calvin P. Alling,

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CALVIN P. ALLING, OF CAMBRIDGE, KANSAS, ASSIGNOR OF ONE-HALF TO JOHN H. FAZEL, OF WICHITA, KANSAS.

GRAIN-HARVESTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 589,380, dated August 31, 1897.

Application filed August 2, 1892. Serial No. 441,917. (No model.)

To all whom it may concern:

Be it known that I, CALVIN P. ALLING, a citizen of the United States of America, residing at Cambridge, in the county of Cowley and State of Kansas, have invented certain new and useful Improvements in Grain-Harvesting Machines, of which the following is a specification, reference being had therein to the accompanying drawings, and the figures of reference thereon, forming a part of this specification, in which—

Figure 1 is a top plan of the machine; Fig. 2, a rear elevation of the same; Fig. 3, a sectional elevation of the binder mechanism of the machine on line *y y* of Fig. 1, looking in the direction of the arrow; Fig. 4, a sectional elevation of the binder mechanism of the machine in part on line *z z* of Fig. 1, looking in the direction of the arrow; Fig. 5, a detailed side view of the needle of the binder mechanism of the machine; Fig. 6, a similar view of the cradle of the binder mechanism of the machine; Fig. 7, a cross-sectional view of the vertical guideway and sliding head of the binder mechanism of the machine on line *x x* of Fig. 3. Fig. 8 is a face view of the lower end portion of said sliding head and of the wheel-traveler and a portion of the connecting-rod carried by said head. Fig. 9 is side view of the same, showing, however, the entire length of said head. Fig. 10 is a detailed side view of the cradle latch-piece and the mechanism for releasing the cradle-arm from said latch-piece, which device forms a part of the binder mechanism of the machine. Fig. 11 is a detailed perspective of the knotter mechanism of the machine. Fig. 12 is a side view of the knotter-head of said mechanism. Fig. 13 is a detailed perspective of the knotter-hook and twine-holding mechanism of said knotter-head. Fig. 14 is a similar view of said twine-holding mechanism, showing the jaw thereof open. Fig. 15 is a detailed view of the rack-bar and pinion mechanism of the said knotter mechanism, looking stubbleward. Figs. 16, 17, 18, 19, 20, and 21 are detailed perspectives of the knotter-hook of said knotter mechanism, showing its rotary position, the position of its pivoted finger, and the position of the binder-twine during the several stages of the operation of tying a knot to bind a bundle of grain. Fig. 22 is a detail perspective view of a slotted hooked plate for holding one end of the twine while packing and tying the bundle of grain. Fig. 23 is a sectional elevation of a portion of the binder mechanism and the clutch-operating mechanism. Figs. 24, 25, and 26 are side views of the sliding head and wheel-traveler with the connection-rod carrying said wheel, showing the operation of the same.

This invention relates to certain improvements in grain-harvesting machines and is of that class known as "low-down binders;" and it consists in certain novel construction and arrangement of parts of that portion of the machine known as the "binder," and the essential feature of said construction is the means whereby the knot-tying and twine-holding mechanism of the binder is actuated by a horizontal reciprocating movement, which improvements are fully set forth and explained in the following specification and pointed out in the claims.

The object sought to be obtained in this invention is to provide means whereby the grain may be taken from the harvester-platform and packed into a bundle, the bundle bound with twine and tied, and finally ejected from the machine without elevating the grain above the plane of said platform; and I attain such object by carrying the knotter mechanism of the binder below the plane of said platform, and by means of the horizontal reciprocating movement which actuates the knotter-hook and twine-holder in this binder, which construction avoids the use of bulky wheel mechanism, it becomes possible to arrange the said knotter mechanism very close to the ground and thereby attain the result sought.

