(No Model.) 11 Sheets—Sheet 1.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

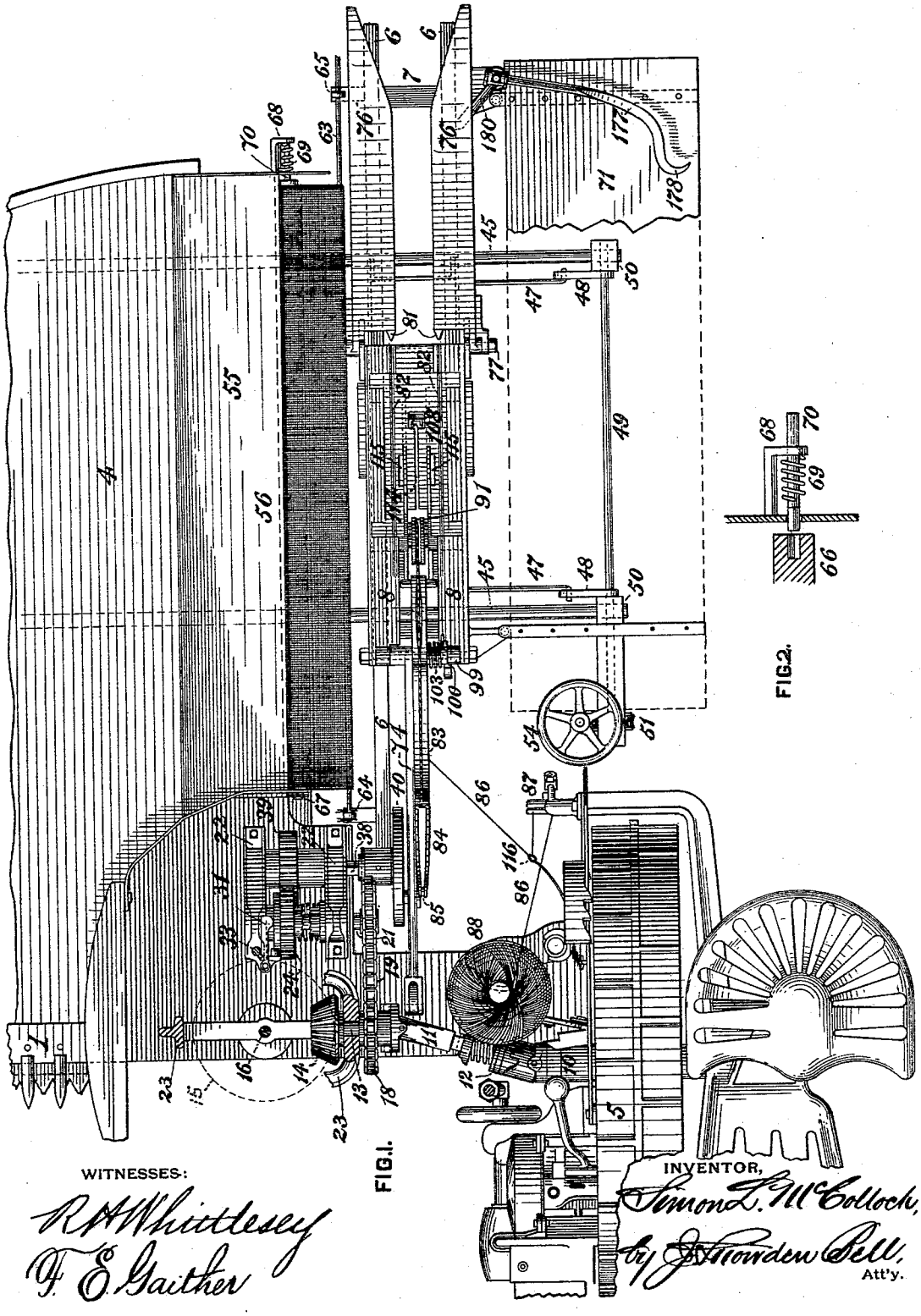


FIG. 1.

FIG. 2.

WITNESSES:

R. A. Whittlesey

F. E. Gaither

INVENTOR,

Simon L. McColloch,

by J. Stewardson Bell,

Att'y.

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

(No Model.) 11 Sheets—Sheet 2.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

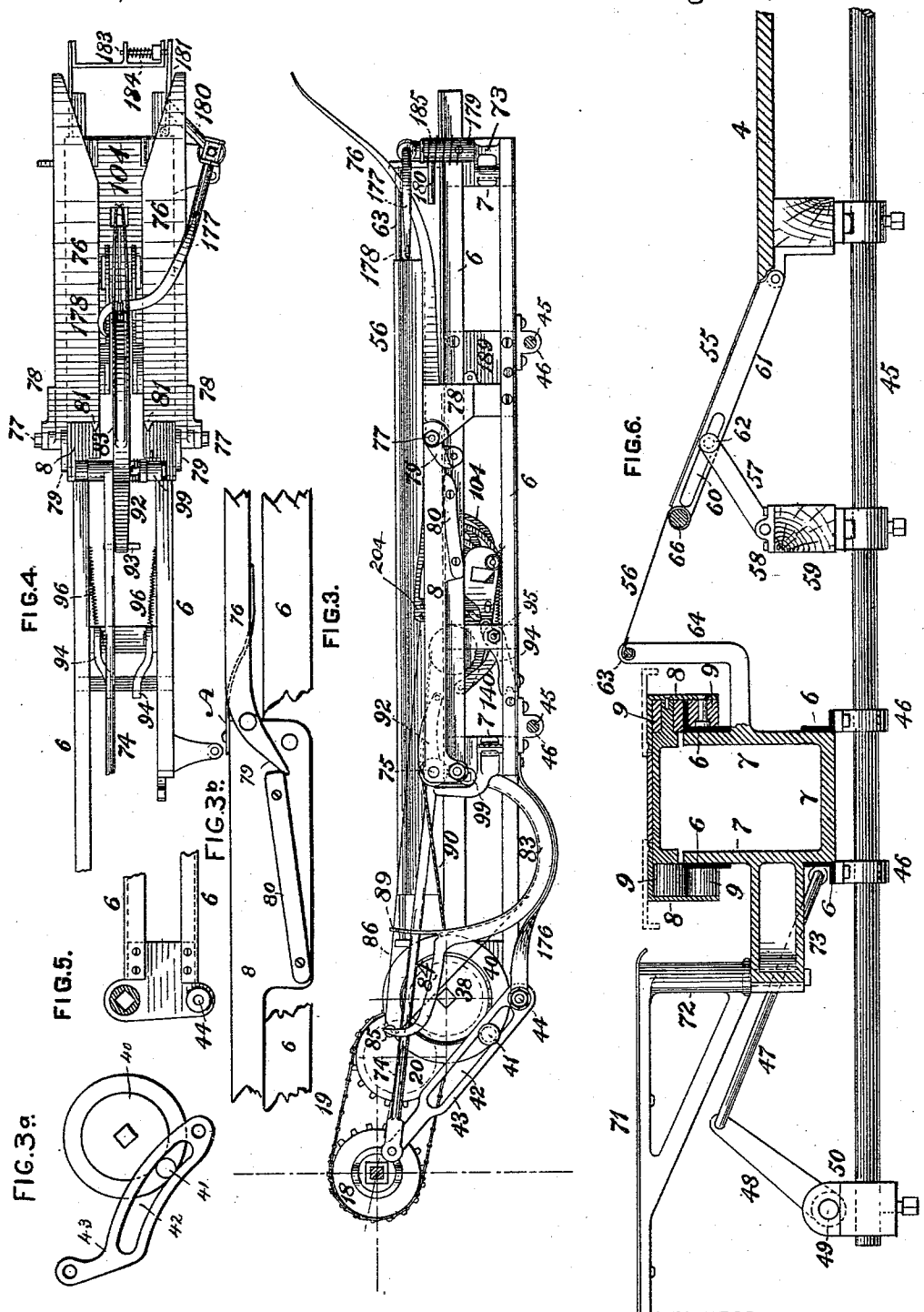


FIG.4.

FIG.3.

FIG.3b.

FIG.5.

FIG.3a.

FIG.6.

WITNESSES:

R. F. Whittlesey

F. E. Gaither.

INVENTOR,

Lemuel L. McColloch

by J. Snowden Bell.

Att'y.

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

(No Model.) 11 Sheets—Sheet 3.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

FIG. 9.

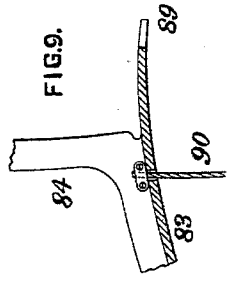


FIG. 7.

FIG. 8.

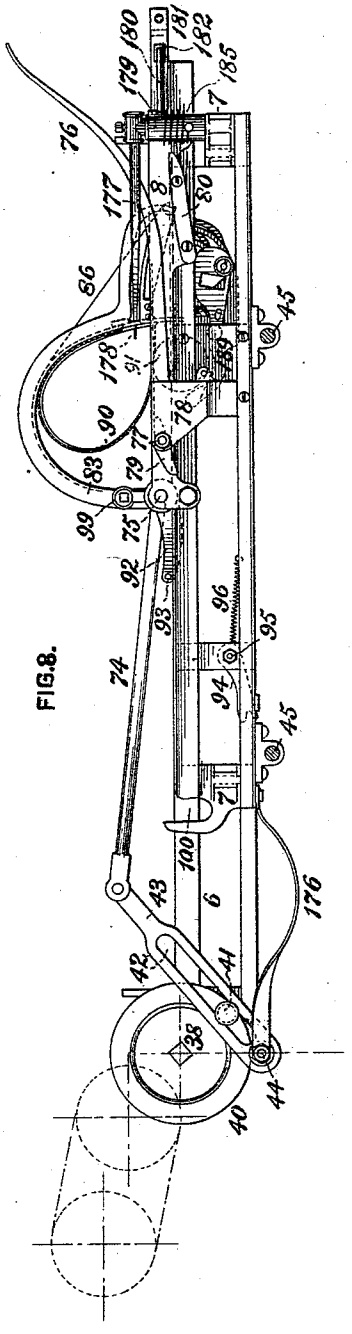
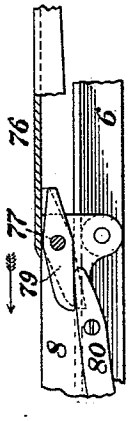


FIG. 10.



WITNESSES:

R. H. Whittlesey

F. E. Gaither.

INVENTOR,

Simon L. McColloch,

by J. Thornden Bell, Att'y.

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

(No Model.) 11 Sheets—Sheet 4.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

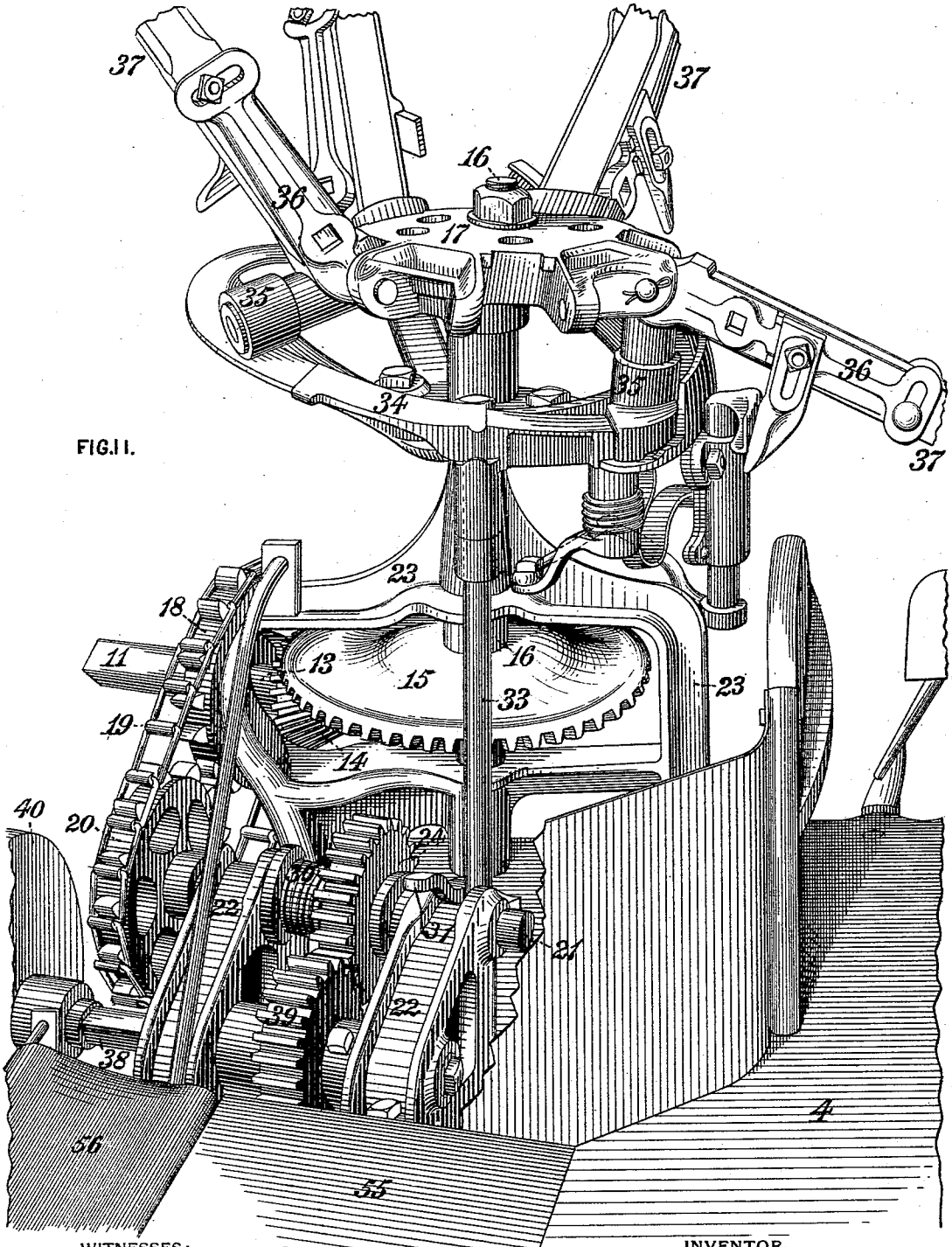


FIG. 1.