Referring to the drawings, 1 represents the main frame of the harvester-binder mechanism, and 2 the harvester-platform, which platform is of the usual construction, having a cutter-bar and reciprocating sickle thereof of the usual pattern, and also is provided with the usual endless carrier-apron 4, the slats of which are notched, and a series of parallel wires 5 are stretched taut across the platform immediately above the apron in the direction of travel of the apron and arranged in the

notches of the apron-slats for the purpose of preventing straws from being carried down through the platform at the end of the apron adjacent the binder mechanism. Said binder-frame 1 and platform 2 are secured together in a suitable manner, preferably by bolts passing through holes of adjoining parts in such a manner as to adapt the said platform to be adjusted forward or rearward to accommodate its position to the binder mechanism; but the manner of such connection is not essential, and I deem it unnecessary to illustrate or describe any particular manner of such connection. As a means of support for said frame and platform I have arranged passing under them an axle-bar 3, which is made with an upturned part at each end, and to the upturned part thereof at the outer end of the platform is attached a traveling wheel 6, commonly known as the "grain-wheel," having its attachment of such construction as to permit vertical adjustment of that end of the said platform, and attached to the opposite upturned end part of said axle-bar is a head 8, having its attachment of such construction as to permit vertical adjustment of that end or side portion of the harvester and is provided with an extending spindle, upon which is arranged a traveling wheel 7, which is the drive-wheel of the harvester and carries on its hub or otherwise suitably attached a spur gear-wheel 9, which meshes with other gears to drive the operative mechanism of the harvester. Said head 8 is further provided at its upper end with a horizontal box having arranged therein a short shaft 10, which has fixed thereon at one end a spur-pinion 11, which is arranged in mesh with gear 9, and on its opposite end portion a bevel gear-wheel 12. Said head 8 is further provided with two side extending bracket-bearings 13 and 14, which support an upright shaft 15, which shaft has fixed thereon at its upper end a bevel-pinion 16, arranged in mesh with gear 12, and on its lower end a crank 17, which is commonly known as a "pitman-crank" and is adapted to operate the sickle of the harvester cutter-bar through the agency of a pitman 18.

19 is a horizontal shaft suitably supported in bearings 20 and 21 of parts attached to and supported by frame 1 and is arranged at right angle to and on or about on a plane with shaft 10, but, however, at the side adjacent the platform 2, and is driven by shaft 10 through the agency of a shaft 22, which is suitably supported in bearings 23 and 24, carried by parts connected with frame 1 of the pair of miter gear-wheels 25 and of an interposed section of shafting 26, which is connected at one end with shaft 10 by means of a knuckle-joint 27 and with shaft 22 at its opposite end by means of a like joint 28, which interposed knuckle-joints and shaft permit the shaft 10 and its parts, together with its support, to be adjusted vertically independent of shaft 19 and not interfere with the operation. Said shaft 19 is provided with a sprocket-wheel 29, which drives the endless apron-carrier 4 of the harvester through the agency of a sprocket-chain 31, which is arranged about said sprocket-wheel and a similar wheel or roller 30 of said apron mechanism. Said shaft 19 is further provided at its rear end portion with two opposite cranks 32 and 33, which carry and operate a pair of binder packer-arms 34 and 35, which packer-arms are governed in their movement by means of pivoted arms 36 and 37, each said arm being arranged connecting a packer-arm pivotally with a stationary bearing supported by parts connected with frame 1.

38 is a horizontal shaft arranged forward of and parallel with shaft 10 and is supported in bearings 39 and 40, which are supported by parts connected with frame 1. Sleeved on the outer end of said shaft is a clutch-head 41, the sleeve of which bears in bearing 39 and has fixed on it at the outer side of and adjacent to said bearing a spur gear-wheel 43, which is arranged in mesh with and driven by gear-wheel 9. Feathered on said shaft 38, adjacent to clutch-head 41, is a corresponding clutch-head 42, and when said clutch-heads are thrown into gear with each other said shaft will thereby be caused to rotate and when thrown out of gear said shaft will not be driven and hence will not rotate. Fixed on said shaft 38, adjacent bearing 40, is a collar carrying a spring latch-bolt 44, which is connected with clutch-head 42 by means of a wire 45, so arranged that when the clutch is out of gear the spring-bolt will be relaxed so it is permitted to enter a corresponding notch 46 of bearing 40, and thereby hold said shaft 38 from rotating at certain intervals of time, and when the clutch is in gear said spring-bolt will be withdrawn from its notch, and thereby release the latchhold and permit the shaft to rotate at certain intervals of time. The inner end of said shaft 38 is provided with a crank 47, which operates, when said shaft rotates, a vertically-reciprocating head 48 through the agency of a connecting-rod 49, which reciprocating head is supported and guided in its movement by means of an upright guideway 50.