WITNESSES:

R. F. Whittlesey

F. E. Gaither

INVENTOR,

Simon L. McColloch,

by J. Stowdew Bell,

Att'y.

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

(No Model.) 11 Sheets—Sheet 5.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

FIG. 13.

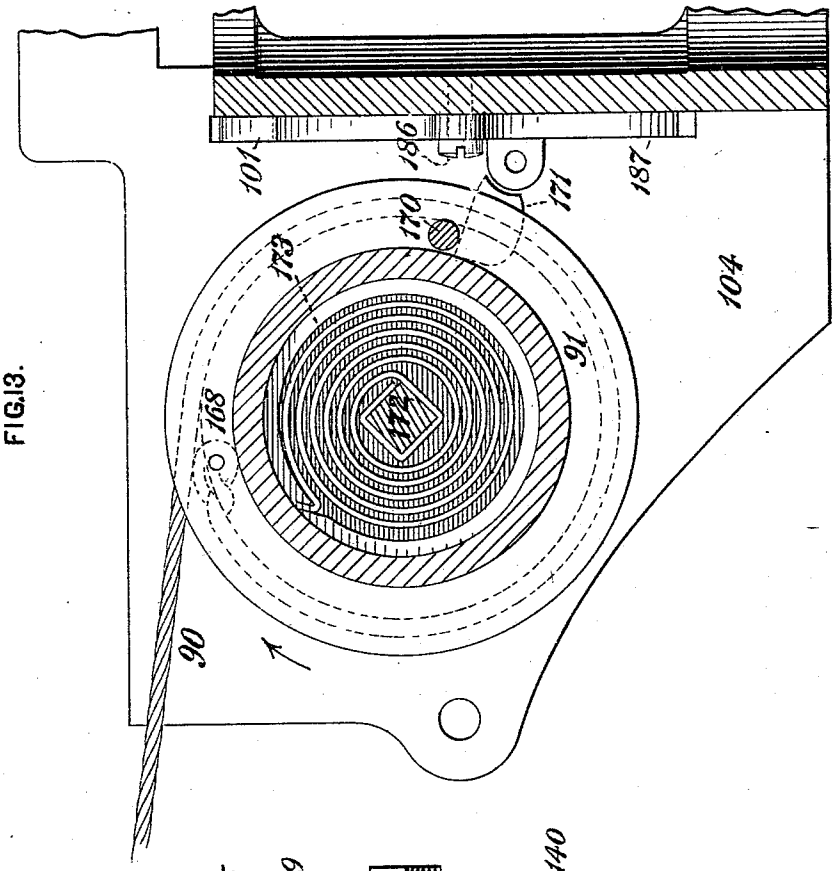
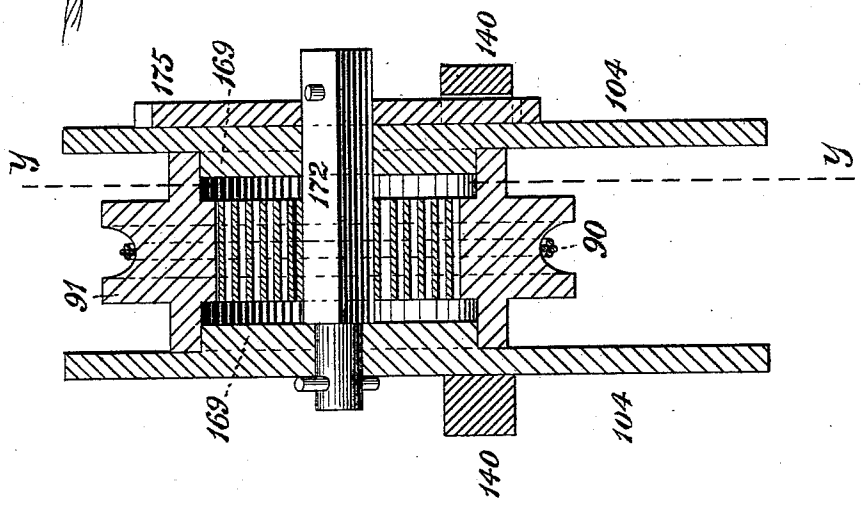


FIG. 12.



WITNESSES:

R. F. Whittlesey

F. E. Gaither.

INVENTOR,

Lemuel L. McColloch.

by J. Snowden Bell.

Att'y.

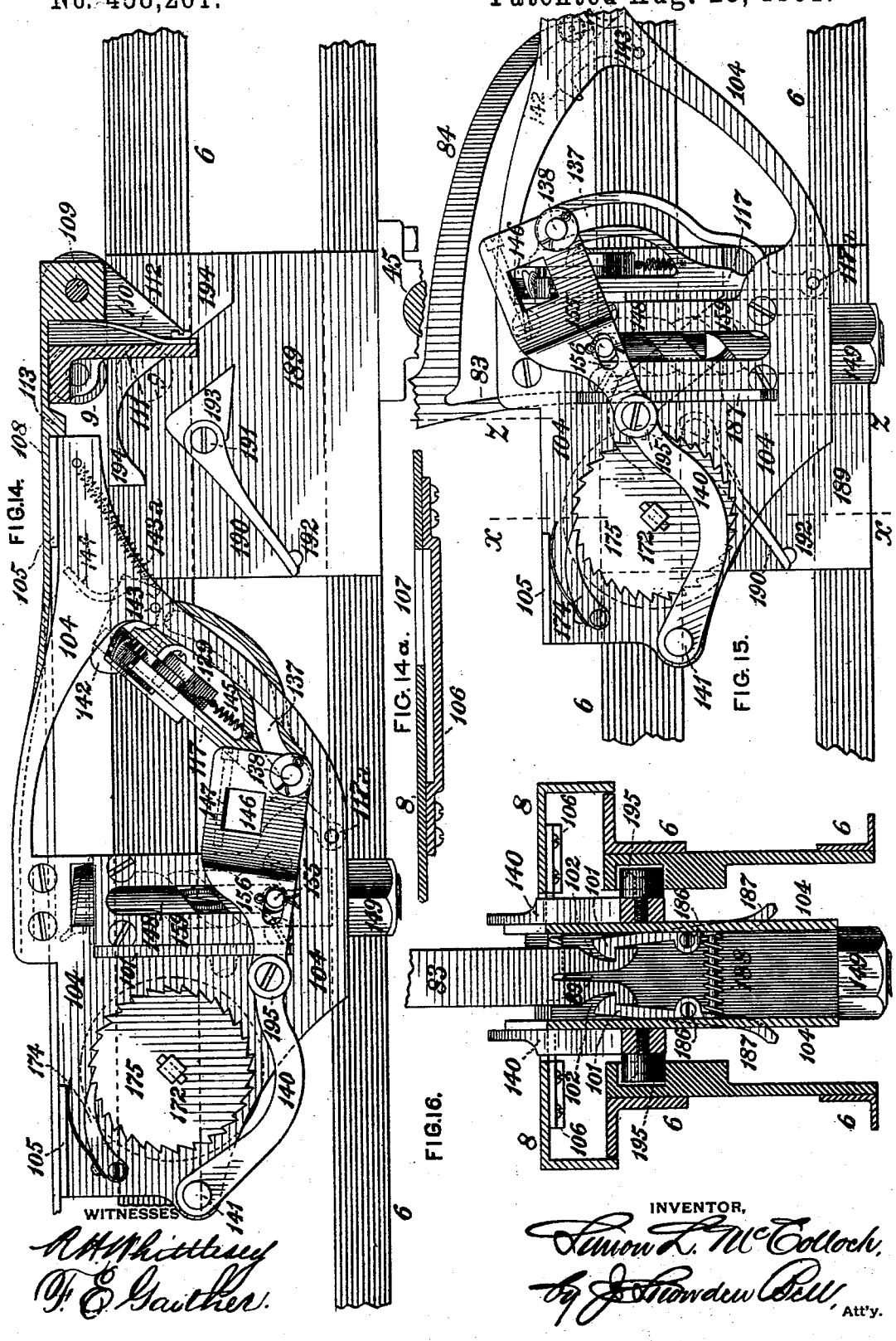
THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 11 Sheets—Sheet 6.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.



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

(No Model.) 11 Sheets—Sheet 7.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

FIG. 17.

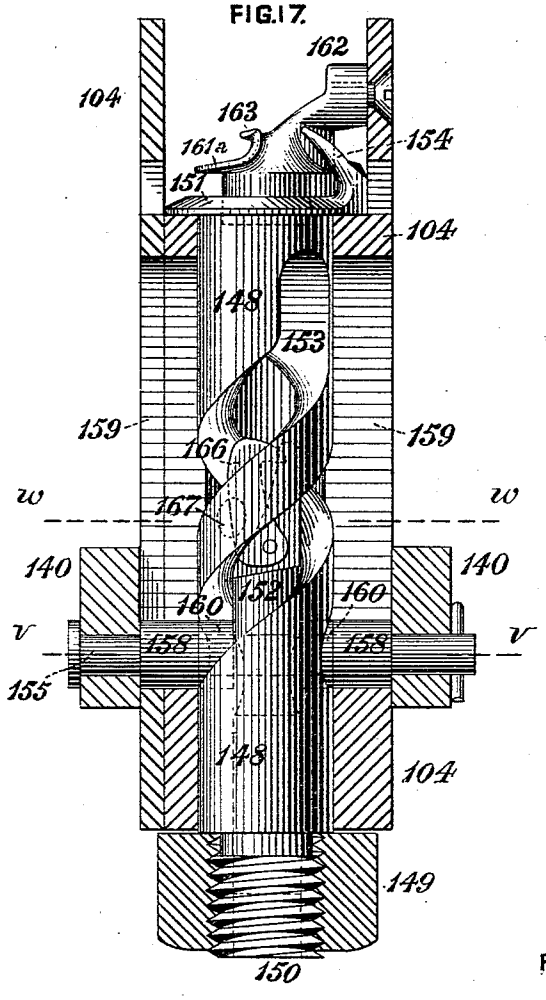


FIG. 18.

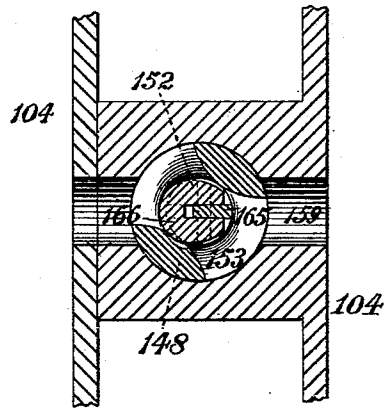


FIG. 21.

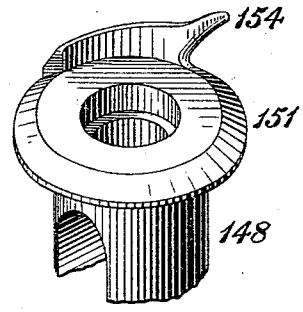


FIG. 20.

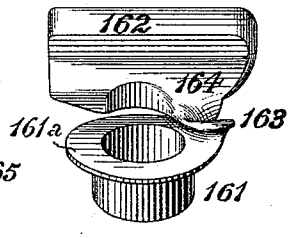


FIG. 22.

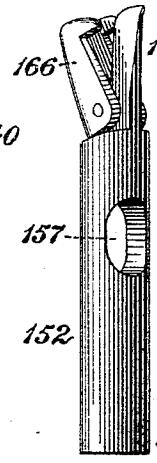
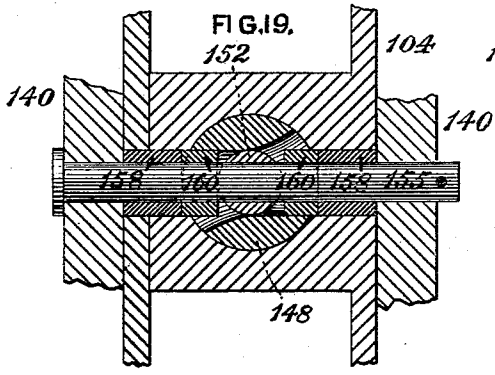


FIG. 19.



WITNESSES:

R. F. Whittlesey

F. C. Gaither.

INVENTOR,

Simon L. McColloch.

By J. Snowden Bell, Att'y.

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

(No Model.) 11 Sheets—Sheet 8.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

FIG. 23.

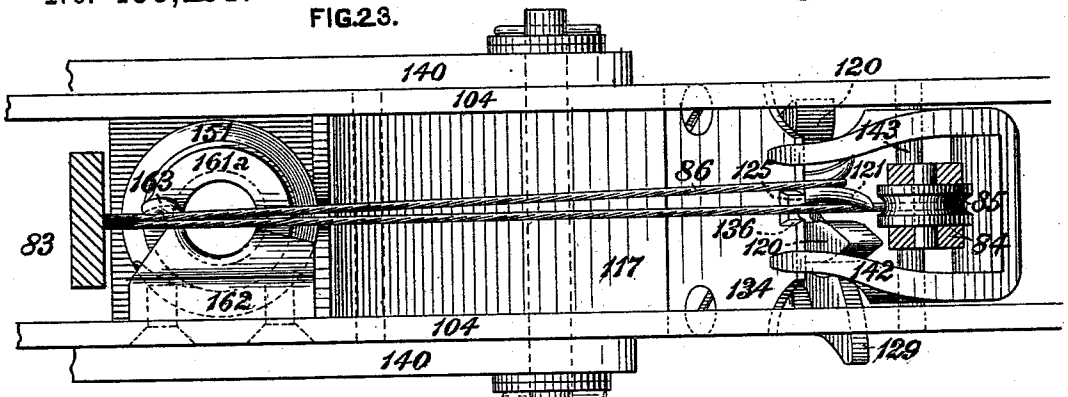


FIG. 24.