51 is a shaft known in this machine as the "needle-shaft" and is supported in a horizontal position at right angles to and below the plane of shaft 38 by means of bearings 54 and 55, which bearings are secured to a beam 56, which is in turn supported by frame 1, as shown in Fig. 3. The forward end of said shaft 51 has fixed on it a crank-arm 52, which is connected with the vertically-reciprocating head 48 at the lower end of said head by means of a connecting-rod 53, which is pivoted at one end in the forked end of said crank-arm and is provided at its opposite end with a fork and with a traveling guide-wheel 57, arranged in said fork, and said fork and wheel are jointly pivoted in a fork of the lower end of said head. (See Figs. 8 and 9.)

By such construction when said head is operated the connecting-rod 53 will be operated, and thereby operate crank-arm 52 and impart an oscillating movement to shaft 51, and by reason of the said head having an intermittent movement said shaft-oscillating movement is likewise intermittent, and during the down movement of head 48 the said needle-shaft is caused to turn until the wheel 57 of connecting-rod 53 reaches a junction, (shown at 58 in Fig. 4,) when a curved form of the upright of guide 5 between junctions 58 and 59, which curve has a radius equal to the length of connecting-rod 53, permits said crank-arm 52 of the needle-shaft to stop further movement and the connecting-rod to move radially the distance of said curved section. (See Figs. 24, 25, and 26, and dotted lines, Fig. 4.) Fixed on the rear end portion of the said needle-shaft is the binder-needle 60, which is of the pattern shown in Fig. 5 and is provided with the wing 61, extending from its hub, reaching out to the junction of its face-curve and at its rear part secured to its hub portion with an extended yielding arm 62. The movement imparted to the needle-shaft likewise actuates the said needle, which movement, when the head 48 is at its highest position, holds the needle up, as shown by full lines in Fig. 4, which position the needle assumes when a bundle of grain is being accumulated in the binder, and when the head 48 is brought to its lowest position the needle will have been brought down about one side of the bundle, thereby placing the twine about the bundle and delivering the twine to the knotter mechanism in position to be tied, which operation will be more fully explained hereinafter.

Loosely hung on the needle-shaft 51, at the station of the needle, is a cradle 63, which comprises a central main arm terminating with a side latch-hook 64 of two side arms, somewhat shorter than the center arm, and of a board connecting said arms, as shown in Fig. 3, which arms are provided with a face-curve corresponding with that of the needle and are for the purpose of providing a barrier against which to pack a bundle when the same is being accumulated. Said cradle is further provided with a wing 67, extending from the hub of the central arm, reaching out to the junction of the face-curve of said arm, which wing being arranged adjoining wing 61 of the needle acts jointly with that of the needle to prevent straw from being crowded beyond the proper limit of the bundle at that place during the packing and tying of a bundle.

When the needle is held up, its yielding arm 62 is brought to extend downward and in such position as to bear against the back of cradle 63 and hold said cradle forward yieldingly to a position indicated by dotted lines shown at *a* in Fig. 4, where it remains until pressure against it caused by the packing of an accumulated bundle of grain overcomes the tension of needle-arm 62, when said cradle is forced back to a position shown by full lines in Fig. 4, where its latch-hook 64 engages a stationary latch-piece 68, and thereby prevents further back movement of the cradle for a time, and until after the tying of the bundle, when it is released by mechanism which will hereinafter be described. Immediately after the releasing of said cradle from its latched position, which takes place at a time when the head 48 has lowered nearly to its lowest position, the cradle is raised to a position shown by dotted lines *c* in Fig. 4 by means of a lever 70, which is shown in Fig. 3 fulcrumed to a post 71 and connected at its rear end to the cradle through the agency of a wire link 72, and is arranged at its forward end at the face of head 48 in such position as to be engaged by an extending pin 73 of said head and be carried down at that end and thereby raised at its opposite or rear end at the proper time to effect the raising of the cradle. Be it understood that such releasing and raising of said cradle takes place at the conclusion of the tying of each bundle, and by means of an extending arm 65 of said cradle, which is caused to be turned down as the cradle is raised, the bound bundles are ejected from the binder by reason of the striking of the bundle by said arm 65.

The cradle 63 is further provided on its back with an arm-piece 66, which when the cradle is in the position shown by said dotted lines *a* is held extending horizontally, and 74 is a rock-shaft supported in a position parallel with and a distance to one side from the needle-shaft by means of suitable bearings, as shown, and has fixed on its rear end a side extending arm 75, which arm rests at its free end on arm 66 of the cradle, and fixed on the opposite or forward end of said shaft 74 is an upright forked lever 76, having its fork arranged in an annular groove of the feathered clutch-head 42, which construction is of such character that when the cradle is moved back from the position indicated by dotted lines *a* in Fig. 4 to the position shown therein by full lines the arm 66 of the cradle will be raised correspondingly and will have raised arm 75 of rock-shaft 74 from the position indicated by dotted lines *d* in Fig. 4 to the position represented therein by full lines, which movement will cause the forked lever 76 to be thrown and thereby throw the clutch-head 42 in gear, but not, however, the full limit with clutch-head 41, which action will take place automatically when a bundle of grain is ready to be bound and will by reason of such registering of clutch cause the latch-bolt 44 to be withdrawn, as before stated, and the binder mechanism to operate to bind and tie the band of the bundle, eject the bound bundle, and bring the parts to proper position for a succeeding bundle, which action will require but a single rotation of shaft 38, and during the latter part of said rotation an extending pin 77 of

clutch-head 41 will have engaged a cam-faced extension on arm 78 of the forked lever 76, (see Fig. 2,) said pin acting as a wiper, which causes said forked lever 76 to be reversely thrown, and will thereby, aided by the momentum of the moving parts and the downward-moving weighted rearward side of shaft 38, throw said clutch-heads out of gear, which action will release the spring latch-bolt 44, so it will be free to enter its notch 46 at the conclusion of said rotation, and will thereby hold the binder parts from movement until a succeeding bundle is ready to be bound, when another like operation will take place.

The binder in this machine is provided with a table 69, upon which the grain is conducted from the platform endless carrier-apron by the action of the packer-arms, and immediately below this table is arranged the knotter-head 79, which head is supported at its end, adjacent to the harvester-platform, against the rear extending portion of frame 1, and at its opposite end portion by means of a rear extending bar 80, which is secured to the rear side part of frame 1, the head 79 being provided with a recess 81, into which said bar is arranged. Said knotter-head is of the substantial form shown in Figs. 11 and 12 and is arranged in an inclined position, as shown in Figs. 2 and 12, and has a portion of its side or face formed as by cutting away from a true outline, which face and upper side thereof also is supplanted by an irregular-shaped bar, which serves as a guide for properly conducting the binder-twine to and upon the knotter-hook. The said knotter-hook is shown at 83 arranged immediately within the bounds of bar 82 and made integral with a short shaft 84, which is boxed in head 79 and has fixed thereon in a rear recess of said head a toothed pinion 85, and adjacent said pinion is a rider-head 86, and arranged in said recess is a horizontally-operating bar 87, provided with a section of rack-teeth 88, adapted to be brought to mesh with and rotate pinion 85, and with a straight rider 89 at the rear end of the bar and adjoining the toothed section, which when that portion of the bar is in the head-recess rides upon one straight side of head 86, while the rack-teeth and pinion are out of mesh, for the purpose of holding the knotter-hook from rotation at such position of parts, and also with a corresponding section or rider 90, adjoining the opposite end of rack 88, which is for a like purpose, and, further, with an inclined rider-section 91, adjoining section 90, which when riding upon head 86 causes said head to partially rotate in accommodating its engaged side to such angle and thereby partially rotates the knotter-hook, for a purpose which will hereinafter be explained. Said knotter-hook is provided with a pivoted finger 92, arranged in a recess of said hook, which finger is provided with a rear extending arm 93, which operates when the hook is rotated between two stationary cams 94 and 95 of the knotter-head, which cams cause said finger to be operated to open at a given junction during such rotation, so the binder-twine may be entered between said hook and finger and to close upon said twine and hold it during other stages of tying a knot until the knot is made and to finally open and release the knot. Obliquely below said knotter-hook is arranged attached to the knotter-head a twine-holder consisting of a stationary plate 96, having in its upper portion a horizontal slot 97 and provided at its lower portion with a downwardly and outwardly extending horn 98, of a spring-plate 99, having its free upper end arranged at the inner side of and bearing against the plate 96, and of a pivoted jaw 100, having a down-extending arm 101, which is fixed on a short rock-shaft 102, which is boxed to head 79, and by means of which said jaw is pivoted, which shaft is further provided with a lever 103, which is provided with a side extending stud 104 at its end portion, which stud is arranged to operate in a channel 106 of a cam-bar 105, which bar is arranged to operate horizontally through a recess of the knotter-head and parallel with the rack-bar 87, and when reciprocated will impart movement by reason of the form of its cam-channel to lever 103 and thereby actuate the twine-holding jaw 100. Said cam-bar is provided in the construction of its cam-channel with a pivoted cam-section 107, which is made heaviest at its forward end, so that by gravity the rear end thereof will be held elevated, so that when the bar 105 moves rearwardly the stud of lever 103 will be conducted downwardly in the lower circuit of said channel, and as it emerges from said down circuit it will raise the weighted end of said pivoted section 107 and pass into the upper circuit of the channel, and so that when the return movement is given bar 105 said stud will be directed along the upper circuit of said channel and hence above said pivoted section, crowding down the elevated end of said section as it is passed. Said twine-holding jaw 100 is further provided, extending from its face, with an arm 108, which is arranged extending through one end of slot 97 of plate 96 and serves as a guard to prevent the twine as it enters between the face of jaw 100 and plate 96 from being carried beyond a proper limit. Also one side of said jaw is made inclined toward the face thereof, as shown at 109, so as to properly guide the twine to the position between said jaw-face and plate 96, during which time the twine is placed in the grip of the jaw and after looped about the horn 98 of plate 96, and is brought up between said plate and the spring-plate 99. (See position of one twine part in Fig. 13, which is the position of the twine end held by said jaw 100 when the needle is raised and bundle is being accumulated.