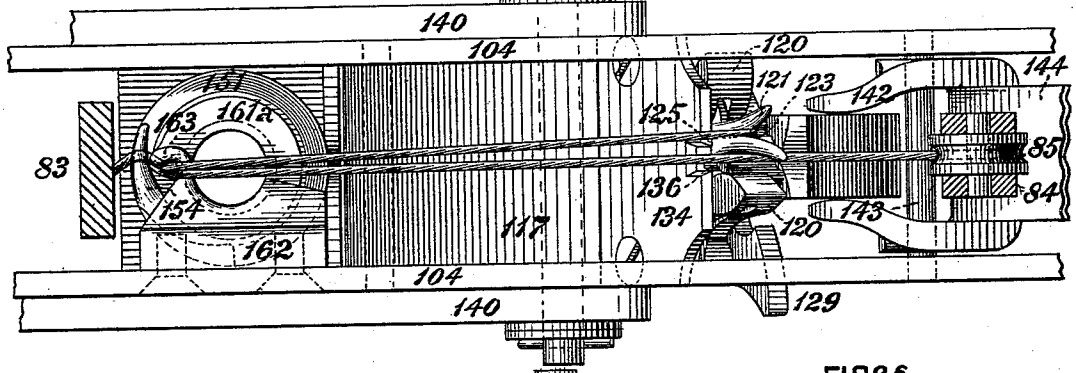


FIG. 25.

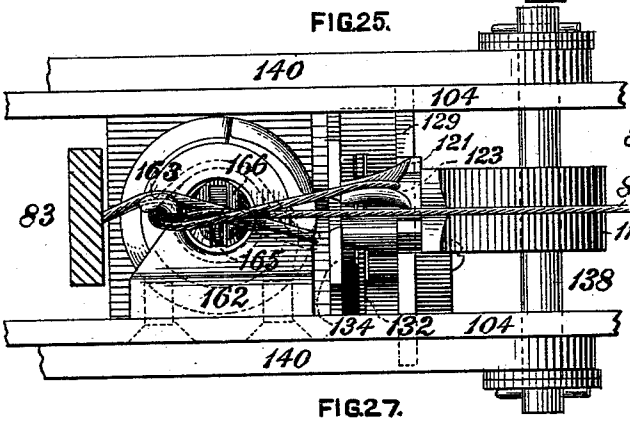


FIG. 26.

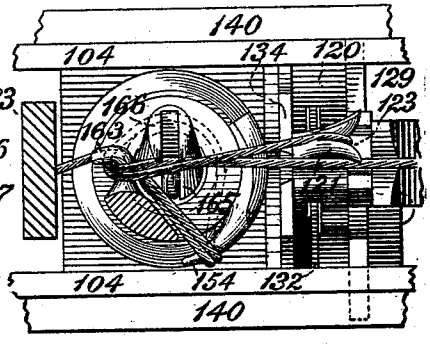
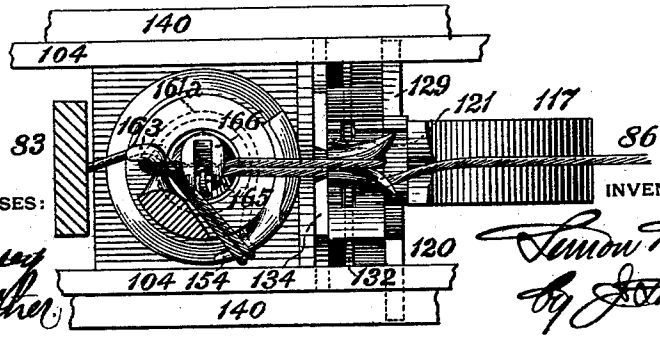


FIG. 27.



WITNESSES:

R. F. Whittlesey

F. E. Gaither

INVENTOR,

Lemuel L. McCulloch

by J. Snowden Bell,

Att'y.

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

(No Model.) 11 Sheets—Sheet 9.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

FIG. 28.

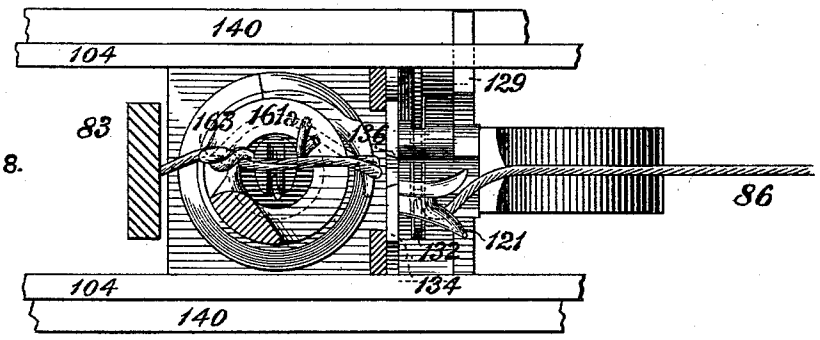


FIG. 29.

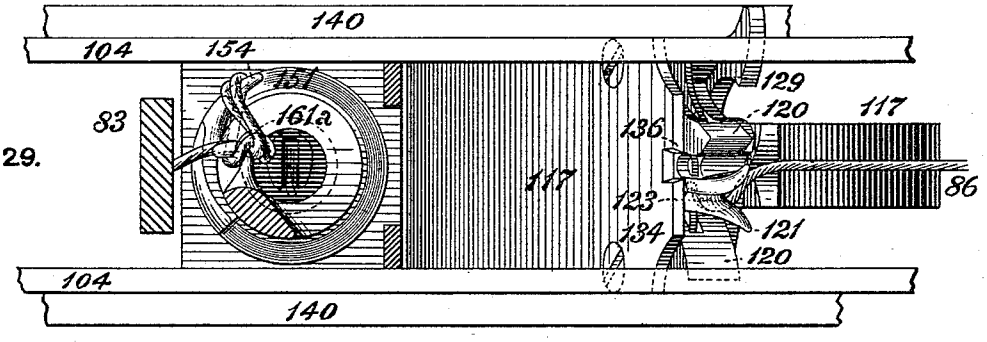


FIG. 30.

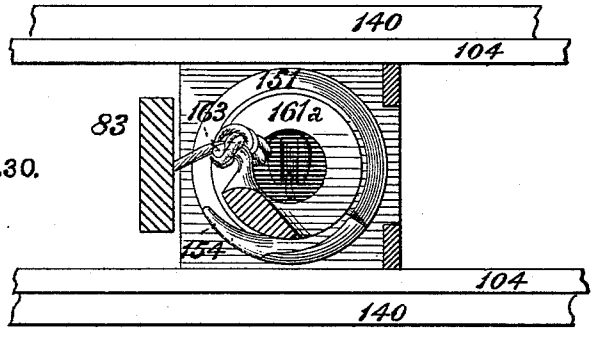


FIG. 31.

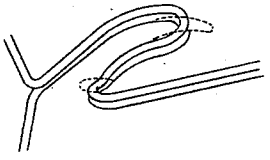


FIG. 32.

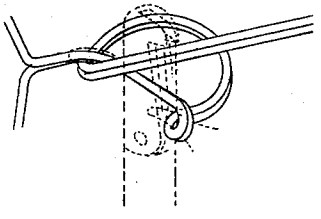


FIG. 34.

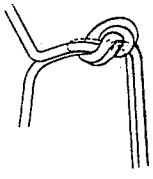
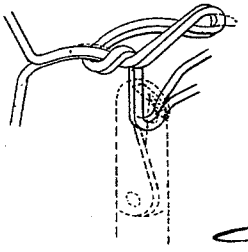


FIG. 33.



WITNESSES:

R. F. Whittlesey

F. E. Gaither

INVENTOR,

Simon L. McCulloch

by J. Lowndes Bell Att'y.

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

(No Model.) 11 Sheets—Sheet 10.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

FIG. 35.

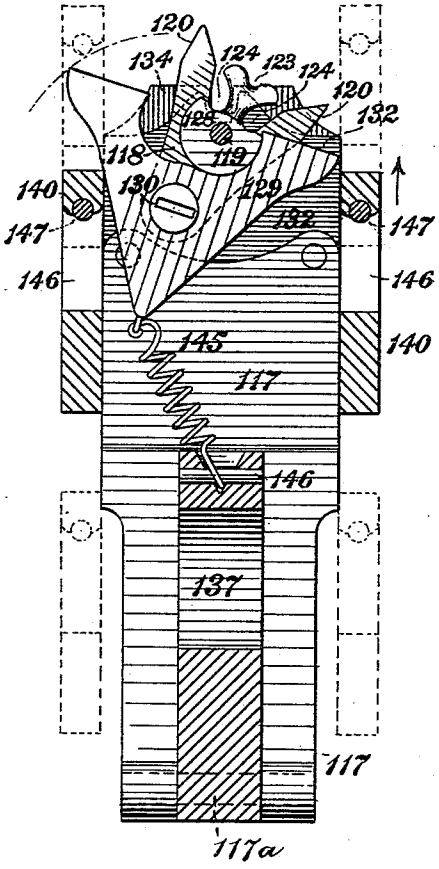


FIG. 36.

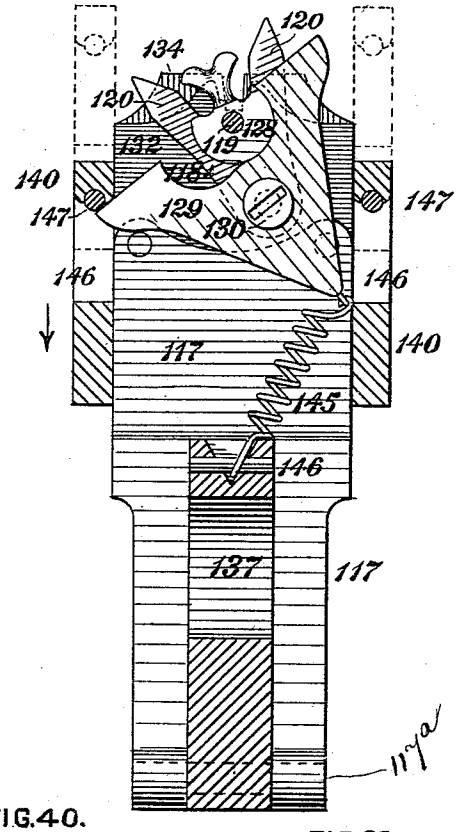


FIG. 37.

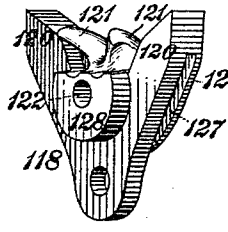


FIG. 38.

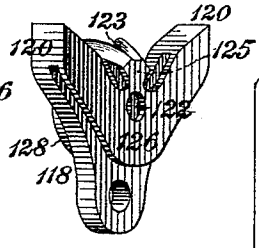


FIG. 40.

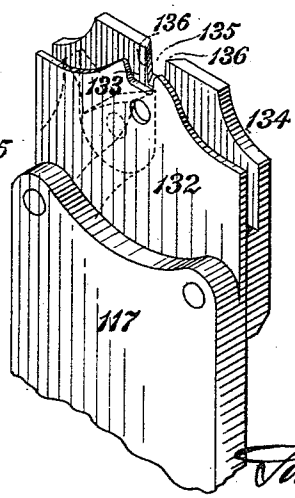
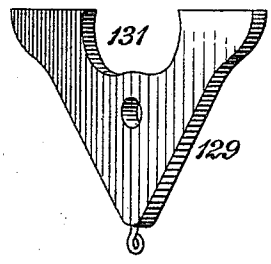


FIG. 39.



WITNESSES:

R. F. Whittlesey

F. E. Gaither.

INVENTOR,

Lemuel L. McCollock,

by J. Lowndes Bell

Att'y.

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

(No Model.) 11 Sheets—Sheet 11.

S. L. McCOLLOCH.

GRAIN BINDING MACHINE.

No. 458,261. Patented Aug. 25, 1891.

FIG. 41.

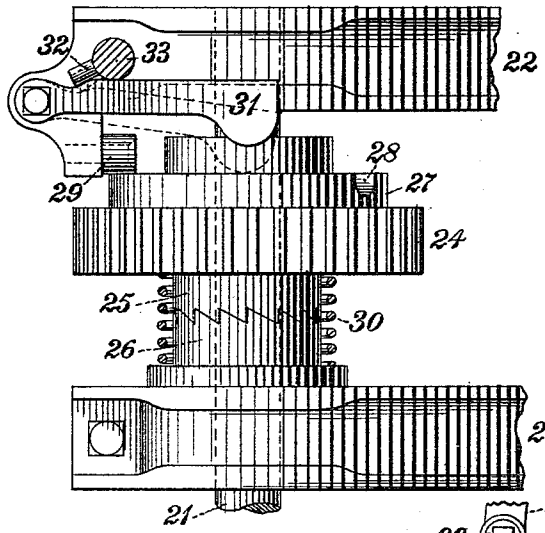


FIG. 45.

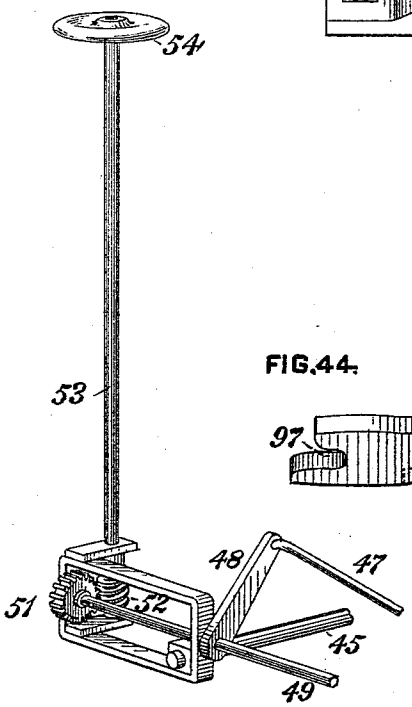


FIG. 42.

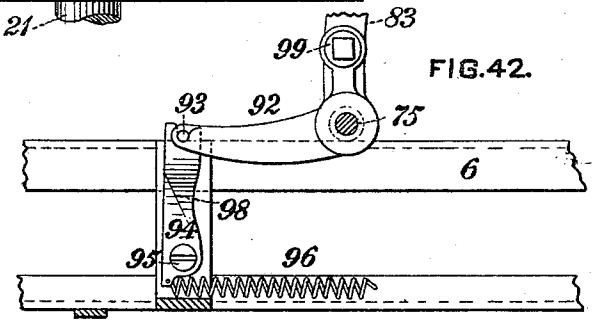


FIG. 44.