The binder-twine is represented by 111 and is held in a box 112, the end thereof being drawn from the box and threaded in the needle, as shown. The first movement down of

the needle places the twine in the holder, as stated, and thereafter the raised position of the needle holds the twine extended from the holder up to the needle, as represented in Fig. 2, and in such position that the grain of an accumulated bundle will be packed against it, and also the twine thus placed is drawn over the knotter-hook 83 in a manner as shown in Figs. 13 and 16, and when the bundle is packed against it will rest upon the lateral portion 113 of a pivoted arm 114, which prevents it from moving too far down.

At the junction of the knotter-head the binder-table is divided so as to form a slot for the down-passage of the needle and twine to the knotter mechanism, the path of the needle being at one side of the knotter-head 79, as shown in Figs. 11 and 12, and as the needle is moved down it brings the twine about the bundle and carries it down, laying it against the knotter-hook, against the inclined face 109 of the holding-jaw 100, against the jaw-finger 110, and past the horn 98 of plate 96, as shown in Fig. 13, where the needle remains for a short period of time, caused by the curved form of the upright guideway 50, holding it thus until the knot is tied, which is caused by the movement of bars 87 and 105, which bars are jointly pivoted to the lower ends of the arm 115, (see Fig. 3,) which arm is pivoted to a bracket-bearing and is provided with a laterally-extending arm 116, which is bent a distance from arm 115, so as to extend upright at the face of head 48, when the parts are in the position shown in full lines in Fig. 3. A keeper is fixed to head 48 and about the upright part of arm 116, and when the head 48 moves down the keeper 117 slides over the upright part of arm 116 and does not operate the said arm until after the needle has been brought down as last described, when the keeper 117 will have lowered to engage the lateral portion of said arm 116 at the bend thereof, and during the later portion of the down movement of head 48 carries said arm 116 down, and thereby operates arm 115, as represented by the dotted lines, thus causing said bars 87 and 105 to be operated as they are moved rearward, section 89 of bar 87 rides off the rider-head 86 and the rack 88 meshes with pinion 85, causing the pinion to rotate, and likewise rotating the knotter-hook from a position shown in Figs. 13 and 16 upward and over from the right toward the left, and at the same time the twine-holding jaw is being actuated by the movement of the cam-bar 105, causing said jaw to open, as represented in Fig. 14, which releases the end of the twine held by the jaw-face, thereafter permitting that end of the twine to be held between plate 96 and spring-plate 99 only by the tension of said spring-plate, so that it may be drawn therefrom as it is required in tying the knot without liability of breaking it. Also by such opening of the jaw the twine extending from the needle, which has been bearing against the inclined side of the jaw, is permitted to enter between said jaw-face and plate 96, which takes place as the stud of lever 103 rides down the inclined channel portion shown to the left in Fig. 11. Immediately thereafter said lever-stud changes its course up the first inclined section to the right in said figure and gains a horizontal section of the channel indicated by *z*, which causes the jaw to partially close and hold but lightly on the twine, in order that the twine may be permitted to draw from the needle to feed the knotter-hook with twine during the tying of the knot without liability of breaking that portion of the twine, and as the knot is nearing completion the said lever-stud rides up the last inclined section of channel at the right in said Fig. 11, and thus causes the jaw to fully close, which firmly grips the twine which is between said jaw and plate. At this stage of movement a knife-arm 118, which is carried by the cam-bar 105, as shown in Fig. 11, is advanced toward the knotter-head so its knife 119 has entered the space between the knotter-hook and twine-holder and has severed the twine which has extended from said hook through the holder to the needle, and thus formed, by said cutting, a second end of twine, which ends have been gripped by the pivoted finger of the knotter-hook and held until the knot is complete. At this juncture of movement the knife-arm 118, which is provided with a side extending stud 120, has advanced to bring said stud to bear against a lever 121, (see Fig. 10,) which is fulcrumed to table 69, causing said lever to be operated against the latched end of the end of the central arm of the cradle 63 in such manner as to release said cradle-arm, so the bound bundle may be ejected in the manner described. Also at said stage of movement the needle commences to move upward, and in so doing loops the twine which has been carried up in front of plate 96, as shown in Fig. 13, past its horn 98, and now returns in rear of the same, as shown in Fig. 14 by the dotted line, about the horn 98 of plate 96, and then draws it up between said plate and the yielding plate 99, where it is held ready for a succeeding bundle.