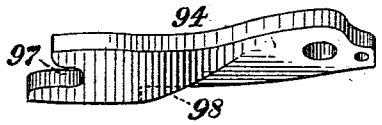
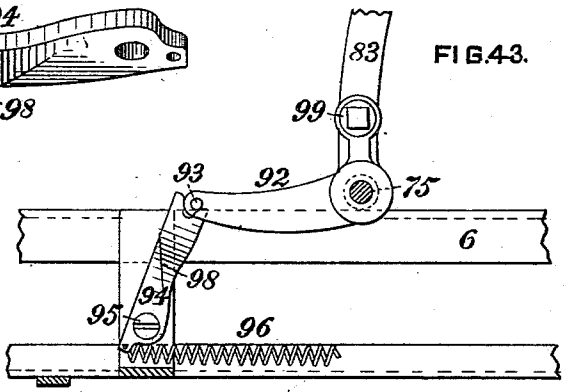


FIG. 43.



WITNESSES:

R. A. Whittlesey

F. E. Gaither

INVENTOR,

Simon L. McColloch,

by J. Snowden Bell,

Att'y.

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

UNITED STATES PATENT OFFICE.

SIMON L. McCOLLOCH, OF WHEELING, WEST VIRGINIA.

GRAIN-BINDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 458,261, dated August 25, 1891.

Application filed February 21, 1888. Serial No. 264,797. (No model.)

To all whom it may concern:

Be it known that I, SIMON L. McCOLLOCH, a citizen of the United States, residing at Wheeling, in the county of Ohio and State of West Virginia, have invented or discovered a certain new and useful Improvement in Grain-Binding Machines, of which improvement the following is a specification.

My invention relates to self-binding attachments to harvesting-machines, and is an improvement upon that for which Letters Patent of the United States No. 315,528 were granted and issued to me under date of April 14, 1885.

The objects of my invention are to effect a simplification and perfection of mechanism and a material reduction of the power required for binding and to provide a binder which shall be specially applicable to self-raking harvesting-machines, while equally applicable to harvesting-machines of other constructions.

To this end my invention consists in certain novel devices and combinations hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a partial plan or top view of a harvesting-machine embodying my invention, the rake-head being removed; Fig. 2, a section, on an enlarged scale, through one end of the supporting-roller of the apron; Fig. 3, a side view in elevation of the binding mechanism proper, the parts being shown as at rest and in readiness for the commencement of the binding operation; Fig. 4, a partial plan or top view of the same, showing the discharge-arm in position to engage the cord of the bound sheaf and effect its discharge; Fig. 5, a view in elevation of the end casting which connects the frame-bars and supports the rotating disk and pivot of the slotted rocker-arm; Fig. 6, a view, partly in elevation and partly in section and on an enlarged scale, showing a portion of the platform, a hinged platform-extension, a connected roller and apron, a section through the frame and carriage of the binding mechanism, and an elevation of one of the supports for the supplemental platform, one of the supporting and guiding shafts of the binding mechanism, and connections for adjusting the position of the binding mechanism for different lengths of grain; Fig. 7, a side view in elevation of the binding mechanism proper, the parts being shown in positions occupied when the grain is gathered and in readiness to be compressed for binding; Fig. 8, a similar view, the parts being shown in positions occupied when nearly at the completion of the operation; Fig. 9, a sectional elevation showing a portion of the compressor-arm with the compressor-cord attached; Fig. 10, a similar view showing the relation of the cam-block which actuates the gathering-fingers and the short double-armed lever of one of said fingers; Fig. 11, a view in perspective and on an enlarged scale, showing the rake-head and the driving mechanism thereof and of the binding mechanism; Fig. 12, an axial section through the spring-drum to which the compressor-cord is attached at the line $x\,x$ of Fig. 15; Fig. 13, a transverse section through the same at the line $y\,y$ of Fig. 12; Fig. 14, a view in elevation illustrating the positions of the parts of the knotting mechanism and the operating devices thereof when at rest and in readiness to commence the knotting of the binding-cord, together with the devices for regulating the tension of the compressor-spring; Fig. 14^a, a partial longitudinal section through the carriage and through one of the supports of the frame of the knotting mechanism; Fig. 15, a view in elevation, showing the knotting mechanism in position when the knot has been formed, but before it has been drawn tight; Fig. 16, a transverse section at the line $z\,z$ of Fig. 15; Fig. 17, a view in elevation and on an enlarged scale of the knotter, and a vertical transverse section through the frame thereof; Figs. 18 and 19, horizontal sections through the same at the lines $w\,w$ and $v\,v$, respectively, of Fig. 17; Fig. 20, a view in perspective of the head-piece of the knotter; Fig. 21, a similar view of the upper portion of the rotating cord-throwing cylinder; Fig. 22, a similar view of the cord-tightening spindle and its hooks. Figs. 23 to 29, inclusive, are plan views of the knotting, cord-holding, and cutting mechanism, illustrating, respectively, different stages of the operation of tying a knot, the upper portion of the head-piece of the knotter, which is shown in Fig. 20, being removed in Figs. 26 to 29, inclusive, to show the position of the cord; Fig. 30, a similar view of the knotter, showing the completed knot, the upper por-

tion of the head-piece being removed, as in Figs. 26 to 29, inclusive. Figs. 31 to 34, inclusive, are views in perspective of a cord, showing different stages of the formation and tightening of a knot. Figs. 35 and 36 are views, partly in elevation and partly in section, of the cord holding and cutting mechanism, illustrating the shearing and crimping plate and its carrier in positions occupied by them during the upward and the downward traverse, respectively, of their operating-levers; Figs. 37 and 38 are respectively front and rear views in perspective of the movable shearing and crimping plate; Fig. 39, a view in perspective of the carrier of said plate; Fig. 40, a similar view of the fixed crimping-plate and the stationary knife-plate, together with a portion of the frame to which they are connected; Fig. 41, a plan view on an enlarged scale, showing the engaging and disengaging devices of the driving mechanism of the binder. Figs. 42 and 43 are side views, in elevation, of a portion of the frame of the binding mechanism, showing the pivoted lever which throws the compressor-arm in positions corresponding respectively with the limit of the throw of the arm and with one adjacent to the point of disengagement from the arm; Fig. 44, a view in perspective and on an enlarged scale of said pivoted lever detached, and Fig. 45 a similar view of the gearing for adjusting the position of the binding mechanism.

My invention is herein illustrated in connection with a self-raking harvesting-machine, which in particulars other than those relating to the construction and operative relation of the features of improvement applied by me accords with those heretofore well known and generally employed, and need not therefore be specifically described.

In the practice of my invention I locate the binding mechanism proper at the inner side of the platform 4 of the machine, the major portion of said mechanism lying between the side of the platform and the line of traverse of the main or drive wheel 5, and the frame of said mechanism being placed at or nearly at a right angle to the finger-beam 1 and cutter-bar. The binding mechanism is mounted upon a frame 6, which is preferably formed, as shown, of a series of bars of angle-iron secured to interposed connecting-pieces 7. A carriage 8, composed of a pair of angle-plates connected by transverse members, is fitted to reciprocate longitudinally upon the upper bars of the frame 6, and for the purpose of reducing friction the carriage may be provided at or near its ends with rollers 9, bearing on the upper and lower sides of the flanges of the upper frame-bars. Intermittent reciprocating motion is imparted to the carriage 8 from the drive-wheel 5, the preferable construction being one in which, as shown, such motion is derived through the shaft which drives the rake.

Under the construction and arrangement of the binding mechanism herein shown and described it is necessary that the shaft which directly actuates the same shall rotate in opposite direction to the drive-wheel. Said shaft is therefore driven through an intermediate shaft, which is rotated by a chain from the driving-shaft, as presently to be described, and is provided with a clutch mechanism for intermitting the action of the binding mechanism. It will, however, be obvious that an intermediate shaft might be dispensed with, if preferred, and the driving-shaft of the binding mechanism be connected directly with the shaft of the drive-wheel or with a member of the driving mechanism of the rake, being, as in the former case, provided with a suitable engaging and disengaging mechanism. In the instance illustrated the axle 10 of the drive-wheel is coupled, through an intermediate shaft 11, provided at its ends with suitable universal joints and having a clutch 12, by which it may be disengaged from the axle 10 when required, to a shaft 13, carrying a bevel-pinion 14, which engages a corresponding gear 15 on the shaft 16, to which the rake-head 17 is secured. A sprocket-wheel 18 is secured upon the shaft 13 and a drive-chain 19 engages the teeth of said sprocket-wheel and those of a similar wheel 20, fixed upon a clutch-shaft 21, mounted on bearings in a frame 22, secured upon the platform 4 adjacent to the frame 23 of the rake-head or made integral with the latter frame. A clutch-section 25 is mounted freely upon the shaft 21, said section having teeth at one end adapted to engage the corresponding teeth of a clutch-section 26, fixed upon the shaft 21. A hub 27 is formed upon the opposite end of the clutch-section 25, and a segmental recess 28 in the outer end of the hub 27 is adapted once in each revolution of the clutch-section 25 to engage a roller 29, journaled upon a stud on the frame, when the clutch-section 25 is moved along the shaft out of engagement with the clutch-section 26 and toward said roller, such movement being effected by a helical spring 30, bearing against a collar on the clutch-section 26 and against a similar collar or equivalent surface on the section 25. A spur-gear 24 is mounted upon the clutch-section 25, and may be either fixed thereto, as shown, or connected therewith by a longitudinal feather and groove, so as to admit of longitudinal movement of the clutch-section relatively to the gear.

The engagement of the clutch-sections 25 and 26 to rotate the former is effected by means of a lever 31, pivoted at one end to the frame 22 and having a projection upon its free end adapted to bear against the outer end of the hub 27, said lever being pressed against the hub by a cam or projection 32 on a vertical shaft 33, journaled in bearings on the frame 22 and rake-head frame 23. The shaft 33 is rocked in its bearings, so as to effect the engagement of the clutch-section 25 with the clutch-section 26 of the shaft 21 for

such period during each revolution of the shaft 21 as the recess 28 of the clutch-section 25 is disengaged from the roller 29, and the gear 24 will therefore be rotated by the shaft 21 during such period, the roller 29 bearing upon the end of the hub 27 and serving to maintain the clutch-sections 25 and 26 in engagement. When the recess 28 engages the roller 29, which will occur once in each revolution of the shaft 21, the spring 30 disengages the clutch-sections 25 and 26, and the gear 24 will hence remain stationary until the next succeeding movement of the vertical shaft 33 in direction to press the lever 31 against the hub of the clutch-section 25 and re-engage the same with the clutch-section 26.

Each rotation of the shaft 21 imparts, through connections presently to be described, reciprocating movement in opposite directions and in each direction through its entire traverse to the carriage 8, the grain being gathered, compressed, and bound during the advancing movement of the carriage, which in this case is that toward the rear of the platform, and the sheaf being discharged and the parts returned to position for the next succeeding operation during the returning movement of the carriage, or, in this case, that toward the front of the platform. The movements of the carriage must be so timed relatively to those of the rake as to allow the binding mechanism to perform its functions upon the gavel before a new gavel is gathered and delivered for binding. To this end the shaft 33 is connected to and moves axially with one of the latches 34 of the rake-arm-guiding mechanism, and at each outward movement of said latch by the roller 35 of a rake-arm carrying casting 36, as the rake attached to the rake-arm 37 of said casting brings the gavel across the carriage 8, the projection 32 of the shaft 33 presses the lever 31 against the hub 27 of the clutch-section 25, and thereby engages the clutch-sections 25 and 26, so as to cause the gear 24 to make one revolution with the shaft 21, the rotation of said shaft being stopped at the termination of a revolution by the engagement of the recess 28 and roller 29, as before explained. The reel-rake selected for illustration herein is that termed the "Johnson rake," and, being well known to those skilled in the art and not constituting in and of itself any part of my present invention, need not be herein at length described. As is familiar to operators of harvesting-machines in which said rake is employed, the same may be adjusted to rake with greater or less frequency, as required, and under the above construction a revolution of the clutch-section 25 and gear 24 is commenced at the termination of each raking operation, which is the only essential governing the relation of the clutch-section 25 and gear 24 to the raking mechanism. The engagement of the clutch-sections may therefore be effected by any suitable device actuated by the movement of a member of the raking mechanism, which will cause the commencement of each revolution of the clutch-section 25 and gear 24 to be practically coincident with the termination of a raking movement.

The requisite movements are imparted to the binding mechanism from a driving-shaft 38, which is in this instance rotated intermittently by the gear 24. The shaft 38 may, however, as before indicated, be driven directly by a gear fixed upon the shaft of the drive-wheel, or by suitable connection with some member of the driving mechanism of the rake, in which case it will be provided with a clutch mechanism similar or equivalent to that above described. The inner section of the shaft 38 is formed of square or polygonal cross-section, or otherwise adapted to move longitudinally within, while maintaining rotative engagement with, an outer sleeve or tubular section having suitable journals mounted in bearings in the frame 22, and having fixed upon it a gear 39, meshing with the gear 24.

The object of providing the capacity of longitudinal movement of the driving-shaft section 38 within the sleeve which carries the gear by which said section is rotated is to admit of movement of the frame 6 of the binding mechanism toward and from the delivery or binding side of the platform 4 to adjust the former in proper relation to the latter to effect the binding of grain of different lengths, as may from time to time be required, and at the same time to maintain its connection with the driving mechanism. To this end the frame 6 is adapted to slide longitudinally upon a pair of supporting and guide rods or bars 45, secured to the frame of the platform 4 at a right angle to the frame 6, lugs 46, secured to the lower frame-bars, fitting freely on the rods or bars 45. The frame 6 is coupled by links 47 to arms 48 upon a shaft 49, journaled in bearings 50, fixed to the rods or bars 45, and carrying a worm-wheel 51, meshing with a worm 52, secured upon a vertical shaft 53, which is provided with a hand-wheel 54 at its upper end. By the rotation of the shaft 53 in one or the other direction the shaft 49 may be rocked in its bearings, and through its connections with the frame 6 will move the latter toward or from the platform, as the case may be. The top of the frame 6 is in this case located at a higher level than that of the platform 4, and the space between the platform and frame, the width of which, as above indicated, varies with different lengths of grain, must be suitably bridged over in each adjusted position of the frame 6 to admit of the proper delivery of the grain thereto. In the instance illustrated this end is attained by the employment of an automatically-adjustable bridge consisting of an extension or plate 55, hinged to the delivery side of the platform at an upward angle thereto and at or near the point at which the rakes leave the gavels, together

with an adjustable apron 56, extending from the extension 55 to a point adjacent to the top of the carriage 8, which moves upon the frame and which may be either on a level with, or, as shown, slightly above the same. The free end of the extension 55 is supported by arms 57, pivoted in bearings 58, fixed to one of the transverse beams or bars 59, to which the guide and supporting rods 45 are secured, the arms 57 having pins on their outer ends which slide freely in slots 60 in the hinged arms 61, which carry the extension 55, and are adapted to be fixed at different desired positions in said slots, as by set-screws 62. The apron 56 is connected at one side to an elastic rod 63, secured at one end to an arm 64, projecting from the frame 6 near one of its ends, and fitted freely at its opposite end in a bearing in an arm 65, adjacent to the other extremity of the frame 6. The elasticity of the rod 63, together with its free fit in the bearing of the arm 65, permits it to be sprung downwardly at and adjacent to its middle portion in the compression of the sheaf and to return to normal position after such compression has been effected. The opposite side of the apron 56 is connected to and wound upon a roller 66, which is mounted in bearings 67 68 on the extension 55, and the apron is maintained at a proper degree of tightness by a helical spring 69, which is secured to and encircles one of the journals 70 of the roller 66, which journal is movable longitudinally in the bearing 68 and is fitted with a squared end to engage a corresponding central recess in the adjacent end of the roller.