A plate 122 is secured to the knotter-head side with one end bearing against the outer knotter-hook cam 95, which plate serves as a guard to prevent the twine catching on the said knotter-hook cam. Nearing the conclusion of the tying of each bundle the pivoted holding-arm 114 is pulled to one side to move its lateral portion 113 from the path of the twine, so the knot may be completed by slipping it from the knotter-hook, which is done by the ejectment of the bundle, said arm 114 being connected with the rack-bar 87, by means of the links 124, in such manner that when the said bar is moved out nearly its full limit said links will become taut and carry out said arm, and when said links are slackened said arm will be returned by the action of a spring shown at 123 in Fig. 11.

In forming the upper portion of the cam-

channel of cam-bar 105 it is given a slight curve, as shown in Fig. 11, in order that the lever 103 of the twine-holding jaw may be held steady, whereas the said bar 105 is given a slight rocking motion combined with its reciprocating movement, caused by the curved circuit of the pivotal connection of said bar with the arm 115.

It will also be understood by reference to the drawings that the latch mechanism of the cradle-arm is located below the binder-table 69 and that said arm has access to its latch-piece through a slot in said table, and the latching of the cradle-arm is accomplished by the said arm being made yielding, so as to spring off from and pass the fixed beveled latch-piece below the binder-table.

The harvester-reel 129[a] is carried on a shaft 125, boxed in the forward outer part of a frame 126, (see Fig. 1,) which frame is hinged on shaft 22, as shown. A sheave-pulley 127 is fixed on said shaft 22 and serves as a drive-pulley to operate the reel, and to that end and purpose a belt is passed about said pulley and about a corresponding pulley 128 of shaft 125, which belt serves as the agent to drive the reel from said former pulley. Said hinged frame 126 is provided with a side extending lever 129, which is of the usual construction of levers, and provided with a spring latch-bolt 130, which is actuated to engage notches of a post 131, which parts render the lever adjustable to vertically adjust the reel by turning frame 126, which latch mechanism is of the usual pattern and requires no further illustration or description.

The harvester is further provided with a driver's seat 132, with a foot-rest 133, and with a draft-tongue 134, which tongue is arranged connected with the axle-bar 3 and braced to the harvester-frame and located in such position as to prevent side draft of the harvester when in service.

It will be observed that the construction of the harvester is such that there is a free open space adjacent the binder-table and in the rear of the axle-bar, so that nothing will interfere with the free discharge of the bound bundles, and therefore the bundles are dropped from the binder-table to the ground without elevating or handling and at a distance sufficient from the standing-grain side of the harvester so as not to be in the path of the harvester.