In lieu of the form of adjustable bridge above described and as a mechanical equivalent therefor any other suitable device for effecting the transfer of the grain from the platform to the carriage of the binding mechanism capable of automatic adjustment in conformity with the variation of positions of the frame of the binding mechanism may be employed without involving a departure from the operative principle and relation of the construction described and shown. As an instance of a device proper for the purpose there may be mentioned a series of sliding or telescopic plates connected at opposite sides to the platform and to the frame 6, or a light sheet of metal connected at one side to the frame 6 and adapted to slide freely at its opposite side below the platform-extension 55, or the delivery side of the platform proper, if preferred. A supplemental platform 71 is supported upon brackets 72, secured to lateral extensions 73 on the side of the connecting-pieces 7 of the frame 6 farthest from the platform 4, said supplemental platform serving for the support of that portion of the grain which overhangs the carriage 8 during the binding operation. The supporting-brackets 72 of the supplemental platform 71 are preferably connected to the extensions 73 by suitable stems or pivots passing through lugs on the extensions, so that upon the removal of the platform the brackets may be swung inwardly toward the binding mechanism frame for greater convenience in storage and transportation.

A crank disk or arm 40, fixed upon the end of the driving-shaft 38, carries a crank-pin 41, which fits freely in a longitudinal slot 42, formed in a rocking arm 43, journaled upon a pivot 44, fixed in the frame 6 of the binding mechanism at the end adjacent to the driving mechanism. The rocking arm 43 is coupled by a connecting-rod 74 to a pin 75 on the adjacent end of the carriage and is rocked on its pivot by the rotation of the crank disk or arm 40, and its crank-pin 41 effects the reciprocation of the carriage 8 upon the frame 6. By the provision of the slot 42 in the arm 43 there is attained a varying leverage of the arm upon the carriage as well as a variation of the speed of the latter in different portions of its traverse, as is desirable for the most effective and advantageous performance of the operations of compressing, binding, and discharging the gavel. A gavel is compressed, bound, and discharged and the carriage returned to position for operation upon another gavel during each revolution of the crank 40, and these several operations are most advantageously performed at different rates of speed and by the exertion of different degrees of power, respectively, such advantage not being attainable by a connection of the carriage to the crank-pin without the intermediation of the slotted arm 43. The slot 42 of the arm may be either rectilineal, as shown, or formed of curvature or inclination varying at different points in its length, as may be best adapted to attain the varying speed and leverage desired. As shown in Fig. 3, the rocking arm is in position corresponding with the commencement of the advancing movement of the carriage, the early portion of which is effected with comparative rapidity and a comparatively slight exertion of power. As the carriage advances and the compressing operation progresses, the leverage of the arm 43 is gradually increased and its speed diminished, thus affording the most favorable conditions for the exertion of power in compressing, and in the returning movement of the carriage the average speed of the arm is correspondingly increased and its leverage reduced, which conditions comply with the requirements of the discharge of the sheaf and return of the carriage to initial position. The slot 42 may be formed of outward curvature or inclination above the point at which the advancing movement of the carriage commences, as shown in Fig. 3ª, and in such case the variations of speed and leverage above specified will be effected to a greater degree than where a straight slot, as shown, is employed.

The first operation performed in the advancing movement of the carriage 8 and its accessories is the gathering and compressing

of the gavel into a bundle, which operation is effected by the following mechanism: A pair of gathering and compressing fingers 76, having upper faces of proper width, is pivoted to the frame 6, the fingers being journaled upon pivots 77, fixed to brackets 78 on opposite sides of the frame, and being straight for a portion of their length, and thereafter upwardly curved toward their free ends. A short double-armed lever 79 is mounted freely upon each of the pivots 77, one arm of the lever fitting beneath the adjacent gathering-finger 76 when the carriage is at its initial position, and the other arm, which is suitably rounded at its point to form a proper bearing-surface, extending in direction to be acted upon by a cam-block 80, secured to the side of the carriage. The upper surfaces of the cam-blocks 80 are downwardly curved or inclined in the direction of the end of the carriage to which the binder-arm is attached, and the cam-blocks, striking the double-armed levers 79 in the advancing movement of the carriage, first swing the gathering and compressing fingers 76 from the position shown in Fig. 3 to that shown in Fig. 7. In the further movement of the carriage in the same direction the points of the levers 79 ride on the downwardly-inclined surfaces of the cam-blocks, and thereby admit of a sufficient degree of upward and backward movement of the gathering and compressing fingers to provide for the yielding of the same to the pressure of the gavel without permitting the grain to be moved outside of or beyond the path of the free end of the binder-arm. Upon the release of the levers 79 from the cam-block the gathering and compressing fingers are thrown by the advancing movement of the bundle of grain within the binder-arm into their original positions, in which they are in readiness for the next succeeding operation. In lieu of employing a double-armed lever independent of each finger, as shown, the fingers might, if preferred, be prolonged to form lever-arms below their pivots and be provided with springs by which they could be thrown up sufficiently to move said lever-arms into position to be actuated by the cam-blocks, as shown at A in Fig. 3b. One or more teeth or projections 81 are formed on the ends of the upper plates of the gathering and compressing fingers adjacent to their pivots, said teeth sliding in longitudinal grooves 82 in the top of the carriage and in a shield 108, pivoted thereto and serving to prevent the grain from bulging outside of the path of the free end of the binder-arm by narrowing the distance between the bearing-points of the gathering and compressing fingers upon the grain.

To further assist in keeping the grain out of the path of the free end of the binder-arm, the top of the frame 104, in which the knotting mechanism is mounted and which is connected to the carriage 8, is made to project above the top of the same and is inclined downwardly in the direction of its advancing movement, as shown at 204 in Figs. 3 and 7, thereby preventing the grain which lies above them from getting under the adjacent ends of the gathering and compressing fingers. A corresponding projection or projections may be fixed to the top of the carriage in lieu of extending the knotter-frame upwardly, or in addition to the projections formed by the upward extension of said frame. A curved or segmental binder-arm 83 is pivoted to the end of the carriage 8, which constitutes its rear in its advancing movement, so as to move in opposite direction to the forward movement of the gathering and compressing fingers, the arm 83 being in this instance journaled, for convenience, upon the pin 75, to which the connecting-rod 74 is coupled. The arm 83 is preferably of channel or U form in cross-section, to combine strength with lightness, and carries near its free end a standard or standards 84, in which is mounted a sheave 85, or a guide-opening, around or through which the binding-cord 86 passes freely. Said cord is led through a suitable tension device 87 from a ball 88 and passes along the curved outer surface of the binder-arm 33 to the sheave 85, and thence through a central recess 89 in the free end of the binder-arm, from which it passes to the knotting mechanism, hereinafter described. A compressor-cord 90 is secured to the binder-arm 83 near the inner end of the recess 89 and extends to a spring-drum 91, mounted on bearings in the frame 104 of the knotting mechanism, which is connected to the carriage 8. The spring-drum 91 is of annular form, provided with a circumferential groove for the reception of the compressor-cord 90, the end of which is secured to a pin 168 in said groove and is fitted to rotate freely upon cylindrical bearings 169 on the frame 104, its rotation being limited by a pin or projection 170, which abuts at the limit of its traverse against a stop 171, fixed on the frame. A tension-adjusting shaft 172 passes freely and centrally through the drum and its bearings, and a spirally-coiled tension-spring 173 is connected at one end to the shaft 172 and at the other to the drum 91. The tension of the spring 173, which acts to rotate the drum in the direction of the arrow, Fig. 13, may be adjusted as required by the application of a wrench to the squared end of the shaft 172, and the shaft is held in position as adjusted by a spring-pawl 174, engaging the teeth of a ratchet-wheel 175, fixed upon the end of the shaft. A short lever-arm or heel-extension 92 is formed upon or fixed to the binder-arm 83, projecting therefrom on the side of its pivot 75 opposite the main body of the arm, said lever-arm carrying on its outer end a pin or projection 93, adapted to engage a recess 97 in the free end of a pivoted lever or pair of levers 94, each of which is journaled upon a stud 95, fixed in the frame 6. The levers 94 are coupled to the frame on the sides of

their pivots opposite their free ends by springs 96, by which they are returned to their initial positions when released from the pin or projection 93 of the lever-arm 92 of the binder-arm 83. An inclined or curved flange or cam-surface 98 is formed on the inner side of each of the pivoted levers, against which the pin or projection 93 of the lever-arm 92 bears in the returning movement of the carriage, and thereby raises the levers 94 sufficiently to enable the lever-arm 92 to pass by the same, on the return of the binder-arm to initial position, the levers 94 being thereafter returned to and held in position for their slots 97 to engage the projection 93 in the next advancing movement of the carriage by the springs 96. A roller 99 is journaled on a stud on one side of the binder-arm at a short distance from its pivot 75, said roller fitting in a slot 100, formed in one of the connecting-pieces 7 of the frame 6, and extending downwardly from the top of the same for a sufficient distance to allow the binder-arm to assume the desired position at the initial point of the advancing movement of the carriage 8, as shown in Fig. 8. The side of the slot nearest the driving-shaft 38 should be extended above the level of the top of the carriage, so as to form an end stop to insure the contact of the roller 99 with the side of the slot in the returning movement of the carriage, and thereby effect the movement of the binder-arm into the position shown in Fig. 3 against such tension as may be exerted by the compressor-cord 90. A downwardly-curved shield-plate 176 is secured at one end to the pivot 44 of the rocking arm 43 and at the other to the adjacent connecting-piece 7 of the frame 6, said plate serving to protect the compressor-arm, when in the position shown in Fig. 3, from contact with stones or other obstructions. In the advancing movement of the carriage 8 the roller 99, bearing against the side of the slot 100 farthest from the shaft 38, rises in said slot, and thereby rocks the binder-arm upon its pivot 75 until said arm assumes a position relatively to the carriage corresponding with that shown in Fig. 7. The further traverse of the carriage in the same direction in which the roller 99 rides on the top of the frame 6 brings the pin or projection 93 of the binder-arm into engagement with the recesses 97 of the pivoted levers 94, which, in connection with the short lever-arm 92, then form a toggle-joint and in the further movement of the carriage force the binder-arm into the position relatively to the carriage, (shown in Figs. 8, 42, and 43,) shortly after which the pin or projection 93 is disengaged from the recesses 97 and the pivoted levers 94 are returned to initial position by the springs 96. The binder-arm is locked in position when the pivoted levers 94 have reached the limit of their upward throw, as indicated in Fig. 42, by the engagement of a pair of hooks 101, pivoted by pins 186 to the frame 104 of the knotting mechanism, with lateral notches or recesses 102, formed in the binder-arm 83, adjoining its free end. The binder-arm is held in such locked position during the further advancing movement until the completion of the knotting operation, upon which the hooks 101 are released from the notches 102 and the tension of the spring which is connected to the spring-drum 91, to which the compressor-cord 90 is attached, throws the binder-arm into position relatively to the carriage corresponding to that shown in Fig. 7, a supplemental spring 103, which encircles the hub or bearing of the binder-arm on its pivot 75, as shown in Fig. 1, being provided to insure the performance of this operation. In this position the roller 99 rests upon the top of the frame on which it rides in the returning movement of the carriage, in which the pin or projection 93 bears against the cam-surfaces 98 of the pivoted levers 94 and raises the latter sufficiently to pass below their recesses 97, and at the termination of the returning movement the roller 99 strikes the side of the slot 100 nearest the driving-shaft 38 and throws the binder-arm into the initial position shown in Fig. 3, this operation being promoted by the tension of the supplemental spring 103. The cam-blocks 80, passing under the lower arms of the double-armed levers 79 in the returning movement of the carriage, raise and pass by said levers, which then drop into the position shown in Figs. 3 and 8, in readiness to be actuated by the cam-blocks in the next succeeding advancing movement.