In operation the cut grain falls upon the platform endless apron-carrier 4, which travels continuously, and is by said apron carried in the direction of the binder mechanism the limit of the platform, from which junction the packer-arms engage and convey it upon the binder-table 69 and pack it against the cradle 63, which when a sufficient quantity has accumulated for a bundle has forced back said cradle, overcoming its yielding holder and latch, which action has caused the clutch-trip mechanism to be operated to throw the clutch-heads into gear, which further causes the binder mechanism to at that time start the operation of binding the bundle in the manner described, which is accomplished in a single rotation of the clutch-shaft, as before stated, and during the binding of a bundle the spine or back of the needle, which is at that time down, serves as a divider of the straw contained in the bundle and that being delivered from the platform-apron, and as it is the plan in this machine that the limit of movement of the packer-arms shall not be beyond the limit of the needle-spine when the needle is down, it is evident that said packers will for a time operate idly and that the grain delivered by the apron during the binding operation will be upon the end of said apron adjacent the binder and in readiness to be taken into the binder as soon as the needle shall be raised, and therefore in harvesting the usual growth of grain a succeeding bundle will be quickly made up.

By reference to Figs. 16, 17, 18, 19, 20, and 21 the several stages of the tying of a knot may be observed, which has practically been described; but, however, I desire to state more fully that after the process of tying a knot has reached the stage shown in Fig. 19, which has required about one and one-half rotations of the knotter-hook, wherein the twine is wrapped about the said hook and finger thereof in rear of the twine ends held in the grasp of said finger, the bundle is ready to be ejected from the binder, which is done by the arm 65 of the cradle being brought down as the cradle is raised, causing said arm to engage the bundle, which forces it from the binder-table, which force draws on the twine and pulls the twine parts which are wrapped about the knotter-hook and finger thereof off said hook and finger and over the twine ends held in the grasp of said finger, thus drawing said ends through the knot and forming the loop, as represented in Fig. 20. At this stage of operation the knotter-hook is given a partial further rotation in the manner hereinbefore described, which causes the finger thereof to slightly open and release said loop, as represented in Fig. 21, when the bundle is fully liberated from the binder.

It will be observed by reference to the drawings that the binder-table 69 conforms to the knotter-head guide-bar 82, and by reference to Fig. 12 it will be observed that the path of the binder-needle is a distance from the angle of said bar, which is necessary in order that the needle may in its down movement lay the twine upon the knotter-hook, as described.

It will also be observed that the junction of tying the band-knot is a distance down the inclined side of the knotter-head, and therefore it becomes necessary that the upper portion of the binder-twine shall be crowded from its down-path to the junction of tying the knot, which position of twine is shown in Figs. 12, 13, and 14, which operation is accomplished by means of an arm 135, which is pivoted to the needle-spine, held in

its inactive position by means of a spring 136, as shown in Fig. 5, and adapted when the needle is down to engage upon the horizontal surface of the binder-table 69 and ride out upon said table and down the inclined face thereof to the junction of the knotter-hook, as shown in Fig. 12, the free end of said arm being sufficiently broad to span the table-slot, as shown by dotted lines in Fig. 11, and will therefore engage and crowd the twine along and down said slot, as stated. Also any grain-straw which may chance to be upon the horizontal portion of the binder-table will be crowded along with the twine, which construction not only facilitates in holding the twine in proper position for tying, but assists in compacting the bundle and therefore insures a tighter binding of the bundle.

Having thus described my invention, what I claim as new and useful, and desire to secure by Letters Patent, is as follows:

1. In the harvesting-machine described, the combination with the binder drive-shaft thereof provided with a driven clutch-head sleeved thereon, with a corresponding clutch-head feathered thereon; of the rock-shaft provided with a forked lever arranged to throw said feathered clutch-head into and out of gear with the sleeved clutch-head, and with an extending arm arranged resting upon and adapted to be operated, to rock the shaft, by an extending arm of the binder-cradle, and of the said binder-cradle adapted to be given movement to actuate said arms by means of the pressure of an accumulating bundle of grain, substantially as and for the purpose set forth.