The knotting mechanism is mounted in an independent frame 104, which is connected to the carriage 8, so as to be readily detatched and removed therefrom and replaced in position for the operation of the mechanism, as may from time to time be required for renewal or repair, or for storage separately from the other members of the apparatus. To this end the frame 104 is provided with lugs 105, which may either be connected by screws or bolts to the carriage or be fitted to rest and be held by a movable member in suitable receptacles in the top of the carriage. In the instance shown the frame 104 rests upon supports 106, fixed to the under sides of the plates of the carriage 8. A slot 107 (see Fig. 14[a]) is cut in said plates above each of the supports and extending for about one-half the length of the bearing-surface thereof, said slots enabling the lugs 105 to be entered and slid along below the plates of the carriage until they abut against shoulders at the opposite ends of the supports. The lugs and connected frame 104 are held firmly in this position by a movable member which bears against the end of the frame 104 farthest from the end shoulders of the supports 106, against which the lugs 105 abut when the frame is in position, which function may be performed by a shield 108, pivoted by a pin 109 to lugs 110 on a cross-bar 111, connecting the side plates of the carriage 8 at one end thereof. The shield 108,

which covers and protects the knotting mechanism, as well as covers the slots 107, which are cut in the side plates of the carriage for the admission of the lugs 105, and the openings formed in the carriage for the insertion and removal of the frame 104, is held in position by a spring 112, fixed to the cross-bar 111 of the carriage and bearing against a squared face on the portion of the shield which incloses its pivot 109. A stop or shoulder 113 on the under side of the shield 108 bears against the ends of the adjacent lugs 105 and holds the same and the frame 104 in position until the shield is swung upwardly upon its pivot to admit of the removal of the frame 104. The shield is curved upwardly at its center to fit over the knotter, and a longitudinal slot 114 is formed in said curved central portion for the admission of the binding-cord to the head-piece of the knotter, said slot being widened at the proper point for the passage of the standards 84, which carry the sheave 85. A slot 115 is also formed in the shield on each side of the slot 114, said slots serving for the passage of a pair of levers connected with the knotting mechanism. The binding-cord 86 is led from the ball 88 through the tension device 87 and through a take-up 116 to the binder-arm 83, passing over the curved outer surface thereof, around the sheave 85 or through an equivalent guide-way, and through the slot 89 to a cord holding and cutting device pivoted to the frame 104, in which its end is held while the gavel is laid upon it, which is done while it is in the position indicated in Fig. 3 and while it is carried around the gavel by the movement of the binder-arm 83 in compressing the grain into a bundle for binding, by which movement it is brought successively into the positions indicated in Figs. 7 and 8 and is doubled throughout the distance between the cord holding and cutting device and the slot 89 of the binder-arm, which at the termination of said movement is on the side of the knotter farthest from the cord holding and cutting device, and the doubled portion of the cord is laid across the knotter. The binding-cord is then in position for the formation and tightening of the knot in readiness for the discharge of the sheaf.

The cord holding and cutting mechanism is of the following construction: A swinging frame 117 is journaled upon a pivot 117^a in the frame 104 of the knotting mechanism near its lower side. A movable shearing and crimping plate 118 (shown in Figs. 35 to 38, inclusive) is pivoted upon a pin 119 in a fixed crimping-plate 132, secured to the upper portion of the frame 117, said plate 118 having two outwardly-projecting guide-arms 120 above its pivot and serving to support a shearer and crimper 125, and also to act as a guide for the cord 86 into proper position for cutting and crimping. A central projection is formed upon the plate 118 between the arms 120 and above the opening 122 for the pivot of the plate, said projection having two arms or horns 121, which curve or project outwardly from a central guide groove or recess 123 for the cord, and lateral grooves or recesses 124 being formed between the lower sides of the arms 121 and the outer arms 120 of the plate. A shearer and crimper 125, having shearing-edges on its outer face, is formed upon one end of the central projection of the plate 118, said shearer and crimper being connected with the arms 120 of the main body of the plate 118 by lateral extensions 126, constituting the outer wall of a slot 127, formed in the plate at a right angle to the axial line of its pivot-opening. The end of the central projection of the plate on the opposite or inner wall of the slot 127 provides a crimping-bearing on each side, said bearings coacting with those of the shearer and crimper 125 and with the fixed crimping-plate 132 in crimping the cord. A segmental hub or boss 128 is formed upon the plate 118, concentric with its pivot-opening, its function being to provide increased bearing for the plate upon its pivot and to form a bearing or abutment for a carrier 129, by which the plate 118 is rocked in alternately-opposite directions upon its pivot to cut and crimp the binding-cord and to place one or the other of the guide-grooves 124 in position to receive the binding-cord in readiness for the next succeeding cutting and crimping operation thereon. The carrier, which is of substantially triangular form or provided with side surfaces oppositely inclined relatively to its top, is pivoted to the plate 118 by a stud 130, located below and in line with the pivot 119 of the plate and the central guide-groove 123 of the same, and is provided at top with a curved recess 131 of sufficient width to admit of the requisite degree of vibration of the carrier and conforming at each side to the curvature of the hub 128 of the plate 118, so as to fit closely against the same and rock the plate upon its pivot in opposite directions in its lateral traverse, such traverse being effected as presently to be described. A fixed crimping-plate 132 is formed upon or secured to the frame 117 and fits freely in the slot 127 of the movable shearing and crimping plate 118, the pivot 119 of which passes through an opening in the plate 132. The frame 117 is suitably recessed to admit of the traverse of the plate 118, in the movement of which the inner edges of the shearer and crimper 125 of said plate swing past the adjacent edges of a central notch or recess 133 in the fixed crimping-plate 132. A knife-plate 134, having a central notch 135, provided with shear or cutting edges 136 on each side, is secured to the outer face of the fixed crimping-plate 132, the shear-edges of the knife-plate being located in such proximity to the plane of movement of those of the shearer and crimper 125 as to act in conjunction therewith in the performance of a cutting operation at each lateral traverse of the plate 118 upon its pivot.

The carrier 129 is coupled by a spring 145, connected to its end below the pivot 130, by which it is journaled to the movable shearing and crimping plate 118, to a pin 146, fixed in the frame 117, and is oscillated upon its independent pivot 130, as well as oscillated coincidently with the plate 118 upon the pivot 119 of the latter, to alternately throw the plate 118 to the opposite limits of its traverse upon the pivot 119 by a pair of lever-arms 140, journaled in parallel planes by pivots 141 to the rear end of the knotter-frame 104.

Fig. 35 shows the movable shearing and crimping plate 118 at the limit of its movement to the right, the left-hand arm of the carrier 129 having been drawn into the plane of movement of the left-hand lever-arm 140 by the action of its spring 145, which oscillates the carrier upon its independent pivot 130, and the carrier being held in such position by the tension of its spring acting on one side of said pivot and by the bearing of the hub 128 of the movable shearing and crimping plate 118 against the adjacent surfaces of the slot 131 of the carrier on the other side of said pivot. The movable shearing and crimping plate 118 is at this period held stationary by the crimping of the binding-cord, which is crimped between it and the stationary crimping-plate 132. The left-hand lever-arm 140 in its upward traverse bears against the under surface of the left-hand arm of the carrier 129, and thereby moves said arm upwardly and inwardly out of its path by oscillating the carrier upon its independent pivot 130. When released from contact with the lever-arm, the carrier will be oscillated in reverse direction and returned to its former position by the action of the spring 145, its left-hand arm being thrown back into the slot 146 of the left-hand lever-arm and in the path of the bearing-facing 147 thereof, in position to be acted upon by said bearing-facing in the next succeeding downward traverse of the lever-arms, the action of which bearing-facing coincidently oscillates the carrier 129 and movable shearing and crimping plate 118 upon the pivot 119 of the latter, throwing the plate 118 to the limit of its traverse to the left.

Fig. 36 shows the movable shearing and crimping plate 118 and carrier 129 adjacent to the limit of their movement to the left, the left-hand lever-arm being in its downward traverse and still in contact with the carrier, which, together with the movable shearing and crimping plate, will be further moved to the left in the continued downward traverse of the lever-arms until released from the left-hand lever-arm, when it will be oscillated upon its independent pivot 130 by the spring 145 and its right-hand arm thrown to the right and into the plane of movement of the right-hand lever-arm 140, in position to be acted upon by the same in its next succeeding upward and downward movements to effect in a similar manner to that above described the movement of the movable shearing and crimping plate 118 to the limit of its traverse to the right, in which position it is shown in Fig. 35.

In lieu of employing a spring in effecting the oscillatory movements of the carrier 129 upon its independent pivot 130, the carrier may be weighted below the same and the force of gravity utilized instead of spring-tension.

The positions of the lever-arms 140 at the upward and downward limits of their traverse are indicated by dotted lines in Figs. 35 and 36. By means of the pivot 130 the carrier is connected to the movable shearing and crimping plate and about which it oscillates independently of said plate as actuated by its spring and by one or the other of the lever-arms 140, being alternately thrown upon opposite sides of a vertical plane passing through the axis of the pivot of the movable shearing and crimping plate. A limited range of movement of the carrier upon its pivot 130 independently of the shearing and crimping plate is provided for, such movement permitting the carrier to be cleared by each lever-arm in its upward movement and presented alternately to the bearing-facings of the lever-arms to be acted on by the same in their downward movements, or vice versa. Such pivotal traverse of the carrier further admits of its being made sufficiently narrow at its top to clear both of the lever-arms when its pivot is brought into a vertical central plane between the same.

From the foregoing description it will be seen that the essential feature of the cord holding and cutting mechanism consists in a movable shearing and crimping plate adapted to oscillate upon a pivot and carrying cord-guides and a crimper and shearer which acts in conjunction with relatively fixed crimping and shearing members located on opposite sides of the axis of its pivot. The swinging carrier, with its spring and the pivoted levers by which it is actuated, together constitute a mechanism whereby the required oscillatory movements may be imparted to the movable shearing and crimping plate; but my invention is not in this particular limited to this or any other specific mechanism for effecting such movements, as the same end may be attained by the employment of actuating devices differing structurally from those herein set forth, but which, in combination with the fixed and movable cutting and crimping members, would act as the mechanical equivalents of the actuating mechanism described and shown, and would accord with the spirit and operative principle of my invention.

In the formation of a knot it is necessary that the frame 117 shall move upon its pivot toward and from the knotter in order to supply the same with the cord required to form the knot, and remain stationary when its free end is in position nearest the knotter for a sufficient period to admit of the cutting and

crimping of the cord. To this end it is provided with a camway or slot 137, of proper curvature to effect the desired traverse and admit of the proper period of rest of the frame, to which the required movement is imparted by a pin 138, fitting in the camway 137, and connected at its ends to the lever-arms 140. In order to hold the frame 117 in position, as against the tension of the binding-cord in the compression of the bundle, as well as to prevent it from being moved out of position by the cord-tightening spindle of the knotter in the discharge of the sheaf, the frame 117 is locked at the limit of its traverse upon its pivot farthest from the knotter, as shown in Fig. 14, by a swinging hook or hooks 142, pivoted upon a pin 143 in the frame 104. The hooks 142 are drawn into and held in locking position by a spring 143ª, connected to the frame and to an extension of the hooks beyond their pivot, and are disengaged from the frame 117 to admit of the movement of the latter by the contact of the standards 84 of the binder-arm with an arm 144, formed upon or fixed to the hooks. An additional function of the hooks 142 is to prevent the lateral displacement of the movable cutting and crimping plate by the strain of the binding-cord in the compression of the sheaf, one of said hooks bearing against one side of the cutting and crimping plate, as shown in Fig. 23, and thereby preventing its movement in the direction induced by the strain of the cord.

The mechanism by which the knot of the binding-cord is formed and tightened is of the following construction: A cord-throwing cylinder 148 is fitted with the capacity of free axial movement in bearings in the knotter-frame 104, longitudinal movement of the cylinder being prevented by a nut 149, engaging a screw-thread 150 on the lower end of the cylinder below the frame 104 and by an annular flange 151 on the upper end or head of the cylinder. A central cylindrical opening or bore is formed in the cylinder for the reception of a cord-tightening spindle 152, and a slot 153 is also formed in the cylinder from its central bore to its periphery, said slot being parallel with its axis at and for a portion of its length adjoining the end nearest the head of the cylinder and thereafter extending in helical form to or near its lower terminal, which is located at or about the upper level of the lower bearing of the cylinder in the frame 104. An upwardly-curved cord-throwing hook or finger 154 is formed upon the periphery of the upper flange 151 of the cylinder, the rear of the hook being downwardly beveled or inclined to form a guide for the cord in passing over it. A pin 155 passes freely through slots 156 in the pivoted lever-arms 140, before specified, through the slot 153 of the cylinder 148, and through a longitudinal slot 157 in the cord-tightening spindle 152, said pin carrying a pair of rollers 158, fitting vertical grooves 159 in the frame 104, and a pair of rollers 160, fitting the slot 153 of the cylinder. The slots 156 of the lever-arms 140 are elongated sufficiently to admit of the oscillating movements of said arms about their pivots 141 without binding upon the pin 155 in its vertical traverse in the slots 159. An annular head-piece 161, the bore of which corresponds substantially with that of the cylinder and which is provided with an upper circumferential flange 161ª, fits freely within the upper end thereof and is secured by a lateral flange 162 to one side of the knotter-frame 104. An upwardly and outwardly inclined hook 163 is formed upon the top of the flange 161ª of the head-piece, the connection of the flange 162 therewith being slotted or cut away in rear of the hook to form a recess or passage-way 164 for the binding-cord, which extends around and under the top of the hook 163. A longitudinal crimping projection 165 is formed upon the upper end of the spindle 152, and a hook 166, which may be forked or divided, as shown, is pivoted to the spindle at the lower end of the projection 165, so that its free end may be pressed up to the latter by the contact of the surface of the bore of the cylinder 148 in the downward movement of the spindle 152 through the same. A recess 167 (indicated in dotted lines in Fig. 17) is formed in the surface of the bore of the cylinder at such height as to permit of a slight outward movement of the hook 166 when the spindle is at the lower extremity of its traverse to effect the release of the cord which has been crimped between said hook and the projection 165. In Fig. 18 the hook is shown as projecting into the recess 167, the bore of the cylinder being indicated by the inner dotted line. The hooks 101, by which the binder-arm 83 is locked in position during the formation and tightening of the knot, are pivoted by the pins or studs 186 on each side of the frame 104 of the knotting mechanism in such position thereon as to stand in line with the free end of the binder-arm when the latter is thrown into the position indicated in Figs. 8, 15, and 16. The hooks 101 are provided with outwardly-curved arms or extensions 187 below their pivots, which extensions are pressed outwardly, so as to project through vertical slots in the frame 104 into the planes of movement of the pivoted levers 140 by an interposed spring 188. The disengagement of the hooks 101 from the recesses 102 of the binder-arm is effected by the levers 140, which in their downward movement bear upon and press inwardly the extensions 187, thereby outwardly moving and releasing the hooks, which are returned by the spring 188 to position to re-engage the recesses 102 upon the next succeeding upward movement of the levers. The pivoted levers 140 are oscillated upon their pivots 141 to impart movements, as required, to the cord holding and cutting mechanism, to the cord-throwing cylinder 148 and cord-tightening spindle 152, and to