2. In the harvesting-machine described, the combination with the binder drive-shaft provided with the crank; of the vertically-arranged reciprocating head, the connecting-rod, for connecting said crank and head, the oscillating arm provided with the laterally-extending and bent arm, the keeper fixed to said head for retaining and actuating said bent arm, the horizontal reciprocating rack and cam bars connected with and adapted to be actuated by said oscillating arm, the knife-arm carried by said cam-bar and the knotter-head and mechanism thereof, substantially as and for the purpose set forth.

3. In a grain-harvesting machine, in combination with the drive mechanism thereof, a grain-binder comprising a shaft provided with a clutch mechanism adapted to be thrown into gear to rotate said shaft, by the pressure of an accumulating bundle of grain, an interposed trip mechanism for actuating said clutch, a vertically-arranged reciprocating head, a crank and connecting-rod arranged connecting said shaft and head for imparting movement from said shaft to said head, of an oscillating needle-shaft connected with and adapted to be operated by said reciprocating head, a knotter-head provided with mechanism for holding the binder-twine and tying the binding-knot, a cam-bar and a rack-bar connected with and adapted to be reciprocated horizontally by said reciprocating head to actuate said twine-holding and knot-tying mechanism, a yielding cradle for holding an accumulating bundle of grain, packer-arms operated to deliver grain to and pack it against said cradle, and a needle for placing the binder-twine about the bundle and to the knotter mechanism, substantially as set forth.

4. In the grain-binder described, the combination with the knotter-head, and with the horizontally-arranged channeled cam-bar adapted to have a reciprocating movement imparted thereto, of the twine-holding device consisting of the stationary slotted plate provided with the extending horn, the spring-plate in the rear of said slotted plate, and the pivoted jaw provided with the extending arm and arranged to operate at the face of said slotted plate, and provided with the lever having the side extending stud arranged in the channel of and adapted to be actuated, to operate said jaw, by the movement of said cam-bar, in the manner substantially as and for the purpose set forth.

5. In the grain-binder described, the twine-holding device consisting of the combination with the cam-bar adapted to have a horizontal reciprocating movement imparted thereto, of the stationary slotted plate provided with the downwardly and outwardly extending horn; the spring-plate arranged at the back of, and bearing against said stationary plate, and of the pivoted jaw provided with the inclined side, with the guard-arm, with the twine-holding finger, and with the actuating-lever, substantially as set forth.

6. In the grain-binder described, the combination with the vertically-reciprocating head provided with the extending face stud or lug and with the hinged binder-cradle; of the lever arranged at one end connected with said cradle, and at its opposite end in the path of said head-stud, wherein a down movement of said head will cause said cradle to be raised, in the manner substantially as and for the purpose specified.

7. In the grain-binder described, the combination with the stationary latch-piece of the binder-cradle provided with the extending hook-arm adapted to register with said latch-piece, the pivoted lever arranged adjacent to said latch-piece, adapted to be operated to engage said cradle-arm and release it from said latch-piece, and the horizontally-arranged arm having the extending stud adapted, when reciprocated, to engage and operate said lever, in the manner substantially as set forth.

8. In the grain-binder described the combination with the binder-needle provided with the extending, yielding arm; of the hinged binder-cradle arranged to be held forward by said arm, when the needle is raised, in the manner substantially as and for the purpose set forth.

9. In the grain-binder described, the binder-

needle and binder-cradle thereof respectively provided with the adjacent wings arranged extending from their hub portion to the junction of their face-curve, in the manner substantially as and for the purpose set forth.

10. In the grain-binder described, the combination with the vertically-reciprocating head 48, and the horizontally-reciprocating bars 87, and 105; of the oscillating arm 115, provided with the lateral extending and bent arm 116, and arranged pivoted at its swinging end with said bars, and of the keeper 117, of said head, arranged to hold said lateral arm from movement during certain partial reciprocations of said head, and to operate said arm to impart movement to said bars at other certain partial reciprocations of said head, in the manner substantially as and for the purpose set forth.

11. In the grain-binder described, in combination with the knotter-head and the knotter-hook and twine-holder thereof; the stationary guide-bar, 82, the pivoted twine-holding arm 114, the spring for holding said arm into position for service, and the reciprocating bar-and-link connection for operating said arm, in the manner substantially as and for the purpose set forth.

CALVIN P. ALLING.

Witnesses:
WM. J. HUTCHINS,
JNO. H. FAZEL.