the hooks 101, which lock and release the binder-arm by the bearing of rollers 195, one of which is pivoted upon the outside of each lever upon a series of inclined guideways upon the frame 6 of the binding mechanism, the contact of the rollers with the guideways being effected in and by the traverse of the carriage 8 in its advancing movement. A vertical plate 189 is secured to the upper and lower bars of each side of the frame 6, said plates serving as the support of the guideways above mentioned, and being, for convenience of construction, formed integral with the brackets 78, which carry the pivot of the gathering and compressing fingers. The guideways 190, nearest the side of the plates 189, which is toward the carriage 8 in its advancing movement, and which impart upward movement to the levers 140, are formed of arms or bars pivoted at their upper ends to the plates 189 and inclined downwardly in the direction of the approach of the carriage, their lower ends resting against stops 192 in the plates 189. Guideways 193, having short faces inclined in the direction of the pivoted guideways to enable the upward traverse of the rollers to be completed after they are wholly released from the pivoted guideways, may be fixed immediately adjoining the same, as shown. The downward movement of the levers is effected by the contact of the rollers 195 with downwardly-inclined guideways 194, fixed to the plates 189 in such relation to the pivot ends of the guideways that the rollers 195 shall be brought into contact with them at the termination of their upward movement, the bearing of the guideways 194 upon said rollers effecting their downward traverse and that of the lever-arms to which they are pivoted, the traverse of the rollers along the guideways 194 being terminated slightly before the termination of the advancing movement of the carriage, at which period the rollers rest below horizontal bearings at the lower ends of the guideways 194. In the returning movement of the carriage the rollers 195 pass under the lower sides of the pivoted guideways 190, raising said guideways on the pivots 191 sufficiently to admit of the passage of the rollers, after which the guideways drop against the stops 192, when they rest in readiness to receive the rollers on their upper surfaces in the next succeeding advancing movement of the carriage. The sheaf is discharged, after having been bound, by a swinging discharge-arm 177, having a hook 178 at its free end and secured at its opposite end to a vertical shaft, (not shown,) which is journaled in a bearing 179 on the lateral extension 73 of the connecting-piece 7 of the frame 6 at the end thereof adjacent to which the sheaf is bound. A short lever-arm 180 is fixed upon the vertical shaft of the discharge-arm and projects therefrom toward the path of the carriage 8 in such relation as to be moved by a projection upon the carriage in and by the advancing movement thereof and to bring the discharge-arm into the position shown in Fig. 4, in which position the discharge-arm and its accessories remain during the formation and tightening of the knot. Upon the completion of the knot the end of the lever-arm 180 is engaged by a slot or pressed upon by a bearing-surface on the carriage, and in and by the returning movement thereof is moved so as to swing the discharge-arm 177 outwardly into the position shown in Fig. 1, thereby effecting the discharge of the sheaf by the engagement of the hook 178 with the band-cord thereof.

In lieu of providing the discharge-arm with a hook for connection with the band-cord, a penetrating-fork might be formed upon the outer end of said arm, upon which the sheaf would be pressed in the advancing movement of the carriage, and by which it would be correspondingly removed in the outward movement of the discharge-arm. In the instance illustrated a longitudinal plate or projection 181, having a slot 182 adapted to engage the end of the lever-arm 180, is pivoted to the carriage 8, the plate 181 carrying a pin 183 provided with a collar fitting against a spring 184, the opposite end of which bears against a stop or abutment fixed to the carriage. A spring 185 is connected at one end to the bearing 179 and at the other to the lever-arm 180, the tendency of said spring being to retain the parts in the position shown in Fig. 1. In the advancing movement of the carriage the outer end of the plate 181 bears upon the lever-arm 180 and rocks the shaft thereof in the bearing 179, so as to swing the discharge-arm into the position shown in Fig. 4, at the same time winding the spring 185 to cause its tension to be exerted upon the lever-arm 180 in such manner as to press the same against the plate 181 and force its end into the slot 182 when the latter passes the end of the lever-arm. In the returning movement of the carriage the outer end of the slot 182 bears against the lever-arm and rocks the shaft thereof to such degree as to swing the discharge-arm 177 into the position shown in Fig. 1. The plate 181, bearing against the spring 184, yields outwardly for a sufficient distance to free the slot 182 from the lever-arm, and is returned by the spring to position to bear against the lever-arm in the next succeeding advancing movement of the carriage.

In the operation of the machine the grain, as it is severed by the cutters which reciprocate between the guard-fingers of the finger-beam 1, falls upon the platform 4 and is carried by the rakes along the same and over the extension 55 and apron 56 until it rests across the top of the binding mechanism, which is then at rest in the position shown in Figs. 1 and 3, in readiness to commence the performance of its functions, rotation being imparted through the clutch mechanism before described to the driving-shaft 38 of the binding mechanism, which shaft has remained stationary during

the gathering of the gavel by the rake. The advancing movement of the carriage 8 then commences, in the course of which movement the grain is gathered and compressed into a bundle by the gathering and compressing fingers 76 and binder-arm 83, with its compressor-cord 90, the traverse of the fingers 76 and arm 83 upon their respective pivots in this operation being effected during and by means of the traverse of the carriage in the manner hereinbefore described. As soon as the binder-arm 83 has been brought to the limit of its throw upon its pivot 75 in the direction of the advancing movement of the carriage the binding-cord 86 has been laid across the knotter and is in position for the formation of the knot, which when tightened secures the sheaf, the severance of the sheaf-band from the remainder of the cord and retention of the adjacent end of the cord in readiness for the next succeeding binding operation, and the tightening of the knot of the band-cord, these several last-mentioned operations being effected in the order stated during the latter portion of the advancing movement of the carriage.

The operation of the knotting mechanism is as follows: The binding-cord 86 having been laid double across the knotter, occupies a position within the curve of the hook 163 of the fixed head piece 161 and in the path of the hook 154 of the cord-throwing cylinder 148, as shown in the enlarged plan view, Fig. 23. The upward movement of the levers 140, effected by the traverse of the rollers 195 over the inclined guideways 190, in the advancing movement of the carriage 8, imparts rotary movement to the cord-throwing cylinder 148, through the pin 155 and helical slot 153, such movement engaging the hook 154 of the cord-throwing cylinder with the cord 86 and drawing the cord around the body of the head-piece below its flange 161^a, as indicated in dotted lines in Figs. 25 to 28, inclusive, as well as drawing the cord in its rear over the top of the flange 161^a and under the strands which lie on the top of the knotter, to form a loop, the cord being carried by the hook 154 into the recess 164 of the head-piece, so as to be clear of the cord-tightening spindle 152 in its upward traverse. Said spindle is moved upwardly coincidently with the rotation of the cylinder 148, and continues its movement after the stoppage of the latter by the passage of the pin 155 through the upper portion of the slot 153, which, as before explained, is parallel with the axis of the cylinder 148. At the termination of the upward movement of the spindle its pivoted hooks 166, which have in their traverse pressed upwardly against the cord, swing outwardly so as to be clear of the same and to be in readiness to engage the cord between themselves and the projection 165, which is fixed upon the spindle 152, on the ensuing downward movement of the latter, their position at the termination of the upward movement of the spindle being shown in Fig. 26. The pin 155 then rests within the upper end of the slot 157 of the spindle, and the length of said slot being greater than the diameter of the pin a limited range of downward movement of the pin independently of the spindle is thereby provided for. During these movements the frame 117 of the cord holding and cutting mechanism has been moved upwardly upon its pivots 117^a and toward the cord-throwing cylinder to furnish the knotter with sufficient cord for the formation of the knot by the upward traverse of the pin 138 in the curved slot 137 of the frame 117, which is effected by the movement of the pivoted levers 140. The upper portion of the slot 137 is curved to a radius equal to the distence between the axes of the pin 138 and the pivot 141 of the lever-arms 140, so that while passing through said upper portion the pin 138 will not impart movement to the frame. The termination of the upward movement of the frame 117 is coincident with the termination of the movement of the cord-throwing cylinder 148, and the frame and cylinder remain stationary during the remainder of the upward traverse of the lever-arms, in which the cord-tightening spindle 152 has been brought to the position last described, as shown in Fig. 26, and the bearing-facings 147 of the lever-arms have passed above the arms of the carrier 129, one of which arms is, as before explained, in position to be acted upon by one of said bearing-facings in the succeeding downward movement of the lever-arms. One of the guide-slots 124 of the movable shearing and crimping plate has previously been presented to and received a strand of cord, which is led over the sheave 85, which is supported in the standard 84 of the binder-arm in position for said strand to be acted upon by the shearer and crimper 125. In the downward movement of the pivoted levers 140 the bearing-facing 147 of one of said levers acts upon the adjacent arm of the carrier 129 and oscillates the same, together with the shearing and crimping plate, upon the pivot 119 of the latter, moving the advancing edge of the shearer and crimper 125 toward and past the adjacent and opposing edges of the recesses 133 and 135 of the fixed crimping-plate 132 and knife-plate 134. In this oscillating movement of the shearer and crimper 125 the strand of cord is severed between its advancing shearing-edge and the corresponding shear-edge 136 of the knife-plate, and the cord in rear thereof or in the direction of the sheave 85 is crimped and held between the rear crimping-edges of the shearer and crimper 125 and the adjacent edges of the recess 133 of the stationary crimping-plate 132, the end of the cord which has been previously crimped and held being simultaneously released. While the cutting and crimping of the cord have been effected, the pin 155 has moved downwardly in the straight portion of the slot 153 of the cord-throwing cylinder, and has by bearing on the lower end of the slot 157 tightened the

hooks 166 on the cord, as shown in Fig. 27, the engagement of said hooks and the projection 165 with the cord drawing the same through the loop to form the knot. The pin 155 having in the continued downward movement of the levers 140 entered the helical portion of the slot 153, rotation is imparted in the opposite direction to the cord-throwing cylinder 148, and further downward movement is likewise imparted to the cord-tightening spindle 152. The length and pitch of the helical portion of the slot 153 are such that in the coincident rotation of the cylinder 148 and downward movement of the spindle 152 the strands of cord are held taut between the same and are carried backwardly by the hook 154 of the cylinder 148 to the hook 163 of the head-piece 161 of the knotter, around or at the point of which hook the knot is drawn tight. The backward movement of the cord-throwing cylinder and the tightening of the knot are completed before the binder-arm has been released, and the knot is drawn as closely as practicable to the binder-arm, so that its distance from the sheaf shall not substantially exceed the thickness of the binder-arm. It will readily be seen that the closer to the sheaf the knot is tied the less will be the expansion of the sheaf required to fill the band, and inasmuch as the power required to compress the gavel increases in greater ratio toward the termination of the operation of compression the nearer to the sheaf the knot is tied the less will be the power required for the compression of the sheaf. Under the above construction, the knot being drawn tight adjacent to the binder-arm, the expansion of the sheaf is reduced to a minimum, its measure being practically the thickness of the binder-arm in lieu of a much greater distance through which heretofore it has been necessary for the sheaf to expand in order to fill the band. The material reduction of power required in the compression which is thus attained is accomplished by the close proximity of the cord-receiving hook around which the knot is tied to the sheaf and the range of movement of the knot-tightening spindle, which takes up all the slack used in the formation of the knot in bringing the tightened knot to the receiving-hook adjacent to the binder-arm. At the termination of the downward movement of the spindle 152 the hooks 166 are permitted by the recess 167 of the bore of the cylinder 148 to loosen their hold upon the cord sufficiently to allow the ends which are held by them to be withdrawn on the withdrawal of the bound sheaf by the engagement of the discharging-arm 177 with the band-cord in the discharge of the sheaf. Different positions of the parts at different progressive stages of their movements and of the tightening of the knot are shown in Figs. 28 to 30, inclusive, Fig. 30 showing the knot in readiness to be detached from the hook 163 by the movement of the discharging-arm. Figs. 31 to 34 show a portion of the cord in progressive stages of the formation and tightening of the knot. At the termination of the downward movement of the pivoted levers 140 and prior to the commencement of the returning movement of the carriage, the knot has been completed, the hooks 101 have been released by the pivoted levers 140 from engagement with the recesses 102 of the binder-arm 83, and the frame 117 of the cord holding and cutting mechanism has been returned by the pin 138 and groove 137 to its initial position. At this stage the position of the sheave 85, around which the cord is carried relatively to the arms 121 of the central projection of the movable shearing and crimping plate, is such that the cord occupies the position as shown in Fig. 29, and being carried upwardly and backwardly by the binder-arm in assuming the position relatively to the carriage shown in Fig. 7, to which the binder-arm is brought upon its release from the hooks by the tension of the spring 173 of the spring-drum 91 and supplemental spring 103, is guided between the arms 121 and into the central recess 123, so as to be carried above the shearing-edges of the shearer and crimper 125 and knife-plate 134 and kept out of the slot 124, which is to receive the other strand of cord, which is laid in position by the binder-arm to be severed and crimped in the next succeeding operation. One strand of cord only is therefore severed at each operation, with the result of preventing undue and unnecessary duty and strain upon the cutting-edges. In the returning movement of the carriage to initial position the discharging-arm 177 engages the band-cord and draws the knot away from the knotting mechanism in effecting the withdrawal and discharge of the sheaf. At the termination of the returning movement of the carriage the rotation of the driving-shaft 38 of the binding mechanism is discontinued by the disengagement of the clutch-sections, before described, for such interval as is required for gathering and delivering another gavel, after which, the members of the binding mechanism being in proper positions to perform their several functions thereon, the driving-shaft is again rotated by the re-engagement of the clutch-sections, and the operations which have been severally described are similarly repeated.

I claim as my invention and desire to secure by Letters Patent—

1. The combination, in a self-binding harvester, of a quadrangular side-delivery grain-receiving platform, a grain gathering, bundling, and binding mechanism which reciprocates in a plane substantially parallel with the delivery side of said platform and is laterally adjustable relatively thereto, and a rotary sweep-rake adapted to deliver grain in gavels to said mechanism, and an automatically-adjustable bridge spanning the space

between the grain-platform and the gathering, bundling, and binding mechanism, substantially as set forth.

2. The combination, in a self-binding harvester, of a side-delivery grain-receiving platform, a grain gathering, bundling, and binding mechanism which reciprocates in a plane substantially parallel with the delivery side of said platform and is laterally adjustable relatively thereto, a rake adapted to deliver grain in gavels to said mechanism, and a removable supplemental platform supported upon and projecting from the delivery side of said mechanism, substantially as set forth.

3. The combination, in a self-binding harvester, of a side-delivery grain-receiving platform, a grain gathering, bundling, and binding mechanism which reciprocates in a plane substantially parallel with the delivery side of said platform and is adjustable toward and from the same, a rake mounted on the frame of the grain-receiving platform and adapted to deliver the grain in gavels to said mechanism, driving-gearing for operating said mechanism, said gearing being also mounted on the frame of the grain-receiving platform, and an automatically-adjustable bridge spanning the space between the grain-receiving platform and the said gathering, bundling, and binding mechanism, substantially as described.

4. The combination, in a self-binding harvester, of a side-delivery grain-receiving platform, a grain gathering, bundling, and binding mechanism which reciprocates in a plane substantially parallel with the delivery side of said platform and is adjustable toward and from the same, a rake mounted on the frame of the grain-receiving platform and adapted to deliver the grain in gavels to said mechanism, driving-gearing for operating said mechanism, said gearing being also mounted on the frame of the grain-receiving platform, a device actuated by a member of the raking mechanism for intermitting the operation of said driving-gearing, and an automatically-adjustable bridge spanning the space between the grain-platform and the gathering, bundling, and binding mechanism, substantially as described.

5. The combination, in a self-binding harvester, of a side-delivery grain-receiving platform, a frame fitted to slide upon supporting rods or bars toward and from the delivery side of the platform, a carriage, supporting mechanism for gathering, bundling, and binding gavels of grain and fitted to reciprocate on said frame parallel with the delivery side of the platform, a tubular driving-shaft to which intermittent rotation is imparted from a rake-driving mechanism, a shaft having squared faces fitting corresponding faces in the bore of the driving-shaft and adapted to slide longitudinally therein, and a crank-arm secured upon said longitudinally-movable shaft and coupled by a connecting-rod to the carriage, substantially as set forth.

6. The combination, in a self-binding harvester, of a side-delivery grain-receiving platform, a carriage, supporting mechanism for gathering, bundling, and binding gavels of grain and fitted to reciprocate upon a frame parallel with the delivery side of the platform, a driving-shaft coupled by a crank-arm and connecting-rod to the carriage and rotated from a rake-driving mechanism, a clutch device for periodically intermitting the rotation of the driving-shaft, a pivoted lever and spring adapted to effect the disengagement and engagement of the sections of the clutch device, and a shaft actuated by a member of a raking mechanism and adapted to effect periodical movement of the pivoted lever, substantially as set forth.

7. The combination of a supporting-frame, a carriage, supporting mechanism for gathering, bundling, and binding gavels of grain and fitted to reciprocate upon said frame, a driving-shaft journaled in bearings at a right angle to the line of said frame and carrying an arm or disk on which a crank-pin is secured, a rocking arm pivoted at one end to the frame and having a longitudinal slot fitting the crank-pin of the driving-shaft, and a connecting-rod coupled to a pin on the free end of the rocking arm and to the carriage, substantially as set forth.

8. The combination of a supporting-frame, a pair of curved gathering-fingers pivoted thereto and having lever-arms extending on the side of their pivots opposite their bodies, a carriage reciprocating upon the supporting-frame, and a pair of cam-blocks fixed upon the carriage in position to act upon the lever-arms of the gathering-fingers in the traverse of the cam-blocks past the same, substantially as set forth.

9. The combination of a supporting-frame, a pair of curved gathering-fingers pivoted thereto, lever-arms journaled upon the pivots of the fingers with the capacity of a limited degree of vibratory traverse independently of the fingers, a carriage reciprocating upon the supporting-frame, and a pair of cam-blocks fixed upon the carriage in position to act upon the lever-arms of the gathering-fingers in the traverse of the cam-blocks past the same and being downwardly inclined on their upper faces toward their ends which are in rear in the traverse of the carriage in the direction of the gathering-fingers, substantially as set forth.

10. The combination of a supporting-frame, a pair of curved gathering-fingers pivoted thereto, each having a flat upper face and a tooth or projection on or near the side of its face farthest from the connection of the finger with its pivot, and a carriage reciprocating upon the supporting-frame, said carriage carrying a pair of cam-blocks which reciprocate the fingers upon their pivots and having longitudinal grooves or channels in its upper surface in the planes of the teeth or projections of the fingers, substantially as set forth.

11. The combination of a supporting-frame,

a pair of curved gathering and compressing fingers pivoted thereto, and a carriage reciprocating upon the supporting-frame and carrying a pair of cam-blocks which oscillate the fingers upon their pivots, said carriage having projections upon its top which are downwardly inclined in the direction of its initial movement, substantially as set forth.

12. The combination of a supporting-frame having an end bearing for a roller, a carriage reciprocating upon the supporting-frame, a curved binder-arm pivoted to the end of the carriage, and a roller journaled upon the side of the binder-arm above its pivot in position to traverse over the top of the supporting-frame and over the face of the end bearing thereof, substantially as set forth.

13. The combination of a supporting-frame having an end stop and roller-bearing, a carriage reciprocating upon the supporting-frame, a curved binder-arm pivoted to the end of the carriage, and a roller journaled upon the side of the binder-arm in position to traverse over the top of the supporting-frame and bear against the end stop and roller-bearing thereof, substantially as set forth.

14. The combination of a supporting-frame, a lever or pair of levers pivoted to the frame and recessed at their free ends and coupled to the frame on the side of their pivot opposite their free ends by a spring, a carriage reciprocating upon the supporting-frame, a curved binder-arm pivoted to the end of the carriage, and a heel-extension or lever-arm fixed on the binder-arm on the side of its pivot opposite its main body and having lateral projections adapted to engage the recesses of the levers, which are pivoted to the supporting-frame, substantially as set forth.

15. The combination of a supporting-frame having an end bearing for a roller, a lever or pair of levers pivoted to the frame and recessed at their free ends and coupled to the frame on the side of their pivot opposite their free ends by a spring, a carriage reciprocating upon the supporting-frame, a curved binder-arm pivoted to the end of the carriage, a roller journaled upon the side of the compressor-arm above its pivot in position to traverse over the top of the supporting-frame and over the face of the end bearing thereof, and a heel-extension or lever-arm fixed on the binder-arm on the side of its pivot opposite its main body and having lateral projections adapted to engage the recesses of the levers which are pivoted to the frame, substantially as set forth.

16. In a harvester and binder, a reciprocating carriage carrying a gathering and bundling mechanism, a pivoted curved binder-arm, a compressor-cord connected at one end to the outer end of and extending across the inner concave side of the binder-arm and connected at its opposite end to a point on the carriage in front of the pivot of the binder-arm, and an adjustable tension device for said cord, substantially as described.

17. The combination of a supporting-frame, a carriage reciprocating thereon, a curved binder-arm pivoted to one end of the carriage below the top surface thereof, a spring-drum mounted in bearings on the carriage at a point in front of the binder-arm's pivot and also below the top surface thereof, and a compressor-cord connecting the binder-arm and spring-drum, substantially as set forth.

18. In a harvester and binder, a reciprocating carriage carrying a gathering and bundling mechanism, a curved binder-arm pivoted near one end of and below the top surface of the carriage, a spring-drum mounted in bearings below the top surface of the carriage at a point in front of the binder-arm's pivot, a compressing-cord connected at one end to the binder-arm near its outer end and at its other end to the spring-drum, and means for adjusting the tension of the spring, substantially as described.

19. In a grain gathering, bundling, and binding mechanism, the combination of a curved pivoted binder-arm, a hook journaled upon a pivot located adjacent to the limit of the traverse of the free end of the binder-arm and adapted to engage a recess therein, and a device for releasing the hook from the recess, substantially as set forth.

20. The combination of a supporting-frame, a carriage reciprocating thereon, a curved binder-arm pivoted to one end of the carriage, a hook pivoted upon the carriage adjacent to the limit of the traverse of the free end of the binder-arm and adapted to engage a recess therein, and a lever pivoted to the carriage and actuated by a fixed guideway to release the hook from the recess at the termination of the advancing movement of the carriage, substantially as set forth.

21. In a cord holding and cutting mechanism, the combination of a fixed crimping-plate having two opposite crimping-edges and a pivoted crimping-plate having two opposite crimping-edges separated by a slot extending over the fixed crimping-plate from two corresponding crimping-edges on a crimper fixed to the movable crimping-plate and oscillating adjacent to and parallel with the fixed crimping-plate, substantially as set forth.

22. In a cord holding and cutting mechanism, the combination of a fixed knife-plate and a fixed crimping-plate, each having two opposite edges adapted to serve as shearing-edges and crimping-bearings on the respective plates, a movable shearing and crimping plate having on each side a cord guide or recess and a crimping bearing and oscillating in a plane adjacent to and parallel with the fixed plates, and a crimper and shearer connected to the movable plate at one end of the cord-guides and having on each side a shearing-edge and a crimping-bearing traversing between and adjacent to the fixed crimping and knife plates, substantially as set forth.

23. In a cord holding and cutting mechanism, a movable shearing and crimping plate

having a central projection provided with an upper cord-guide and a lateral cord guide or recess and a crimping-bearing below and on each side of the central projection, and a shearer and crimper provided with a shearing-edge and a crimping-bearing on each side and located at one end of the central projection, said shearer and crimper forming the outer boundary of a slot between itself and the main body of the shearing and crimping plate, substantially as set forth.

24. In a cord holding and cutting mechanism, the combination of a movable shearing and crimping plate mounted upon a fixed pivot, a fixed knife-plate, a fixed crimping-plate, a carrier journaled upon the movable shearing and crimping plate by an independent pivot located in the center line of the plate, but separated longitudinally from the fixed pivot thereof, said carrier having a pair of laterally-projecting arms and being adapted to abut against the movable shearing and crimping plate on alternately-opposite sides of its center, a spring or weight acting centrally on the carrier below its independent pivot, and a pair of lever-arms having bearings adapted to alternately act upon the opposite arms of the carrier and effect the oscillation of the same upon its independent pivot as well as its oscillation in unison with the movable shearing and crimping plate upon the fixed pivot of the latter, substantially as set forth.

25. The combination of a reciprocating carriage, a knotting mechanism mounted in a frame connected to the carriage, a cord holding and cutting mechanism mounted in a frame which is pivoted to the frame of the knotting mechanism and is movable toward and from the knotter, a hook or hooks pivoted to the frame of the knotting mechanism and engaging the frame of the cord holding and cutting mechanism when at the limit of its traverse farthest from the knotting mechanism, and a binder-arm pivoted to the carriage and having a standard or projection adapted to disengage the hooks from the frame of the cord holding and cutting mechanism at the limit of the traverse of the compressor-arm into position occupied during the binding of a sheaf, substantially as set forth.

26. In a knotting mechanism, a rotating cord-throwing cylinder and hook and a fixed head-piece and cord-receiving hook, in combination with a reciprocating cord-tightening spindle, said spindle being adapted to engage a cord in rear of a knot formed by the cord-throwing hook around the cord-receiving hook and to draw the knot tight upon said cord-receiving hook in and by the longitudinal movement of the spindle, substantially as set forth.

27. In a knotting mechanism, a rotating cord-throwing cylinder and hook, a fixed head-piece and cord-receiving hook, and a reciprocating cord-tightening spindle and hook, in combination with a pivoted binder-arm, the hook of the cord-tightening spindle being adapted to engage a cord in rear of a knot formed by the cord-throwing hook around the cord-receiving hook and to draw the knot tight upon said cord-receiving hook in and by the longitudinal movement of the spindle, and the cord-receiving hook being located closely adjacent to the binder-arm when said arm is in the position which it occupies during the formation and tightening of a knot, substantially as described.

28. In a knotting mechanism, the combination of a rotating cord-throwing cylinder, which is open at top and is provided thereat with a cord-throwing hook, a stationary head-piece concentric with the cylinder and having a circumferential upper flange forming a boundary for a cord-guiding groove, with a cord-receiving hook projecting above said flange, and a cord-tightening spindle having a pivoted hook for engaging a cord and fitted to reciprocate longitudinally within the cord-throwing cylinder through a sufficient range of movement to take up and hold the slack of the cord used in the formation of a knot as the same is fed toward it by the backward movement of the cord-throwing hook in the tightening of the knot, substantially as set forth.

29. In a knotting mechanism, the combination of an open-topped tubular cord-throwing cylinder journaled in bearings in a knotter-frame, said cylinder being provided with a groove which extends from its bore to its periphery and is parallel with its axis for a portion of its length and thereafter helical in form, a cord-throwing hook fixed upon one end of the cylinder, a cord-receiving hook formed upon a fixed head-piece which is concentric with the cylinder, a cord-tightening spindle carrying a hook and fitted to reciprocate in the bore of the cylinder, an actuating-pin passing through slots in the knotter-frame parallel with the axis of the cylinder, through the slot of the cylinder and through a slot whose length exceeds the diameter of the pin and which is formed in the cord-tightening spindle, and one or more levers pivoted to the knotter-frame and provided with slots which engage the actuating-pin and reciprocate the same in the slots of the knotter-frame in and by the oscillatory movements of the pivoted lever or levers, substantially as set forth.

30. The combination, in a self-binding harvester, of a side-delivery grain-receiving platform, a grain gathering, bundling, and binding mechanism which reciprocates in a plane substantially parallel with the delivery side of the platform, rods or bars fixed to the frame of the platform and supporting the frame of said mechanism, a horizontal shaft journaled in bearings upon the supporting rods or bars and having arms coupled by links to the frame of said mechanism, and a

vertical adjusting-shaft carrying a gear meshing with a gear upon the horizontal shaft, substantially as set forth.

31. The combination, in a self-binding harvester, of a side-delivery grain-receiving platform, a frame supported adjacent to and substantially parallel with the delivery side of said platform, a supplemental platform supported adjacent and exterior to said frame, a carriage, supporting mechanism for gathering, bundling, and binding gavels of grain and fitted to reciprocate upon said frame, a discharging-arm journaled in a bearing adjacent to the frame and having a hook upon its free end adapted to rest periodically above and in the line of traverse of the carriage, an actuating-arm connected with the discharging-arm and projecting into the path of the carriage in position to be oscillated by the contact of a yielding projection thereon in the movement of the carriage in one direction to bring the hook of the discharging-arm in position to engage the band-cord of a sheaf, and a spring which engages the actuating-arm with a slot in the carriage in the movement thereof in the opposite direction to effect its oscillation in direction to discharge a sheaf by the engagement of the hook of the discharging-arm with the band-cord of the sheaf and the oscillation of said arm outwardly over the supplemental platform, substantially as set forth.

In testimony whereof I have hereunto set my hand.

SIMON L. McCOLLOCH.

Witnesses:
J. SNOWDEN BELL,
W. B. CORWIN.